Lower Bounds for Enumerative Counts of Positive-Genus Real Curves, Appendix

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Positive-genus real GW-invariants of real orientable symplectic manifolds of odd "complex" dimensions are constructed in [2]. The genus 1 real GW-invariants of sufficiently positive targets of "complex" dimension 3, such as $\mathbb{P}^3$, have no contribution from genus 0 curves and thus directly provide lower bounds for the number of real genus 1 irreducible curves in such manifolds; see [3, Theorem 1.5] for a precise statement. The real invariants of higher genus do have such contributions; they are determined by [9, (1.6)]. This relation is lower-triangular with respect to the genus and thus can be used to determine invariant signed counts of real genus g curves from the real GW-invariants of genus g and lower.

The real GW-invariants of $\mathbb{P}^{2m-1}$ can be computed using the virtual localization theorem of [6] and the equivariant localization data of [3, Theorem 4.6]. They are used to compute the genus g degree d real GW-invariant of $\mathbb{P}^3$ with d pairs of conjugate point constraints with $d \le 4$ in [3, Section 4.3] and [9, Section 6]. The accompanying hand-drawn graphs and *Mathematica* printouts, which are the work of the first named author, compute these invariants for

- $d=5,7$ and $g=0,2,4$, and
- $d=6,8$ and $g=1,3,5$.

By [3, Theorem 1.6], the genus g degree d real GW-invariant of $\mathbb{P}^3$ with $d-g\in 2\mathbb{Z}$ vanish. The $g=0$ numbers obtained in the accompanying notes agree with [1, Table 1]. The $(g,d)=(1,6)$ number is also obtained in [4] through a less systematic localization computation.

The accompanying notes apply the equivariant localization theorem of [6] with the standard $(\mathbb{C}^*)^2$-action on $\mathbb{P}^3$ with its standard conjugation τ_4. The relevant localization data in the present setting is described in detail in [9, Section 6.1], specializing from the more general setting of [3, Theorem 4.6]. We denote the weights of this action by $\alpha_1=-\alpha_2$ and $\alpha_3=-\alpha_4$; they correspond to the fixed points P_1,P_2,P_3,P_4 with $P_1=\tau_4(P_2)$ and $P_3=\tau_4(P_4)$. For $i\in\mathbb{Z}$, let

$$\langle i\rangle = \begin{cases} 1, & \text{if } i\notin 2\mathbb{Z};\\ 3, & \text{if } i\in 2\mathbb{Z}. \end{cases}$$

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The genus g degree d real GW-invariant of $\mathbb{P}^3$ with d pairs of conjugate point constraints then equals

$$\mathrm{GW}_{g,d}^{\mathbb{P}^3,\tau_4}\big(\underbrace{H^3,\ldots,H^3}_{d}\big)=\int_{[\overline{\mathfrak{M}}_{g,d}(\mathbb{P}^3,d)^{\tau_4}]^{\mathrm{vir}}}\prod_{i=1}^{d}\Big(\mathrm{ev}_i^*\prod_{j\neq\langle i\rangle}(\mathbf{x}-\alpha_j)\Big) \qquad (\star)$$

where $\mathbf{x}$ is the equivariant hyperplane class.

In the non-equivariant reduction, $\alpha_k=0$ and $(\star)$ becomes integration of pullbacks of the Poincare dual of the point in $\mathbb{P}^3$. The use of Pandharipande's trick of twisting by the equivariant weights reduces the number of contributing torus-fixed loci (the restrictions of the integrand to other loci vanish). This trick works spectacularly in reducing the proof of the Aspinwall-Morrison formula to computing the contribution of the simplest possible fixed locus; see [7, Lemma 27.5.3]. In our case, it leaves only the fixed loci consisting of morphisms passing through all 4 torus-fixed points and severely restricts the possible distributions of the d conjugate pairs of marked points.

For $d=5,6,7,8$, the hand-drawn diagrams show every type of graph possibly contributing to $(\star)$. The $d=5$ graphs show half of the possible assignments of the vertex labels indicating the associated fixed point in $\mathbb{P}^3$; the other half is obtained by interchanging the labels 3 and 4. The $d=6,7,8$ graphs show only a quarter of these assignments; the remainder are obtained by swapping the role of the pair $(1,2)$ with that of $(3,4)$ and/or by interchanging the labels 3 and 4. In all cases, the sums are taken over all admissible distributions of the degree between the edges, of the genus between the vertices, and of the marked points between the vertices. The last distribution is subject to the condition that the odd-numbered marked points are mapped to the vertices labeled 1 and 2 and the even-numbered marked points are mapped to the vertices labeled 3 and 4. The number above the curly bracket (or aside the circled vertices if $d=7,8$) of each graph indicates the number of marked points to be distributed between the associated vertices. The graphs that cancel in pairs according to [3, Corollary 4.8] are not shown in these pictures. The set of all relevant graphs for each degree is followed by a computation, via [9, (1.7)], of the enumerative invariants in the three relevant genera from the corresponding numbers obtained in the associated *Mathematica* printout.

In the *Mathematica* computations, the weights α_1 and α_3 are denoted by x and y. All four weights, along with one set of copies, are put into the vector called a. The functions EC and ER encode the complex and real edge contributions given by (6.9) and (6.10), respectively, in [9]. The functions Z and $L0$ compute the integrals of ψ-classes over the Deligne-Mumford moduli spaces $\overline{\mathcal{M}}_{g,m}$ of genus g k-marked complex curves with $g=0,1,2$, respectively. The functions $L1$ and $L3$ compute the integrals of the forms

$$\int_{\overline{\mathcal{M}}_{2,k}} c_1(\mathbb{E})\psi_1^{b_1}\ldots\psi_k^{b_k} \qquad \text{and} \qquad \int_{\overline{\mathcal{M}}_{2,k}} c_1(\mathbb{E})^3\psi_1^{b_1}\ldots\psi_k^{b_k}\,,$$

respectively, where $\mathbb{E}\longrightarrow\overline{\mathcal{M}}_{g,k}$ is the Hodge vector bundle of holomorphic differentials. The remaining relevant Hodge integrals are determined from

$$c_2(\mathbb{E})=\frac{1}{2}c_1(\mathbb{E})^2, \qquad \int_{\overline{\mathcal{M}}_{0,k}}\psi_1^{b_1}\ldots\psi_k^{b_k}=\binom{k-3}{b_1,\ldots,b_k},$$

$$\int_{\overline{\mathcal{M}}_{1,k}} c_1(\mathbb{E})\psi_1^{b_1}\ldots\psi_k^{b_k}=\frac{1}{24}\binom{k-1}{b_1,\ldots,b_k}, \qquad \int_{\overline{\mathcal{M}}_{2,k}} c_1(\mathbb{E})^2\psi_1^{b_1}\ldots\psi_k^{b_k}=\frac{7}{2880}\binom{k+1}{b_1,\ldots,b_k};$$

see [8, Section 5] for the first identity and [5, Section 1.3] for the other three. The function V encodes the vertex contributions given by (6.6)-(6.8) in [3].

The set of graphs for each degree is followed by a *Mathematica* printout computing the contributions of all graphs in the set. All four of these printouts begin with the above functions. They are then applied to the graphs in the set under consideration. The contribution of each graph in the *Mathematica* printout is labeled in the same way as the associated graph.

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References

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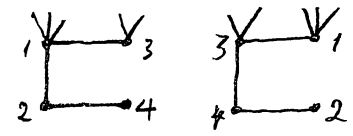
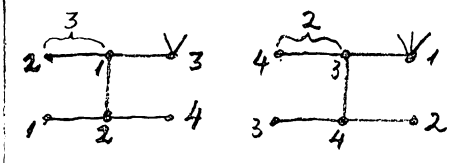
degree 5

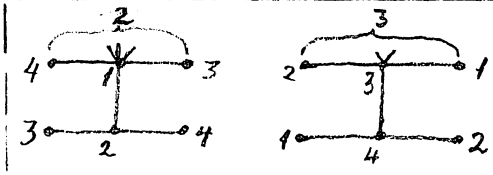
A1



B1

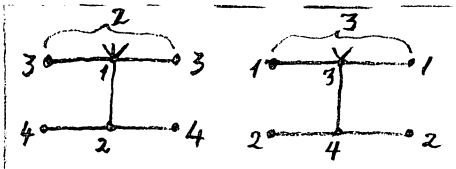


[1]



$\frac{1}{2}\cdot\{3\leftrightarrow 4\}$

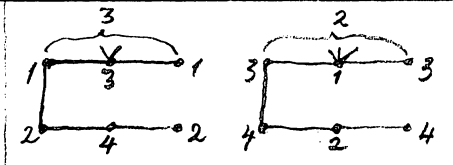
[2]



$\frac{1}{2}\{Aut\}$

[3]

B2



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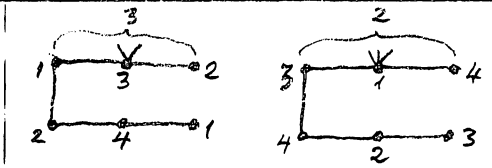
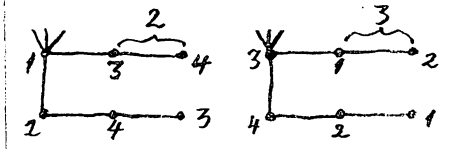
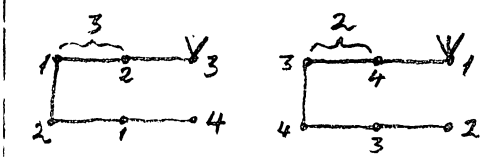


[2]

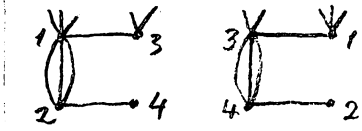


[3]



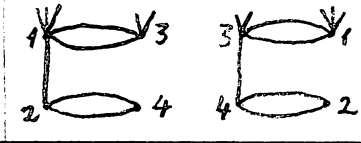
[4]

C1



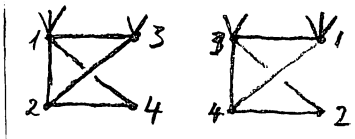
$-\frac{1}{3}\cdot\{111\}$

C2



$\frac{1}{2}\{Aut\}$

C3



$\frac{1}{2}\{3\leftrightarrow 4\}$

$g=0$: $E^{\mathbb{P}^3,\tau_4}_{0,5} = GW^{\mathbb{P}^3,\tau_4}_{0,5} = 5$

$g=2$: $E^{\mathbb{P}^3,\tau_4}_{2,5} = GW^{\mathbb{P}^3,\tau_4}_{2,5} - \frac{4\cdot 5-2}{48}\cdot E^{\mathbb{P}^3,\tau_4}_{0,5} = \frac{15}{8} - \frac{18}{48}\cdot 5 = 0$

$g=4$: $E^{\mathbb{P}^3,\tau_4}_{4,5} = GW^{\mathbb{P}^3,\tau_4}_{4,5} - \frac{4\cdot 5+2}{48}\cdot E^{\mathbb{P}^3,\tau_4}_{2,5} - \frac{(5\cdot 4\cdot 5-14)(4\cdot 5-2)}{23040}\cdot E^{\mathbb{P}^3,\tau_4}_{0,5} = \frac{43}{128} - \frac{1548}{23040}\cdot 5 = 0.$

In[1]:=
```
a = {x, -x, y, -y, x, -x, y, -y};
EC[i_, j_, d_] := Factor[
  (-1)^d * d^(2 d-3) / (d!)^2 * (1 / (a[[i]] - a[[j]])^(2 d-2)) *
   Product[1 / (∏_{r=0}^{d} ((1/d) ((d - r) a[[i]] + r a[[j]]) - a[[k]])),
    {k, Complement[Range[1, 4], {i, j}]}
   ]
 ]
ER[i_, d_] := Factor[
  (-1)^((d-1)/2) / (d * 2^(d-1) * d!) * (((a[[i]]/d))^(1-d) / (∏_{r=0}^{(d-1)/2} (((1/d) (d - 2 r) a[[i]])^2 - a[[5 - i]]^2)))
 ]
F[t_, i_] := ReplacePart[t, i → t[[i]] - 1]
G[x_] := If[
  Min[x] < 0, 0,
  If[Max[x] == 1, 1/24 (Count[x, Except[0]] - 1)!,
   ∑_{i=1}^{Length[x]} G[F[x, i]]]]
Z[x_, k_] := If[Length[x] > k, Array[0 &, k], Join[x, Array[0 &, k - Length[x]]]]
L0[x_] := If[
  Min[x] < 0, 0,
  If[Total[x] - 3 < Count[x, Except[0]], 0,
   If[Total[x] - 3 > Count[x, Except[0]], ∑_{i=1}^{Length[x]} L0[F[x, i]],
    If[Min[DeleteCases[x, 0]] == 1,
     (Total[x] - 2) * L0[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
     If[Count[x, Except[0]] == 1, 1/1152,
      If[Count[x, Except[0]] == 2, 29/5760, 7/240]
     ]
    ]
   ]
  ]
 ]
L1[x_] := If[
  Min[x] < 0, 0,
```

```
    If[Total[x] - 2 < Count[x, Except[0]], 0,
     If[Total[x] - 2 > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L1[F[x, i]],
      If[Min[DeleteCases[x, 0]] == 1,
       (Total[x] - 1) * L1[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
       If[Count[x, Except[0]] == 2, 5/576, 1/480]
       ]
      ]
     ]
    ]
   ]
L3[x_] := If[
   Min[x] < 0, 0,
   If[Total[x] < Count[x, Except[0]], 0,
    If[Total[x] > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L3[F[x, i]],
     (Total[x] + 1)!/2880
    ]
   ]
  ]
V[g_, i_, h_, v_, d_] := With[{
    len = Length[v],
    ET = Product_{r=1}^{3} (a[[i]] - a[[i + r]]),
    ES = Coefficient[Product_{r=1}^{3} (a[[i]] - a[[i + r]] - t), t, 1],
    EA0 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 0],
    EA1 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 1],
    EA2 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 2],
    EA3 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 3]
   },
   If[g == 0,
    Factor[
     (-1)^(len-1) * ((ET)^(h+len-1) / (Product_{k=1}^{len} (((a[[i]] - a[[v[[k]]]]) / d[[k]])^2))) *
```

```
   (Sum_{j=1}^{len} (d[[j]] / (a[[i]] - a[[v[[j]]]])))^(h+len-3)
],
If[g == 1,
 Factor[
  (-1)^len * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (ET *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * G[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len]}]
     + ES/24 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len-1)
   )],
 Factor[
  (-1)^(len-1) * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (EA0 *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L0[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 3]}]
     + EA1 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L1[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 2]}]
     + 7 * EA2/2880 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len+1)
     + EA3 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L3[b],
```

```
            {b, Permutations[Z[bb, len]]}],
          {bb, IntegerPartitions[len]}]
       )
     ]
   ]
  ]
 ]
```

In[11]:=
```
A1G0 = Sum_{k=0}^{1} Sum_{j=1}^{2} EC[1 + 2 k, 3 - 2 k, j] ER[1 + 2 k, 5 - 2 j]
    V[0, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k}, {5 - 2 j, j}] V[0, 3 - 2 k, 2 + k, {1 + 2 k}, {j}];
B1G0[1] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] V[0, 2 + 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 3 - k - i,
     {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 2 + k, {1 + 2 k}, {1}];
B1G0[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{2+k} Binomial[2 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] V[0, 4 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 3 - k,
     {4 - 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 2 + k - i, {1 + 2 k}, {1}];
B1G0[3] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{2+k} Binomial[2 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] V[0, 3 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 3 - k,
     {3 - 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 2 + k - i, {1 + 2 k}, {1}];
B2G0[1] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
    ER[1 + 2 k, 1] V[0, 1 + 2 k, 3 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}]
    V[0, 3 - 2 k, 2 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, i, {3 - 2 k}, {1}];
B2G0[2] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
    ER[1 + 2 k, 1] V[0, 1 + 2 k, 3 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}]
    V[0, 3 - 2 k, 2 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, i, {3 - 2 k}, {1}];
B2G0[3] = Sum_{k=0}^{1} Sum_{i=0}^{2+k} Binomial[2 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
    ER[1 + 2 k, 1] V[0, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k}, {1, 1}]
    V[0, 3 - 2 k, 2 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, i, {3 - 2 k}, {1}];
B2G0[4] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] V[0, 1 + 2 k, 3 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}]
    V[0, 2 + 2 k, i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 2 + k, {2 + 2 k}, {1}];
GW05Half = Factor[A1G0 + Sum_{j=1}^{3} B1G0[j] + Sum_{j=1}^{4} B2G0[j]];
GW05 = Simplify[GW05Half + (GW05Half /. y → -y)]
```

Out[20]= 5

In[21]:=
```
A1G2 = Sum_{k=0}^{1} Sum_{j=1}^{2} EC[1 + 2 k, 3 - 2 k, j] ER[1 + 2 k, 5 - 2 j]
```

```
      (∑_{p=0}^{1} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k}, {5 - 2 j, j}]
          V[1 - p, 3 - 2 k, 2 + k, {1 + 2 k}, {j}]);
B1G2[1] = ∑_{k=0}^{1} ∑_{i=0}^{3-k} Binomial[3 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 3 - k - i,
          {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[1 - p - q, 3 - 2 k, 2 + k, {1 + 2 k}, {1}]);
B1G2[2] = 1/2 * ∑_{k=0}^{1} ∑_{i=0}^{2+k} Binomial[2 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 3 - k, {4 - 2 k,
          2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[1 - p - q, 3 - 2 k, 2 + k - i, {1 + 2 k}, {1}]);
B1G2[3] = 1/2 * ∑_{k=0}^{1} ∑_{i=0}^{2+k} Binomial[2 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 3 - k, {3 - 2 k,
          2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[1 - p - q, 3 - 2 k, 2 + k - i, {1 + 2 k}, {1}]);
B2G2[1] = ∑_{k=0}^{1} ∑_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 3 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
          2 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[1 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]);
B2G2[2] = ∑_{k=0}^{1} ∑_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 3 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
          2 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[1 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]);
B2G2[3] = ∑_{k=0}^{1} ∑_{i=0}^{2+k} Binomial[2 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
          2 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}] V[1 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}]);
B2G2[4] = ∑_{k=0}^{1} ∑_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 3 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}] V[q, 2 + 2 k,
          i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q, 3 - 2 k, 2 + k, {2 + 2 k}, {1}]);
C1G2 = -1/3 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^3 V[0, 1 + 2 k, 3 - k,
      {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}] V[0, 3 - 2 k, 2 + k, {1 + 2 k}, {1}];
C2G2 = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1]^2 ER[1 + 2 k, 1] V[0, 1 + 2 k, 3 - k,
      {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 2 + k, {1 + 2 k, 1 + 2 k}, {1, 1}];
C3G2 = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1] V[0, 1 + 2 k, 3 - k,
      {2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 2 + k, {1 + 2 k, 2 + 2 k}, {1, 1}];
```

```
GW25Half = Factor[A1G2 + Sum_{j=1}^{3} B1G2[j] + Sum_{j=1}^{4} B2G2[j] + C1G2 + C2G2 + C3G2];
GW25 = Simplify[GW25Half + (GW25Half /. y → -y)]
```

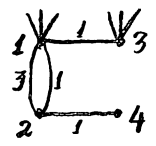
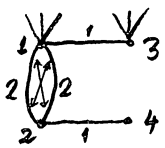
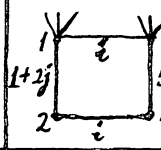
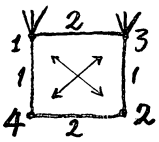
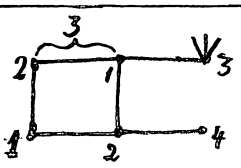
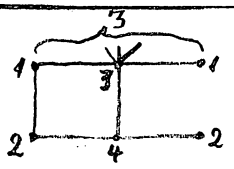
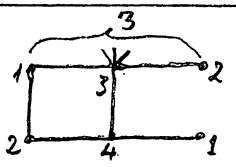
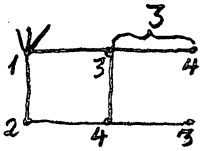
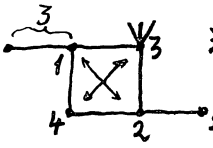
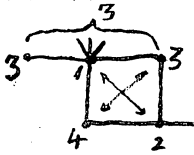
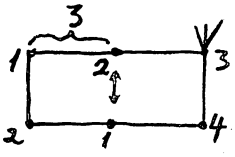
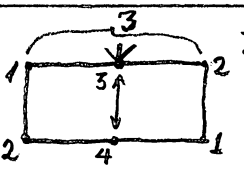
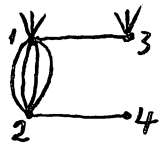
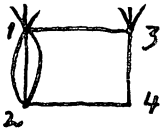
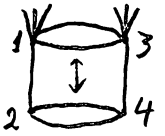
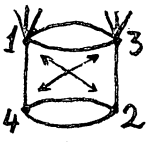
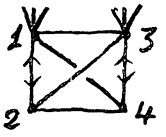
Out[33]= $\frac{15}{8}$

In[34]:=
```
A1G4 = Sum_{k=0}^{1} Sum_{j=1}^{2} EC[1 + 2 k, 3 - 2 k, j] ER[1 + 2 k, 5 - 2 j]
    (Sum_{p=0}^{2} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k}, {5 - 2 j, j}]
      V[2 - p, 3 - 2 k, 2 + k, {1 + 2 k}, {j}]);
B1G4[1] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 3 - k - i,
       {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[2 - p - q, 3 - 2 k, 2 + k, {1 + 2 k}, {1}]);
B1G4[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{2+k} Binomial[2 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 3 - k, {4 - 2 k,
        2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[2 - p - q, 3 - 2 k, 2 + k - i, {1 + 2 k}, {1}]);
B1G4[3] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{2+k} Binomial[2 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 3 - k, {3 - 2 k,
        2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[2 - p - q, 3 - 2 k, 2 + k - i, {1 + 2 k}, {1}]);
B2G4[1] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 1 + 2 k, 3 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
       2 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[2 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]);
B2G4[2] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 1 + 2 k, 3 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
       2 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[2 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]);
B2G4[3] = Sum_{k=0}^{1} Sum_{i=0}^{2+k} Binomial[2 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
       2 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}] V[2 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}]);
B2G4[4] = Sum_{k=0}^{1} Sum_{i=0}^{3-k} Binomial[3 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 1 + 2 k, 3 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}] V[q, 2 + 2 k,
       i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q, 3 - 2 k, 2 + k, {2 + 2 k}, {1}]);
C1G4 = -1/3 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^3
```

```
        (Sum_{p=0}^{1} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}]
           V[1 - p, 3 - 2 k, 2 + k, {1 + 2 k}, {1}]);
C2G4 = 1/2 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1]^2 ER[1 + 2 k, 1]
        (Sum_{p=0}^{1} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}]
           V[1 - p, 3 - 2 k, 2 + k, {1 + 2 k, 1 + 2 k}, {1, 1}]);
C3G4 = 1/2 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
        (Sum_{p=0}^{1} V[p, 1 + 2 k, 3 - k, {2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1}]
           V[1 - p, 3 - 2 k, 2 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);
GW45Half = Factor[A1G4 + Sum_{j=1}^{3} B1G4[j] + Sum_{j=1}^{4} B2G4[j] + C1G4 + C2G4 + C3G4];
GW45 = Simplify[GW45Half + (GW45Half /. y → -y)]
```

Out[46]= $\frac{43}{128}$

degree 6

A1	 [1]	 [2]		
A2	$\frac{1}{2}\{1\leftrightarrow 3\}$  $1+2j$ $5-2i-2j$ $1\le i\le 2$ $0\le j\le 2-i$ [1]	 $\frac{1}{2}\{1\leftrightarrow 3\}$ [2]		
B1	 [1]	 [2]	 [3]	 [4]
B2	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]		
B3	 [1]	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [2]		
C1 ($g\ge 3$)	 $-\frac{1}{12}\{\mathrm{Aut}\}$			
C2 ($g\ge 3$)	 $-\frac{1}{3}\{\mathrm{Aut}\}$			
C3 ($g\ge 3$)	 $\frac{1}{2}\{\mathrm{Aut}\}\cdot\frac{1}{2}\{1\leftrightarrow 3\}$ [1]	 $\frac{1}{2}\{\mathrm{Aut}\}\cdot\frac{1}{2}\{1\leftrightarrow 3\}$ [2]		
C4 ($g\ge 3$)	 $\frac{1}{2}\{1\leftrightarrow 3\}\cdot\frac{1}{2}\{3\leftrightarrow 4\}$			

$g=1$: $E^{\mathbb{P}^3,\tau_4}_{1,6} = GW^{\mathbb{P}^3,\tau_4}_{1,6} = -4$

$g=3$: $E^{\mathbb{P}^3,\tau_4}_{3,6} = GW^{\mathbb{P}^3,\tau_4}_{3,6} - \frac{4\cdot 6}{48} E^{\mathbb{P}^3,\tau_4}_{1,6} = -3 - \frac{24}{48}\cdot(-4) = -1$

$g=5$: $E^{\mathbb{P}^3,\tau_4}_{5,6} = GW^{\mathbb{P}^3,\tau_4}_{5,6} - \frac{4\cdot 6+4}{48}\cdot E^{\mathbb{P}^3,\tau_4}_{3,6} - \frac{5\cdot(4\cdot 6)^2 - 4\cdot(4\cdot 6)}{23040} E^{\mathbb{P}^3,\tau_4}_{1,6}$

$= -\frac{16}{15} - \frac{28}{48}\cdot(-1) - \frac{2784}{23040}\cdot(-4) = 0.$

In[1]:=
```
a = {x, -x, y, -y, x, -x, y, -y};
EC[i_, j_, d_] := Factor[
  (-1)^d * d^(2 d-3) / (d!)^2 * (1 / (a[[i]] - a[[j]])^(2 d-2)) *
   Product[1 / (∏_{r=0}^{d} ((1/d) ((d - r) a[[i]] + r a[[j]]) - a[[k]])),
    {k, Complement[Range[1, 4], {i, j}]}
   ]
 ]
ER[i_, d_] := Factor[
  (-1)^((d-1)/2) / (d * 2^(d-1) * d!) * (((a[[i]]/d))^(1-d) / (∏_{r=0}^{(d-1)/2} (((1/d) (d - 2 r) a[[i]])^2 - a[[5 - i]]^2)))
 ]
F[t_, i_] := ReplacePart[t, i → t[[i]] - 1]
G[x_] := If[
  Min[x] < 0, 0,
  If[Max[x] == 1, 1/24 (Count[x, Except[0]] - 1)!,
   ∑_{i=1}^{Length[x]} G[F[x, i]]]]
Z[x_, k_] := If[Length[x] > k, Array[0 &, k], Join[x, Array[0 &, k - Length[x]]]]
L0[x_] := If[
  Min[x] < 0, 0,
  If[Total[x] - 3 < Count[x, Except[0]], 0,
   If[Total[x] - 3 > Count[x, Except[0]], ∑_{i=1}^{Length[x]} L0[F[x, i]],
    If[Min[DeleteCases[x, 0]] == 1,
     (Total[x] - 2) * L0[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
     If[Count[x, Except[0]] == 1, 1/1152,
      If[Count[x, Except[0]] == 2, 29/5760, 7/240]
     ]
    ]
   ]
  ]
 ]
L1[x_] := If[
  Min[x] < 0, 0,
```

```
  If[Total[x] - 2 < Count[x, Except[0]], 0,
   If[Total[x] - 2 > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L1[F[x, i]],
    If[Min[DeleteCases[x, 0]] == 1,
     (Total[x] - 1) * L1[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
     If[Count[x, Except[0]] == 2, 5/576, 1/480]
     ]
    ]
   ]
  ]
L3[x_] := If[
  Min[x] < 0, 0,
  If[Total[x] < Count[x, Except[0]], 0,
   If[Total[x] > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L3[F[x, i]],
    (Total[x] + 1)!/2880
   ]
  ]
 ]
V[g_, i_, h_, v_, d_] := With[{
   len = Length[v],
   ET = Product_{r=1}^{3} (a[[i]] - a[[i + r]]),
   ES = Coefficient[Product_{r=1}^{3} (a[[i]] - a[[i + r]] - s), s, 1],
   EA0 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 0],
   EA1 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 1],
   EA2 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 2],
   EA3 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 3]
  },
  If[g == 0,
   Factor[
    (-1)^(len-1) * ((ET)^(h+len-1) / (Product_{k=1}^{len} (((a[[i]] - a[[v[[k]]]]) / d[[k]])^2))) *
```

```
   (Sum_{j=1}^{len} (d[[j]] / (a[[i]] - a[[v[[j]]]])))^(h+len-3)
],
If[g == 1,
 Factor[
  (-1)^len * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (ET *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * G[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len]}]
     + ES/24 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len-1)
   )],
 Factor[
  (-1)^(len-1) * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (EA0 *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L0[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 3]}]
     + EA1 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L1[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 2]}]
     + 7 * EA2/2880 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len+1)
     + EA3 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L3[b],
        {b, Permutations[Z[bb, len]]}],
```

```
            {bb, IntegerPartitions[len]}]
        )
      ]
     ]
    ]
   ]
```

In[11]:=
```
A1G1[1] =
  EC[1, 3, 1] ER[1, 1] ER[1, 3] (V[0, 1, 3, {2, 2, 3}, {1, 3, 1}] V[0, 3, 3, {1}, {1}]);
A1G1[2] = 1/2 * EC[1, 3, 1] EC[1, 2, 2]
   (V[0, 1, 3, {2, 2, 3}, {2, 2, 1}] V[0, 3, 3, {1}, {1}]);
A2G1[1] = 1/2 * Sum_{i=1}^{2} Sum_{j=0}^{2-i} EC[1, 3, i] ER[1, 1 + 2 j] ER[3, 5 - 2 i - 2 j]
      (V[0, 1, 3, {3, 2}, {i, 1 + 2 j}] V[0, 3, 3, {1, 4}, {i, 5 - 2 i - 2 j}]);
A2G1[2] = 1/2 * EC[1, 3, 2] EC[1, 4, 1] (V[0, 1, 3, {4, 3}, {1, 2}]
    V[0, 3, 3, {1, 2}, {2, 1}]);
B1G1[1] = Sum_{i=0}^{3} Binomial[3, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 1] ER[1, 1]
    (V[0, 2, i, {1, 1}, {1, 1}] V[0, 1, 3 - i, {2, 2, 3}, {1, 1, 1}] V[0, 3, 3, {1}, {1}]);
B1G1[2] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[3, 1]
    (V[0, 1, i, {2, 3}, {1, 1}] V[0, 3, 3, {1, 4, 1}, {1, 1, 1}] V[0, 1, 3 - i, {3}, {1}]);
B1G1[3] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[3, 1]
    (V[0, 1, i, {2, 3}, {1, 1}] V[0, 3, 3, {1, 4, 2}, {1, 1, 1}] V[0, 2, 3 - i, {3}, {1}]);
B1G1[4] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 4, 1] ER[1, 1] ER[3, 1]
    (V[0, 1, 3, {2, 3}, {1, 1}] V[0, 3, i, {1, 4, 4}, {1, 1, 1}] V[0, 4, 3 - i, {3}, {1}]);
B2G1[1] = 1/2 * Sum_{i=0}^{3} Binomial[3, i] EC[2, 1, 1] EC[1, 3, 1] EC[1, 4, 1] (V[0, 2, i, {1}, {1}]
       V[0, 1, 3 - i, {2, 3, 4}, {1, 1, 1}] V[0, 3, 3, {1, 2}, {1, 1}]);
B2G1[2] = Sum_{i=0}^{3} Binomial[3, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 4, 1]
    (V[0, 3, i, {1}, {1}] V[0, 1, 3, {4, 3, 3}, {1, 1, 1}] V[0, 3, 3 - i, {1, 2}, {1, 1}]);
B3G1[1] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 2, 1] EC[2, 3, 1] ER[1, 1] ER[3, 1]
    (V[0, 1, i, {2, 2}, {1, 1}] V[0, 2, 3 - i, {1, 3}, {1, 1}] V[0, 3, 3, {2, 4}, {1, 1}]);
B3G1[2] = 1/2 * Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[2, 1] (V[0, 1, i,
         {2, 3}, {1, 1}] V[0, 3, 3, {1, 2}, {1, 1}] V[0, 2, 3 - i, {3, 1}, {1, 1}]);
GW16Quarter = Sum_{j=1}^{2} A1G1[j] + Sum_{j=1}^{2} A2G1[j] + Sum_{j=1}^{4} B1G1[j] + Sum_{j=1}^{2} B2G1[j] + Sum_{j=1}^{2} B3G1[j];
GW16Half = GW16Quarter + (GW16Quarter /. {y → x, x → y});
GW16 = Simplify[GW16Half + (GW16Half /. {x → -x})]
```

Out[25]= -4

In[26]:=
```
A1G3[1] = EC[1, 3, 1] ER[1, 1] ER[1, 3]
    (Sum_{p=0}^{1} V[p, 1, 3, {2, 2, 3}, {1, 3, 1}] V[1 - p, 3, 3, {1}, {1}]);
A1G3[2] = 1/2 * EC[1, 3, 1] EC[1, 2, 2]
    (Sum_{p=0}^{1} V[p, 1, 3, {2, 2, 3}, {2, 2, 1}] V[1 - p, 3, 3, {1}, {1}]);
A2G3[1] = 1/2 * Sum_{i=1}^{2} Sum_{j=0}^{2-i} EC[1, 3, i] ER[1, 1 + 2 j] ER[3, 5 - 2 i - 2 j]
      (Sum_{p=0}^{1} V[p, 1, 3, {3, 2}, {i, 1 + 2 j}] V[1 - p, 3, 3, {1, 4}, {i, 5 - 2 i - 2 j}]);
A2G3[2] = 1/2 * EC[1, 3, 2] EC[1, 4, 1]
    (Sum_{p=0}^{1} V[p, 1, 3, {4, 3}, {1, 2}] V[1 - p, 3, 3, {1, 2}, {2, 1}]);
B1G3[1] = Sum_{i=0}^{3} Binomial[3, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1, 1}, {1, 1}]
        V[q, 1, 3 - i, {2, 2, 3}, {1, 1, 1}] V[1 - p - q, 3, 3, {1}, {1}]);
B1G3[2] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1]
    ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 3}, {1, 1}]
        V[q, 3, 3, {1, 4, 1}, {1, 1, 1}] V[1 - p - q, 1, 3 - i, {3}, {1}]);
B1G3[3] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1]
    ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 3}, {1, 1}]
        V[q, 3, 3, {1, 4, 2}, {1, 1, 1}] V[1 - p - q, 2, 3 - i, {3}, {1}]);
B1G3[4] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 4, 1] ER[1, 1]
    ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 3, {2, 3}, {1, 1}]
        V[q, 3, i, {1, 4, 4}, {1, 1, 1}] V[1 - p - q, 4, 3 - i, {3}, {1}]);
B2G3[1] = 1/2 * Sum_{i=0}^{3} Binomial[3, i] EC[2, 1, 1] EC[1, 3, 1] EC[1, 4, 1]
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1}, {1}] V[q, 1, 3 - i, {2, 3, 4}, {1, 1, 1}]
          V[1 - p - q, 3, 3, {1, 2}, {1, 1}]);
B2G3[2] = Sum_{i=0}^{3} Binomial[3, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 4, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {1}, {1}] V[q, 1, 3, {4, 3, 3}, {1, 1, 1}]
        V[1 - p - q, 3, 3 - i, {1, 2}, {1, 1}]);
B3G3[1] = Sum_{i=0}^{3} Binomial[3, i] EC[1, 2, 1] EC[2, 3, 1] ER[1, 1]
```

```
    ER[3, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, i, {2, 2}, {1, 1}]
        V[q, 2, 3 - i, {1, 3}, {1, 1}] V[1 - p - q, 3, 3, {2, 4}, {1, 1}]);
B3G3[2] = 1/2 * ∑_{i=0}^{3} Binomial[3, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1]
    ER[2, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, i, {2, 3}, {1, 1}]
        V[q, 3, 3, {1, 2}, {1, 1}] V[1 - p - q, 2, 3 - i, {3, 1}, {1, 1}]);
C1G3 = -1/12 * EC[1, 3, 1] ER[1, 1]^4 (V[0, 1, 3, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
    V[0, 3, 3, {1}, {1}]);
C2G3 = -1/3 * EC[1, 3, 1] ER[1, 1]^3 ER[3, 1]
    (V[0, 1, 3, {2, 2, 2, 3}, {1, 1, 1, 1}] V[0, 3, 3, {1, 4}, {1, 1}]);
C3G3[1] = 1/4 * EC[1, 3, 1]^2 ER[1, 1] ER[3, 1]
    (V[0, 1, 3, {2, 3, 3}, {1, 1, 1}] V[0, 3, 3, {1, 1, 4}, {1, 1, 1}]);
C3G3[2] = 1/4 * EC[1, 3, 1]^2 EC[1, 4, 1]
    (V[0, 1, 3, {4, 3, 3}, {1, 1, 1}] V[0, 3, 3, {1, 1, 2}, {1, 1, 1}]);
C4G3 = 1/4 * EC[1, 3, 1] EC[1, 4, 1] ER[1, 1] ER[3, 1]
    (V[0, 1, 3, {2, 3, 4}, {1, 1, 1}] V[0, 3, 3, {1, 2, 4}, {1, 1, 1}]);
GW36Quarter = ∑_{j=1}^{2} A1G3[j] + ∑_{j=1}^{2} A2G3[j] + ∑_{j=1}^{4} B1G3[j] +
    ∑_{j=1}^{2} B2G3[j] + ∑_{j=1}^{2} B3G3[j] + C1G3 + C2G3 + ∑_{j=1}^{2} C3G3[j] + C4G3;
GW36Half = GW36Quarter + (GW36Quarter /. {y → x, x → y});
GW36 = Simplify[GW36Half + (GW36Half /. {x → -x})]
```

Out[45]= − 3

```
In[46]:= A1G5[1] = EC[1, 3, 1] ER[1, 1] ER[1, 3]
    (∑_{p=0}^{2} V[p, 1, 3, {2, 2, 3}, {1, 3, 1}] V[2 - p, 3, 3, {1}, {1}]);
A1G5[2] = 1/2 * EC[1, 3, 1] EC[1, 2, 2]
    (∑_{p=0}^{2} V[p, 1, 3, {2, 2, 3}, {2, 2, 1}] V[2 - p, 3, 3, {1}, {1}]);
A2G5[1] = 1/2 * ∑_{i=1}^{2} ∑_{j=0}^{2-i} EC[1, 3, i] ER[1, 1 + 2 j] ER[3, 5 - 2 i - 2 j]
        (∑_{p=0}^{2} V[p, 1, 3, {3, 2}, {i, 1 + 2 j}] V[2 - p, 3, 3, {1, 4}, {i, 5 - 2 i - 2 j}]);
A2G5[2] = 1/2 * EC[1, 3, 2] EC[1, 4, 1]
    (∑_{p=0}^{2} V[p, 1, 3, {4, 3}, {1, 2}] V[2 - p, 3, 3, {1, 2}, {2, 1}]);
B1G5[1] = ∑_{i=0}^{3} Binomial[3, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 1]
```

$$\text{ER}[1,1]\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,2,i,\{1,1\},\{1,1\}]\right.$$
$$\left.\text{V}[q,1,3-i,\{2,2,3\},\{1,1,1\}]\,\text{V}[2-p-q,3,3,\{1\},\{1\}]\right);$$

$$\text{B1G5}[2]=\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[1,3,1]\,\text{EC}[3,1,1]\,\text{ER}[1,1]$$
$$\text{ER}[3,1]\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,1,i,\{2,3\},\{1,1\}]\right.$$
$$\left.\text{V}[q,3,3,\{1,4,1\},\{1,1,1\}]\,\text{V}[2-p-q,1,3-i,\{3\},\{1\}]\right);$$

$$\text{B1G5}[3]=\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[1,3,1]\,\text{EC}[3,2,1]\,\text{ER}[1,1]$$
$$\text{ER}[3,1]\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,1,i,\{2,3\},\{1,1\}]\right.$$
$$\left.\text{V}[q,3,3,\{1,4,2\},\{1,1,1\}]\,\text{V}[2-p-q,2,3-i,\{3\},\{1\}]\right);$$

$$\text{B1G5}[4]=\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[1,3,1]\,\text{EC}[3,4,1]\,\text{ER}[1,1]$$
$$\text{ER}[3,1]\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,1,3,\{2,3\},\{1,1\}]\right.$$
$$\left.\text{V}[q,3,i,\{1,4,4\},\{1,1,1\}]\,\text{V}[2-p-q,4,3-i,\{3\},\{1\}]\right);$$

$$\text{B2G5}[1]=\frac{1}{2}*\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[2,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,4,1]$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,2,i,\{1\},\{1\}]\,\text{V}[q,1,3-i,\{2,3,4\},\{1,1,1\}]\right.$$
$$\left.\text{V}[2-p-q,3,3,\{1,2\},\{1,1\}]\right);$$

$$\text{B2G5}[2]=\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[3,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,4,1]$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,3,i,\{1\},\{1\}]\,\text{V}[q,1,3,\{4,3,3\},\{1,1,1\}]\right.$$
$$\left.\text{V}[2-p-q,3,3-i,\{1,2\},\{1,1\}]\right);$$

$$\text{B3G5}[1]=\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[1,2,1]\,\text{EC}[2,3,1]\,\text{ER}[1,1]$$
$$\text{ER}[3,1]\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,1,i,\{2,2\},\{1,1\}]\right.$$
$$\left.\text{V}[q,2,3-i,\{1,3\},\{1,1\}]\,\text{V}[2-p-q,3,3,\{2,4\},\{1,1\}]\right);$$

$$\text{B3G5}[2]=\frac{1}{2}*\sum_{i=0}^{3}\text{Binomial}[3,i]\,\text{EC}[1,3,1]\,\text{EC}[3,2,1]\,\text{ER}[1,1]$$
$$\text{ER}[2,1]\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\text{V}[p,1,i,\{2,3\},\{1,1\}]\right.$$
$$\left.\text{V}[q,3,3,\{1,2\},\{1,1\}]\,\text{V}[2-p-q,2,3-i,\{3,1\},\{1,1\}]\right);$$

$$\text{C1G5}=-\frac{1}{12}*\text{EC}[1,3,1]\,\text{ER}[1,1]^4\left(\sum_{p=0}^{1}\text{V}[p,1,3,\{2,2,2,2,3\},\{1,1,1,1,1\}]\right.$$
$$\left.\text{V}[1-p,3,3,\{1\},\{1\}]\right);$$

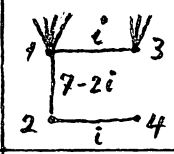
$$\text{C2G5}=-\frac{1}{3}*\text{EC}[1,3,1]\,\text{ER}[1,1]^3\,\text{ER}[3,1]$$
$$\left(\sum_{p=0}^{1}\text{V}[p,1,3,\{2,2,2,3\},\{1,1,1,1\}]\,\text{V}[1-p,3,3,\{1,4\},\{1,1\}]\right);$$

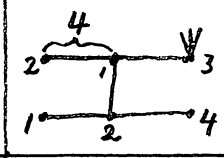
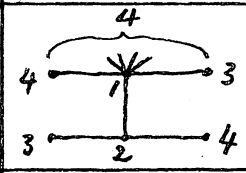
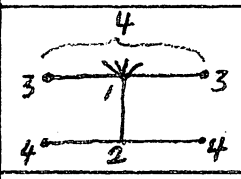
$$\text{C3G5}[1]=\frac{1}{4}*\text{EC}[1,3,1]^2\,\text{ER}[1,1]\,\text{ER}[3,1]$$

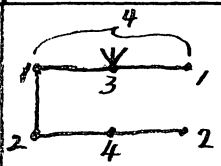
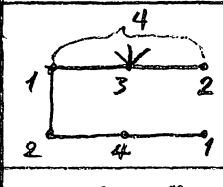
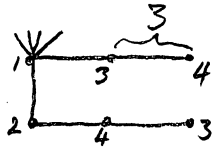
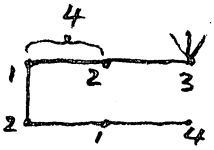
```
    (∑_{p=0}^{1} V[p, 1, 3, {2, 3, 3}, {1, 1, 1}] V[1 - p, 3, 3, {1, 1, 4}, {1, 1, 1}]);
C3G5[2] = 1/4 * EC[1, 3, 1]^2 EC[1, 4, 1]
    (∑_{p=0}^{1} V[p, 1, 3, {4, 3, 3}, {1, 1, 1}] V[1 - p, 3, 3, {1, 1, 2}, {1, 1, 1}]);
C4G5 = 1/4 * EC[1, 3, 1] EC[1, 4, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{1} V[p, 1, 3, {2, 3, 4}, {1, 1, 1}] V[1 - p, 3, 3, {1, 2, 4}, {1, 1, 1}]);
GW56Quarter = ∑_{j=1}^{2} A1G5[j] + ∑_{j=1}^{2} A2G5[j] + ∑_{j=1}^{4} B1G5[j] +
    ∑_{j=1}^{2} B2G5[j] + ∑_{j=1}^{2} B3G5[j] + C1G5 + C2G5 + ∑_{j=1}^{2} C3G5[j] + C4G5;
GW56Half = GW56Quarter + (GW56Quarter /. {y → x, x → y});
GW56 = Simplify[GW56Half + (GW56Half /. {x → -x})]
```

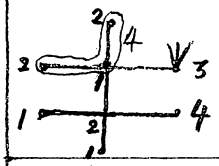
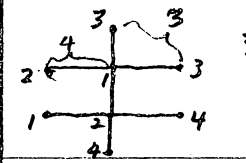
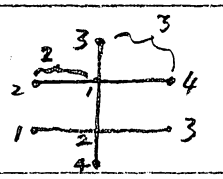
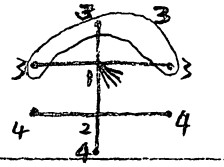
Out[65]= $-\frac{16}{15}$

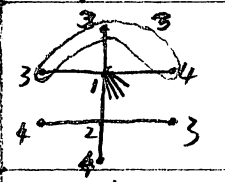
Degree 7

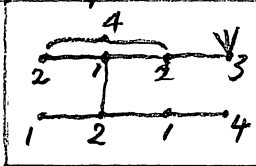
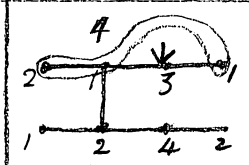
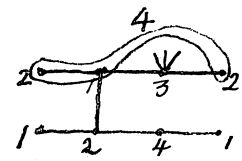
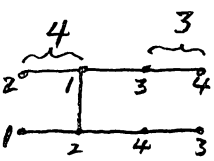
A1  $1 \le i \le 3$

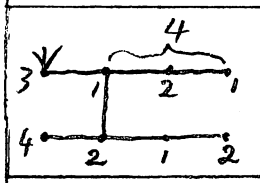
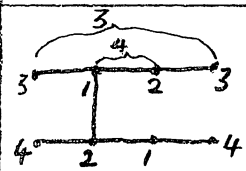
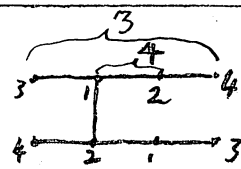
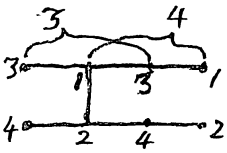
B1  [1]  $\frac{1}{2}\{3 \leftrightarrow 4\}$ [2]  $\frac{1}{2}\{\mathrm{Aut}\}$ [3]

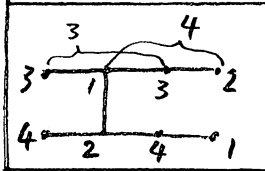
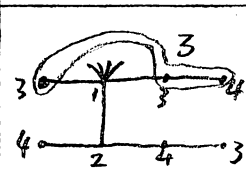
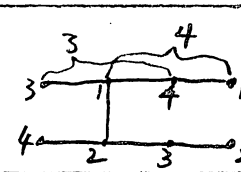
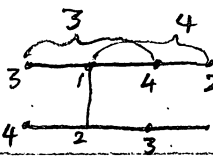
B2  [1]  [2]  [3]  [4]

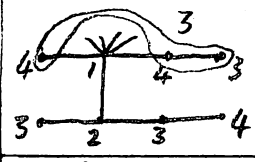
C1  [1]  $\frac{1}{2}\{\mathrm{Aut}\}$ [2]  $\frac{1}{2}\{3 \leftrightarrow 4\}$ [3]  $\frac{1}{6}\{\mathrm{Aut}\}$ [4]

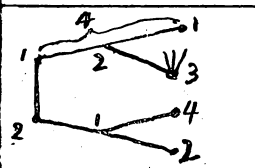
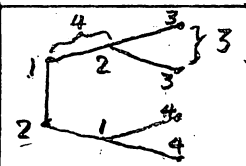
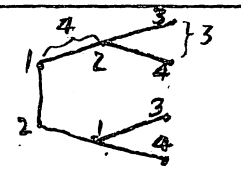
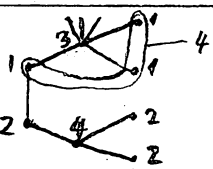
 $\frac{1}{2}\{\mathrm{Aut}\}$ [5]

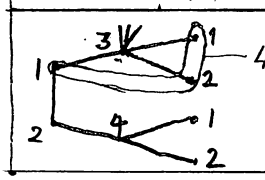
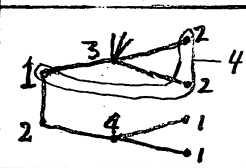
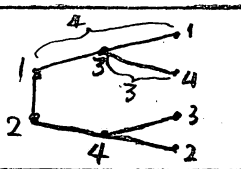
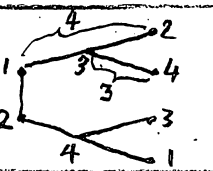
C2  [1]  [2]  [3]  [4]

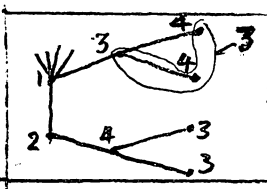
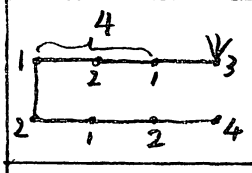
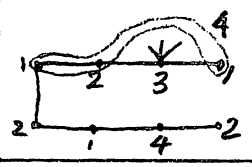
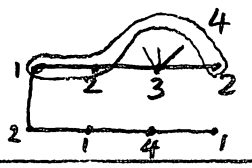
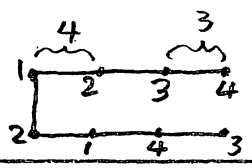
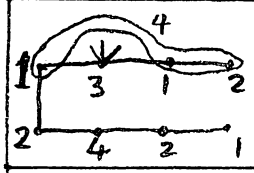
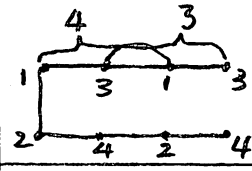
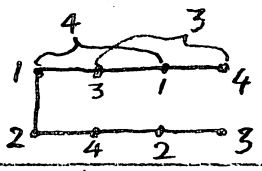
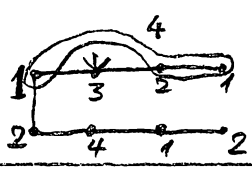
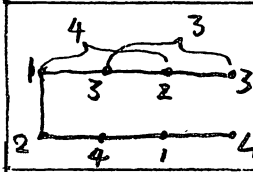
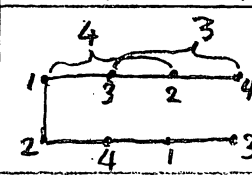
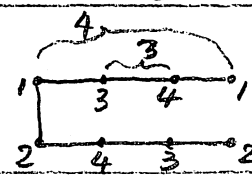
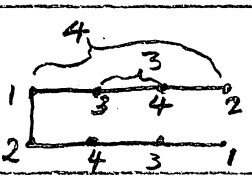
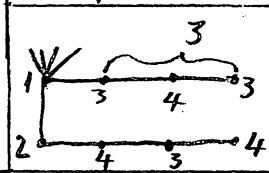
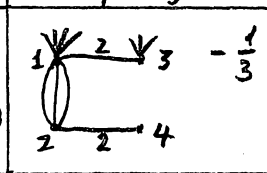
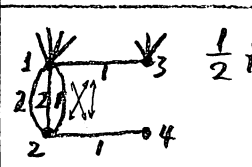
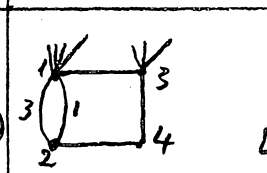
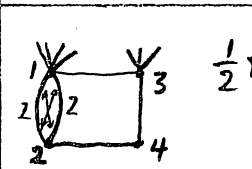
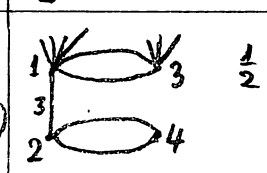
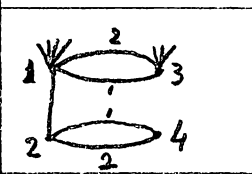
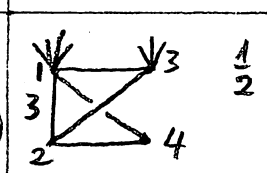
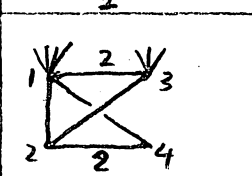
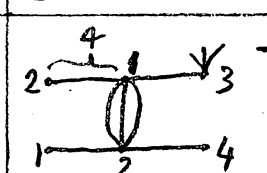
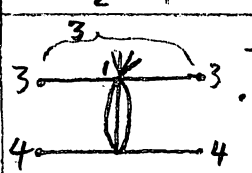
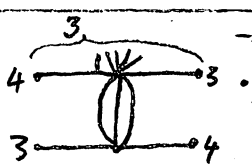
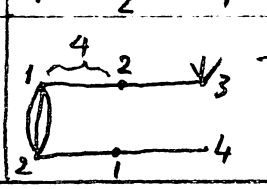
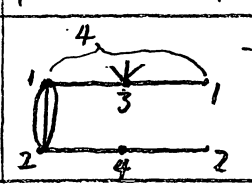
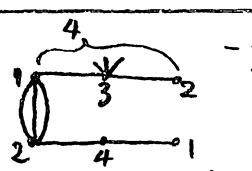
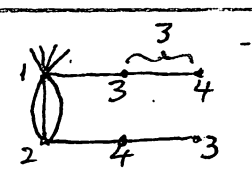
 [5]  [6]  [7]  [8]

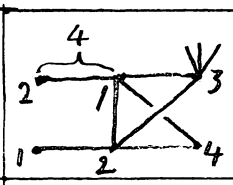
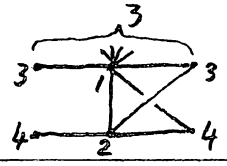
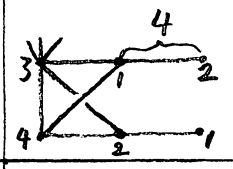
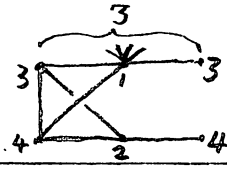
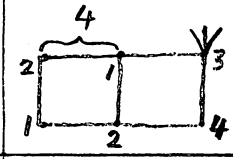
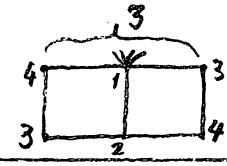
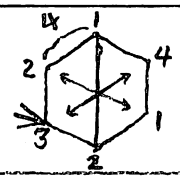
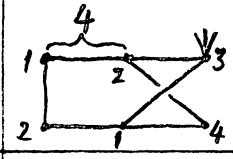
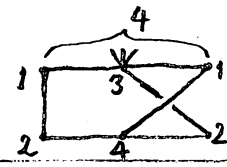
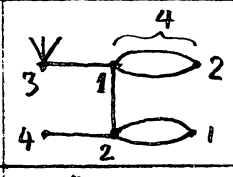
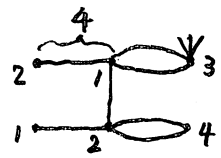
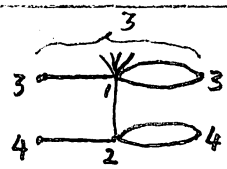
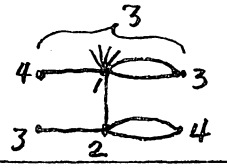
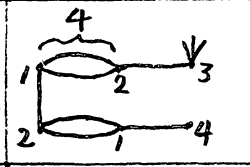
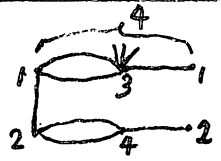
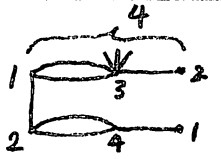
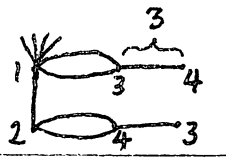
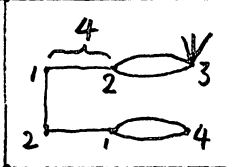
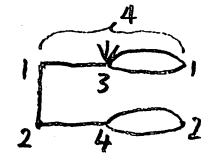
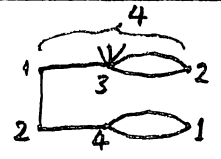
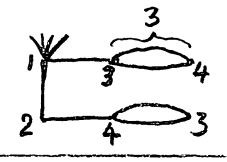
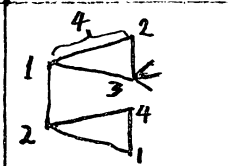
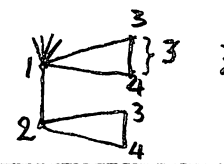
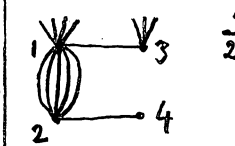
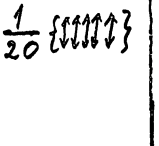
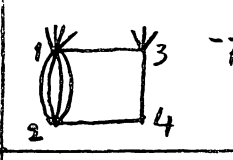
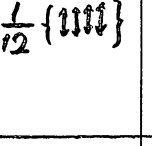
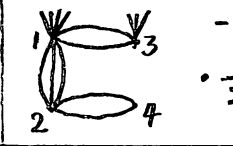
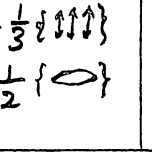
 [9]  [10]  [11]  [12]

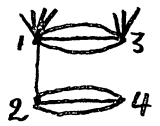
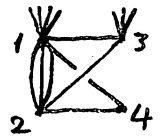
 [13]

C3  [1]  $\frac{1}{2}\{\mathrm{Aut}\}$ [2]  $\frac{1}{2}\{3 \leftrightarrow 4\}$ [3]  $\frac{1}{2}\{\mathrm{Aut}\}$ [4]

 [5]  $\frac{1}{2}\{\mathrm{Aut}\}$ [6]  [7]  [8]

	 $\frac{1}{2}\{Aut\}$ [9]			
C4	 [1]	 [2]	 [3]	 [4]
	 [5]	 [6]	 [7]	 [8]
	 [9]	 [10]	 [11]	 [12]
	 [13]			
D1 (g≥2)	 $-\frac{1}{3}\{\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]		
D2 (g≥2)	 [1]	 $\frac{1}{2}\{Aut+\}$ [2]		
D3 (g≥2)	 $\frac{1}{2}\{Aut\}$ [1]	 [2]		
D4 (g≥2)	 $\frac{1}{2}\{3\leftrightarrow4\}$ [1]	 [2]		
E1 (g≥2)	 $-\frac{1}{3}\{\}$ [1]	 $-\frac{1}{3}\{\}$ $\cdot\frac{1}{2}\{Aut\}$ [2]	 $-\frac{1}{3}\{\}$ $\cdot\frac{1}{2}\{3\leftrightarrow4\}$ [3]	
E2 (g≥2)	 $-\frac{1}{3}\{\}$ [1]	 $-\frac{1}{3}\{\}$ [2]	 $-\frac{1}{3}\{\}$ [3]	 $-\frac{1}{3}\{\}$ [4]

E3 ($g\geq 2$)	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]		
E4 ($g\geq 2$)	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]		
E5 ($g\geq 2$)	 [1]	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [2]	 [3]	
E6 ($g\geq 2$)	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]		
E7 ($g\geq 2$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	 $\frac{1}{2}\{Aut\}$ [4]
E8 ($g\geq 2$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	 $\frac{1}{2}\{Aut\}$ [4]
E9 ($g\geq 2$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	 $\frac{1}{2}\{Aut\}$ [4]
E10 ($g\geq 2$)	 [1]	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [2]		
F1 ($g\geq 4$)	 $\frac{1}{20}\{$  $\}$			
F2 ($g\geq 4$)	 $-\frac{1}{12}\{$  $\}$			
F3 ($g\geq 4$)	 $-\frac{1}{3}\{$  $\}$ $\cdot\frac{1}{2}\{$ $\}$			

F4 $(g\geq 4)$		$\frac{1}{6}\{Aut\}$		
F5 $(g\geq 4)$		$-\frac{1}{3}\{\text{III}\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$		
F6 $(g\geq 4)$		$\frac{1}{2}\{Aut\}$		

$g=0$: $E^{\mathbb{P}^3,\tau_4}_{0,7} = GW^{\mathbb{P}^3,\tau_4}_{0,7} = -85$

$g=2$: $E^{\mathbb{P}^3,\tau_4}_{2,7} = GW^{\mathbb{P}^3,\tau_4}_{2,7} - \frac{4\cdot 7-2}{48} E^{\mathbb{P}^3,\tau_4}_{0,7} = -\frac{1345}{24} - \frac{26}{48}\cdot(-85) = -10$

$g=4$: $E^{\mathbb{P}^3,\tau_4}_{4,7} = GW^{\mathbb{P}^3,\tau_4}_{4,7} - \frac{4\cdot 7+2}{48} E^{\mathbb{P}^3,\tau_4}_{2,7} - \frac{(5\cdot 4\cdot 7-14)(4\cdot 7-2)}{23040} E^{\mathbb{P}^3,\tau_4}_{0,7}$

$= -\frac{2475}{128} - \frac{30}{48}\cdot(-10) - \frac{3276}{23040}\cdot(-85) = -1$

In[1]:=
```
a = {x, -x, y, -y, x, -x, y, -y};
EC[i_, j_, d_] := Factor[
  (-1)^d * d^(2 d-3) / (d!)^2 * (1 / (a[[i]] - a[[j]])^(2 d-2)) *
   Product[1 / (∏_{r=0}^{d} ((1/d) ((d - r) a[[i]] + r a[[j]]) - a[[k]])),
    {k, Complement[Range[1, 4], {i, j}]}
   ]
 ]
ER[i_, d_] := Factor[
  (-1)^((d-1)/2) / (d * 2^(d-1) * d!) * (((a[[i]]/d))^(1-d) / (∏_{r=0}^{(d-1)/2} (((1/d) (d - 2 r) a[[i]])^2 - a[[5 - i]]^2)))
 ]
F[t_, i_] := ReplacePart[t, i → t[[i]] - 1]
G[x_] := If[
  Min[x] < 0, 0,
  If[Max[x] == 1, 1/24 (Count[x, Except[0]] - 1)!,
   ∑_{i=1}^{Length[x]} G[F[x, i]]]]
Z[x_, k_] := If[Length[x] > k, Array[0 &, k], Join[x, Array[0 &, k - Length[x]]]]
L0[x_] := If[
  Min[x] < 0, 0,
  If[Total[x] - 3 < Count[x, Except[0]], 0,
   If[Total[x] - 3 > Count[x, Except[0]], ∑_{i=1}^{Length[x]} L0[F[x, i]],
    If[Min[DeleteCases[x, 0]] == 1,
     (Total[x] - 2) * L0[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
     If[Count[x, Except[0]] == 1, 1/1152,
      If[Count[x, Except[0]] == 2, 29/5760, 7/240]
     ]
    ]
   ]
  ]
 ]
L1[x_] := If[
  Min[x] < 0, 0,
```

```
  If[Total[x] - 2 < Count[x, Except[0]], 0,
   If[Total[x] - 2 > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L1[F[x, i]],
    If[Min[DeleteCases[x, 0]] == 1,
     (Total[x] - 1) * L1[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
     If[Count[x, Except[0]] == 2, 5/576, 1/480]
     ]
    ]
   ]
  ]
L3[x_] := If[
  Min[x] < 0, 0,
  If[Total[x] < Count[x, Except[0]], 0,
   If[Total[x] > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L3[F[x, i]],
    (Total[x] + 1)!/2880
   ]
  ]
 ]
V[g_, i_, h_, v_, d_] := With[{
   len = Length[v],
   ET = Product_{r=1}^{3} (a[[i]] - a[[i + r]]),
   ES = Coefficient[Product_{r=1}^{3} (a[[i]] - a[[i + r]] - t), t, 1],
   EA0 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 0],
   EA1 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 1],
   EA2 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 2],
   EA3 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 3]
  },
  If[g == 0,
   Factor[
    (-1)^(len-1) * ((ET)^(h+len-1) / (Product_{k=1}^{len} (((a[[i]] - a[[v[[k]]]]) / d[[k]])^2))) *
```

```
   (Sum_{j=1}^{len} (d[[j]] / (a[[i]] - a[[v[[j]]]])))^(h+len-3)
],
If[g == 1,
 Factor[
  (-1)^len * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (ET *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * G[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len]}]
     + ES/24 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len-1)
   )],
 Factor[
  (-1)^(len-1) * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (EA0 *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L0[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 3]}]
     + EA1 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L1[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 2]}]
     + 7 * EA2/2880 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len+1)
     + EA3 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L3[b],
```

```
            {b, Permutations[Z[bb, len]]}],
          {bb, IntegerPartitions[len]}]
       )
     ]
    ]
   ]
  ]
```

In[11]:=
```
A1G0 = Factor[
  Sum_{k=0}^{1} Sum_{j=1}^{3} EC[1 + 2 k, 3 - 2 k, j] ER[1 + 2 k, 7 - 2 j] (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k},
      {7 - 2 j, j}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {j}])];
B1G0[1] = Factor[Sum_{k=0}^{1} ((Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 2] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 2 + 2 k, i, {1 + 2 k}, {2}] V[0, 1 + 2 k, 4 - k - i,
        {2 + 2 k, 2 + 2 k, 3 - 2 k}, {2, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}])) +
    (Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2]
      ER[1 + 2 k, 1] (V[0, 2 + 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k - i,
        {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 2}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {2}])) +
    (Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 3] (V[0, 2 + 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k - i,
        {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 3, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]))))];
B1G0[2] = Factor[1/2 * Sum_{k=0}^{1} ((Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 2] EC[1 + 2 k,
      3 - 2 k, 1] ER[1 + 2 k, 1] (V[0, 4 - 2 k, i, {1 + 2 k}, {2}] V[0, 1 + 2 k, 4 - k,
        {4 - 2 k, 2 + 2 k, 3 - 2 k}, {2, 1, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}])) +
    (Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2]
      ER[1 + 2 k, 1] (V[0, 4 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k,
        {4 - 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 2}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k}, {2}])) +
    (Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
      (V[0, 4 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k, 3 - 2 k},
        {1, 3, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]))))];
B1G0[3] = Factor[1/2 * Sum_{k=0}^{1} ((Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 2] EC[1 + 2 k, 3 - 2 k,
      1] ER[1 + 2 k, 1] (V[0, 3 - 2 k, i, {1 + 2 k}, {2}] V[0, 1 + 2 k, 4 - k, {3 - 2 k,
        2 + 2 k, 3 - 2 k}, {2, 1, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}])) +
    (Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2]
```

```
      ER[1 + 2 k, 1] (V[0, 3 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k,
          {3 - 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 2}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k}, {2}]) ) +
    ( Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
      (V[0, 3 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k, 3 - 2 k},
          {1, 3, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]) ) ) ];

B2G0[1] = Factor[ Sum_{k=0}^{1} ( ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 2] EC[3 - 2 k, 1 + 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 2}]
        V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {2, 1}] V[0, 1 + 2 k, i, {3 - 2 k}, {1}]) ) +
    ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 2]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 2}] V[0, 1 + 2 k, i, {3 - 2 k}, {2}]) ) +
    ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
      ER[1 + 2 k, 3] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {3, 1}] V[0, 3 - 2 k,
          3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, i, {3 - 2 k}, {1}]) ) ) ];

B2G0[2] = Factor[ Sum_{k=0}^{1} ( ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 2] EC[3 - 2 k, 2 + 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 2}]
        V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {2, 1}] V[0, 2 + 2 k, i, {3 - 2 k}, {1}]) ) +
    ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 2]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 2}] V[0, 2 + 2 k, i, {3 - 2 k}, {2}]) ) +
    ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
      ER[1 + 2 k, 3] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {3, 1}] V[0, 3 - 2 k,
          3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, i, {3 - 2 k}, {1}]) ) ) ];

B2G0[3] = Factor[ Sum_{k=0}^{1} ( ( Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 2] EC[3 - 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 2}] V[0, 3 - 2 k,
          3 + k - i, {1 + 2 k, 4 - 2 k}, {2, 1}] V[0, 4 - 2 k, i, {3 - 2 k}, {1}]) ) +
    ( Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 2]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k,
          3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 2}] V[0, 4 - 2 k, i, {3 - 2 k}, {2}]) ) +
    ( Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 3] (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {3, 1}] V[0, 3 - 2 k,
          3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, i, {3 - 2 k}, {1}]) ) ) ];

B2G0[4] = Factor[ Sum_{k=0}^{1} ( ( Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 2] EC[2 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 2}]
        V[0, 2 + 2 k, i, {1 + 2 k, 3 - 2 k}, {2, 1}] V[0, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]) ) +
```

```
        (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 2]
           ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[0, 2 + 2 k, i, {1 + 2 k, 3 - 2 k}, {1, 2}] V[0, 3 - 2 k, 3 + k, {2 + 2 k}, {2}]) +
        (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
           ER[1 + 2 k, 3] (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {3, 1}] V[0, 2 + 2 k,
                i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))) ];

C1G0[1] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (V[0, 2 + 2 k, r, {1 + 2 k}, {1}] V[0, 2 + 2 k, s, {1 + 2 k}, {1}]
          V[0, 1 + 2 k, 4 - k - r - s, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}]
          V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}])) ];

C1G0[2] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[2 + 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (V[0, 2 + 2 k, r, {1 + 2 k}, {1}] V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
          V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1}]
          V[0, 3 - 2 k, 3 + k - s, {1 + 2 k}, {1}])) ];

C1G0[3] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[2 + 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1]
        ER[1 + 2 k, 1] (V[0, 2 + 2 k, r, {1 + 2 k}, {1}] V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
          V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1, 1}]
          V[0, 4 - 2 k, 3 + k - s, {1 + 2 k}, {1}])) ];

C1G0[4] = Factor[1/6 * ∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
        ER[1 + 2 k, 1] (V[0, 3 - 2 k, r, {1 + 2 k}, {1}] V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
          V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1}]
          V[0, 3 - 2 k, 3 + k - r - s, {1 + 2 k}, {1}])) ];

C1G0[5] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[4 - 2 k, 1 + 2 k, 1]
        ER[1 + 2 k, 1] (V[0, 3 - 2 k, r, {1 + 2 k}, {1}] V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
          V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1, 1}]
          V[0, 4 - 2 k, 3 + k - r - s, {1 + 2 k}, {1}])) ];

C2G0[1] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
       EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
       ER[1 + 2 k, 1] (V[0, 2 + 2 k, s, {1 + 2 k}, {1}]
         V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1}] V[0, 2 + 2 k, 4 - k - r - s,
          {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k, {2 + 2 k}, {1}])) ];
```

```
C2G0[2] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[2 + 2 k, 1 + 2 k, 1]
          EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1] (V[0, 2 + 2 k, s, {1 + 2 k},
              {1}] V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 3 + k,
              {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C2G0[3] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[2 + 2 k, 1 + 2 k, 1]
          EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1] (V[0, 2 + 2 k, s, {1 + 2 k},
              {1}] V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 3 + k,
              {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C2G0[4] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 2 + 2 k, r, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k,
              s, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, 3 + k - s, {3 - 2 k}, {1}]))];

C2G0[5] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
          EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 2 + 2 k, s,
              {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r - s, {2 + 2 k}, {1}]))];

C2G0[6] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 2 + 2 k,
              r, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C2G0[7] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[4 - 2 k, 2 + 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 2 + 2 k,
              r, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C2G0[8] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k,
              3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, r, {3 - 2 k}, {1}]))];

C2G0[9] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k,
              3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, r, {3 - 2 k}, {1}]))];
```

```
C2G0[10] = Factor[Sum_k=0^1 (Sum_r=0^3+k Sum_s=0^3+k-r Multinomial[r, s, 3 + k - r - s] EC[3 - 2 k, 1 + 2 k, 1]
          EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1] (V[0, 3 - 2 k, r, {1 + 2 k},
              {1}] V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k,
              s, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, 3 + k - r - s, {3 - 2 k}, {1}]))];

C2G0[11] = Factor[Sum_k=0^1 (Sum_r=0^4-k Sum_s=0^3+k Binomial[4 - k, r] Binomial[3 + k, s]
          EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 1 + 2 k, 1]
          ER[1 + 2 k, 1] (V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
            V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[0, 4 - 2 k,
              3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, r, {4 - 2 k}, {1}]))];

C2G0[12] = Factor[Sum_k=0^1 (Sum_r=0^4-k Sum_s=0^3+k Binomial[4 - k, r] Binomial[3 + k, s]
         EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 2 + 2 k, 1]
         ER[1 + 2 k, 1] (V[0, 3 - 2 k, s, {1 + 2 k}, {1}]
           V[0, 1 + 2 k, 4 - k - r, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}]
           V[0, 4 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, r, {4 - 2 k}, {1}]))];

C2G0[13] = Factor[Sum_k=0^1 (Sum_r=0^3+k Sum_s=0^3+k-r Multinomial[r, s, 3 + k - r - s] EC[3 - 2 k, 1 + 2 k, 1]
         EC[1 + 2 k, 4 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1] (V[0, 3 - 2 k, r, {1 + 2 k},
             {1}] V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[0, 4 - 2 k,
             s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k - r - s, {4 - 2 k}, {1}]))];

C3G0[1] = Factor[Sum_k=0^1 (Sum_r=0^4-k Sum_s=0^4-k-r Multinomial[r, s, 4 - k - r - s] EC[1 + 2 k, 2 + 2 k, 1]
          EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1] (V[0, 1 + 2 k, r,
              {2 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, s, {1 + 2 k, 1 + 2 k, 3 - 2 k}, {1, 1, 1}]
            V[0, 1 + 2 k, 4 - k - r - s, {2 + 2 k}, {1}] V[0, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))];

C3G0[2] = Factor[1/2 * Sum_k=0^1 (Sum_r=0^4-k Sum_s=0^3+k Binomial[4 - k, r] Binomial[3 + k, s]
           EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
           ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
             V[0, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}]
             V[0, 3 - 2 k, s, {2 + 2 k}, {1}] V[0, 3 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C3G0[3] = Factor[1/2 * Sum_k=0^1 (Sum_r=0^4-k Sum_s=0^3+k Binomial[4 - k, r] Binomial[3 + k, s]
           EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
           ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
             V[0, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}]
             V[0, 3 - 2 k, s, {2 + 2 k}, {1}] V[0, 4 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C3G0[4] = Factor[1/2 * Sum_k=0^1 (Sum_r=0^4-k Sum_s=0^4-k-r Multinomial[r, s, 4 - k - r - s]
           EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
           ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
             V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 1 + 2 k}, {1, 1, 1}]
             V[0, 1 + 2 k, s, {3 - 2 k}, {1}] V[0, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];
```

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C3G0[5] = Factor[Sum[k, {k, 0, 1}] (Sum[Sum[Multinomial[r, s, 4 - k - r - s], {s, 0, 4 - k - r}], {r, 0, 4 - k}]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
      V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 2 + 2 k}, {1, 1, 1}]
      V[0, 1 + 2 k, s, {3 - 2 k}, {1}] V[0, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C3G0[6] = Factor[1/2 * Sum[k, {k, 0, 1}] (Sum[Sum[Multinomial[r, s, 4 - k - r - s], {s, 0, 4 - k - r}], {r, 0, 4 - k}]
     EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
     ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
       V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1}]
       V[0, 2 + 2 k, s, {3 - 2 k}, {1}] V[0, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C3G0[7] = Factor[Sum[k, {k, 0, 1}] (Sum[Sum[Binomial[4 - k, r] Binomial[3 + k, s], {s, 0, 3 + k}], {r, 0, 4 - k}]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
      V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k, 4 - 2 k}, {1, 1, 1}]
      V[0, 4 - 2 k, s, {3 - 2 k}, {1}] V[0, 1 + 2 k, 4 - k - r, {3 - 2 k}, {1}]))];

C3G0[8] = Factor[Sum[k, {k, 0, 1}] (Sum[Sum[Binomial[4 - k, r] Binomial[3 + k, s], {s, 0, 3 + k}], {r, 0, 4 - k}]
    EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
      V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k, 4 - 2 k}, {1, 1, 1}]
      V[0, 4 - 2 k, s, {3 - 2 k}, {1}] V[0, 2 + 2 k, 4 - k - r, {3 - 2 k}, {1}]))];

C3G0[9] = Factor[1/2 * Sum[k, {k, 0, 1}] (Sum[Sum[Multinomial[r, s, 3 + k - r - s], {s, 0, 3 + k - r}], {r, 0, 3 + k}]
     EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
     ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}]
       V[0, 3 - 2 k, 3 + k - r - s, {1 + 2 k, 4 - 2 k, 4 - 2 k}, {1, 1, 1}]
       V[0, 4 - 2 k, s, {3 - 2 k}, {1}] V[0, 4 - 2 k, r, {3 - 2 k}, {1}]))];

C4G0[1] = Factor[Sum[k, {k, 0, 1}] (Sum[Sum[Multinomial[r, s, 4 - k - r - s], {s, 0, 4 - k - r}], {r, 0, 4 - k}]
    EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
      V[0, 2 + 2 k, s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r - s,
       {2 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]))];

C4G0[2] = Factor[Sum[k, {k, 0, 1}] (Sum[Sum[Multinomial[r, s, 4 - k - r - s], {s, 0, 4 - k - r}], {r, 0, 4 - k}]
    EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
      V[0, 2 + 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k,
       {2 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C4G0[3] = Factor[Sum[k, {k, 0, 1}] (Sum[Sum[Multinomial[r, s, 4 - k - r - s], {s, 0, 4 - k - r}], {r, 0, 4 - k}]
    EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
      V[0, 2 + 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k,
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        {2 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}])) ];

C4G0[4] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
        V[0, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k - s,
         {2 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, s, {3 - 2 k}, {1}])) ];

C4G0[5] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r - s,
         {2 + 2 k, 3 - 2 k}, {1, 1}] V[0, 2 + 2 k, s, {1 + 2 k}, {1}])) ];

C4G0[6] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r,
         {3 - 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, s, {1 + 2 k}, {1}])) ];

C4G0[7] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r,
         {3 - 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, s, {1 + 2 k}, {1}])) ];

C4G0[8] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, 4 - k - r - s,
         {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 1 + 2 k, s, {2 + 2 k}, {1}])) ];

C4G0[9] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, 4 - k - r,
         {3 - 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, s, {2 + 2 k}, {1}])) ];

C4G0[10] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, 4 - k - r,
         {3 - 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, s, {2 + 2 k}, {1}])) ];

C4G0[11] = Factor[ Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
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        V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, s,
         {3 - 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - r, {4 - 2 k}, {1}])];

C4G0[12] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, 3 + k - s, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, s,
         {3 - 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, 4 - k - r, {4 - 2 k}, {1}])];

C4G0[13] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
      EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[0, 3 - 2 k, r, {1 + 2 k, 4 - 2 k}, {1, 1}] V[0, 4 - 2 k, s,
         {3 - 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, 3 + k - r - s, {4 - 2 k}, {1}])];

GW07Half = Factor[A1G0 + ∑_{j=1}^{3} B1G0[j] + ∑_{j=1}^{4} B2G0[j] + ∑_{j=1}^{5} C1G0[j] +
    ∑_{j=1}^{13} C2G0[j] + ∑_{j=1}^{9} C3G0[j] + ∑_{j=1}^{13} C4G0[j]];
GW07 = Simplify[GW07Half + (GW07Half /. y → -y)]
```

Out[59]= -85

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In[60]:= A1G2 = Factor[
    ∑_{k=0}^{1} ∑_{j=1}^{3} EC[1 + 2 k, 3 - 2 k, j] ER[1 + 2 k, 7 - 2 j] (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k,
          3 - 2 k}, {7 - 2 j, j}] V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k}, {j}])];

B1G2[1] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 2]
        EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {2}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
              2 k, 3 - 2 k}, {2, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {1}])) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
              2 k, 3 - 2 k}, {1, 1, 2}] V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {2}])) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
              2 k, 3 - 2 k}, {1, 3, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {1}])))];

B1G2[2] = Factor[1/2 * ∑_{k=0}^{1} ((∑_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 2]
        EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 4 - 2 k, i, {1 + 2 k}, {2}] V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k,
              3 - 2 k}, {2, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}])) +
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        (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k,
                    3 - 2 k}, {1, 1, 2}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {2}]) ) +
        (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k,
                    3 - 2 k}, {1, 3, 1}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]) ))) ];

B1G2[3] = Factor[ 1/2 * ∑_{k=0}^{1} ( (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 2]
      EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {2}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k,
                3 - 2 k}, {2, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]) ) +
        (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k,
                    3 - 2 k}, {1, 1, 2}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {2}]) ) +
        (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k,
                    3 - 2 k}, {1, 3, 1}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]) ))) ];

B2G2[1] = Factor[ ∑_{k=0}^{1} ( (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 2]
      EC[3 - 2 k, 1 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 2}] V[q, 3 - 2 k, 3 + k,
                {1 + 2 k, 1 + 2 k}, {2, 1}] V[1 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]) ) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k,
                {1 + 2 k, 1 + 2 k}, {1, 2}] V[1 - p - q, 1 + 2 k, i, {3 - 2 k}, {2}]) ) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {3, 1}] V[q, 3 - 2 k, 3 + k,
                {1 + 2 k, 1 + 2 k}, {1, 1}] V[1 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]) ))) ];

B2G2[2] = Factor[ ∑_{k=0}^{1} ( (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 2]
      EC[3 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 2}] V[q, 3 - 2 k, 3 + k,
                {1 + 2 k, 2 + 2 k}, {2, 1}] V[1 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]) ) +
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        (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 2] ER[1 + 2 k, 1]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k,
                    {1 + 2 k, 2 + 2 k}, {1, 2}] V[1 - p - q, 2 + 2 k, i, {3 - 2 k}, {2}])) +
        (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 3]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {3, 1}] V[q, 3 - 2 k, 3 + k,
                    {1 + 2 k, 2 + 2 k}, {1, 1}] V[1 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]))))];
B2G2[3] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 2] EC[3 - 2 k, 4 - 2 k, 1]
            ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 2}] V[q, 3 - 2 k,
                    3 + k - i, {1 + 2 k, 4 - 2 k}, {2, 1}] V[1 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}])) +
        (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 2]
            ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
                    3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 2}] V[1 - p - q, 4 - 2 k, i, {3 - 2 k}, {2}])) +
        (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 3]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {3, 1}] V[q, 3 - 2 k, 3 + k - i,
                    {1 + 2 k, 4 - 2 k}, {1, 1}] V[1 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}]))))];
B2G2[4] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 2]
            EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 2}] V[q, 2 + 2 k, i,
                    {1 + 2 k, 3 - 2 k}, {2, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {1}])) +
        (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}] V[q, 2 + 2 k, i,
                    {1 + 2 k, 3 - 2 k}, {1, 2}] V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {2}])) +
        (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {3, 1}] V[q, 2 + 2 k, i,
                    {1 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))))];
C1G2[1] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
            EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
            (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2 + 2 k, r, {1 + 2 k}, {1}] V[q, 2 + 2 k, s, {1 + 2 k}, {1}]
                V[u, 1 + 2 k, 4 - k - r - s, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}]
                V[1 - p - q - u, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]))];
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C1G2[2] = Factor[1/2 * Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[2 + 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2 + 2 k, r, {1 + 2 k}, {1}] V[q, 3 - 2 k, s, {1 + 2 k}, {1}]
        V[u, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1}]
        V[1 - p - q - u, 3 - 2 k, 3 + k - s, {1 + 2 k}, {1}]))];

C1G2[3] = Factor[1/2 * Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[2 + 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2 + 2 k, r, {1 + 2 k}, {1}] V[q, 3 - 2 k, s, {1 + 2 k}, {1}]
        V[u, 1 + 2 k, 4 - k - r, {2 + 2 k, 2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1, 1}]
        V[1 - p - q - u, 4 - 2 k, 3 + k - s, {1 + 2 k}, {1}]))];

C1G2[4] = Factor[1/6 * Sum_{k=0}^{1} (Sum_{r=0}^{3+k} Sum_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
    EC[3 - 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3 - 2 k, r, {1 + 2 k}, {1}] V[q, 3 - 2 k, s, {1 + 2 k}, {1}]
        V[u, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1}]
        V[1 - p - q - u, 3 - 2 k, 3 + k - r - s, {1 + 2 k}, {1}]))];

C1G2[5] = Factor[1/2 * Sum_{k=0}^{1} (Sum_{r=0}^{3+k} Sum_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
    EC[3 - 2 k, 1 + 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[4 - 2 k, 1 + 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3 - 2 k, r, {1 + 2 k}, {1}] V[q, 3 - 2 k, s, {1 + 2 k}, {1}]
        V[u, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1, 1}]
        V[1 - p - q - u, 4 - 2 k, 3 + k - r - s, {1 + 2 k}, {1}]))];

C2G2[1] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
    EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2 + 2 k, s, {1 + 2 k}, {1}]
        V[q, 1 + 2 k, r, {2 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1}] V[u, 2 + 2 k, 4 - k - r - s,
        {1 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q - u, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))];

C2G2[2] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[2 + 2 k, 1 + 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2 + 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, r,
        {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k},
        {1, 1}] V[1 - p - q - u, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C2G2[3] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[2 + 2 k, 1 + 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2 + 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, r,
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                {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k},
                {1, 1}] V[1 - p - q - u, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C2G2[4] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2 + 2 k, r, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - r,
                {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, s, {1 + 2 k, 4 - 2 k},
                {1, 1}] V[1 - p - q - u, 4 - 2 k, 3 + k - s, {3 - 2 k}, {1}]))];

C2G2[5] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[3 - 2 k, 1 + 2 k, 1]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, 3 + k, {1 + 2 k}, {1}] V[q, 1 + 2 k, r,
                {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 2 + 2 k, s, {1 + 2 k, 1 + 2 k},
                {1, 1}] V[1 - p - q - u, 1 + 2 k, 4 - k - r - s, {2 + 2 k}, {1}]))];

C2G2[6] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - r,
                {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 2 + 2 k, r, {1 + 2 k, 3 - 2 k},
                {1, 1}] V[1 - p - q - u, 3 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C2G2[7] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[4 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - r,
                {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 2 + 2 k, r, {1 + 2 k, 4 - 2 k},
                {1, 1}] V[1 - p - q - u, 4 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C2G2[8] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
                4 - k - r, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k - s,
                {1 + 2 k, 1 + 2 k}, {1, 1}] V[1 - p - q - u, 1 + 2 k, r, {3 - 2 k}, {1}]))];

C2G2[9] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
                4 - k - r, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k - s,
                {1 + 2 k, 2 + 2 k}, {1, 1}] V[1 - p - q - u, 2 + 2 k, r, {3 - 2 k}, {1}]))];

C2G2[10] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
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        (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, r, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k,
              {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, s, {1 + 2 k, 4 - 2 k},
              {1, 1}] V[1 - p - q - u, 4 - 2 k, 3 + k - r - s, {3 - 2 k}, {1}]))];

C2G2[11] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
     EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 1 + 2 k, 1]
     ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
           4 - k - r, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k, 3 + k - s,
           {1 + 2 k, 1 + 2 k}, {1, 1}] V[1 - p - q - u, 1 + 2 k, r, {4 - 2 k}, {1}]))];

C2G2[12] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 2 + 2 k, 1]
    ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
          4 - k - r, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k, 3 + k - s,
          {1 + 2 k, 2 + 2 k}, {1, 1}] V[1 - p - q - u, 2 + 2 k, r, {4 - 2 k}, {1}]))];

C2G2[13] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
    EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3 - 2 k, r, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k,
          {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}]
        V[1 - p - q - u, 3 - 2 k, 3 + k - r - s, {4 - 2 k}, {1}]))];

C3G2[1] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
     EC[1 + 2 k, 2 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
     ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
          V[q, 2 + 2 k, s, {1 + 2 k, 1 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 1 + 2 k, 4 - k - r - s,
           {2 + 2 k}, {1}] V[1 - p - q - u, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))];

C3G2[2] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
           V[q, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k,
            s, {2 + 2 k}, {1}] V[1 - p - q - u, 3 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C3G2[3] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
      EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
      ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
           V[q, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k,
            s, {2 + 2 k}, {1}] V[1 - p - q - u, 4 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];
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$$\text{C3G2[4]} = \text{Factor}\left[\frac{1}{2} * \sum_{k=0}^{1} \left(\sum_{r=0}^{4-k} \sum_{s=0}^{4-k-r} \text{Multinomial}[r, s, 4-k-r-s]\right.\right.$$
$$\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[1+2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, r, \{2+2k, 3-2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 3-2k, 3+k, \{1+2k, 1+2k, 1+2k\}, \{1, 1, 1\}]\,\text{V}[u, 1+2k, s,$$
$$\left.\left.\{3-2k\}, \{1\}]\,\text{V}[1-p-q-u, 1+2k, 4-k-r-s, \{3-2k\}, \{1\}]\right)\right)\Big];$$

$$\text{C3G2[5]} = \text{Factor}\left[\sum_{k=0}^{1} \left(\sum_{r=0}^{4-k} \sum_{s=0}^{4-k-r} \text{Multinomial}[r, s, 4-k-r-s]\right.\right.$$
$$\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[2+2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, r, \{2+2k, 3-2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 3-2k, 3+k, \{1+2k, 1+2k, 2+2k\}, \{1, 1, 1\}]\,\text{V}[u, 1+2k, s,$$
$$\left.\left.\{3-2k\}, \{1\}]\,\text{V}[1-p-q-u, 2+2k, 4-k-r-s, \{3-2k\}, \{1\}]\right)\right)\Big];$$

$$\text{C3G2[6]} = \text{Factor}\left[\frac{1}{2} * \sum_{k=0}^{1} \left(\sum_{r=0}^{4-k} \sum_{s=0}^{4-k-r} \text{Multinomial}[r, s, 4-k-r-s]\right.\right.$$
$$\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[2+2k, 3-2k, 1]\,\text{EC}[2+2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, r, \{2+2k, 3-2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 3-2k, 3+k, \{1+2k, 2+2k, 2+2k\}, \{1, 1, 1\}]\,\text{V}[u, 2+2k, s,$$
$$\left.\left.\{3-2k\}, \{1\}]\,\text{V}[1-p-q-u, 2+2k, 4-k-r-s, \{3-2k\}, \{1\}]\right)\right)\Big];$$

$$\text{C3G2[7]} = \text{Factor}\left[\sum_{k=0}^{1} \left(\sum_{r=0}^{4-k} \sum_{s=0}^{3+k} \text{Binomial}[4-k, r]\,\text{Binomial}[3+k, s]\right.\right.$$
$$\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[4-2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, r, \{2+2k, 3-2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 3-2k, 3+k-s, \{1+2k, 1+2k, 4-2k\}, \{1, 1, 1\}]\,\text{V}[u, 4-2k,$$
$$\left.\left.s, \{3-2k\}, \{1\}]\,\text{V}[1-p-q-u, 1+2k, 4-k-r, \{3-2k\}, \{1\}]\right)\right)\Big];$$

$$\text{C3G2[8]} = \text{Factor}\left[\sum_{k=0}^{1} \left(\sum_{r=0}^{4-k} \sum_{s=0}^{3+k} \text{Binomial}[4-k, r]\,\text{Binomial}[3+k, s]\right.\right.$$
$$\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[2+2k, 3-2k, 1]\,\text{EC}[4-2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, r, \{2+2k, 3-2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 3-2k, 3+k-s, \{1+2k, 2+2k, 4-2k\}, \{1, 1, 1\}]\,\text{V}[u, 4-2k,$$
$$\left.\left.s, \{3-2k\}, \{1\}]\,\text{V}[1-p-q-u, 2+2k, 4-k-r, \{3-2k\}, \{1\}]\right)\right)\Big];$$

$$\text{C3G2[9]} = \text{Factor}\left[\frac{1}{2} * \sum_{k=0}^{1} \left(\sum_{r=0}^{3+k} \sum_{s=0}^{3+k-r} \text{Multinomial}[r, s, 3+k-r-s]\right.\right.$$
$$\text{EC}[1+2k, 3-2k, 1]\,\text{EC}[4-2k, 3-2k, 1]\,\text{EC}[4-2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, 4-k, \{2+2k, 3-2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 3-2k, 3+k-r-s, \{1+2k, 4-2k, 4-2k\}, \{1, 1, 1\}]$$
$$\left.\left.\text{V}[u, 4-2k, s, \{3-2k\}, \{1\}]\,\text{V}[1-p-q-u, 4-2k, r, \{3-2k\}, \{1\}]\right)\right)\Big];$$

$$\text{C4G2[1]} = \text{Factor}\left[\sum_{k=0}^{1} \left(\sum_{r=0}^{4-k} \sum_{s=0}^{4-k-r} \text{Multinomial}[r, s, 4-k-r-s]\right.\right.$$
$$\text{EC}[1+2k, 2+2k, 1]\,\text{EC}[2+2k, 1+2k, 1]\,\text{EC}[1+2k, 3-2k, 1]$$
$$\text{ER}[1+2k, 1]\left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \sum_{u=0}^{1-p-q} \text{V}[p, 1+2k, r, \{2+2k, 2+2k\}, \{1, 1\}]\right.$$
$$\text{V}[q, 2+2k, s, \{1+2k, 1+2k\}, \{1, 1\}]\,\text{V}[u, 1+2k, 4-k-r-s,$$

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                {2 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q - u, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]))];

C4G2[2] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[u, 3 - 2 k, 3 + k, {2 + 2 k, 1 + 2 k},
                {1, 1}] V[1 - p - q - u, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C4G2[3] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[u, 3 - 2 k, 3 + k, {2 + 2 k, 2 + 2 k},
                {1, 1}] V[1 - p - q - u, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C4G2[4] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k}, {1, 1}] V[u, 3 - 2 k, 3 + k - s,
                {2 + 2 k, 4 - 2 k}, {1, 1}] V[1 - p - q - u, 4 - 2 k, s, {3 - 2 k}, {1}]))];

C4G2[5] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
              V[q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r - s,
                {2 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q - u, 2 + 2 k, s, {1 + 2 k}, {1}]))];

C4G2[6] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
              V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r,
                {3 - 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q - u, 3 - 2 k, s, {1 + 2 k}, {1}]))];

C4G2[7] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
              V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r,
                {3 - 2 k, 4 - 2 k}, {1, 1}] V[1 - p - q - u, 4 - 2 k, s, {1 + 2 k}, {1}]))];

C4G2[8] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
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        V[q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[u, 2 + 2 k, 4 - k - r - s,
         {1 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q - u, 1 + 2 k, s, {2 + 2 k}, {1}]))];

C4G2[9] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[u, 2 + 2 k, 4 - k - r,
         {3 - 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q - u, 3 - 2 k, s, {2 + 2 k}, {1}]))];

C4G2[10] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
    ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[u, 2 + 2 k, 4 - k - r,
         {3 - 2 k, 4 - 2 k}, {1, 1}] V[1 - p - q - u, 4 - 2 k, s, {2 + 2 k}, {1}]))];

C4G2[11] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k - s,
         {1 + 2 k, 4 - 2 k}, {1, 1}] V[u, 4 - 2 k, s, {3 - 2 k, 1 + 2 k}, {1, 1}]
        V[1 - p - q - u, 1 + 2 k, 4 - k - r, {4 - 2 k}, {1}]))];

C4G2[12] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k - s,
         {1 + 2 k, 4 - 2 k}, {1, 1}] V[u, 4 - 2 k, s, {3 - 2 k, 2 + 2 k}, {1, 1}]
        V[1 - p - q - u, 2 + 2 k, 4 - k - r, {4 - 2 k}, {1}]))];

C4G2[13] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
    ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[q, 3 - 2 k, r, {1 + 2 k, 4 - 2 k}, {1, 1}] V[u, 4 - 2 k, s, {3 - 2 k, 3 - 2 k},
         {1, 1}] V[1 - p - q - u, 3 - 2 k, 3 + k - r - s, {4 - 2 k}, {1}]))];

D1G2[1] = -1/3 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]^3 (V[0, 1 + 2 k, 4 - k,
    {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 2}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {2}]);

D1G2[2] = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 2 + 2 k, 2] ER[1 + 2 k, 1]
   (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {2, 1, 2, 1}]
     V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]);

D2G2[1] = ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1] ER[1 + 2 k, 3] ER[3 - 2 k, 1]
  (V[0, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 3, 1}]
    V[0, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k}, {1, 1}]);
```

$$D2G2[2] = \frac{1}{2} * \sum_{k=0}^{1} EC[1+2k, 3-2k, 1]\, EC[1+2k, 2+2k, 2]\, ER[3-2k, 1]$$
$$(V[0, 1+2k, 4-k, \{2+2k, 2+2k, 3-2k\}, \{2, 2, 1\}]$$
$$V[0, 3-2k, 3+k, \{1+2k, 4-2k\}, \{1, 1\}]);$$

$$D3G2[1] = \frac{1}{2} * \sum_{k=0}^{1} EC[1+2k, 3-2k, 1]^2\, ER[1+2k, 3]\, (V[0, 1+2k, 4-k,$$
$$\{2+2k, 3-2k, 3-2k\}, \{3, 1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k, 1+2k\}, \{1, 1\}]);$$

$$D3G2[2] = \sum_{k=0}^{1} EC[1+2k, 3-2k, 2]\, EC[1+2k, 3-2k, 1]\, ER[1+2k, 1]$$
$$(V[0, 1+2k, 4-k, \{2+2k, 3-2k, 3-2k\}, \{1, 2, 1\}]$$
$$V[0, 3-2k, 3+k, \{1+2k, 1+2k\}, \{2, 1\}]);$$

$$D4G2[1] = \frac{1}{2} * \sum_{k=0}^{1} EC[1+2k, 3-2k, 1]\, EC[1+2k, 4-2k, 1]\, ER[1+2k, 3]$$
$$(V[0, 1+2k, 4-k, \{2+2k, 4-2k, 3-2k\}, \{3, 1, 1\}]$$
$$V[0, 3-2k, 3+k, \{1+2k, 2+2k\}, \{1, 1\}]);$$

$$D4G2[2] = \sum_{k=0}^{1} EC[1+2k, 3-2k, 2]\, EC[1+2k, 4-2k, 1]\, ER[1+2k, 1]$$
$$(V[0, 1+2k, 4-k, \{2+2k, 4-2k, 3-2k\}, \{1, 1, 2\}]$$
$$V[0, 3-2k, 3+k, \{1+2k, 2+2k\}, \{2, 1\}]);$$

$$E1G2[1] = -\frac{1}{3} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[2+2k, 1+2k, 1]\, EC[1+2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 2+2k, i, \{1+2k\}, \{1\}]\, V[0, 1+2k, 4-k-i, \{2+2k, 2+2k,$$
$$2+2k, 2+2k, 3-2k\}, \{1, 1, 1, 1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k\}, \{1\}]);$$

$$E1G2[2] = -\frac{1}{6} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[3-2k, 1+2k, 1]\, EC[1+2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 3-2k, i, \{1+2k\}, \{1\}]\, V[0, 1+2k, 4-k, \{2+2k, 2+2k,$$
$$2+2k, 3-2k, 3-2k\}, \{1, 1, 1, 1, 1\}]\, V[0, 3-2k, 3+k-i, \{1+2k\}, \{1\}]);$$

$$E1G2[3] = -\frac{1}{6} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[4-2k, 1+2k, 1]\, EC[1+2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 4-2k, i, \{1+2k\}, \{1\}]\, V[0, 1+2k, 4-k, \{2+2k, 2+2k,$$
$$2+2k, 4-2k, 3-2k\}, \{1, 1, 1, 1, 1\}]\, V[0, 3-2k, 3+k-i, \{1+2k\}, \{1\}]);$$

$$E2G2[1] = -\frac{1}{3} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[1+2k, 2+2k, 1]\, EC[2+2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 1+2k, 4-k-i, \{2+2k, 2+2k, 2+2k, 2+2k\}, \{1, 1, 1, 1\}]$$
$$V[0, 2+2k, i, \{1+2k, 3-2k\}, \{1, 1\}]\, V[0, 3-2k, 3+k, \{2+2k\}, \{1\}]);$$

$$E2G2[2] = -\frac{1}{3} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[1+2k, 3-2k, 1]\, EC[1+2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 1+2k, 4-k-i, \{2+2k, 2+2k, 2+2k, 3-2k\}, \{1, 1, 1, 1\}]$$
$$V[0, 3-2k, 3+k, \{1+2k, 1+2k\}, \{1, 1\}]\, V[0, 1+2k, i, \{3-2k\}, \{1\}]);$$

$$E2G2[3] = -\frac{1}{3} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[1+2k, 3-2k, 1]\, EC[2+2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 1+2k, 4-k-i, \{2+2k, 2+2k, 2+2k, 3-2k\}, \{1, 1, 1, 1\}]$$
$$V[0, 3-2k, 3+k, \{1+2k, 2+2k\}, \{1, 1\}]\, V[0, 2+2k, i, \{3-2k\}, \{1\}]);$$

$$E2G2[4] = -\frac{1}{3} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[1+2k, 3-2k, 1]\, EC[4-2k, 3-2k, 1]$$
$$ER[1+2k, 1]^3\, (V[0, 1+2k, 4-k, \{2+2k, 2+2k, 2+2k, 3-2k\}, \{1, 1, 1, 1\}]$$
$$V[0, 3-2k, 3+k-i, \{1+2k, 4-2k\}, \{1, 1\}]\, V[0, 4-2k, i, \{3-2k\}, \{1\}]);$$

```
E3G2[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (V[0, 2 + 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 4 - 2 k, 2 + 2 k, 3 - 2 k},
       {1, 1, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);
E3G2[2] = Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1]
  EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
  (V[0, 3 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k, {3 - 2 k, 4 - 2 k, 2 + 2 k, 3 - 2 k},
     {1, 1, 1, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k, 2 + 2 k}, {1, 1}]);
E4G2[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[3 - 2 k, 1]
    (V[0, 2 + 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 4 - 2 k, 3 - 2 k},
       {1, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k, 2 + 2 k}, {1, 1, 1}]);
E4G2[2] = Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1]
  EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[3 - 2 k, 1]
  (V[0, 3 - 2 k, i, {1 + 2 k}, {1}] V[0, 1 + 2 k, 4 - k, {3 - 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1}]
    V[0, 3 - 2 k, 3 + k - i, {1 + 2 k, 4 - 2 k, 2 + 2 k}, {1, 1, 1}]);
E5G2[1] = Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1]
  EC[1 + 2 k, 3 - 2 k, 1] ER[2 + 2 k, 1] ER[1 + 2 k, 1] ER[3 - 2 k, 1]
  (V[0, 2 + 2 k, i, {1 + 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - i,
     {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k}, {1, 1}]);
E5G2[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] ER[4 - 2 k, 1] ER[1 + 2 k, 1] ER[3 - 2 k, 1]
    (V[0, 4 - 2 k, i, {3 - 2 k, 1 + 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k, 3 - 2 k},
       {1, 1, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}]);
E5G2[3] = Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]^2
  ER[1 + 2 k, 1] (V[0, 2 + 2 k, i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k - i,
     {2 + 2 k, 2 + 2 k, 4 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 3 + k, {2 + 2 k, 2 + 2 k}, {1, 1}]);
E6G2[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1]
    EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}] V[0, 2 + 2 k, i, {1 + 2 k, 3 - 2 k,
       4 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);
E6G2[2] = Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1]
  EC[2 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
  (V[0, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[0, 1 + 2 k, i, {3 - 2 k, 4 - 2 k},
     {1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 2 + 2 k}, {1, 1, 1}]);
E7G2[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1]^2
    ER[1 + 2 k, 1] (V[0, 2 + 2 k, 4 - k - i, {1 + 2 k, 1 + 2 k}, {1, 1}]
      V[0, 1 + 2 k, i, {3 - 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1, 1}]
      V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]);
```

$$E7G2[2] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[1+2k, 2+2k, 1]\, EC[1+2k, 3-2k, 1]^2$$
$$ER[1+2k, 1]\, (V[0, 2+2k, 4-k-i, \{1+2k\}, \{1\}]\, V[0, 1+2k, i, \{3-2k, 3-2k, 2+2k, 2+2k\}, \{1, 1, 1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k, 1+2k\}, \{1, 1\}]);$$

$$E7G2[3] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[1+2k, 3-2k, 1]\, EC[1+2k, 3-2k, 1]^2$$
$$ER[1+2k, 1]\, (V[0, 3-2k, 3+k-i, \{1+2k\}, \{1\}]$$
$$V[0, 1+2k, 4-k, \{3-2k, 3-2k, 3-2k, 2+2k\}, \{1, 1, 1, 1\}]$$
$$V[0, 3-2k, i, \{1+2k, 1+2k\}, \{1, 1\}]);$$

$$E7G2[4] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[1+2k, 4-2k, 1]$$
$$EC[1+2k, 3-2k, 1]^2\, ER[1+2k, 1]\, (V[0, 4-2k, 3+k-i, \{1+2k\}, \{1\}]$$
$$V[0, 1+2k, 4-k, \{4-2k, 3-2k, 3-2k, 2+2k\}, \{1, 1, 1, 1\}]$$
$$V[0, 3-2k, i, \{1+2k, 1+2k\}, \{1, 1\}]);$$

$$E8G2[1] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[2+2k, 3-2k, 1]\, EC[1+2k, 2+2k, 1]^2$$
$$ER[1+2k, 1]\, (V[0, 2+2k, 4-k-i, \{1+2k, 1+2k, 3-2k\}, \{1, 1, 1\}]\, V[0, 1+2k, i, \{2+2k, 2+2k, 2+2k\}, \{1, 1, 1\}]\, V[0, 3-2k, 3+k, \{2+2k\}, \{1\}]);$$

$$E8G2[2] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[1+2k, 3-2k, 1]\, EC[1+2k, 3-2k, 1]^2$$
$$ER[1+2k, 1]\, (V[0, 1+2k, 4-k-i, \{3-2k\}, \{1\}]\, V[0, 1+2k, i, \{3-2k, 3-2k, 2+2k\}, \{1, 1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k, 1+2k, 1+2k\}, \{1, 1, 1\}]);$$

$$E8G2[3] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[2+2k, 3-2k, 1]\, EC[1+2k, 3-2k, 1]^2$$
$$ER[1+2k, 1]\, (V[0, 2+2k, 4-k-i, \{3-2k\}, \{1\}]\, V[0, 1+2k, i, \{3-2k, 3-2k, 2+2k\}, \{1, 1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k, 1+2k, 2+2k\}, \{1, 1, 1\}]);$$

$$E8G2[4] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[3-2k, 4-2k, 1]$$
$$EC[1+2k, 3-2k, 1]^2\, ER[1+2k, 1]$$
$$(V[0, 4-2k, 3+k-i, \{3-2k\}, \{1\}]\, V[0, 1+2k, 4-k, \{3-2k, 3-2k, 2+2k\}, \{1, 1, 1\}]\, V[0, 3-2k, i, \{4-2k, 1+2k, 1+2k\}, \{1, 1, 1\}]);$$

$$E9G2[1] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[2+2k, 3-2k, 1]^2\, EC[1+2k, 2+2k, 1]$$
$$ER[1+2k, 1]\, (V[0, 2+2k, 4-k-i, \{1+2k, 3-2k, 3-2k\}, \{1, 1, 1\}]\, V[0, 1+2k, i, \{2+2k, 2+2k\}, \{1, 1\}]\, V[0, 3-2k, 3+k, \{2+2k, 2+2k\}, \{1, 1\}]);$$

$$E9G2[2] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[1+2k, 3-2k, 1]^2$$
$$EC[1+2k, 3-2k, 1]\, ER[1+2k, 1]$$
$$(V[0, 1+2k, 4-k-i, \{3-2k, 3-2k\}, \{1, 1\}]\, V[0, 1+2k, i, \{2+2k, 3-2k\}, \{1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k, 1+2k, 1+2k\}, \{1, 1, 1\}]);$$

$$E9G2[3] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{4-k} Binomial[4-k, i]\, EC[2+2k, 3-2k, 1]^2$$
$$EC[1+2k, 3-2k, 1]\, ER[1+2k, 1]$$
$$(V[0, 2+2k, 4-k-i, \{3-2k, 3-2k\}, \{1, 1\}]\, V[0, 1+2k, i, \{2+2k, 3-2k\}, \{1, 1\}]\, V[0, 3-2k, 3+k, \{1+2k, 2+2k, 2+2k\}, \{1, 1, 1\}]);$$

$$E9G2[4] = \frac{1}{2} * \sum_{k=0}^{1} \sum_{i=0}^{3+k} Binomial[3+k, i]\, EC[4-2k, 3-2k, 1]^2\, EC[1+2k, 3-2k, 1]$$

```
        ER[1 + 2 k, 1] (V[0, 4 - 2 k, 3 + k - i, {3 - 2 k, 3 - 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k,
            {2 + 2 k, 3 - 2 k}, {1, 1}] V[0, 3 - 2 k, i, {1 + 2 k, 4 - 2 k, 4 - 2 k}, {1, 1, 1}]);
E10G2[1] = Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1]
      EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
      (V[0, 2 + 2 k, 4 - k - i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 1 + 2 k, i,
          {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);
E10G2[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1]
       EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
       (V[0, 4 - 2 k, i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[0, 1 + 2 k, 4 - k, {2 + 2 k, 4 - 2 k, 3 - 2 k},
           {1, 1, 1}] V[0, 3 - 2 k, 3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}]);
GW27Half = Factor[A1G2 + Sum_{j=1}^{3} B1G2[j] + Sum_{j=1}^{4} B2G2[j] + Sum_{j=1}^{5} C1G2[j] +
    Sum_{j=1}^{13} C2G2[j] + Sum_{j=1}^{9} C3G2[j] + Sum_{j=1}^{13} C4G2[j] + Sum_{j=1}^{2} D1G2[j] +
    Sum_{j=1}^{2} D2G2[j] + Sum_{j=1}^{2} D3G2[j] + Sum_{j=1}^{2} D4G2[j] + Sum_{j=1}^{3} E1G2[j] +
    Sum_{j=1}^{4} E2G2[j] + Sum_{j=1}^{2} E3G2[j] + Sum_{j=1}^{2} E4G2[j] + Sum_{j=1}^{3} E5G2[j] + Sum_{j=1}^{2} E6G2[j] +
    Sum_{j=1}^{4} E7G2[j] + Sum_{j=1}^{4} E8G2[j] + Sum_{j=1}^{4} E9G2[j] + Sum_{j=1}^{2} E10G2[j]];
GW27 = Simplify[GW27Half + (GW27Half /. y → -y)]
```

Out[146]= $-\frac{1345}{24}$

```
In[147]:= A1G4 = Factor[
    Sum_{k=0}^{1} Sum_{j=1}^{3} EC[1 + 2 k, 3 - 2 k, j] ER[1 + 2 k, 7 - 2 j] (Sum_{p=0}^{2} V[p, 1 + 2 k, 4 - k, {2 + 2 k,
            3 - 2 k}, {7 - 2 j, j}] V[2 - p, 3 - 2 k, 3 + k, {1 + 2 k}, {j}])];
B1G4[1] = Factor[Sum_{k=0}^{1} ((Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 2]
          EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
          (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2 + 2 k, i, {1 + 2 k}, {2}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
                2 k, 3 - 2 k}, {2, 1, 1}] V[2 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {1}])) +
        (Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
          (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
                2 k, 3 - 2 k}, {1, 1, 2}] V[2 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {2}])) +
        (Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
          (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
                2 k, 3 - 2 k}, {1, 3, 1}] V[2 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {1}])))];
B1G4[2] = Factor[1/2 * Sum_{k=0}^{1} ((Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 2]
          EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
```

```
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 4 - 2 k, i, {1 + 2 k}, {2}] V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k,
              3 - 2 k}, {2, 1, 1}] V[2 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]) +
      (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k,
              3 - 2 k}, {1, 1, 2}] V[2 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {2}]) +
      (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k,
              3 - 2 k}, {1, 3, 1}] V[2 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]))))];
B1G4[3] = Factor[1/2 * ∑_{k=0}^{1} ((∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 2]
      EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 3 - 2 k, i, {1 + 2 k}, {2}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k,
              3 - 2 k}, {2, 1, 1}] V[2 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]) +
      (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k,
              3 - 2 k}, {1, 1, 2}] V[2 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {2}]) +
      (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 2 + 2 k,
              3 - 2 k}, {1, 3, 1}] V[2 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]))))];
B2G4[1] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 2]
      EC[3 - 2 k, 1 + 2 k, 1] ER[1 + 2 k, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 2}] V[q, 3 - 2 k, 3 + k,
              {1 + 2 k, 1 + 2 k}, {2, 1}] V[2 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k,
              {1 + 2 k, 1 + 2 k}, {1, 2}] V[2 - p - q, 1 + 2 k, i, {3 - 2 k}, {2}]) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {3, 1}] V[q, 3 - 2 k, 3 + k,
              {1 + 2 k, 1 + 2 k}, {1, 1}] V[2 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]))))];
B2G4[2] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 2]
      EC[3 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
```

```
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 2}] V[q, 3 - 2 k, 3 + k,
              {1 + 2 k, 2 + 2 k}, {2, 1}] V[2 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k,
              {1 + 2 k, 2 + 2 k}, {1, 2}] V[2 - p - q, 2 + 2 k, i, {3 - 2 k}, {2}]) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {3, 1}] V[q, 3 - 2 k, 3 + k,
              {1 + 2 k, 2 + 2 k}, {1, 1}] V[2 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]))];
B2G4[3] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 2] EC[3 - 2 k, 4 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 2}] V[q, 3 - 2 k,
              3 + k - i, {1 + 2 k, 4 - 2 k}, {2, 1}] V[2 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}]) +
      (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 2]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k,
              3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 2}] V[2 - p - q, 4 - 2 k, i, {3 - 2 k}, {2}]) +
      (∑_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {3, 1}] V[q, 3 - 2 k, 3 + k - i,
              {1 + 2 k, 4 - 2 k}, {1, 1}] V[2 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}]))];
B2G4[4] = Factor[∑_{k=0}^{1} ((∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 2]
        EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 2}] V[q, 2 + 2 k, i,
              {1 + 2 k, 3 - 2 k}, {2, 1}] V[2 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}] V[q, 2 + 2 k, i,
              {1 + 2 k, 3 - 2 k}, {1, 2}] V[2 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {2}]) +
      (∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 3]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {3, 1}] V[q, 2 + 2 k, i,
              {1 + 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))];
C1G4[1] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
```

```
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2+2k, r, {1+2k}, {1}] V[q, 2+2k, s, {1+2k}, {1}]
            V[u, 1+2k, 4-k-r-s, {2+2k, 2+2k, 2+2k, 3-2k}, {1, 1, 1, 1}]
            V[2-p-q-u, 3-2k, 3+k, {1+2k}, {1}]))];

C1G4[2] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4-k, r] Binomial[3+k, s]
    EC[2+2k, 1+2k, 1] EC[3-2k, 1+2k, 1] EC[1+2k, 3-2k, 1] ER[1+2k, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2+2k, r, {1+2k}, {1}] V[q, 3-2k, s, {1+2k}, {1}]
        V[u, 1+2k, 4-k-r, {2+2k, 2+2k, 3-2k, 3-2k}, {1, 1, 1, 1}]
        V[2-p-q-u, 3-2k, 3+k-s, {1+2k}, {1}]))];

C1G4[3] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4-k, r] Binomial[3+k, s]
    EC[2+2k, 1+2k, 1] EC[3-2k, 1+2k, 1] EC[1+2k, 4-2k, 1] ER[1+2k, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2+2k, r, {1+2k}, {1}] V[q, 3-2k, s, {1+2k}, {1}]
        V[u, 1+2k, 4-k-r, {2+2k, 2+2k, 3-2k, 4-2k}, {1, 1, 1, 1}]
        V[2-p-q-u, 4-2k, 3+k-s, {1+2k}, {1}]))];

C1G4[4] = Factor[1/6 * ∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3+k-r-s]
    EC[3-2k, 1+2k, 1] EC[3-2k, 1+2k, 1] EC[3-2k, 1+2k, 1] ER[1+2k, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3-2k, r, {1+2k}, {1}] V[q, 3-2k, s, {1+2k}, {1}]
        V[u, 1+2k, 4-k, {2+2k, 3-2k, 3-2k, 3-2k}, {1, 1, 1, 1}]
        V[2-p-q-u, 3-2k, 3+k-r-s, {1+2k}, {1}]))];

C1G4[5] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3+k-r-s]
    EC[3-2k, 1+2k, 1] EC[3-2k, 1+2k, 1] EC[4-2k, 1+2k, 1] ER[1+2k, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3-2k, r, {1+2k}, {1}] V[q, 3-2k, s, {1+2k}, {1}]
        V[u, 1+2k, 4-k, {2+2k, 3-2k, 3-2k, 4-2k}, {1, 1, 1, 1}]
        V[2-p-q-u, 4-2k, 3+k-r-s, {1+2k}, {1}]))];

C2G4[1] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4-k-r-s]
    EC[2+2k, 1+2k, 1] EC[1+2k, 2+2k, 1] EC[2+2k, 3-2k, 1]
    ER[1+2k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2+2k, s, {1+2k}, {1}]
        V[q, 1+2k, r, {2+2k, 2+2k, 2+2k}, {1, 1, 1}] V[u, 2+2k, 4-k-r-s,
        {1+2k, 3-2k}, {1, 1}] V[2-p-q-u, 3-2k, 3+k, {2+2k}, {1}]))];

C2G4[2] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4-k-r-s] EC[2+2k, 1+2k, 1]
    EC[1+2k, 3-2k, 1] EC[1+2k, 3-2k, 1] ER[1+2k, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2+2k, s, {1+2k}, {1}] V[q, 1+2k, r,
        {2+2k, 2+2k, 3-2k}, {1, 1, 1}] V[u, 3-2k, 3+k, {1+2k, 1+2k},
        {1, 1}] V[2-p-q-u, 1+2k, 4-k-r-s, {3-2k}, {1}]))];
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C2G4[3] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[2 + 2 k, 1 + 2 k, 1]
        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2 + 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, r,
              {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k},
              {1, 1}] V[2 - p - q - u, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C2G4[4] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2 + 2 k, r, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - r,
              {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, s, {1 + 2 k, 4 - 2 k},
              {1, 1}] V[2 - p - q - u, 4 - 2 k, 3 + k - s, {3 - 2 k}, {1}]))];

C2G4[5] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s] EC[3 - 2 k, 1 + 2 k, 1]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, 3 + k, {1 + 2 k}, {1}] V[q, 1 + 2 k, r,
              {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 2 + 2 k, s, {1 + 2 k, 1 + 2 k},
              {1, 1}] V[2 - p - q - u, 1 + 2 k, 4 - k - r - s, {2 + 2 k}, {1}]))];

C2G4[6] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - r,
              {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 2 + 2 k, r, {1 + 2 k, 3 - 2 k},
              {1, 1}] V[2 - p - q - u, 3 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C2G4[7] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[4 - 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k - r,
              {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 2 + 2 k, r, {1 + 2 k, 4 - 2 k},
              {1, 1}] V[2 - p - q - u, 4 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C2G4[8] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
              4 - k - r, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k - s,
              {1 + 2 k, 1 + 2 k}, {1, 1}] V[2 - p - q - u, 1 + 2 k, r, {3 - 2 k}, {1}]))];

C2G4[9] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 2 + 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
              4 - k - r, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, 3 + k - s,
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                {1 + 2 k, 2 + 2 k}, {1, 1}] V[2 - p - q - u, 2 + 2 k, r, {3 - 2 k}, {1}]))];

C2G4[10] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, r, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k,
              {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k, s, {1 + 2 k, 4 - 2 k},
              {1, 1}] V[2 - p - q - u, 4 - 2 k, 3 + k - r - s, {3 - 2 k}, {1}]))];

C2G4[11] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 1 + 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
              4 - k - r, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k, 3 + k - s,
              {1 + 2 k, 1 + 2 k}, {1, 1}] V[2 - p - q - u, 1 + 2 k, r, {4 - 2 k}, {1}]))];

C2G4[12] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
       EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[4 - 2 k, 2 + 2 k, 1]
       ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, s, {1 + 2 k}, {1}] V[q, 1 + 2 k,
             4 - k - r, {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k, 3 + k - s,
             {1 + 2 k, 2 + 2 k}, {1, 1}] V[2 - p - q - u, 2 + 2 k, r, {4 - 2 k}, {1}]))];

C2G4[13] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
       EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
       (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3 - 2 k, r, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k,
             {2 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}]
            V[2 - p - q - u, 3 - 2 k, 3 + k - r - s, {4 - 2 k}, {1}]))];

C3G4[1] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
             V[q, 2 + 2 k, s, {1 + 2 k, 1 + 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 1 + 2 k, 4 - k - r - s,
              {2 + 2 k}, {1}] V[2 - p - q - u, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]))];

C3G4[2] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
          ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
               V[q, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k,
                s, {2 + 2 k}, {1}] V[2 - p - q - u, 3 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C3G4[3] = Factor[1/2 * ∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
          EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
          ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
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        V[q, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 3 - 2 k,
         s, {2 + 2 k}, {1}] V[2 - p - q - u, 4 - 2 k, 3 + k - s, {2 + 2 k}, {1}]))];

C3G4[4] = Factor[1/2 * Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 1 + 2 k}, {1, 1, 1}] V[u, 1 + 2 k, s,
         {3 - 2 k}, {1}] V[2 - p - q - u, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C3G4[5] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
   EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
       V[q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 2 + 2 k}, {1, 1, 1}] V[u, 1 + 2 k, s,
        {3 - 2 k}, {1}] V[2 - p - q - u, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C3G4[6] = Factor[1/2 * Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1}] V[u, 2 + 2 k, s,
         {3 - 2 k}, {1}] V[2 - p - q - u, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];

C3G4[7] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
   EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
       V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k,
        s, {3 - 2 k}, {1}] V[2 - p - q - u, 1 + 2 k, 4 - k - r, {3 - 2 k}, {1}]))];

C3G4[8] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
   EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
   ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
       V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k, 4 - 2 k}, {1, 1, 1}] V[u, 4 - 2 k,
        s, {3 - 2 k}, {1}] V[2 - p - q - u, 2 + 2 k, 4 - k - r, {3 - 2 k}, {1}]))];

C3G4[9] = Factor[1/2 * Sum_{k=0}^{1} (Sum_{r=0}^{3+k} Sum_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
    EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}]
        V[q, 3 - 2 k, 3 + k - r - s, {1 + 2 k, 4 - 2 k, 4 - 2 k}, {1, 1, 1}]
        V[u, 4 - 2 k, s, {3 - 2 k}, {1}] V[2 - p - q - u, 4 - 2 k, r, {3 - 2 k}, {1}]))];

C4G4[1] = Factor[Sum_{k=0}^{1} (Sum_{r=0}^{4-k} Sum_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
   EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
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        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r - s,
                {2 + 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q - u, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]))];
C4G4[2] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[u, 3 - 2 k, 3 + k, {2 + 2 k, 1 + 2 k},
                {1, 1}] V[2 - p - q - u, 1 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];
C4G4[3] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, s, {1 + 2 k, 3 - 2 k}, {1, 1}] V[u, 3 - 2 k, 3 + k, {2 + 2 k, 2 + 2 k},
                {1, 1}] V[2 - p - q - u, 2 + 2 k, 4 - k - r - s, {3 - 2 k}, {1}]))];
C4G4[4] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 2 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 2 + 2 k}, {1, 1}]
              V[q, 2 + 2 k, 4 - k - r, {1 + 2 k, 3 - 2 k}, {1, 1}] V[u, 3 - 2 k, 3 + k - s,
                {2 + 2 k, 4 - 2 k}, {1, 1}] V[2 - p - q - u, 4 - 2 k, s, {3 - 2 k}, {1}]))];
C4G4[5] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
              V[q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r - s,
                {2 + 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q - u, 2 + 2 k, s, {1 + 2 k}, {1}]))];
C4G4[6] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
              V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r,
                {3 - 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q - u, 3 - 2 k, s, {1 + 2 k}, {1}]))];
C4G4[7] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
              V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 1 + 2 k}, {1, 1}] V[u, 1 + 2 k, 4 - k - r,
                {3 - 2 k, 4 - 2 k}, {1, 1}] V[2 - p - q - u, 4 - 2 k, s, {1 + 2 k}, {1}]))];
C4G4[8] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{4-k-r} Multinomial[r, s, 4 - k - r - s]
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        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
            V[q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[u, 2 + 2 k, 4 - k - r - s,
              {1 + 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q - u, 1 + 2 k, s, {2 + 2 k}, {1}]))];

C4G4[9] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
            V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[u, 2 + 2 k, 4 - k - r,
              {3 - 2 k, 3 - 2 k}, {1, 1}] V[2 - p - q - u, 3 - 2 k, s, {2 + 2 k}, {1}]))];

C4G4[10] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}]
            V[q, 3 - 2 k, 3 + k - s, {1 + 2 k, 2 + 2 k}, {1, 1}] V[u, 2 + 2 k, 4 - k - r,
              {3 - 2 k, 4 - 2 k}, {1, 1}] V[2 - p - q - u, 4 - 2 k, s, {2 + 2 k}, {1}]))];

C4G4[11] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k - s,
              {1 + 2 k, 4 - 2 k}, {1, 1}] V[u, 4 - 2 k, s, {3 - 2 k, 1 + 2 k}, {1, 1}]
            V[2 - p - q - u, 1 + 2 k, 4 - k - r, {4 - 2 k}, {1}]))];

C4G4[12] = Factor[∑_{k=0}^{1} (∑_{r=0}^{4-k} ∑_{s=0}^{3+k} Binomial[4 - k, r] Binomial[3 + k, s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
        (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, r, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 3 - 2 k, 3 + k - s,
              {1 + 2 k, 4 - 2 k}, {1, 1}] V[u, 4 - 2 k, s, {3 - 2 k, 2 + 2 k}, {1, 1}]
            V[2 - p - q - u, 2 + 2 k, 4 - k - r, {4 - 2 k}, {1}]))];

C4G4[13] = Factor[∑_{k=0}^{1} (∑_{r=0}^{3+k} ∑_{s=0}^{3+k-r} Multinomial[r, s, 3 + k - r - s]
        EC[1 + 2 k, 3 - 2 k, 1] EC[4 - 2 k, 3 - 2 k, 1] EC[3 - 2 k, 4 - 2 k, 1]
        ER[1 + 2 k, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k}, {1, 1}]
            V[q, 3 - 2 k, r, {1 + 2 k, 4 - 2 k}, {1, 1}] V[u, 4 - 2 k, s, {3 - 2 k, 3 - 2 k},
              {1, 1}] V[2 - p - q - u, 3 - 2 k, 3 + k - r - s, {4 - 2 k}, {1}]))];

D1G4[1] = -1/3 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 2] ER[1 + 2 k, 1]^3
    (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 2}]
        V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k}, {2}]);

D1G4[2] = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 2 + 2 k, 2] ER[1 + 2 k, 1]
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      (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {2, 1, 2, 1}]
         V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]);
D2G4[1] = ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1] ER[1 + 2 k, 3] ER[3 - 2 k, 1]
     (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 3, 1}]
        V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k}, {1, 1}]);
D2G4[2] = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 2 + 2 k, 2] ER[3 - 2 k, 1]
      (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 3 - 2 k}, {2, 2, 1}]
         V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k}, {1, 1}]);
D3G4[1] = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1]^2 ER[1 + 2 k, 3]
      (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {3, 1, 1}]
         V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}]);
D3G4[2] = ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 2] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
     (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 2, 1}]
        V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {2, 1}]);
D4G4[1] = 1/2 * ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 3]
      (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 4 - 2 k, 3 - 2 k}, {3, 1, 1}]
         V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);
D4G4[2] = ∑_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 2] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
     (∑_{p=0}^{1} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 2}]
        V[1 - p, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {2, 1}]);
E1G4[1] = -1/3 * ∑_{k=0}^{1} ∑_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1]^3 (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}]
         V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1, 1}]
         V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]);
E1G4[2] = -1/6 * ∑_{k=0}^{1} ∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
      ER[1 + 2 k, 1]^3 (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}]
         V[q, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1, 1}]
         V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]);
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E1G4[3] = -1/6 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    ER[1 + 2 k, 1]^3 (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4 - 2 k, i, {1 + 2 k}, {1}]
      V[q, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1, 1, 1}]
      V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]);

E2G4[1] = -1/3 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1]
    EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^3
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1, 1}] V[q,
        2 + 2 k, i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]);

E2G4[2] = -1/3 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^3
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}] V[q,
        3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}] V[1 - p - q, 1 + 2 k, i, {3 - 2 k}, {1}]);

E2G4[3] = -1/3 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1]
    EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^3
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}] V[q,
        3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}] V[1 - p - q, 2 + 2 k, i, {3 - 2 k}, {1}]);

E2G4[4] = -1/3 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1]
    EC[4 - 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^3
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}] V[q, 3 -
        2 k, 3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}] V[1 - p - q, 4 - 2 k, i, {3 - 2 k}, {1}]);

E3G4[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
    EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}]
      V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 4 - 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1}]
      V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);

E3G4[2] = Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1]
    EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 4 - 2 k, 2 + 2 k,
        3 - 2 k}, {1, 1, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k, 2 + 2 k}, {1, 1}]);

E4G4[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
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EC[1 + 2 k, 4 - 2 k, 1] ER[3 - 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k}, {1}]
    V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1}]
    V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k, 2 + 2 k}, {1, 1, 1}]);

E4G4[2] = ∑_{k=0}^{1} ∑_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 1 + 2 k, 1]
  EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[3 - 2 k, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3 - 2 k, i, {1 + 2 k}, {1}] V[q, 1 + 2 k, 4 - k, {3 - 2 k, 4 - 2 k, 3 - 2 k},
    {1, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k, 4 - 2 k, 2 + 2 k}, {1, 1, 1}]);

E5G4[1] = ∑_{k=0}^{1} ∑_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
  ER[2 + 2 k, 1] ER[1 + 2 k, 1] ER[3 - 2 k, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k, 1 + 2 k}, {1, 1}] V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 +
      2 k, 3 - 2 k}, {1, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k}, {1, 1}]);

E5G4[2] = 1/2 * ∑_{k=0}^{1} ∑_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 1 + 2 k, 1]
   EC[1 + 2 k, 3 - 2 k, 1] ER[4 - 2 k, 1] ER[1 + 2 k, 1] ER[3 - 2 k, 1]
   (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 4 - 2 k, i, {3 - 2 k, 1 + 2 k}, {1, 1}]
     V[q, 1 + 2 k, 4 - k, {4 - 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1}]
     V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}]);

E5G4[3] = ∑_{k=0}^{1} ∑_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 1 + 2 k, 1] EC[2 + 2 k, 3 - 2 k, 1]^2
  ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, i, {1 + 2 k, 3 - 2 k}, {1, 1}]
    V[q, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k, 4 - 2 k}, {1, 1, 1}]
    V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k, 2 + 2 k}, {1, 1}]);

E6G4[1] = 1/2 * ∑_{k=0}^{1} ∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1]
   EC[2 + 2 k, 3 - 2 k, 1] EC[2 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
   (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 2 + 2 k}, {1, 1}]
     V[q, 2 + 2 k, i, {1 + 2 k, 3 - 2 k, 4 - 2 k}, {1, 1, 1}]
     V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);

E6G4[2] = ∑_{k=0}^{1} ∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1]
  EC[2 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {2 + 2 k, 3 - 2 k}, {1, 1}] V[q, 1 + 2 k, i, {3 - 2 k, 4 -
      2 k}, {1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 2 + 2 k}, {1, 1, 1}]);

E7G4[1] = 1/2 * ∑_{k=0}^{1} ∑_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 2 + 2 k, 1]^2
   ER[1 + 2 k, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {1 + 2 k, 1 + 2 k}, {1, 1}]
     V[q, 1 + 2 k, i, {3 - 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1, 1}]
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        V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k}, {1}]);

E7G4[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]^2
      ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {1 + 2 k}, {1}]
        V[q, 1 + 2 k, i, {3 - 2 k, 3 - 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1, 1}]
        V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}]);

E7G4[3] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]^2
      ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3 - 2 k, 3 + k - i, {1 + 2 k}, {1}]
        V[q, 1 + 2 k, 4 - k, {3 - 2 k, 3 - 2 k, 3 - 2 k, 2 + 2 k}, {1, 1, 1, 1}]
        V[1 - p - q, 3 - 2 k, i, {1 + 2 k, 1 + 2 k}, {1, 1}]);

E7G4[4] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 4 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]^2
      ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4 - 2 k, 3 + k - i, {1 + 2 k}, {1}]
        V[q, 1 + 2 k, 4 - k, {4 - 2 k, 3 - 2 k, 3 - 2 k, 2 + 2 k}, {1, 1, 1, 1}]
        V[1 - p - q, 3 - 2 k, i, {1 + 2 k, 1 + 2 k}, {1, 1}]);

E8G4[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 3 - 2 k, 1]
      EC[1 + 2 k, 2 + 2 k, 1]^2 ER[1 + 2 k, 1]
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {1 + 2 k, 1 + 2 k, 3 - 2 k}, {1, 1, 1}] V[q, 1 + 2 k, i,
          {2 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k}, {1}]);

E8G4[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]^2
      ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {3 - 2 k}, {1}]
        V[q, 1 + 2 k, i, {3 - 2 k, 3 - 2 k, 2 + 2 k}, {1, 1, 1}]
        V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 1 + 2 k}, {1, 1, 1}]);

E8G4[3] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]^2
      ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {3 - 2 k}, {1}]
        V[q, 1 + 2 k, i, {3 - 2 k, 3 - 2 k, 2 + 2 k}, {1, 1, 1}]
        V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 2 + 2 k}, {1, 1, 1}]);

E8G4[4] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[3 - 2 k, 4 - 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]^2
      ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4 - 2 k, 3 + k - i, {3 - 2 k}, {1}]
        V[q, 1 + 2 k, 4 - k, {3 - 2 k, 3 - 2 k, 2 + 2 k}, {1, 1, 1}]
        V[1 - p - q, 3 - 2 k, i, {4 - 2 k, 1 + 2 k, 1 + 2 k}, {1, 1, 1}]);

E9G4[1] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 3 - 2 k, 1]^2
```
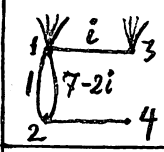
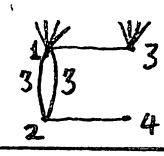
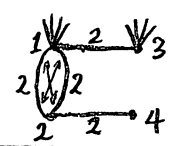
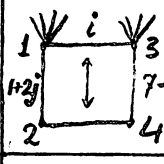
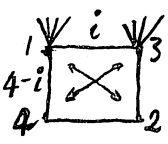
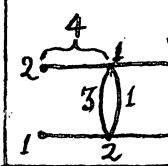
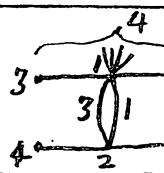
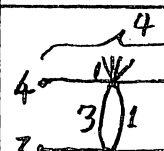
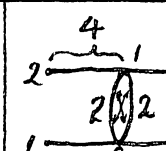
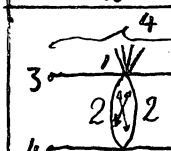
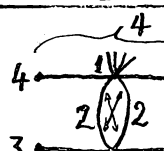
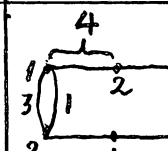
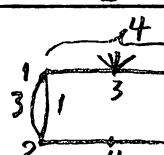
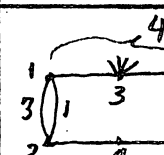
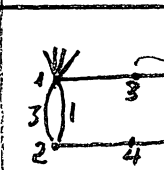
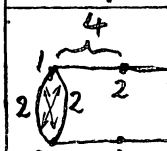
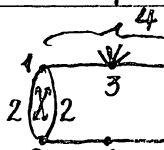
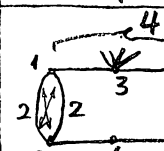
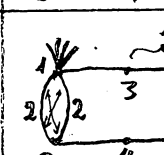
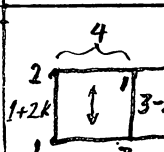
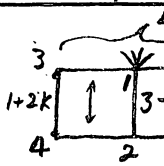
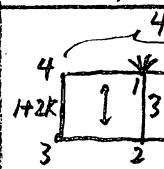
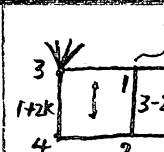
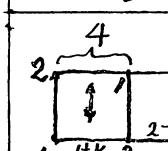
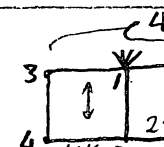
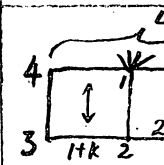
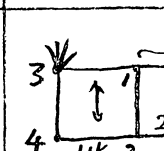
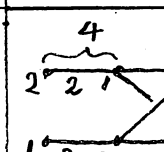
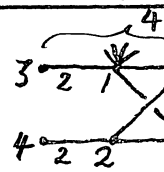
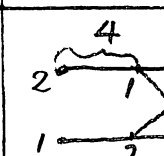
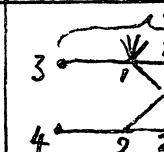
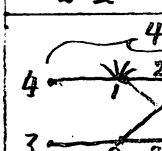
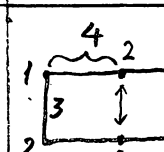
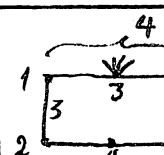
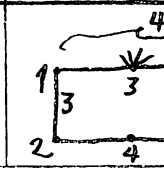
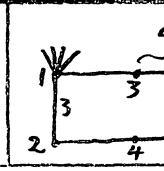
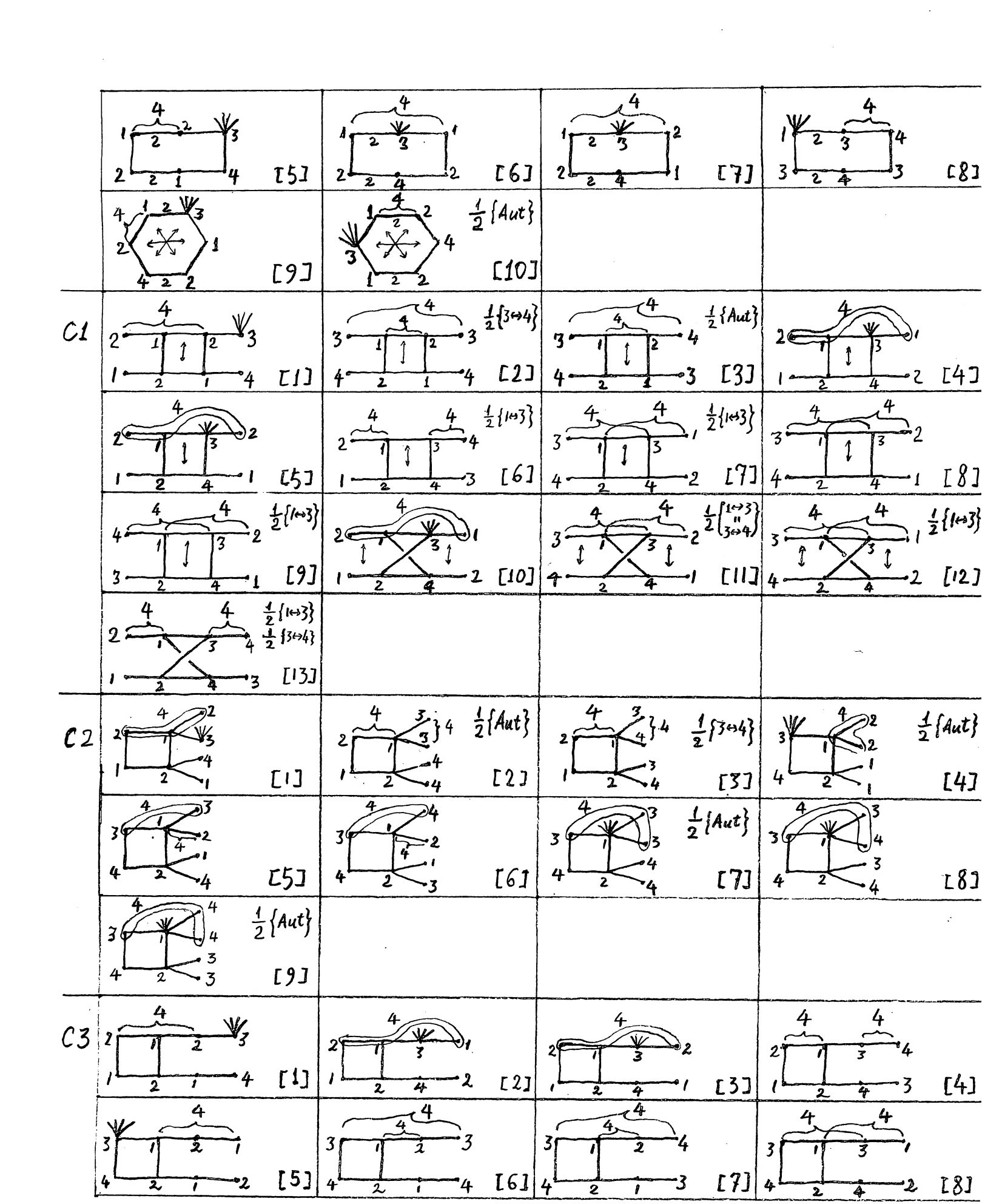

```
EC[1 + 2 k, 2 + 2 k, 1] ER[1 + 2 k, 1]
 (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {1 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1}] V[q, 1 + 2 k, i,
      {2 + 2 k, 2 + 2 k}, {1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {2 + 2 k, 2 + 2 k}, {1, 1}]);

E9G4[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 3 - 2 k, 1]^2 EC[1 + 2 k, 3 - 2 k, 1]
 ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1 + 2 k, 4 - k - i, {3 - 2 k, 3 - 2 k}, {1, 1}]
   V[q, 1 + 2 k, i, {2 + 2 k, 3 - 2 k}, {1, 1}]
   V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 1 + 2 k}, {1, 1, 1}]);

E9G4[3] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[2 + 2 k, 3 - 2 k, 1]^2 EC[1 + 2 k, 3 - 2 k, 1]
 ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {3 - 2 k, 3 - 2 k}, {1, 1}]
   V[q, 1 + 2 k, i, {2 + 2 k, 3 - 2 k}, {1, 1}]
   V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k, 2 + 2 k}, {1, 1, 1}]);

E9G4[4] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[4 - 2 k, 3 - 2 k, 1]^2
 EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
 (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4 - 2 k, 3 + k - i, {3 - 2 k, 3 - 2 k}, {1, 1}] V[q, 1 + 2 k, 4 - k, {2 + 2 k,
      3 - 2 k}, {1, 1}] V[1 - p - q, 3 - 2 k, i, {1 + 2 k, 4 - 2 k, 4 - 2 k}, {1, 1, 1}]);

E10G4[1] = Sum_{k=0}^{1} Sum_{i=0}^{4-k} Binomial[4 - k, i] EC[1 + 2 k, 2 + 2 k, 1] EC[1 + 2 k, 3 - 2 k, 1]
   EC[2 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]
 (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2 + 2 k, 4 - k - i, {1 + 2 k, 3 - 2 k}, {1, 1}] V[q, 1 + 2 k, i, {2 + 2 k, 2 +
      2 k, 3 - 2 k}, {1, 1, 1}] V[1 - p - q, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}]);

E10G4[2] = 1/2 * Sum_{k=0}^{1} Sum_{i=0}^{3+k} Binomial[3 + k, i] EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1]
   EC[4 - 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4 - 2 k, i, {1 + 2 k, 3 - 2 k},
      {1, 1}] V[q, 1 + 2 k, 4 - k, {2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1}]
   V[1 - p - q, 3 - 2 k, 3 + k - i, {1 + 2 k, 4 - 2 k}, {1, 1}]);

F1G4 = 1/20 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^5 V[0, 1 + 2 k, 4 - k,
   {2 + 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k},
   {1, 1, 1, 1, 1, 1}] V[0, 3 - 2 k, 3 + k, {1 + 2 k}, {1}];

F2G4 = -1/12 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] ER[1 + 2 k, 1]^4 ER[3 - 2 k, 1]
   V[0, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k}, {1, 1, 1, 1, 1}]
   V[0, 3 - 2 k, 3 + k, {1 + 2 k, 4 - 2 k}, {1, 1}];

F3G4 = -1/6 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1]^2 ER[1 + 2 k, 1]^3
   V[0, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1, 1}]
   V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k}, {1, 1}];
```

```
F4G4 = 1/6 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1]^3 ER[1 + 2 k, 1]
       V[0, 1 + 2 k, 4 - k, {2 + 2 k, 3 - 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1}]
       V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 1 + 2 k}, {1, 1, 1}];
F5G4 = -1/6 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1] EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]^3
       V[0, 1 + 2 k, 4 - k, {2 + 2 k, 2 + 2 k, 2 + 2 k, 4 - 2 k, 3 - 2 k}, {1, 1, 1, 1, 1}]
       V[0, 3 - 2 k, 3 + k, {1 + 2 k, 2 + 2 k}, {1, 1}];
F6G4 = 1/2 * Sum_{k=0}^{1} EC[1 + 2 k, 3 - 2 k, 1]^2 EC[1 + 2 k, 4 - 2 k, 1] ER[1 + 2 k, 1]
       V[0, 1 + 2 k, 4 - k, {2 + 2 k, 4 - 2 k, 3 - 2 k, 3 - 2 k}, {1, 1, 1, 1}]
       V[0, 3 - 2 k, 3 + k, {1 + 2 k, 1 + 2 k, 2 + 2 k}, {1, 1, 1}];
GW47Half = Factor[A1G4 + Sum_{j=1}^{3} B1G4[j] + Sum_{j=1}^{4} B2G4[j] + Sum_{j=1}^{5} C1G4[j] +
     Sum_{j=1}^{13} C2G4[j] + Sum_{j=1}^{9} C3G4[j] + Sum_{j=1}^{13} C4G4[j] + Sum_{j=1}^{2} D1G4[j] + Sum_{j=1}^{2} D2G4[j] +
     Sum_{j=1}^{2} D3G4[j] + Sum_{j=1}^{2} D4G4[j] + Sum_{j=1}^{3} E1G4[j] + Sum_{j=1}^{4} E2G4[j] + Sum_{j=1}^{2} E3G4[j] +
     Sum_{j=1}^{2} E4G4[j] + Sum_{j=1}^{3} E5G4[j] + Sum_{j=1}^{2} E6G4[j] + Sum_{j=1}^{4} E7G4[j] + Sum_{j=1}^{4} E8G4[j] +
     Sum_{j=1}^{4} E9G4[j] + Sum_{j=1}^{2} E10G4[j] + F1G4 + F2G4 + F3G4 + F4G4 + F5G4 + F6G4];
GW47 = Simplify[GW47Half + (GW47Half /. y → -y)]
```

Out[239]= $-\frac{2475}{128}$

Degree 8

A1	 $1 \le i \le 2$ [1]	 -1 {1} [2]	 $\frac{1}{2}$ {Aut} [3]	
A2	 $\frac{1}{2}\{1\leftrightarrow 3\}$ $1 \le i \le 3$ $0 \le j \le 3-i$ [1]	 $\frac{1}{2}\{1\leftrightarrow 3\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$ $1 \le i \le 3$ [2]		
B1	 [1]	 $\frac{1}{2}$ {Aut} [2]	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [3]	 $\frac{1}{2}$ {Aut} [4]
	 $\frac{1}{4}$ {Aut} [5]	 $\frac{1}{2}$ {Aut} $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$ [6]		
B2	 [1]	 [2]	 [3]	 [4]
	 $\frac{1}{2}$ {Aut} [5]	 $\frac{1}{2}$ {Aut} [6]	 $\frac{1}{2}$ {Aut} [7]	 $\frac{1}{2}$ {Aut} [8]
B3	 $0 \le K \le 1$ [1]	 $0 \le K \le 1$ [2]	 $0 \le K \le 1$ [3]	 $0 \le K \le 1$ [4]
	 $0 \le K \le 1$ [5]	 $0 \le K \le 1$ [6]	 $0 \le K \le 1$ [7]	 $0 \le K \le 1$ [8]
B4	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]	 [3]	 [4]
	 [5]			
B5	 [1]	 [2]	 [3]	 [4]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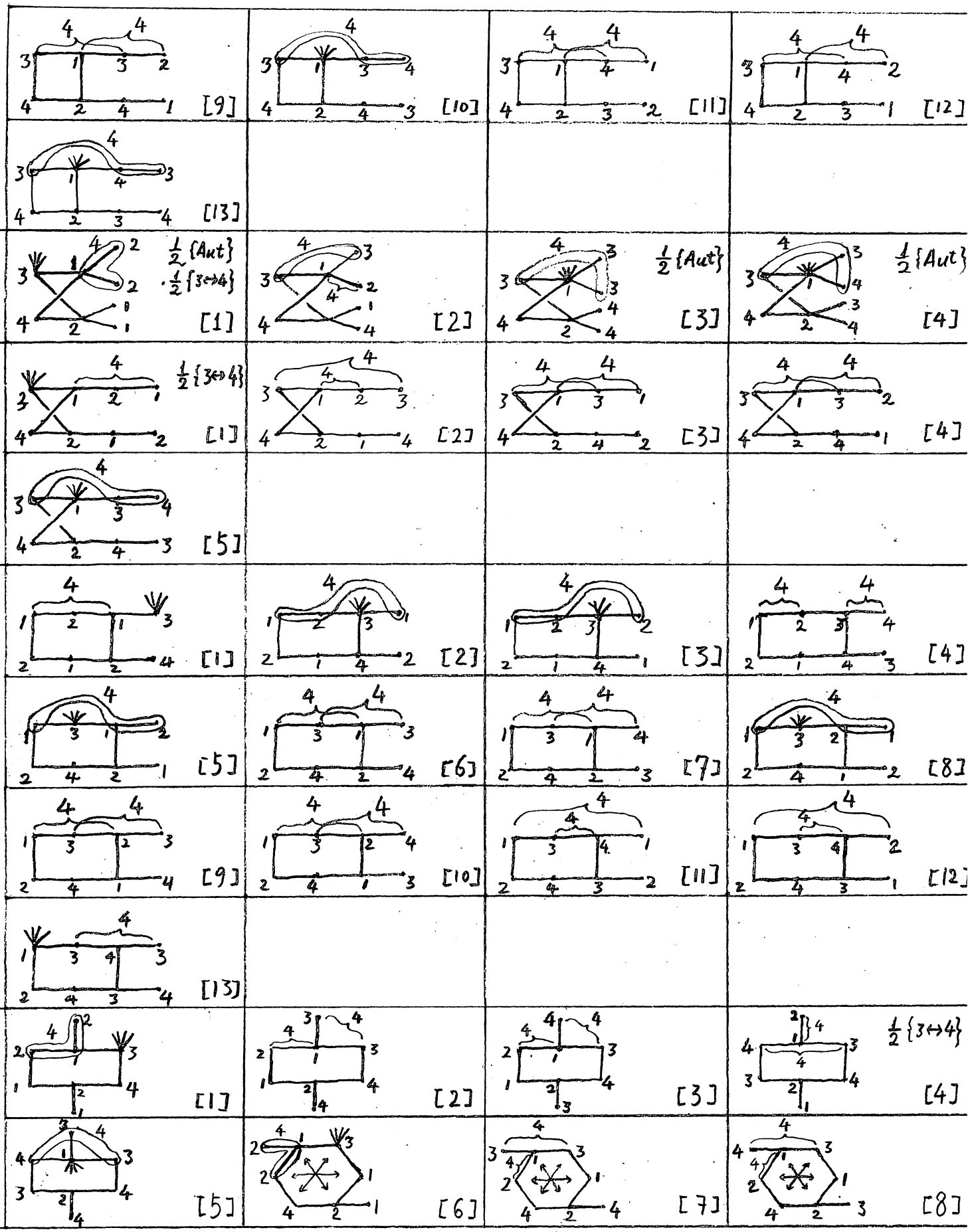
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C7
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$\frac{1}{2}\{Aut\}$ $\cdot\frac{1}{2}\{3\leftrightarrow4\}$
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$\frac{1}{2}\{3\leftrightarrow4\}$
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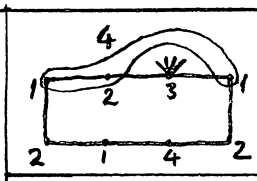
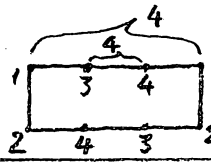
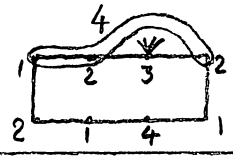
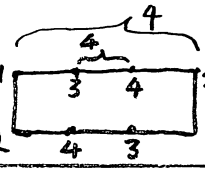
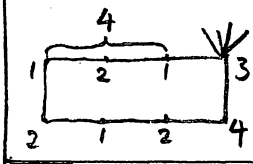
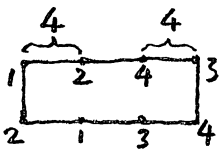
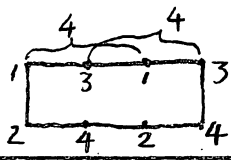
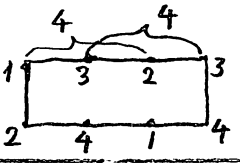
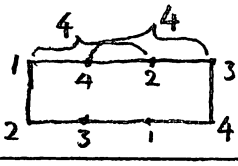
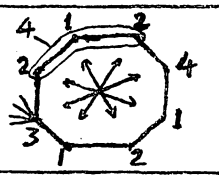
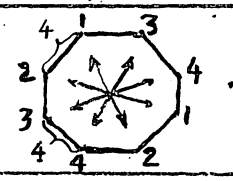
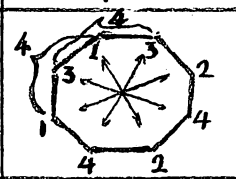
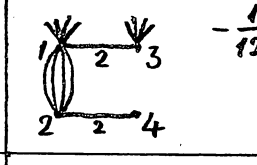
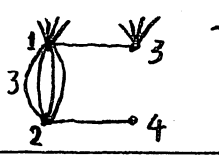
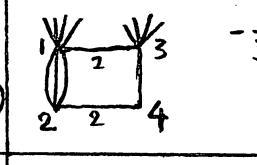
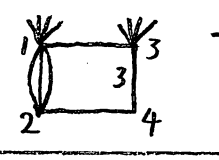
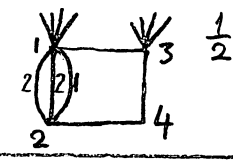
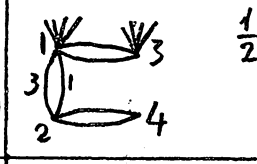
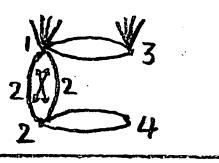
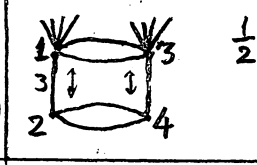
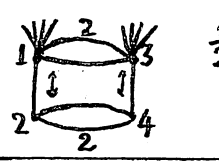
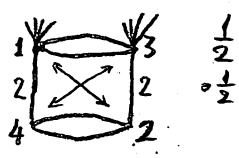
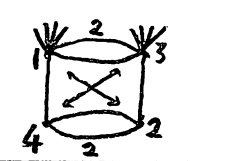
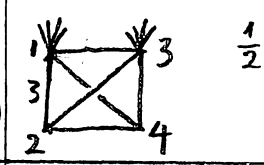
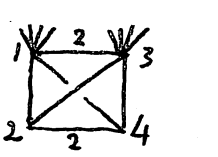
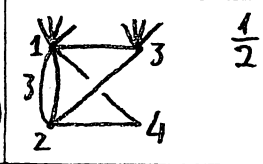
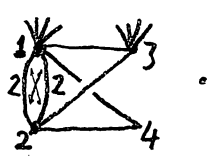
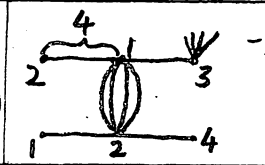
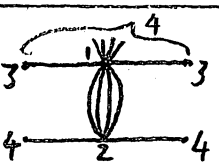
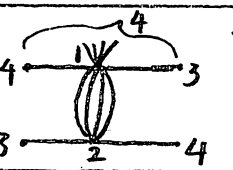
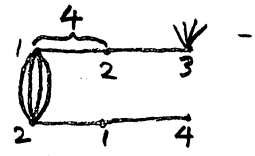
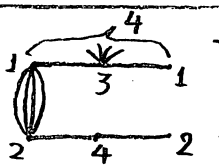
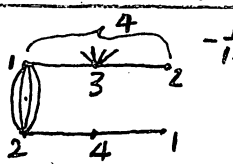
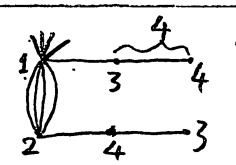
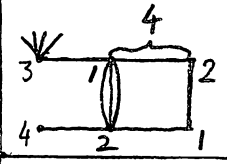
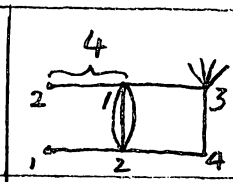
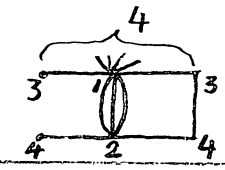
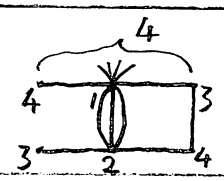
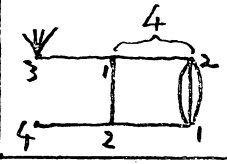
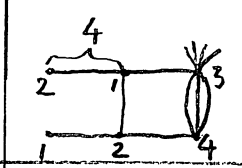
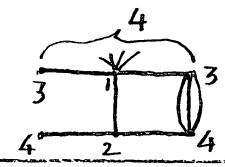
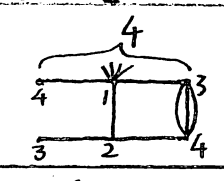
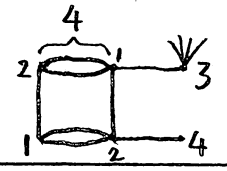
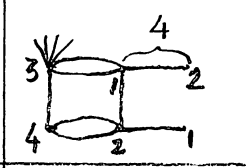
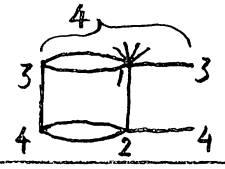
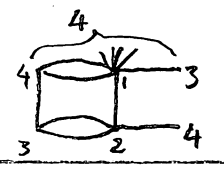
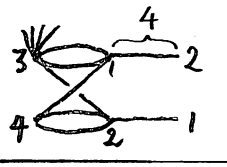
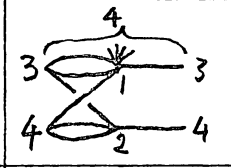
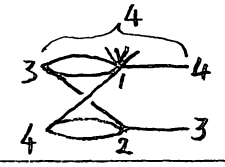
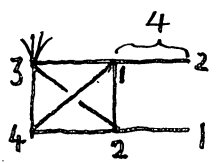
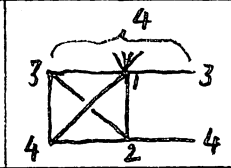
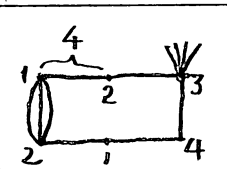
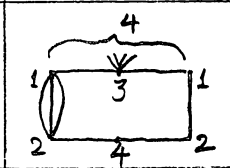
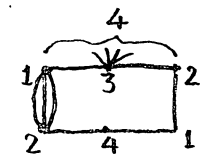
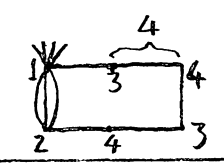
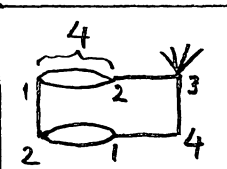
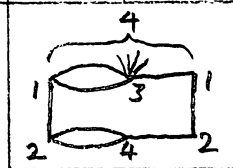
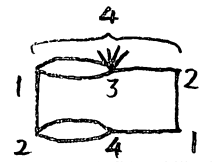
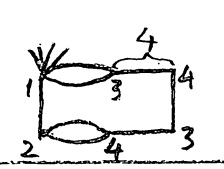
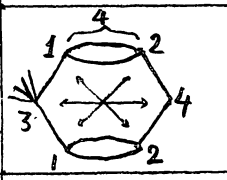
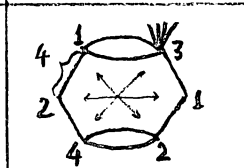
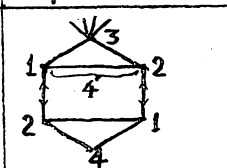
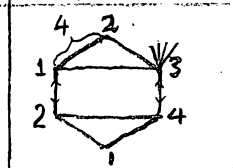
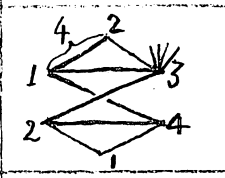
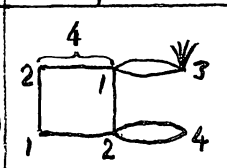
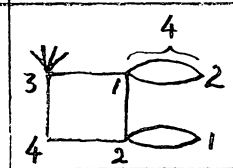
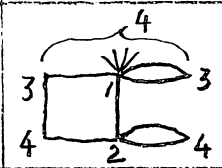
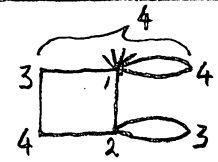
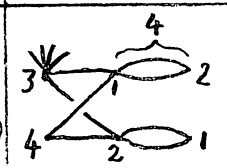
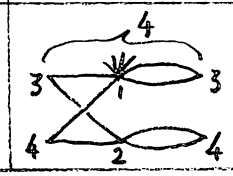
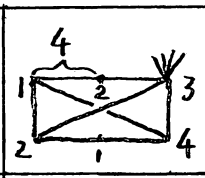
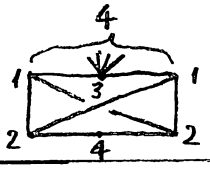
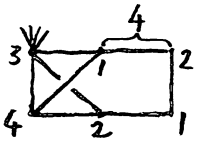
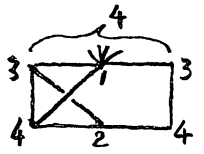
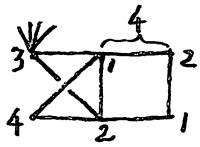
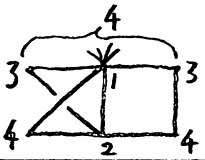
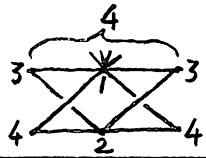
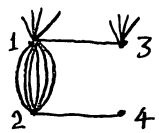
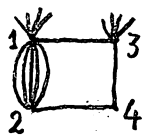
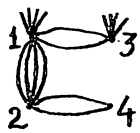
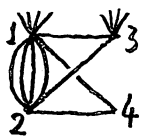
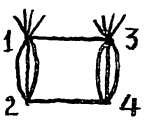
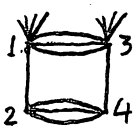
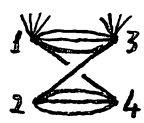
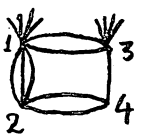
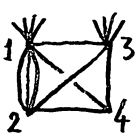
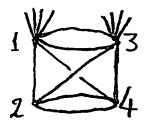
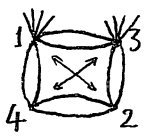
C8	 [1]	 $\frac{1}{2}\{3\leftrightarrow4\}$ [2]	 [3]	 $\frac{1}{2}\{Aut\}$ [4]
	 [5]	 $\frac{1}{2}\{1\leftrightarrow3\}$ [6]	 $\frac{1}{2}\{1\leftrightarrow3\}$ [7]	 [8]
	 $\frac{1}{2}\{1\leftrightarrow3\}$ [9]	 $\frac{1}{2}\{3\leftrightarrow4\}$ [10]	 $\frac{1}{2}\{1\leftrightarrow3\}$ $\cdot\frac{1}{2}\{3\leftrightarrow4\}$ [11]	 $\frac{1}{2}\{1\leftrightarrow3\}$ [12]
D1 ($g\geq3$)	 $-\frac{1}{12}\{11111\}$ [1]	 $-\frac{1}{3}\{111\}$ [2]		
D2 ($g\geq3$)	 $-\frac{1}{3}\{112\}$ [1]	 $-\frac{1}{3}\{112\}$ [2]	 $\frac{1}{2}\{X\}$ [3]	
D3 ($g\geq3$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{4}\{Aut\}$ [2]		
D4 ($g\geq3$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{1\leftrightarrow3\}$ [2]	 $\frac{1}{2}\{Aut\}$ $\cdot\frac{1}{2}\{1\leftrightarrow3\}$ [3]	 $\frac{1}{2}\{1\leftrightarrow3\}$ [4]
D5 ($g\geq3$)	 $\frac{1}{2}\{3\leftrightarrow4\}$ [1]	 $\frac{1}{2}\{1\leftrightarrow3\}$ [2]		
D6 ($g\geq3$)	 $\frac{1}{2}\{3\leftrightarrow4\}$ [1]	 $\frac{1}{2}\{Aut\}$ $\cdot\frac{1}{2}\{3\leftrightarrow4\}$ [2]		
E1 ($g\geq3$)	 $-\frac{1}{12}\{11111\}$ [1]	 $-\frac{1}{24}\{11111\}$ [2]	 $-\frac{1}{12}\{11112\}$ $\cdot\frac{1}{2}\{3\leftrightarrow4\}$ [3]	
E2 ($g\geq3$)	 $-\frac{1}{12}\{11112\}$ [1]	 $-\frac{1}{12}\{11112\}$ [2]	 $-\frac{1}{12}\{11112\}$ [3]	 $-\frac{1}{12}\{11112\}$ [4]

E3 ($g\geq 3$)	 $-\frac{1}{3}\{\}\{\}\{\}$ [1]	 $-\frac{1}{3}\{\}\{\}\{\}$ [2]	 $-\frac{1}{3}\{\}\{\}\{\}$ [3]	 $-\frac{1}{3}\{\}\{\}\{\}$ [4]
E4 ($g\geq 3$)	 $-\frac{1}{3}\{\}\{\}\{\}$ [1]	 $-\frac{1}{3}\{\}\{\}\{\}$ [2]	 $-\frac{1}{3}\{\}\{\}$ [3]	 $-\frac{1}{3}\{\}\{\}$ [4]
E5 ($g\geq 3$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	 $\frac{1}{2}\{Aut\}$ [4]
E6 ($g\geq 3$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	
E7 ($g\geq 3$)	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]		
E8 ($g\geq 3$)	 $-\frac{1}{3}\{\}\{\}\{\}$ [1]	 $-\frac{1}{3}\{\}\{\}\{\}$ [2]	 $-\frac{1}{3}\{\}\{\}\{\}$ [3]	 $-\frac{1}{3}\{\}\{\}\{\}$ [4]
E9 ($g\geq 3$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	 $\frac{1}{2}\{Aut\}$ [4]
E10 ($g\geq 3$)	 $\frac{1}{4}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]		
E11 ($g\geq 3$)	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]	 [3]	
E12 ($g\geq 3$)	 $\frac{1}{2}\{Aut\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]	 $\frac{1}{2}\{Aut\}$ [3]	 $\frac{1}{2}\{Aut\}$ [4]
E13 ($g\geq 3$)	 $\frac{1}{2}\{Aut\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 $\frac{1}{2}\{Aut\}$ [2]		

E14 $(g\geq 3)$	 [1]	 $\frac{1}{2}\{Aut\}$ [2]		
E15 $(g\geq 3)$	 $\frac{1}{2}\{Aut\}$ [1]	 [2]		
E16 $(g\geq 3)$	 $\frac{1}{2}\{3\leftrightarrow 4\}$ [1]	 [2]		
E17 $(g\geq 3)$	 $\frac{1}{2}\{Aut\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$			
F1 $(g\geq 5)$	 $\frac{1}{45}\{\text{IIIIII}\}$			
F2 $(g\geq 5)$	 $\frac{1}{20}\{\text{IIIII}\}$			
F3 $(g\geq 5)$	 $-\frac{1}{24}\{\text{IIII}\}$			
F4 $(g\geq 5)$	 $-\frac{1}{12}\{\text{III}\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$			
F5 $(g\geq 5)$	 $\frac{1}{9}\{\text{III},\text{III}\}$ $\cdot\frac{1}{2}\{1\leftrightarrow 3\}$ [1]	 $\frac{1}{6}\{Aut\}$ $\cdot\frac{1}{2}\{1\leftrightarrow 3\}$ [2]	 $\frac{1}{6}\{Aut\}$ $\cdot\frac{1}{2}\{1\leftrightarrow 3\}$ [3]	
F6 $(g\geq 5)$	 $-\frac{1}{6}\{\text{III}\}$			
F7 $(g\geq 5)$	 $-\frac{1}{3}\{\text{III}\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$			

F8 ($g\geq 5$)		$\frac{1}{2}\{Aut\}$ $\cdot\frac{1}{2}\{1\leftrightarrow 3\}$			
F9 ($g\geq 5$)		$\frac{1}{4}\{Aut\}$ $\cdot\frac{1}{2}\{1\leftrightarrow 3\}$ $\cdot\frac{1}{2}\{3\leftrightarrow 4\}$			

$g=1$: $E^{\mathbb{P}^3,\tau_4}_{1,8} = GW^{\mathbb{P}^3,\tau_4}_{1,8} = -1000$

$g=3$: $E^{\mathbb{P}^3,\tau_4}_{3,8} = GW^{\mathbb{P}^3,\tau_4}_{3,8} - \frac{4\cdot 8}{48} E^{\mathbb{P}^3,\tau_4}_{1,8} = -\frac{2840}{3} - \frac{32}{48}\cdot(-1000) = -280$

$g=5$: $E^{\mathbb{P}^3,\tau_4}_{5,8} = GW^{\mathbb{P}^3,\tau_4}_{5,8} - \frac{4\cdot 8+4}{48}\cdot E^{\mathbb{P}^3,\tau_4}_{3,8} - \frac{5\cdot(4\cdot 8)^2 - 4\cdot 4\cdot 8}{23040} E^{\mathbb{P}^3,\tau_4}_{1,8}$

$= -\frac{1400}{3} - \frac{36}{48}\cdot(-280) - \frac{4992}{23040}\cdot(-1000) = -40$

In[1]:=
```
a = {x, -x, y, -y, x, -x, y, -y};
EC[i_, j_, d_] := Factor[
  (-1)^d * d^(2 d-3) / (d!)^2 * (1 / (a[[i]] - a[[j]])^(2 d-2)) *
   Product[1 / (∏_{r=0}^{d} ((1/d) ((d - r) a[[i]] + r a[[j]]) - a[[k]])),
    {k, Complement[Range[1, 4], {i, j}]}
   ]
 ]
ER[i_, d_] := Factor[
  (-1)^((d-1)/2) / (d * 2^(d-1) * d!) * (((a[[i]]/d))^(1-d) / (∏_{r=0}^{(d-1)/2} (((1/d) (d - 2 r) a[[i]])^2 - a[[5 - i]]^2)))
 ]
F[t_, i_] := ReplacePart[t, i → t[[i]] - 1]
G[x_] := If[
  Min[x] < 0, 0,
  If[Max[x] == 1, 1/24 (Count[x, Except[0]] - 1)!,
   ∑_{i=1}^{Length[x]} G[F[x, i]]]]
Z[x_, k_] := If[Length[x] > k, Array[0 &, k], Join[x, Array[0 &, k - Length[x]]]]
L0[x_] := If[
  Min[x] < 0, 0,
  If[Total[x] - 3 < Count[x, Except[0]], 0,
   If[Total[x] - 3 > Count[x, Except[0]], ∑_{i=1}^{Length[x]} L0[F[x, i]],
    If[Min[DeleteCases[x, 0]] == 1,
     (Total[x] - 2) * L0[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
     If[Count[x, Except[0]] == 1, 1/1152,
      If[Count[x, Except[0]] == 2, 29/5760, 7/240]
     ]
    ]
   ]
  ]
 ]
L1[x_] := If[
  Min[x] < 0, 0,
```

```
    If[Total[x] - 2 < Count[x, Except[0]], 0,
     If[Total[x] - 2 > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L1[F[x, i]],
      If[Min[DeleteCases[x, 0]] == 1,
       (Total[x] - 1) * L1[ReplacePart[Sort[DeleteCases[x, 0], Less], 1 → 0]],
       If[Count[x, Except[0]] == 2, 5/576, 1/480]
       ]
      ]
     ]
    ]
   ]
L3[x_] := If[
   Min[x] < 0, 0,
   If[Total[x] < Count[x, Except[0]], 0,
    If[Total[x] > Count[x, Except[0]], Sum_{i=1}^{Length[x]} L3[F[x, i]],
     (Total[x] + 1)!/2880
    ]
   ]
  ]
V[g_, i_, h_, v_, d_] := With[{
    len = Length[v],
    ET = Product_{r=1}^{3} (a[[i]] - a[[i + r]]),
    ES = Coefficient[Product_{r=1}^{3} (a[[i]] - a[[i + r]] - t), t, 1],
    EA0 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 0],
    EA1 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 1],
    EA2 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 2],
    EA3 = Coefficient[Product_{r=1}^{3} ((a[[i]] - a[[i + r]])^2 - z (a[[i]] - a[[i + r]]) + 1/2 z^2), z, 3]
   },
   If[g == 0,
    Factor[
     (-1)^(len-1) * ((ET)^(h+len-1) / (Product_{k=1}^{len} (((a[[i]] - a[[v[[k]]]]) / d[[k]])^2))) *
```

```
   (Sum_{j=1}^{len} (d[[j]] / (a[[i]] - a[[v[[j]]]])))^(h+len-3)
],
If[g == 1,
 Factor[
  (-1)^len * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (ET *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * G[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len]}]
     + ES/24 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len-1)
   )],
 Factor[
  (-1)^(len-1) * ((ET)^(h+len-1) / (Prod_{j=1}^{len} (((a[[i]] - a[[v[[j]]]]) / d[[j]])^2))) *
   (Sum_{k=1}^{len} d[[k]] / (a[[i]] - a[[v[[k]]]]))^h *
   (EA0 *
      Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L0[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 3]}]
     + EA1 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L1[b],
        {b, Permutations[Z[bb, len]]}],
       {bb, IntegerPartitions[len + 2]}]
     + 7 * EA2/2880 * (Sum_{m=1}^{len} d[[m]] / (a[[i]] - a[[v[[m]]]]))^(len+1)
     + EA3 * Sum[
       Sum[(Prod_{n=1}^{len} (d[[n]] / (a[[i]] - a[[v[[n]]]]))^b[[n]]) * L3[b],
```

```
            {b, Permutations[Z[bb, len]]}],
          {bb, IntegerPartitions[len]}]
        )
      ]
    ]
  ]
]
```

In[11]:=

$$\text{A1G1}[1] = \sum_{i=1}^{2} \text{EC}[1,3,i]\,\text{ER}[1,7-2i]\,\text{ER}[1,1]\,(\text{V}[0,1,4,\{2,2,3\},\{1,7-2i,i\}]\,\text{V}[0,3,4,\{1\},\{i\}]);$$

$$\text{A1G1}[2] = -\text{EC}[1,3,1]\,\text{ER}[1,3]\,\text{ER}[1,3]\,(\text{V}[0,1,4,\{2,2,3\},\{3,3,1\}]\,\text{V}[0,3,4,\{1\},\{1\}]);$$

$$\text{A1G1}[3] = \frac{1}{2}\,\text{EC}[1,3,2]\,\text{EC}[1,2,2]\,(\text{V}[0,1,4,\{2,2,3\},\{2,2,2\}]\,\text{V}[0,3,4,\{1\},\{2\}]);$$

$$\text{A2G1}[1] = \frac{1}{2} * \sum_{i=1}^{3} \sum_{j=0}^{3-i} \text{EC}[1,3,i]\,\text{ER}[1,2j+1]\,\text{ER}[3,7-2i-2j]\,(\text{V}[0,1,4,\{2,3\},\{2j+1,i\}]\,\text{V}[0,3,4,\{1,4\},\{i,7-2i-2j\}]);$$

$$\text{A2G1}[2] = \frac{1}{4} * \sum_{i=1}^{3} \text{EC}[1,3,i]\,\text{EC}[1,4,4-i]\,(\text{V}[0,1,4,\{4,3\},\{4-i,i\}]\,\text{V}[0,3,4,\{1,2\},\{i,4-i\}]);$$

$$\text{B1G1}[1] = \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[2,1,1]\,\text{EC}[1,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\,(\text{V}[0,2,i,\{1\},\{1\}]\,\text{V}[0,1,4-i,\{2,2,2,3\},\{1,1,3,1\}]\,\text{V}[0,3,4,\{1\},\{1\}]);$$

$$\text{B1G1}[2] = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[3,1,1]\,\text{EC}[1,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\,(\text{V}[0,3,i,\{1\},\{1\}]\,\text{V}[0,1,4,\{3,2,2,3\},\{1,1,3,1\}]\,\text{V}[0,3,4-i,\{1\},\{1\}]);$$

$$\text{B1G1}[3] = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[4,1,1]\,\text{EC}[1,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\,(\text{V}[0,4,i,\{1\},\{1\}]\,\text{V}[0,1,4,\{4,2,2,3\},\{1,1,3,1\}]\,\text{V}[0,3,4-i,\{1\},\{1\}]);$$

$$\text{B1G1}[4] = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[2,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,2,2]\,(\text{V}[0,2,i,\{1\},\{1\}]\,\text{V}[0,1,4-i,\{2,2,2,3\},\{1,2,2,1\}]\,\text{V}[0,3,4,\{1\},\{1\}]);$$

$$\text{B1G1}[5] = \frac{1}{4} * \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[3,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,2,2]\,(\text{V}[0,3,i,\{1\},\{1\}]\,\text{V}[0,1,4,\{3,2,2,3\},\{1,2,2,1\}]\,\text{V}[0,3,4-i,\{1\},\{1\}]);$$

$$\text{B1G1}[6] = \frac{1}{4} * \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[4,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,2,2]\,(\text{V}[0,4,i,\{1\},\{1\}]\,\text{V}[0,1,4,\{4,2,2,3\},\{1,2,2,1\}]\,\text{V}[0,3,4-i,\{1\},\{1\}]);$$

$$\text{B2G1}[1] = \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[1,2,1]\,\text{EC}[2,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\,(\text{V}[0,1,4-i,\{2,2,2\},\{1,3,1\}]\,\text{V}[0,2,i,\{1,3\},\{1,1\}]\,\text{V}[0,3,4,\{2\},\{1\}]);$$

$$\text{B2G1}[2] = \sum_{i=0}^{4} \text{Binomial}[4,i]\,\text{EC}[1,3,1]\,\text{EC}[3,1,1]\,\text{ER}[1,1]\,\text{ER}[1,3]$$

```
    (V[0, 1, 4 - i, {2, 2, 3}, {1, 3, 1}] V[0, 3, 4, {1, 1}, {1, 1}] V[0, 1, i, {3}, {1}]);
B2G1[3] = Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[1, 3]
    (V[0, 1, 4 - i, {2, 2, 3}, {1, 3, 1}] V[0, 3, 4, {1, 2}, {1, 1}] V[0, 2, i, {3}, {1}]);
B2G1[4] = Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[1, 1] ER[1, 3]
    (V[0, 1, 4, {2, 2, 3}, {1, 3, 1}] V[0, 3, 4 - i, {1, 4}, {1, 1}] V[0, 4, i, {3}, {1}]);
B2G1[5] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] EC[1, 2, 2] (V[0, 1, 4 - i,
        {2, 2, 2}, {2, 2, 1}] V[0, 2, i, {1, 3}, {1, 1}] V[0, 3, 4, {2}, {1}]);
B2G1[6] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] EC[1, 2, 2] (V[0, 1, 4 - i,
        {2, 2, 3}, {2, 2, 1}] V[0, 3, 4, {1, 1}, {1, 1}] V[0, 1, i, {3}, {1}]);
B2G1[7] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] EC[1, 2, 2] (V[0, 1, 4 - i,
        {2, 2, 3}, {2, 2, 1}] V[0, 3, 4, {1, 2}, {1, 1}] V[0, 2, i, {3}, {1}]);
B2G1[8] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] EC[1, 2, 2] (V[0, 1, 4,
        {2, 2, 3}, {2, 2, 1}] V[0, 3, 4 - i, {1, 4}, {1, 1}] V[0, 4, i, {3}, {1}]);
B3G1[1] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 2 k + 1]
     ER[1, 3 - 2 k] (V[0, 2, i, {1, 1}, {2 k + 1, 1}]
       V[0, 1, 4 - i, {2, 2, 3}, {1, 3 - 2 k, 1}] V[0, 3, 4, {1}, {1}]);
B3G1[2] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] ER[3, 2 k + 1]
     ER[1, 3 - 2 k] (V[0, 3, i, {4, 1}, {2 k + 1, 1}]
       V[0, 1, 4, {3, 2, 3}, {1, 3 - 2 k, 1}] V[0, 3, 4 - i, {1}, {1}]);
B3G1[3] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1] ER[4, 2 k + 1]
     ER[1, 3 - 2 k] (V[0, 4, i, {3, 1}, {2 k + 1, 1}]
       V[0, 1, 4, {4, 2, 3}, {1, 3 - 2 k, 1}] V[0, 3, 4 - i, {1}, {1}]);
B3G1[4] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 2, 1] ER[3, 2 k + 1]
     ER[1, 3 - 2 k] (V[0, 3, 4, {4, 1}, {2 k + 1, 1}]
       V[0, 1, i, {3, 2, 2}, {1, 3 - 2 k, 1}] V[0, 2, 4 - i, {1}, {1}]);
B3G1[5] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1 + k] EC[1, 3, 2 - k]
     ER[2, 1] ER[1, 1] (V[0, 2, i, {1, 1}, {1, 1 + k}]
       V[0, 1, 4 - i, {2, 2, 3}, {1 + k, 1, 2 - k}] V[0, 3, 4, {1}, {2 - k}]);
B3G1[6] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1 + k] EC[1, 3, 2 - k]
     ER[3, 1] ER[1, 1] (V[0, 3, i, {4, 1}, {1, 1 + k}]
       V[0, 1, 4, {3, 2, 3}, {1 + k, 1, 2 - k}] V[0, 3, 4 - i, {1}, {2 - k}]);
B3G1[7] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1 + k] EC[1, 3, 2 - k]
     ER[4, 1] ER[1, 1] (V[0, 4, i, {3, 1}, {1, 1 + k}]
       V[0, 1, 4, {4, 2, 3}, {1 + k, 1, 2 - k}] V[0, 3, 4 - i, {1}, {2 - k}]);
B3G1[8] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1 + k] EC[1, 2, 2 - k]
     ER[3, 1] ER[1, 1] (V[0, 3, 4, {4, 1}, {1, 1 + k}]
       V[0, 1, i, {3, 2, 2}, {1 + k, 1, 2 - k}] V[0, 2, 4 - i, {1}, {2 - k}]);
```

$$\text{B4G1}[1] = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[2, 1, 2]\, \text{EC}[1, 3, 1]\, \text{EC}[1, 4, 1]\, (\text{V}[0, 2, i, \{1\}, \{2\}]\, \text{V}[0, 1, 4 - i, \{2, 4, 3\}, \{2, 1, 1\}]\, \text{V}[0, 3, 4, \{1, 2\}, \{1, 1\}]);$$

$$\text{B4G1}[2] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[3, 1, 2]\, \text{EC}[1, 3, 1]\, \text{EC}[1, 4, 1]\, (\text{V}[0, 3, i, \{1\}, \{2\}]\, \text{V}[0, 1, 4, \{3, 4, 3\}, \{2, 1, 1\}]\, \text{V}[0, 3, 4 - i, \{1, 2\}, \{1, 1\}]);$$

$$\text{B4G1}[3] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[2, 1, 1]\, \text{EC}[1, 3, 2]\, \text{EC}[1, 4, 1]\, (\text{V}[0, 2, i, \{1\}, \{1\}]\, \text{V}[0, 1, 4 - i, \{2, 4, 3\}, \{1, 1, 2\}]\, \text{V}[0, 3, 4, \{1, 2\}, \{2, 1\}]);$$

$$\text{B4G1}[4] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[3, 1, 1]\, \text{EC}[1, 3, 2]\, \text{EC}[1, 4, 1]\, (\text{V}[0, 3, i, \{1\}, \{1\}]\, \text{V}[0, 1, 4, \{3, 4, 3\}, \{1, 1, 2\}]\, \text{V}[0, 3, 4 - i, \{1, 2\}, \{2, 1\}]);$$

$$\text{B4G1}[5] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[4, 1, 1]\, \text{EC}[1, 3, 2]\, \text{EC}[1, 4, 1]\, (\text{V}[0, 4, i, \{1\}, \{1\}]\, \text{V}[0, 1, 4, \{4, 4, 3\}, \{1, 1, 2\}]\, \text{V}[0, 3, 4 - i, \{1, 2\}, \{2, 1\}]);$$

$$\text{B5G1}[1] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 2, 1]\, \text{EC}[2, 3, 1]\, \text{ER}[3, 1]\, \text{ER}[1, 3]\, (\text{V}[0, 1, 4 - i, \{2, 2\}, \{3, 1\}]\, \text{V}[0, 2, i, \{1, 3\}, \{1, 1\}]\, \text{V}[0, 3, 4, \{2, 4\}, \{1, 1\}]);$$

$$\text{B5G1}[2] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 3, 1]\, \text{EC}[3, 1, 1]\, \text{ER}[1, 1]\, \text{ER}[1, 3]\, (\text{V}[0, 1, 4 - i, \{2, 3\}, \{3, 1\}]\, \text{V}[0, 3, 4, \{1, 1\}, \{1, 1\}]\, \text{V}[0, 1, i, \{3, 2\}, \{1, 1\}]);$$

$$\text{B5G1}[3] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 3, 1]\, \text{EC}[3, 2, 1]\, \text{ER}[2, 1]\, \text{ER}[1, 3]\, (\text{V}[0, 1, 4 - i, \{2, 3\}, \{3, 1\}]\, \text{V}[0, 3, 4, \{1, 2\}, \{1, 1\}]\, \text{V}[0, 2, i, \{3, 1\}, \{1, 1\}]);$$

$$\text{B5G1}[4] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 3, 1]\, \text{EC}[3, 4, 1]\, \text{ER}[4, 1]\, \text{ER}[1, 3]\, (\text{V}[0, 1, 4, \{2, 3\}, \{3, 1\}]\, \text{V}[0, 3, 4 - i, \{1, 4\}, \{1, 1\}]\, \text{V}[0, 4, i, \{3, 3\}, \{1, 1\}]);$$

$$\text{B5G1}[5] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 2, 2]\, \text{EC}[2, 3, 1]\, \text{ER}[1, 1]\, \text{ER}[3, 1]\, (\text{V}[0, 1, 4 - i, \{2, 2\}, \{1, 2\}]\, \text{V}[0, 2, i, \{1, 3\}, \{2, 1\}]\, \text{V}[0, 3, 4, \{2, 4\}, \{1, 1\}]);$$

$$\text{B5G1}[6] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 3, 2]\, \text{EC}[3, 1, 1]\, \text{ER}[1, 1]\, \text{ER}[1, 1]\, (\text{V}[0, 1, 4 - i, \{2, 3\}, \{1, 2\}]\, \text{V}[0, 3, 4, \{1, 1\}, \{2, 1\}]\, \text{V}[0, 1, i, \{3, 2\}, \{1, 1\}]);$$

$$\text{B5G1}[7] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 3, 2]\, \text{EC}[3, 2, 1]\, \text{ER}[2, 1]\, \text{ER}[1, 1]\, (\text{V}[0, 1, 4 - i, \{2, 3\}, \{1, 2\}]\, \text{V}[0, 3, 4, \{1, 2\}, \{2, 1\}]\, \text{V}[0, 2, i, \{3, 1\}, \{1, 1\}]);$$

$$\text{B5G1}[8] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[1, 3, 2]\, \text{EC}[3, 4, 1]\, \text{ER}[4, 1]\, \text{ER}[1, 1]\, (\text{V}[0, 1, 4, \{2, 3\}, \{1, 2\}]\, \text{V}[0, 3, 4 - i, \{1, 4\}, \{2, 1\}]\, \text{V}[0, 4, i, \{3, 3\}, \{1, 1\}]);$$

$$\text{B5G1}[9] = \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[2, 1, 1]\, \text{EC}[1, 3, 2]\, \text{EC}[3, 1, 1]\, (\text{V}[0, 2, i, \{4, 1\}, \{1, 1\}]\, \text{V}[0, 1, 4 - i, \{2, 3\}, \{1, 2\}]\, \text{V}[0, 3, 4, \{1, 1\}, \{2, 1\}]);$$

$$\text{B5G1}[10] = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\, \text{EC}[3, 1, 1]\, \text{EC}[1, 2, 2]\, \text{EC}[1, 3, 1]\, (\text{V}[0, 3, 4, \{1, 1\}, \{1, 1\}]\, \text{V}[0, 1, 4 - i, \{3, 2\}, \{1, 2\}]\, \text{V}[0, 1, i, \{3, 2\}, \{1, 2\}]);$$

$$\text{C1G1}[1] = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial}[r, s, 4 - r - s]\, \text{EC}[2, 1, 1]\, \text{EC}[1, 2, 1]\, \text{EC}[2, 3, 1]\, \text{ER}[1, 1]\, \text{ER}[2, 1]\, (\text{V}[0, 2, r, \{1\}, \{1\}]\, \text{V}[0, 1, s, \{2, 2, 2\}, \{1, 1, 1\}]\, \text{V}[0, 2, 4 - r - s, \{1, 1, 3\}, \{1, 1, 1\}]\, \text{V}[0, 3, 4, \{2\}, \{1\}]);$$

$$\text{C1G1}[2] = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r]\, \text{Binomial}[4, s]\, \text{EC}[3, 1, 1]\, \text{EC}[1, 2, 1]\, \text{EC}[2, 3, 1]\, \text{ER}[1, 1]\, \text{ER}[2, 1]\, (\text{V}[0, 3, r, \{1\}, \{1\}]\, \text{V}[0, 1, s, \{3, 2, 2\}, \{1, 1, 1\}]\, \text{V}[0, 2, 4 - s, \{1, 1, 3\}, \{1, 1, 1\}]\, \text{V}[0, 3, 4 - r, \{2\}, \{1\}]);$$

$$\text{C1G1}[3] = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r]\, \text{Binomial}[4, s]\, \text{EC}[3, 1, 1]\, \text{EC}[1, 2, 1]$$

```
    EC[2, 4, 1] ER[1, 1] ER[2, 1] (V[0, 3, r, {1}, {1}] V[0, 1, s, {3, 2, 2}, {1, 1, 1}]
      V[0, 2, 4 - s, {1, 1, 4}, {1, 1, 1}] V[0, 4, 4 - r, {2}, {1}]);
```

$$\text{C1G1[4]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial}[r, s, 4 - r - s]$$

```
  EC[2, 1, 1] EC[1, 3, 1] EC[1, 3, 1] ER[1, 1] ER[3, 1] (V[0, 2, r, {1}, {1}] V[0, 1, s, {2, 2, 3}, {1, 1, 1}]
    V[0, 3, 4, {1, 1, 4}, {1, 1, 1}] V[0, 1, 4 - r - s, {3}, {1}]);
```

$$\text{C1G1[5]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial}[r, s, 4 - r - s]$$

```
  EC[2, 1, 1] EC[1, 3, 1] EC[2, 3, 1] ER[1, 1] ER[3, 1] (V[0, 2, r, {1}, {1}] V[0, 1, s, {2, 2, 3}, {1, 1, 1}]
    V[0, 3, 4, {1, 2, 4}, {1, 1, 1}] V[0, 2, 4 - r - s, {3}, {1}]);
```

$$\text{C1G1[6]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[2, 1, 1] EC[1, 3, 1] EC[4, 3, 1] ER[1, 1] ER[3, 1] (V[0, 2, r, {1}, {1}] V[0, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
    V[0, 3, s, {1, 4, 4}, {1, 1, 1}] V[0, 4, 4 - s, {3}, {1}]);
```

$$\text{C1G1[7]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[3, 1, 1] EC[1, 3, 1] EC[1, 3, 1] ER[1, 1] ER[3, 1] (V[0, 3, r, {1}, {1}] V[0, 1, s, {3, 2, 3}, {1, 1, 1}]
    V[0, 3, 4 - r, {1, 4, 1}, {1, 1, 1}] V[0, 1, 4 - s, {3}, {1}]);
```

$$\text{C1G1[8]} = \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[3, 1, 1] EC[1, 3, 1] EC[2, 3, 1] ER[1, 1] ER[3, 1] (V[0, 3, r, {1}, {1}] V[0, 1, s, {3, 2, 3}, {1, 1, 1}]
    V[0, 3, 4 - r, {1, 4, 2}, {1, 1, 1}] V[0, 2, 4 - s, {3}, {1}]);
```

$$\text{C1G1[9]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[4, 1, 1] EC[1, 3, 1] EC[2, 3, 1] ER[1, 1] ER[3, 1] (V[0, 4, r, {1}, {1}] V[0, 1, s, {4, 2, 3}, {1, 1, 1}]
    V[0, 3, 4 - r, {1, 4, 2}, {1, 1, 1}] V[0, 2, 4 - s, {3}, {1}]);
```

$$\text{C1G1[10]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial}[r, s, 4 - r - s]$$

```
  EC[2, 1, 1] EC[1, 4, 1] EC[1, 3, 1] EC[3, 1, 1] (V[0, 2, r, {1}, {1}] V[0, 1, s, {4, 2, 3}, {1, 1, 1}]
    V[0, 3, 4, {1, 1, 2}, {1, 1, 1}] V[0, 1, 4 - r - s, {3}, {1}]);
```

$$\text{C1G1[11]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[3, 1, 1] EC[1, 4, 1] EC[1, 3, 1] EC[3, 2, 1] (V[0, 3, r, {1}, {1}] V[0, 1, s, {4, 3, 3}, {1, 1, 1}]
    V[0, 3, 4 - r, {1, 2, 2}, {1, 1, 1}] V[0, 2, 4 - s, {3}, {1}]);
```

$$\text{C1G1[13]} = \frac{1}{4} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[2, 1, 1] EC[1, 4, 1] EC[1, 3, 1] EC[3, 4, 1] (V[0, 2, r, {1}, {1}] V[0, 1, 4 - r, {4, 2, 3}, {1, 1, 1}]
    V[0, 3, s, {1, 2, 4}, {1, 1, 1}] V[0, 4, 4 - s, {3}, {1}]);
```

$$\text{C1G1[12]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[3, 1, 1] EC[1, 4, 1] EC[1, 3, 1] EC[3, 1, 1] (V[0, 3, r, {1}, {1}] V[0, 1, s, {4, 3, 3}, {1, 1, 1}]
    V[0, 3, 4 - r, {1, 2, 1}, {1, 1, 1}] V[0, 1, 4 - s, {3}, {1}]);
```

$$\text{C2G1[1]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial}[r, s, 4 - r - s]$$

```
  EC[2, 1, 1] EC[1, 2, 1] EC[1, 3, 1] ER[2, 1] ER[1, 1] (V[0, 2, r, {1, 1}, {1, 1}] V[0, 1, s, {2, 2, 2, 3}, {1, 1, 1, 1}]
    V[0, 2, 4 - r - s, {1}, {1}] V[0, 3, 4, {1}, {1}]);
```

$$\text{C2G1[2]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial}[4, r] \text{Binomial}[4, s]$$

```
  EC[2, 1, 1] EC[1, 3, 1] EC[1, 3, 1] ER[2, 1] ER[1, 1] (V[0, 2, r, {1, 1}, {1, 1}] V[0, 1, 4 - r,
      {2, 2, 3, 3}, {1, 1, 1, 1}] V[0, 3, s, {1}, {1}] V[0, 3, 4 - s, {1}, {1}]);
```

$$\text{C2G1[3]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[1, 3, 1]}$$
$$\text{EC[1, 4, 1] ER[2, 1] ER[1, 1] (V[0, 2, r, \{1, 1\}, \{1, 1\}] V[0, 1, 4 - r,}$$
$$\text{\{2, 2, 3, 4\}, \{1, 1, 1, 1\}] V[0, 3, s, \{1\}, \{1\}] V[0, 4, 4 - s, \{1\}, \{1\}]);}$$

$$\text{C2G1[4]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 2, 1] EC[1, 2, 1]}$$
$$\text{ER[3, 1] ER[1, 1] (V[0, 3, 4, \{4, 1\}, \{1, 1\}] V[0, 1, r, \{2, 2, 2, 3\}, \{1, 1, 1, 1\}]}$$
$$\text{V[0, 2, s, \{1\}, \{1\}] V[0, 2, 4 - r - s, \{1\}, \{1\}]);}$$

$$\text{C2G1[5]} = \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 3, 1]}$$
$$\text{EC[1, 2, 1] ER[3, 1] ER[1, 1] (V[0, 3, 4 - s, \{4, 1\}, \{1, 1\}] V[0, 1, r,}$$
$$\text{\{2, 2, 3, 3\}, \{1, 1, 1, 1\}] V[0, 3, s, \{1\}, \{1\}] V[0, 2, 4 - r, \{1\}, \{1\}]);}$$

$$\text{C2G1[6]} = \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 4, 1]}$$
$$\text{EC[1, 2, 1] ER[3, 1] ER[1, 1] (V[0, 3, 4 - s, \{4, 1\}, \{1, 1\}] V[0, 1, r,}$$
$$\text{\{2, 2, 3, 4\}, \{1, 1, 1, 1\}] V[0, 4, s, \{1\}, \{1\}] V[0, 2, 4 - r, \{1\}, \{1\}]);}$$

$$\text{C2G1[7]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1] EC[1, 3, 1]}$$
$$\text{ER[3, 1] ER[1, 1] (V[0, 3, r, \{4, 1\}, \{1, 1\}] V[0, 1, 4, \{2, 3, 3, 3\}, \{1, 1, 1, 1\}]}$$
$$\text{V[0, 3, s, \{1\}, \{1\}] V[0, 3, 4 - r - s, \{1\}, \{1\}]);}$$

$$\text{C2G1[8]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1] EC[1, 4, 1]}$$
$$\text{ER[3, 1] ER[1, 1] (V[0, 3, r, \{4, 1\}, \{1, 1\}] V[0, 1, 4, \{2, 3, 3, 4\}, \{1, 1, 1, 1\}]}$$
$$\text{V[0, 3, s, \{1\}, \{1\}] V[0, 4, 4 - r - s, \{1\}, \{1\}]);}$$

$$\text{C2G1[9]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 4, 1] EC[1, 4, 1]}$$
$$\text{ER[3, 1] ER[1, 1] (V[0, 3, r, \{4, 1\}, \{1, 1\}] V[0, 1, 4, \{2, 3, 4, 4\}, \{1, 1, 1, 1\}]}$$
$$\text{V[0, 4, s, \{1\}, \{1\}] V[0, 4, 4 - r - s, \{1\}, \{1\}]);}$$

$$\text{C3G1[1]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 2, 1] EC[2, 3, 1]}$$
$$\text{ER[1, 1] ER[2, 1] (V[0, 2, s, \{1, 1\}, \{1, 1\}] V[0, 1, r, \{2, 2, 2\}, \{1, 1, 1\}]}$$
$$\text{V[0, 2, 4 - r - s, \{1, 3\}, \{1, 1\}] V[0, 3, 4, \{2\}, \{1\}]);}$$

$$\text{C3G1[2]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1] EC[1, 3, 1]}$$
$$\text{ER[1, 1] ER[2, 1] (V[0, 2, s, \{1, 1\}, \{1, 1\}] V[0, 1, r, \{2, 2, 3\}, \{1, 1, 1\}]}$$
$$\text{V[0, 3, 4, \{1, 1\}, \{1, 1\}] V[0, 1, 4 - r - s, \{3\}, \{1\}]);}$$

$$\text{C3G1[3]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1] EC[2, 3, 1]}$$
$$\text{ER[1, 1] ER[2, 1] (V[0, 2, s, \{1, 1\}, \{1, 1\}] V[0, 1, r, \{2, 2, 3\}, \{1, 1, 1\}]}$$
$$\text{V[0, 3, 4, \{1, 2\}, \{1, 1\}] V[0, 2, 4 - r - s, \{3\}, \{1\}]);}$$

$$\text{C3G1[4]} = \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[1, 3, 1] EC[3, 4, 1]}$$
$$\text{ER[1, 1] ER[2, 1] (V[0, 2, r, \{1, 1\}, \{1, 1\}] V[0, 1, 4 - r, \{2, 2, 3\}, \{1, 1, 1\}]}$$
$$\text{V[0, 3, s, \{1, 4\}, \{1, 1\}] V[0, 4, 4 - s, \{3\}, \{1\}]);}$$

$$\text{C3G1[5]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 2, 1] EC[2, 1, 1]}$$
$$\text{ER[1, 1] ER[3, 1] (V[0, 3, 4, \{4, 1\}, \{1, 1\}] V[0, 1, r, \{2, 2, 3\}, \{1, 1, 1\}]}$$
$$\text{V[0, 2, s, \{1, 1\}, \{1, 1\}] V[0, 1, 4 - r - s, \{2\}, \{1\}]);}$$

$$\text{C3G1[6]} = \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 2, 1] EC[3, 2, 1]}$$
$$\text{ER[1, 1] ER[3, 1] (V[0, 3, s, \{4, 1\}, \{1, 1\}] V[0, 1, 4 - r, \{2, 2, 3\}, \{1, 1, 1\}]}$$
$$\text{V[0, 2, r, \{1, 3\}, \{1, 1\}] V[0, 3, 4 - s, \{2\}, \{1\}]);}$$

```
C3G1[7] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 2, 1] EC[4, 2, 1]
    ER[1, 1] ER[3, 1] (V[0, 3, s, {4, 1}, {1, 1}] V[0, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
      V[0, 2, r, {1, 4}, {1, 1}] V[0, 4, 4 - s, {2}, {1}]);
C3G1[8] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 3, 1] EC[3, 1, 1]
    ER[1, 1] ER[3, 1] (V[0, 3, s, {4, 1}, {1, 1}] V[0, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
      V[0, 3, 4 - s, {1, 1}, {1, 1}] V[0, 1, r, {3}, {1}]);
C3G1[9] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 3, 1] EC[3, 2, 1]
    ER[1, 1] ER[3, 1] (V[0, 3, s, {4, 1}, {1, 1}] V[0, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
      V[0, 3, 4 - s, {1, 2}, {1, 1}] V[0, 2, r, {3}, {1}]);
C3G1[10] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1] EC[3, 4, 1]
    ER[1, 1] ER[3, 1] (V[0, 3, r, {4, 1}, {1, 1}] V[0, 1, 4, {2, 3, 3}, {1, 1, 1}]
      V[0, 3, s, {1, 4}, {1, 1}] V[0, 4, 4 - r - s, {3}, {1}]);
C3G1[11] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 4, 1] EC[4, 1, 1]
    ER[1, 1] ER[3, 1] (V[0, 3, s, {4, 1}, {1, 1}] V[0, 1, 4 - r, {2, 3, 4}, {1, 1, 1}]
      V[0, 4, 4 - s, {1, 1}, {1, 1}] V[0, 1, r, {4}, {1}]);
C3G1[12] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 4, 1] EC[4, 2, 1]
   ER[1, 1] ER[3, 1] (V[0, 3, s, {4, 1}, {1, 1}] V[0, 1, 4 - r, {2, 3, 4}, {1, 1, 1}]
     V[0, 4, 4 - s, {1, 2}, {1, 1}] V[0, 2, r, {4}, {1}]);
C3G1[13] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 4, 1] EC[4, 3, 1]
   ER[1, 1] ER[3, 1] (V[0, 3, r, {4, 1}, {1, 1}] V[0, 1, 4, {2, 3, 4}, {1, 1, 1}]
     V[0, 4, s, {1, 3}, {1, 1}] V[0, 3, 4 - r - s, {4}, {1}]);
C4G1[1] = 1/4 * ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[2, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 2, r, {1}, {1}] V[0, 2, s, {1}, {1}]
        V[0, 1, 4 - r - s, {2, 2, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]);
C4G1[2] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[3, 1, 1]
    EC[1, 4, 1] EC[1, 3, 1] (V[0, 2, r, {1}, {1}] V[0, 3, s, {1}, {1}]
      V[0, 1, 4 - r, {2, 3, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4 - s, {1, 2}, {1, 1}]);
C4G1[3] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[3, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 3, r, {1}, {1}] V[0, 3, s, {1}, {1}]
        V[0, 1, 4, {3, 3, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4 - r - s, {1, 2}, {1, 1}]);
C4G1[4] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[4, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 3, r, {1}, {1}] V[0, 4, s, {1}, {1}]
        V[0, 1, 4, {3, 4, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4 - r - s, {1, 2}, {1, 1}]);
C5G1[1] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 1, r, {2}, {1}] V[0, 2, s, {1, 1}, {1, 1}]
        V[0, 1, 4 - r - s, {2, 4, 3}, {1, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]);
C5G1[2] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[2, 1, 1]
    EC[1, 4, 1] EC[1, 3, 1] (V[0, 3, r, {2}, {1}] V[0, 2, s, {3, 1}, {1, 1}]
      V[0, 1, 4 - s, {2, 4, 3}, {1, 1, 1}] V[0, 3, 4 - r, {1, 2}, {1, 1}]);
```

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C5G1[3] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[3, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 1, r, {3}, {1}] V[0, 3, s, {1, 1}, {1, 1}]
        V[0, 1, 4 - r, {3, 4, 3}, {1, 1, 1}] V[0, 3, 4 - s, {1, 2}, {1, 1}]);
C5G1[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[3, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 2, r, {3}, {1}] V[0, 3, s, {2, 1}, {1, 1}]
        V[0, 1, 4 - r, {3, 4, 3}, {1, 1, 1}] V[0, 3, 4 - s, {1, 2}, {1, 1}]);
C5G1[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 4, 1] EC[3, 1, 1]
      EC[1, 4, 1] EC[1, 3, 1] (V[0, 4, r, {3}, {1}] V[0, 3, s, {4, 1}, {1, 1}]
        V[0, 1, 4, {3, 4, 3}, {1, 1, 1}] V[0, 3, 4 - r - s, {1, 2}, {1, 1}]);
C6G1[1] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1] EC[1, 3, 1]
      ER[1, 1] ER[1, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, s, {1, 1}, {1, 1}]
        V[0, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}] V[0, 3, 4, {1}, {1}]);
C6G1[2] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1] EC[1, 3, 1]
      ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, s, {1, 3}, {1, 1}]
        V[0, 3, 4, {2, 4, 1}, {1, 1, 1}] V[0, 1, 4 - r - s, {3}, {1}]);
C6G1[3] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1] EC[2, 3, 1]
      ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, s, {1, 3}, {1, 1}]
        V[0, 3, 4, {2, 4, 2}, {1, 1, 1}] V[0, 2, 4 - r - s, {3}, {1}]);
C6G1[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 2, 1] EC[2, 3, 1] EC[4, 3, 1]
      ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, 4 - r, {1, 3}, {1, 1}]
        V[0, 3, s, {2, 4, 4}, {1, 1, 1}] V[0, 4, 4 - s, {3}, {1}]);
C6G1[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[1, 3, 1] EC[1, 2, 1]
      ER[1, 1] ER[1, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, 4, {1, 1}, {1, 1}]
        V[0, 1, s, {2, 2, 3}, {1, 1, 1}] V[0, 2, 4 - r - s, {1}, {1}]);
C6G1[6] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[1, 3, 1] EC[1, 3, 1]
      ER[1, 1] ER[1, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 1}, {1, 1}]
        V[0, 1, 4 - r, {2, 3, 3}, {1, 1, 1}] V[0, 3, 4 - s, {1}, {1}]);
C6G1[7] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 1, 1] EC[1, 4, 1]
      ER[1, 1] ER[1, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 1}, {1, 1}]
        V[0, 1, 4 - r, {2, 3, 4}, {1, 1, 1}] V[0, 4, 4 - s, {1}, {1}]);
C6G1[8] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[3, 2, 1] EC[2, 1, 1]
      ER[1, 1] ER[2, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]
        V[0, 2, s, {1, 3, 1}, {1, 1, 1}] V[0, 1, 4 - r - s, {2}, {1}]);
C6G1[9] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 2, 1] EC[2, 3, 1]
      ER[1, 1] ER[2, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 2}, {1, 1}]
        V[0, 2, 4 - r, {1, 3, 3}, {1, 1, 1}] V[0, 3, 4 - s, {2}, {1}]);
C6G1[10] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 2, 1]
      EC[2, 4, 1] ER[1, 1] ER[2, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 2}, {1, 1}]
        V[0, 2, 4 - r, {1, 3, 4}, {1, 1, 1}] V[0, 4, 4 - s, {2}, {1}]);
C6G1[11] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 4, 1]
     EC[1, 4, 1] ER[1, 1] ER[4, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 4}, {1, 1}]
```

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      V[0, 4, 4 - s, {1, 3, 3}, {1, 1, 1}] V[0, 1, 4 - r, {4}, {1}]);
C6G1[12] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 4, 1]
    EC[2, 4, 1] ER[1, 1] ER[4, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 4}, {1, 1}]
      V[0, 4, 4 - s, {2, 3, 3}, {1, 1, 1}] V[0, 2, 4 - r, {4}, {1}]);
C6G1[13] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[3, 4, 1] EC[3, 4, 1]
     ER[1, 1] ER[4, 1] (V[0, 1, 4, {2, 3}, {1, 1}] V[0, 3, s, {1, 4}, {1, 1}]
       V[0, 4, r, {3, 3, 3}, {1, 1, 1}] V[0, 3, 4 - r - s, {4}, {1}]);
C7G1[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[3, 1, 1] EC[2, 1, 1]
     ER[2, 1] ER[3, 1] (V[0, 2, r, {1, 1}, {1, 1}] V[0, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}]
       V[0, 3, 4, {1, 4}, {1, 1}] V[0, 2, s, {1}, {1}]);
C7G1[2] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[3, 1, 1] EC[3, 1, 1]
     ER[2, 1] ER[3, 1] (V[0, 2, r, {1, 1}, {1, 1}] V[0, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
       V[0, 3, 4 - s, {1, 4}, {1, 1}] V[0, 3, s, {1}, {1}]);
C7G1[3] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[4, 1, 1] EC[3, 1, 1]
     ER[2, 1] ER[3, 1] (V[0, 2, r, {1, 1}, {1, 1}] V[0, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
       V[0, 3, 4 - s, {1, 4}, {1, 1}] V[0, 4, s, {1}, {1}]);
C7G1[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[4, 1, 1] EC[3, 1, 1]
      ER[4, 1] ER[3, 1] (V[0, 4, s, {3, 1}, {1, 1}] V[0, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
        V[0, 3, 4 - s, {1, 4}, {1, 1}] V[0, 2, r, {1}, {1}]);
C7G1[5] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[4, 1, 1] EC[3, 1, 1]
     ER[4, 1] ER[3, 1] (V[0, 4, s, {3, 1}, {1, 1}] V[0, 1, 4, {3, 4, 3}, {1, 1, 1}]
       V[0, 3, 4 - r - s, {1, 4}, {1, 1}] V[0, 3, r, {1}, {1}]);
C7G1[6] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[3, 1, 1] EC[2, 1, 1]
     EC[2, 4, 1] (V[0, 2, r, {4, 1}, {1, 1}] V[0, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}]
       V[0, 3, 4, {1, 1}, {1, 1}] V[0, 2, s, {1}, {1}]);
C7G1[7] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[3, 1, 1] EC[3, 1, 1]
     EC[2, 4, 1] (V[0, 2, r, {1, 4}, {1, 1}] V[0, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
       V[0, 3, 4 - s, {1, 1}, {1, 1}] V[0, 3, s, {1}, {1}]);
C7G1[8] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[4, 1, 1] EC[3, 1, 1]
     EC[2, 4, 1] (V[0, 2, r, {1, 4}, {1, 1}] V[0, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
       V[0, 3, 4 - s, {1, 1}, {1, 1}] V[0, 4, s, {1}, {1}]);
C8G1[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1] EC[3, 1, 1]
     ER[1, 1] ER[1, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, s, {1, 3}, {1, 1}]
       V[0, 3, 4, {2, 1}, {1, 1}] V[0, 1, 4 - r - s, {3, 2}, {1, 1}]);
C8G1[2] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[4, 3, 1]
      EC[4, 1, 1] ER[1, 1] ER[1, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 4}, {1, 1}]
        V[0, 4, 4 - s, {3, 1}, {1, 1}] V[0, 1, 4 - r, {4, 2}, {1, 1}]);
C8G1[3] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1] EC[3, 2, 1]
     ER[1, 1] ER[2, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, s, {1, 3}, {1, 1}]
       V[0, 3, 4, {2, 2}, {1, 1}] V[0, 2, 4 - r - s, {3, 1}, {1, 1}]);
```

```
C8G1[4] = 1/2 * Sum[Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[4, 3, 1]
    EC[4, 2, 1] ER[1, 1] ER[2, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 4}, {1, 1}]
      V[0, 4, 4 - s, {3, 2}, {1, 1}] V[0, 2, 4 - r, {4, 1}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
C8G1[5] = Sum[Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1] EC[3, 1, 1]
    ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, s, {1, 1}, {1, 1}]
      V[0, 1, 4 - r - s, {2, 3}, {1, 1}] V[0, 3, 4, {1, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4 - r}];
C8G1[6] = 1/2 * Sum[Binomial[4, r] Binomial[4, s] EC[1, 2, 1] EC[2, 4, 1] EC[3, 4, 1]
    ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 2}, {1, 1}] V[0, 2, 4 - r, {1, 4}, {1, 1}]
      V[0, 4, s, {2, 3}, {1, 1}] V[0, 3, 4 - s, {4, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
C8G1[7] = 1/2 * Sum[Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 1, 1]
    EC[3, 1, 1] ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 1}, {1, 1}]
      V[0, 1, 4 - r, {3, 3}, {1, 1}] V[0, 3, 4 - s, {1, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
C8G1[8] = Sum[Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 2, 1] EC[3, 2, 1]
    ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 3}, {1, 1}] V[0, 3, s, {1, 2}, {1, 1}]
      V[0, 2, 4 - r, {3, 3}, {1, 1}] V[0, 3, 4 - s, {2, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
C8G1[9] = 1/2 * Sum[Binomial[4, r] Binomial[4, s] EC[1, 4, 1] EC[4, 2, 1]
    EC[3, 2, 1] ER[1, 1] ER[3, 1] (V[0, 1, r, {2, 4}, {1, 1}] V[0, 4, s, {1, 2}, {1, 1}]
      V[0, 2, 4 - r, {4, 3}, {1, 1}] V[0, 3, 4 - s, {2, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
C8G1[10] = 1/2 * Sum[Multinomial[r, s, 4 - r - s] EC[3, 2, 1] EC[2, 1, 1]
    EC[1, 2, 1] EC[2, 4, 1] (V[0, 3, 4, {1, 2}, {1, 1}] V[0, 2, r, {3, 1}, {1, 1}]
      V[0, 1, s, {2, 2}, {1, 1}] V[0, 2, 4 - r - s, {1, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4 - r}];
C8G1[11] = 1/4 * Sum[Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[2, 1, 1]
    EC[1, 3, 1] EC[3, 4, 1] (V[0, 3, r, {4, 2}, {1, 1}] V[0, 2, 4 - s, {3, 1}, {1, 1}]
      V[0, 1, s, {2, 3}, {1, 1}] V[0, 3, 4 - r, {1, 4}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
C8G1[12] = 1/2 * Sum[Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[3, 1, 1]
    EC[1, 3, 1] EC[3, 2, 1] (V[0, 1, 4 - s, {4, 3}, {1, 1}] V[0, 3, r, {1, 1}, {1, 1}]
      V[0, 1, s, {3, 3}, {1, 1}] V[0, 3, 4 - r, {1, 2}, {1, 1}]), {r, 0, 4}, {s, 0, 4}];
GW18Quarter = Factor[Sum[A1G1[j], {j, 1, 3}] + Sum[A2G1[j], {j, 1, 2}] + Sum[B1G1[j], {j, 1, 6}] +
    Sum[B2G1[j], {j, 1, 8}] + Sum[B3G1[j], {j, 1, 8}] + Sum[B4G1[j], {j, 1, 5}] + Sum[B5G1[j], {j, 1, 10}] +
    Sum[C1G1[j], {j, 1, 13}] + Sum[C2G1[j], {j, 1, 9}] + Sum[C3G1[j], {j, 1, 13}] + Sum[C4G1[j], {j, 1, 4}] +
    Sum[C5G1[j], {j, 1, 5}] + Sum[C6G1[j], {j, 1, 13}] + Sum[C7G1[j], {j, 1, 8}] + Sum[C8G1[j], {j, 1, 12}]];
GW18Half = Factor[GW18Quarter + (GW18Quarter /. {y → x, x → y})];
GW18 = Simplify[GW18Half + (GW18Half /. {y → -y})]
```

Out[129]= −1000

```
In[130]:= A1G3[1] = Sum[EC[1, 3, i] ER[1, 7 - 2 i] ER[1, 1]
    (Sum[V[p, 1, 4, {2, 2, 3}, {1, 7 - 2 i, i}] V[1 - p, 3, 4, {1}, {i}], {p, 0, 1}]), {i, 1, 2}];
```

$$\text{A1G3}[2] = -\text{EC}[1,3,1]\,\text{ER}[1,3]\,\text{ER}[1,3]\left(\sum_{p=0}^{1}\text{V}[p,1,4,\{2,2,3\},\{3,3,1\}]\,\text{V}[1-p,3,4,\{1\},\{1\}]\right);$$

$$\text{A1G3}[3] = \frac{1}{2}\,\text{EC}[1,3,2]\,\text{EC}[1,2,2]\left(\sum_{p=0}^{1}\text{V}[p,1,4,\{2,2,3\},\{2,2,2\}]\,\text{V}[1-p,3,4,\{1\},\{2\}]\right);$$

$$\text{A2G3}[1] = \frac{1}{2} * \sum_{i=1}^{3}\sum_{j=0}^{3-i}\text{EC}[1,3,i]\,\text{ER}[1,2j+1]\,\text{ER}[3,7-2i-2j]\left(\sum_{p=0}^{1}\text{V}[p,1,4,\{2,3\},\{2j+1,i\}]\,\text{V}[1-p,3,4,\{1,4\},\{i,7-2i-2j\}]\right);$$

$$\text{A2G3}[2] = \frac{1}{4} * \sum_{i=1}^{3}\text{EC}[1,3,i]\,\text{EC}[1,4,4-i]\left(\sum_{p=0}^{1}\text{V}[p,1,4,\{4,3\},\{4-i,i\}]\,\text{V}[1-p,3,4,\{1,2\},\{i,4-i\}]\right);$$

$$\text{B1G3}[1] = \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[2,1,1]\,\text{EC}[1,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\text{V}[p,2,i,\{1\},\{1\}]\,\text{V}[q,1,4-i,\{2,2,2,3\},\{1,1,3,1\}]\,\text{V}[1-p-q,3,4,\{1\},\{1\}]\right);$$

$$\text{B1G3}[2] = \frac{1}{2} * \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[3,1,1]\,\text{EC}[1,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\text{V}[p,3,i,\{1\},\{1\}]\,\text{V}[q,1,4,\{3,2,2,3\},\{1,1,3,1\}]\,\text{V}[1-p-q,3,4-i,\{1\},\{1\}]\right);$$

$$\text{B1G3}[3] = \frac{1}{2} * \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[4,1,1]\,\text{EC}[1,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\text{V}[p,4,i,\{1\},\{1\}]\,\text{V}[q,1,4,\{4,2,2,3\},\{1,1,3,1\}]\,\text{V}[1-p-q,3,4-i,\{1\},\{1\}]\right);$$

$$\text{B1G3}[4] = \frac{1}{2} * \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[2,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,2,2]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\text{V}[p,2,i,\{1\},\{1\}]\,\text{V}[q,1,4-i,\{2,2,2,3\},\{1,2,2,1\}]\,\text{V}[1-p-q,3,4,\{1\},\{1\}]\right);$$

$$\text{B1G3}[5] = \frac{1}{4} * \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[3,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,2,2]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\text{V}[p,3,i,\{1\},\{1\}]\,\text{V}[q,1,4,\{3,2,2,3\},\{1,2,2,1\}]\,\text{V}[1-p-q,3,4-i,\{1\},\{1\}]\right);$$

$$\text{B1G3}[6] = \frac{1}{4} * \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[4,1,1]\,\text{EC}[1,3,1]\,\text{EC}[1,2,2]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\text{V}[p,4,i,\{1\},\{1\}]\,\text{V}[q,1,4,\{4,2,2,3\},\{1,2,2,1\}]\,\text{V}[1-p-q,3,4-i,\{1\},\{1\}]\right);$$

$$\text{B2G3}[1] = \sum_{i=0}^{4}\text{Binomial}[4,i]\,\text{EC}[1,2,1]\,\text{EC}[2,3,1]\,\text{ER}[1,1]\,\text{ER}[1,3]$$

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      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2}, {1, 3, 1}]
          V[q, 2, i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {2}, {1}]);
B2G3[2] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[1, 3]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 3}, {1, 3, 1}]
          V[q, 3, 4, {1, 1}, {1, 1}] V[1 - p - q, 1, i, {3}, {1}]);
B2G3[3] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[1, 3]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 3}, {1, 3, 1}]
          V[q, 3, 4, {1, 2}, {1, 1}] V[1 - p - q, 2, i, {3}, {1}]);
B2G3[4] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[1, 1] ER[1, 3]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4, {2, 2, 3}, {1, 3, 1}]
          V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 4, i, {3}, {1}]);
B2G3[5] = 1/2 * ∑_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] EC[1, 2, 2]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2}, {2, 2, 1}]
           V[q, 2, i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {2}, {1}]);
B2G3[6] = 1/2 * ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] EC[1, 2, 2]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 3}, {2, 2, 1}]
           V[q, 3, 4, {1, 1}, {1, 1}] V[1 - p - q, 1, i, {3}, {1}]);
B2G3[7] = 1/2 * ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] EC[1, 2, 2]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 3}, {2, 2, 1}]
           V[q, 3, 4, {1, 2}, {1, 1}] V[1 - p - q, 2, i, {3}, {1}]);
B2G3[8] = 1/2 * ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] EC[1, 2, 2]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4, {2, 2, 3}, {2, 2, 1}]
           V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 4, i, {3}, {1}]);
B3G3[1] = ∑_{k=0}^{1} ∑_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 2 k + 1]
     ER[1, 3 - 2 k] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 2, i, {1, 1}, {2 k + 1, 1}]
         V[q, 1, 4 - i, {2, 2, 3}, {1, 3 - 2 k, 1}] V[1 - p - q, 3, 4, {1}, {1}]);
B3G3[2] = ∑_{k=0}^{1} ∑_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] ER[3, 2 k + 1]
     ER[1, 3 - 2 k] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3, i, {4, 1}, {2 k + 1, 1}]
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          V[q, 1, 4, {3, 2, 3}, {1, 3 - 2 k, 1}] V[1 - p - q, 3, 4 - i, {1}, {1}]]);

B3G3[3] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1] ER[4, 2 k + 1]
      ER[1, 3 - 2 k] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4, i, {3, 1}, {2 k + 1, 1}]
          V[q, 1, 4, {4, 2, 3}, {1, 3 - 2 k, 1}] V[1 - p - q, 3, 4 - i, {1}, {1}]);

B3G3[4] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 2, 1] ER[3, 2 k + 1]
      ER[1, 3 - 2 k] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, 4, {4, 1}, {2 k + 1, 1}]
          V[q, 1, i, {3, 2, 2}, {1, 3 - 2 k, 1}] V[1 - p - q, 2, 4 - i, {1}, {1}]);

B3G3[5] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1 + k] EC[1, 3, 2 - k] ER[2, 1]
      ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1, 1}, {1, 1 + k}]
          V[q, 1, 4 - i, {2, 2, 3}, {1 + k, 1, 2 - k}] V[1 - p - q, 3, 4, {1}, {2 - k}]);

B3G3[6] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1 + k] EC[1, 3, 2 - k] ER[3, 1]
      ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {4, 1}, {1, 1 + k}]
          V[q, 1, 4, {3, 2, 3}, {1 + k, 1, 2 - k}] V[1 - p - q, 3, 4 - i, {1}, {2 - k}]);

B3G3[7] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1 + k] EC[1, 3, 2 - k] ER[4, 1]
      ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4, i, {3, 1}, {1, 1 + k}]
          V[q, 1, 4, {4, 2, 3}, {1 + k, 1, 2 - k}] V[1 - p - q, 3, 4 - i, {1}, {2 - k}]);

B3G3[8] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1 + k] EC[1, 2, 2 - k] ER[3, 1]
      ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, 4, {4, 1}, {1, 1 + k}]
          V[q, 1, i, {3, 2, 2}, {1 + k, 1, 2 - k}] V[1 - p - q, 2, 4 - i, {1}, {2 - k}]);

B4G3[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 2] EC[1, 3, 1] EC[1, 4, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1}, {2}] V[q, 1, 4 - i, {2, 4, 3}, {2, 1, 1}]
          V[1 - p - q, 3, 4, {1, 2}, {1, 1}]);

B4G3[2] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 2] EC[1, 3, 1] EC[1, 4, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {1}, {2}] V[q, 1, 4, {3, 4, 3}, {2, 1, 1}]
          V[1 - p - q, 3, 4 - i, {1, 2}, {1, 1}]);

B4G3[3] = Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 2] EC[1, 4, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1}, {1}] V[q, 1, 4 - i, {2, 4, 3}, {1, 1, 2}]
          V[1 - p - q, 3, 4, {1, 2}, {2, 1}]);

B4G3[4] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 2] EC[1, 4, 1]
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      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 3, i, {1}, {1}] V[q, 1, 4, {3, 4, 3}, {1, 1, 2}]
          V[1 - p - q, 3, 4 - i, {1, 2}, {2, 1}]);
B4G3[5] = ∑_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 2] EC[1, 4, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 4, i, {1}, {1}] V[q, 1, 4, {4, 4, 3}, {1, 1, 2}]
          V[1 - p - q, 3, 4 - i, {1, 2}, {2, 1}]);
B5G3[1] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] ER[3, 1] ER[1, 3]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2}, {3, 1}]
          V[q, 2, i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {2, 4}, {1, 1}]);
B5G3[2] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[1, 3]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 3}, {3, 1}]
          V[q, 3, 4, {1, 1}, {1, 1}] V[1 - p - q, 1, i, {3, 2}, {1, 1}]);
B5G3[3] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[2, 1] ER[1, 3]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 3}, {3, 1}]
          V[q, 3, 4, {1, 2}, {1, 1}] V[1 - p - q, 2, i, {3, 1}, {1, 1}]);
B5G3[4] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[4, 1]
     ER[1, 3] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4, {2, 3}, {3, 1}]
          V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 4, i, {3, 3}, {1, 1}]);
B5G3[5] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 2, 2] EC[2, 3, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2}, {1, 2}]
          V[q, 2, i, {1, 3}, {2, 1}] V[1 - p - q, 3, 4, {2, 4}, {1, 1}]);
B5G3[6] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 2] EC[3, 1, 1] ER[1, 1] ER[1, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 3}, {1, 2}]
          V[q, 3, 4, {1, 1}, {2, 1}] V[1 - p - q, 1, i, {3, 2}, {1, 1}]);
B5G3[7] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 2] EC[3, 2, 1] ER[2, 1] ER[1, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4 - i, {2, 3}, {1, 2}]
          V[q, 3, 4, {1, 2}, {2, 1}] V[1 - p - q, 2, i, {3, 1}, {1, 1}]);
B5G3[8] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 2] EC[3, 4, 1] ER[4, 1]
     ER[1, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} V[p, 1, 4, {2, 3}, {1, 2}]
          V[q, 3, 4 - i, {1, 4}, {2, 1}] V[1 - p - q, 4, i, {3, 3}, {1, 1}]);
B5G3[9] = ∑_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 2] EC[3, 1, 1]
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    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {4, 1}, {1, 1}]
        V[q, 1, 4 - i, {2, 3}, {1, 2}] V[1 - p - q, 3, 4, {1, 1}, {2, 1}]);

B5G3[10] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 2, 2] EC[1, 3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, 4, {1, 1}, {1, 1}]
        V[q, 1, 4 - i, {3, 2}, {1, 2}] V[1 - p - q, 1, i, {3, 2}, {1, 2}]);

C1G3[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 2, 1]
    EC[2, 3, 1] ER[1, 1] ER[2, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 1, s, {2, 2, 2}, {1, 1, 1}] V[u,
            2, 4 - r - s, {1, 1, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4, {2}, {1}]);

C1G3[2] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 2, 1] EC[2, 3, 1] ER[1, 1] ER[2, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 1, s, {3, 2, 2}, {1, 1, 1}]
        V[u, 2, 4 - s, {1, 1, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - r, {2}, {1}]);

C1G3[3] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 2, 1] EC[2, 4, 1] ER[1, 1] ER[2, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 1, s, {3, 2, 2}, {1, 1, 1}]
        V[u, 2, 4 - s, {1, 1, 4}, {1, 1, 1}] V[1 - p - q - u, 4, 4 - r, {2}, {1}]);

C1G3[4] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1]
    EC[1, 3, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 1, s, {2, 2, 3}, {1, 1, 1}] V[u,
            3, 4, {1, 1, 4}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - r - s, {3}, {1}]);

C1G3[5] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1] EC[2, 3, 1] ER[
    1, 1] ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 1, s, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 2, 4}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - r - s, {3}, {1}]);

C1G3[6] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[1, 3, 1] EC[4, 3, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, s, {1, 4, 4}, {1, 1, 1}] V[1 - p - q - u, 4, 4 - s, {3}, {1}]);

C1G3[7] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 3, 1] EC[1, 3, 1] ER[1, 1] ER[3, 1]
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        (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 1, s, {3, 2, 3}, {1, 1, 1}]
            V[u, 3, 4 - r, {1, 4, 1}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - s, {3}, {1}]);

C1G3[8] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 3, 1] EC[2, 3, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 1, s, {3, 2, 3}, {1, 1, 1}]
          V[u, 3, 4 - r, {1, 4, 2}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - s, {3}, {1}]);

C1G3[9] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[4, 1, 1]
       EC[1, 3, 1] EC[2, 3, 1] ER[1, 1] ER[3, 1]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 4, r, {1}, {1}] V[q, 1, s, {4, 2, 3}, {1, 1, 1}]
           V[u, 3, 4 - r, {1, 4, 2}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - s, {3}, {1}]);

C1G3[10] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 4, 1] EC[1, 3, 1]
      EC[3, 1, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 1, s, {4, 2, 3}, {1, 1, 1}]
          V[u, 3, 4, {1, 1, 2}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - r - s, {3}, {1}]);

C1G3[11] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 4, 1] EC[1, 3, 1]
       EC[3, 2, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 1, s, {4, 3, 3}, {1, 1, 1}]
           V[u, 3, 4 - r, {1, 2, 2}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - s, {3}, {1}]);

C1G3[13] = 1/4 * ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
       EC[1, 4, 1] EC[1, 3, 1] EC[3, 4, 1]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 1, 4 - r, {4, 2, 3}, {1, 1, 1}]
           V[u, 3, s, {1, 2, 4}, {1, 1, 1}] V[1 - p - q - u, 4, 4 - s, {3}, {1}]);

C1G3[12] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[1, 4, 1] EC[1, 3, 1]
       EC[3, 1, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 1, s, {4, 3, 3}, {1, 1, 1}]
           V[u, 3, 4 - r, {1, 2, 1}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - s, {3}, {1}]);

C2G3[1] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 2, 1]
      EC[1, 3, 1] ER[2, 1] ER[1, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, s, {2, 2, 2, 3}, {1, 1, 1, 1}]
          V[u, 2, 4 - r - s, {1}, {1}] V[1 - p - q - u, 3, 4, {1}, {1}]);

C2G3[2] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
       EC[1, 3, 1] EC[1, 3, 1] ER[2, 1] ER[1, 1]
       (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3, 3},
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        {1, 1, 1, 1}] V[u, 3, s, {1}, {1}] V[1 - p - q - u, 3, 4 - s, {1}, {1}]);

C2G3[3] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[1, 3, 1] EC[1, 4, 1] ER[2, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3, 4},
        {1, 1, 1, 1}] V[u, 3, s, {1}, {1}] V[1 - p - q - u, 4, 4 - s, {1}, {1}]);

C2G3[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1]
    EC[1, 2, 1] EC[1, 2, 1] ER[3, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, 4, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 2, 3}, {1, 1, 1, 1}]
        V[u, 2, s, {1}, {1}] V[1 - p - q - u, 2, 4 - r - s, {1}, {1}]);

C2G3[5] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 3, 1] EC[1, 2, 1] ER[3, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, 4 - s, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 3, 3}, {1, 1, 1, 1}]
        V[u, 3, s, {1}, {1}] V[1 - p - q - u, 2, 4 - r, {1}, {1}]);

C2G3[6] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 4, 1] EC[1, 2, 1] ER[3, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, 4 - s, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 3, 4}, {1, 1, 1, 1}]
        V[u, 4, s, {1}, {1}] V[1 - p - q - u, 2, 4 - r, {1}, {1}]);

C2G3[7] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1]
    EC[1, 3, 1] EC[1, 3, 1] ER[3, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 3, 3}, {1, 1, 1, 1}]
        V[u, 3, s, {1}, {1}] V[1 - p - q - u, 3, 4 - r - s, {1}, {1}]);

C2G3[8] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1]
    EC[1, 4, 1] ER[3, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 3, 4}, {1, 1, 1, 1}]
        V[u, 3, s, {1}, {1}] V[1 - p - q - u, 4, 4 - r - s, {1}, {1}]);

C2G3[9] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1]
    EC[1, 4, 1] EC[1, 4, 1] ER[3, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 4, 4}, {1, 1, 1, 1}]
        V[u, 4, s, {1}, {1}] V[1 - p - q - u, 4, 4 - r - s, {1}, {1}]);

C3G3[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 2, 1]
    EC[2, 3, 1] ER[1, 1] ER[2, 1]
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      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, s, {1, 1}, {1, 1}] V[q, 1, r, {2, 2, 2}, {1, 1, 1}]
           V[u, 2, 4 - r - s, {1, 3}, {1, 1}] V[1 - p - q - u, 3, 4, {2}, {1}]);
C3G3[2] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1]
      EC[1, 3, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, s, {1, 1}, {1, 1}] V[q, 1, r, {2, 2, 3}, {1, 1, 1}]
           V[u, 3, 4, {1, 1}, {1, 1}] V[1 - p - q - u, 1, 4 - r - s, {3}, {1}]);
C3G3[3] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1]
      EC[2, 3, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, s, {1, 1}, {1, 1}] V[q, 1, r, {2, 2, 3}, {1, 1, 1}]
           V[u, 3, 4, {1, 2}, {1, 1}] V[1 - p - q - u, 2, 4 - r - s, {3}, {1}]);
C3G3[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
      EC[1, 3, 1] EC[3, 4, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
           V[u, 3, s, {1, 4}, {1, 1}] V[1 - p - q - u, 4, 4 - s, {3}, {1}]);
C3G3[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 2, 1]
      EC[2, 1, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, 4, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 3}, {1, 1, 1}]
           V[u, 2, s, {1, 1}, {1, 1}] V[1 - p - q - u, 1, 4 - r - s, {2}, {1}]);
C3G3[6] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 2, 1] EC[3, 2, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
           V[u, 2, r, {1, 3}, {1, 1}] V[1 - p - q - u, 3, 4 - s, {2}, {1}]);
C3G3[7] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 2, 1] EC[4, 2, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
           V[u, 2, r, {1, 4}, {1, 1}] V[1 - p - q - u, 4, 4 - s, {2}, {1}]);
C3G3[8] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
           V[u, 3, 4 - s, {1, 1}, {1, 1}] V[1 - p - q - u, 1, r, {3}, {1}]);
C3G3[9] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[3, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
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        V[u, 3, 4 - s, {1, 2}, {1, 1}] V[1 - p - q - u, 2, r, {3}, {1}]);

C3G3[10] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1]
    EC[3, 4, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 3}, {1, 1, 1}]
        V[u, 3, s, {1, 4}, {1, 1}] V[1 - p - q - u, 4, 4 - r - s, {3}, {1}]);

C3G3[11] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 4, 1] EC[4, 1, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 4}, {1, 1, 1}]
        V[u, 4, 4 - s, {1, 1}, {1, 1}] V[1 - p - q - u, 1, r, {4}, {1}]);

C3G3[12] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 4, 1] EC[4, 2, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 4}, {1, 1, 1}]
        V[u, 4, 4 - s, {1, 2}, {1, 1}] V[1 - p - q - u, 2, r, {4}, {1}]);

C3G3[13] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 4, 1] EC[4, 3, 1]
    ER[1, 1] ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 4},
        {1, 1, 1}] V[u, 4, s, {1, 3}, {1, 1}] V[1 - p - q - u, 3, 4 - r - s, {4}, {1}]);

C4G3[1] = 1/4 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[2, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 2, s, {1}, {1}] V[u, 1,
        4 - r - s, {2, 2, 4, 3}, {1, 1, 1, 1}] V[1 - p - q - u, 3, 4, {1, 2}, {1, 1}]);

C4G3[2] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1}, {1}] V[q, 3, s, {1}, {1}] V[u, 1, 4 - r,
        {2, 3, 4, 3}, {1, 1, 1, 1}] V[1 - p - q - u, 3, 4 - s, {1, 2}, {1, 1}]);

C4G3[3] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 3, s, {1}, {1}] V[u, 1, 4,
        {3, 3, 4, 3}, {1, 1, 1, 1}] V[1 - p - q - u, 3, 4 - r - s, {1, 2}, {1, 1}]);

C4G3[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[4, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 3, r, {1}, {1}] V[q, 4, s, {1}, {1}] V[u, 1, 4,
        {3, 4, 4, 3}, {1, 1, 1, 1}] V[1 - p - q - u, 3, 4 - r - s, {1, 2}, {1, 1}]);

C5G3[1] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1] EC[1, 4, 1]
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EC[1, 3, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2}, {1}] V[q, 2, s, {1, 1}, {1, 1}]
    V[u, 1, 4 - r - s, {2, 4, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4, {1, 2}, {1, 1}]);
C5G3[2] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[2, 1, 1] EC[1, 4, 1]
  EC[1, 3, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 3, r, {2}, {1}] V[q, 2, s, {3, 1}, {1, 1}]
    V[u, 1, 4 - s, {2, 4, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - r, {1, 2}, {1, 1}]);
C5G3[3] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[3, 1, 1] EC[1, 4, 1]
  EC[1, 3, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {3}, {1}] V[q, 3, s, {1, 1}, {1, 1}]
    V[u, 1, 4 - r, {3, 4, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - s, {1, 2}, {1, 1}]);
C5G3[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[3, 1, 1] EC[1, 4, 1]
  EC[1, 3, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 2, r, {3}, {1}] V[q, 3, s, {2, 1}, {1, 1}]
    V[u, 1, 4 - r, {3, 4, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - s, {1, 2}, {1, 1}]);
C5G3[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 4, 1] EC[3, 1, 1] EC[1, 4, 1]
  EC[1, 3, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 4, r, {3}, {1}] V[q, 3, s, {4, 1}, {1, 1}]
    V[u, 1, 4, {3, 4, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - r - s, {1, 2}, {1, 1}]);
C6G3[1] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1]
  EC[1, 3, 1] ER[1, 1] ER[1, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 1}, {1, 1}] V[u,
    1, 4 - r - s, {2, 2, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4, {1}, {1}]);
C6G3[2] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
  EC[1, 3, 1] ER[1, 1] ER[3, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
    3, 4, {2, 4, 1}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - r - s, {3}, {1}]);
C6G3[3] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
  EC[2, 3, 1] ER[1, 1] ER[3, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
    3, 4, {2, 4, 2}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - r - s, {3}, {1}]);
C6G3[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 2, 1]
  EC[2, 3, 1] EC[4, 3, 1] ER[1, 1] ER[3, 1]
  (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, 4 - r, {1, 3}, {1, 1}]
    V[u, 3, s, {2, 4, 4}, {1, 1, 1}] V[1 - p - q - u, 4, 4 - s, {3}, {1}]);
C6G3[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[1, 3, 1]
  EC[1, 2, 1] ER[1, 1] ER[1, 1]
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      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, 4, {1, 1}, {1, 1}] V[u,
            1, s, {2, 2, 3}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - r - s, {1}, {1}]);
C6G3[6] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[1, 3, 1] EC[1, 3, 1] ER[1, 1] ER[1, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 1}, {1, 1}]
            V[u, 1, 4 - r, {2, 3, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - s, {1}, {1}]);
C6G3[7] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[3, 1, 1] EC[1, 4, 1] ER[1, 1] ER[1, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 1}, {1, 1}]
            V[u, 1, 4 - r, {2, 3, 4}, {1, 1, 1}] V[1 - p - q - u, 4, 4 - s, {1}, {1}]);
C6G3[8] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[3, 2, 1]
      EC[2, 1, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, 4, {1, 2}, {1, 1}] V[u,
            2, s, {1, 3, 1}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - r - s, {2}, {1}]);
C6G3[9] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[3, 2, 1] EC[2, 3, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 2}, {1, 1}]
            V[u, 2, 4 - r, {1, 3, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - s, {2}, {1}]);
C6G3[10] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[3, 2, 1] EC[2, 4, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 2}, {1, 1}]
            V[u, 2, 4 - r, {1, 3, 4}, {1, 1, 1}] V[1 - p - q - u, 4, 4 - s, {2}, {1}]);
C6G3[11] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[3, 4, 1] EC[1, 4, 1] ER[1, 1] ER[4, 1]
     (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}] V[
            u, 4, 4 - s, {1, 3, 3}, {1, 1, 1}] V[1 - p - q - u, 1, 4 - r, {4}, {1}]);
C6G3[12] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 4, 1] EC[2, 4, 1]
     ER[1, 1] ER[4, 1] (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4},
            {1, 1}] V[u, 4, 4 - s, {2, 3, 3}, {1, 1, 1}] V[1 - p - q - u, 2, 4 - r, {4}, {1}]);
C6G3[13] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[3, 4, 1]
      EC[3, 4, 1] ER[1, 1] ER[4, 1]
      (∑_{p=0}^{1} ∑_{q=0}^{1-p} ∑_{u=0}^{1-p-q} V[p, 1, 4, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}] V[u,
```

```
        4, r, {3, 3, 3}, {1, 1, 1}] V[1 - p - q - u, 3, 4 - r - s, {4}, {1}]);

C7G3[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[3, 1, 1]
    EC[2, 1, 1] ER[2, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 4}, {1, 1}] V[1 - p - q - u, 2, s, {1}, {1}]);

C7G3[2] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[3, 1, 1] EC[3, 1, 1] ER[2, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
        V[u, 3, 4 - s, {1, 4}, {1, 1}] V[1 - p - q - u, 3, s, {1}, {1}]);

C7G3[3] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[4, 1, 1] EC[3, 1, 1] ER[2, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
        V[u, 3, 4 - s, {1, 4}, {1, 1}] V[1 - p - q - u, 4, s, {1}, {1}]);

C7G3[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
     EC[4, 1, 1] EC[3, 1, 1] ER[4, 1] ER[3, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 4, s, {3, 1}, {1, 1}] V[q, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
         V[u, 3, 4 - s, {1, 4}, {1, 1}] V[1 - p - q - u, 2, r, {1}, {1}]);

C7G3[5] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[4, 1, 1]
    EC[3, 1, 1] ER[4, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 4, s, {3, 1}, {1, 1}] V[q, 1, 4, {3, 4, 3}, {1, 1, 1}]
        V[u, 3, 4 - r - s, {1, 4}, {1, 1}] V[1 - p - q - u, 3, r, {1}, {1}]);

C7G3[6] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1]
    EC[3, 1, 1] EC[2, 1, 1] EC[2, 4, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {4, 1}, {1, 1}] V[q, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 1}, {1, 1}] V[1 - p - q - u, 2, s, {1}, {1}]);

C7G3[7] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[3, 1, 1] EC[3, 1, 1] EC[2, 4, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1, 4}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
        V[u, 3, 4 - s, {1, 1}, {1, 1}] V[1 - p - q - u, 3, s, {1}, {1}]);

C7G3[8] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[4, 1, 1] EC[3, 1, 1] EC[2, 4, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 2, r, {1, 4}, {1, 1}] V[q, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
```

```
        V[u, 3, 4 - s, {1, 1}, {1, 1}] V[1 - p - q - u, 4, s, {1}, {1}]];

C8G3[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
    EC[3, 1, 1] ER[1, 1] ER[1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
        3, 4, {2, 1}, {1, 1}] V[1 - p - q - u, 1, 4 - r - s, {3, 2}, {1, 1}]);

C8G3[2] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[4, 3, 1] EC[4, 1, 1] ER[1, 1] ER[1, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}]
         V[u, 4, 4 - s, {3, 1}, {1, 1}] V[1 - p - q - u, 1, 4 - r, {4, 2}, {1, 1}]);

C8G3[3] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
    EC[3, 2, 1] ER[1, 1] ER[2, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
        3, 4, {2, 2}, {1, 1}] V[1 - p - q - u, 2, 4 - r - s, {3, 1}, {1, 1}]);

C8G3[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[4, 3, 1] EC[4, 2, 1] ER[1, 1] ER[2, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}]
         V[u, 4, 4 - s, {3, 2}, {1, 1}] V[1 - p - q - u, 2, 4 - r, {4, 1}, {1, 1}]);

C8G3[5] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1]
    EC[3, 1, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 1}, {1, 1}] V[u,
        1, 4 - r - s, {2, 3}, {1, 1}] V[1 - p - q - u, 3, 4, {1, 4}, {1, 1}]);

C8G3[6] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 2, 1]
     EC[2, 4, 1] EC[3, 4, 1] ER[1, 1] ER[3, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, 4 - r, {1, 4}, {1, 1}]
         V[u, 4, s, {2, 3}, {1, 1}] V[1 - p - q - u, 3, 4 - s, {4, 4}, {1, 1}]);

C8G3[7] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[3, 1, 1] EC[3, 1, 1] ER[1, 1] ER[3, 1]
     (Sum_{p=0}^{1} Sum_{q=0}^{1-p} Sum_{u=0}^{1-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 1}, {1, 1}]
         V[u, 1, 4 - r, {3, 3}, {1, 1}] V[1 - p - q - u, 3, 4 - s, {1, 4}, {1, 1}]);

C8G3[8] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
    EC[3, 2, 1] EC[3, 2, 1] ER[1, 1] ER[3, 1]
```

$$\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\sum_{u=0}^{1-p-q} V[p,1,r,\{2,3\},\{1,1\}]\,V[q,3,s,\{1,2\},\{1,1\}]\right.$$
$$\left.V[u,2,4-r,\{3,3\},\{1,1\}]\,V[1-p-q-u,3,4-s,\{2,4\},\{1,1\}]\right);$$

$$C8G3[9] = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial}[4,r]\,\text{Binomial}[4,s]\,EC[1,4,1]$$
$$EC[4,2,1]\,EC[3,2,1]\,ER[1,1]\,ER[3,1]$$
$$\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\sum_{u=0}^{1-p-q} V[p,1,r,\{2,4\},\{1,1\}]\,V[q,4,s,\{1,2\},\{1,1\}]\right.$$
$$\left.V[u,2,4-r,\{4,3\},\{1,1\}]\,V[1-p-q-u,3,4-s,\{2,4\},\{1,1\}]\right);$$

$$C8G3[10] = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4-r} \text{Multinomial}[r,s,4-r-s]\,EC[3,2,1]\,EC[2,1,1]\,EC[1,2,1]$$
$$EC[2,4,1]\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\sum_{u=0}^{1-p-q} V[p,3,4,\{1,2\},\{1,1\}]\,V[q,2,r,\{3,1\},\{1,1\}]\right.$$
$$\left.V[u,1,s,\{2,2\},\{1,1\}]\,V[1-p-q-u,2,4-r-s,\{1,4\},\{1,1\}]\right);$$

$$C8G3[11] = \frac{1}{4} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial}[4,r]\,\text{Binomial}[4,s]\,EC[3,2,1]$$
$$EC[2,1,1]\,EC[1,3,1]\,EC[3,4,1]$$
$$\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\sum_{u=0}^{1-p-q} V[p,3,r,\{4,2\},\{1,1\}]\,V[q,2,4-s,\{3,1\},\{1,1\}]\right.$$
$$\left.V[u,1,s,\{2,3\},\{1,1\}]\,V[1-p-q-u,3,4-r,\{1,4\},\{1,1\}]\right);$$

$$C8G3[12] = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial}[4,r]\,\text{Binomial}[4,s]\,EC[3,1,1]$$
$$EC[3,1,1]\,EC[1,3,1]\,EC[3,2,1]$$
$$\left(\sum_{p=0}^{1}\sum_{q=0}^{1-p}\sum_{u=0}^{1-p-q} V[p,1,4-s,\{4,3\},\{1,1\}]\,V[q,3,r,\{1,1\},\{1,1\}]\right.$$
$$\left.V[u,1,s,\{3,3\},\{1,1\}]\,V[1-p-q-u,3,4-r,\{1,2\},\{1,1\}]\right);$$

$$D1G3[1] = -\frac{1}{12} * EC[1,3,2]\,ER[1,1]^4\,(V[0,1,4,\{2,2,2,2,3\},\{1,1,1,1,2\}]$$
$$V[0,3,4,\{1\},\{2\}]);$$

$$D1G3[2] = -\frac{1}{3} * EC[1,3,1]\,ER[1,3]\,ER[1,1]^3$$
$$(V[0,1,4,\{2,2,2,2,3\},\{3,1,1,1,1\}]\,V[0,3,4,\{1\},\{1\}]);$$

$$D2G3[1] = -\frac{1}{3} * EC[1,3,2]\,ER[1,1]^3\,ER[3,1]$$
$$(V[0,1,4,\{2,2,2,3\},\{1,1,1,2\}]\,V[0,3,4,\{1,4\},\{2,1\}]);$$

$$D2G3[2] = -\frac{1}{3} * EC[1,3,1]\,ER[1,1]^3\,ER[3,3]$$
$$(V[0,1,4,\{2,2,2,3\},\{1,1,1,1\}]\,V[0,3,4,\{1,4\},\{1,3\}]);$$

$$D2G3[3] = \frac{1}{2} * EC[1,3,1]\,EC[1,2,2]\,ER[1,1]\,ER[3,1]$$
$$(V[0,1,4,\{2,2,2,3\},\{2,2,1,1\}]\,V[0,3,4,\{1,4\},\{1,1\}]);$$

$$D3G3[1] = \frac{1}{2} * EC[1,3,1]^2\,ER[1,3]\,ER[1,1]$$
$$(V[0,1,4,\{2,2,3,3\},\{3,1,1,1\}]\,V[0,3,4,\{1,1\},\{1,1\}]);$$

$$D3G3[2] = \frac{1}{4} * EC[1,3,1]^2\,EC[1,2,2]$$

```
    (V[0, 1, 4, {2, 2, 3, 3}, {2, 2, 1, 1}] V[0, 3, 4, {1, 1}, {1, 1}]);
```

$$\text{D4G3[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 3]}\ \text{ER[3, 1]}$$

```
    (V[0, 1, 4, {2, 3, 3}, {3, 1, 1}] V[0, 3, 4, {4, 1, 1}, {1, 1, 1}]);
```

$$\text{D4G3[2]} = \frac{1}{2} * \text{EC[1, 3, 2]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$

```
    (V[0, 1, 4, {2, 3, 3}, {1, 2, 1}] V[0, 3, 4, {4, 1, 1}, {1, 2, 1}]);
```

$$\text{D4G3[3]} = \frac{1}{4} * \text{EC[1, 3, 1]}\ \text{EC[1, 3, 1]}\ \text{EC[1, 4, 2]}$$

```
    (V[0, 1, 4, {4, 3, 3}, {2, 1, 1}] V[0, 3, 4, {2, 1, 1}, {2, 1, 1}]);
```

$$\text{D4G3[4]} = \frac{1}{2} * \text{EC[1, 3, 2]}\ \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}$$

```
    (V[0, 1, 4, {4, 3, 3}, {1, 2, 1}] V[0, 3, 4, {2, 1, 1}, {1, 2, 1}]);
```

$$\text{D5G3[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}\ \text{ER[1, 3]}\ \text{ER[3, 1]}$$

```
    (V[0, 1, 4, {2, 3, 4}, {3, 1, 1}] V[0, 3, 4, {1, 2, 4}, {1, 1, 1}]);
```

$$\text{D5G3[2]} = \frac{1}{2} * \text{EC[1, 3, 2]}\ \text{EC[1, 4, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$

```
    (V[0, 1, 4, {2, 3, 4}, {1, 2, 1}] V[0, 3, 4, {1, 2, 4}, {2, 1, 1}]);
```

$$\text{D6G3[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}\ \text{ER[1, 3]}\ \text{ER[1, 1]}$$

```
    (V[0, 1, 4, {2, 2, 3, 4}, {3, 1, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]);
```

$$\text{D6G3[2]} = \frac{1}{4} * \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}\ \text{EC[1, 2, 2]}$$

```
    (V[0, 1, 4, {2, 2, 3, 4}, {2, 2, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]);
```

$$\text{E1G3[1]} = -\frac{1}{12} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[2, 1, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}^4\ (\text{V[0, 2, i, \{1\}, \{1\}]}\ \text{V[0, 1, 4 - i, \{2, 2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1, 1\}]}\ \text{V[0, 3, 4, \{1\}, \{1\}]});$$

$$\text{E1G3[2]} = -\frac{1}{24} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[3, 1, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}^4\ (\text{V[0, 3, i, \{1\}, \{1\}]}\ \text{V[0, 1, 4, \{3, 2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1, 1\}]}\ \text{V[0, 3, 4 - i, \{1\}, \{1\}]});$$

$$\text{E1G3[3]} = -\frac{1}{24} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[4, 1, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}^4\ (\text{V[0, 4, i, \{1\}, \{1\}]}\ \text{V[0, 1, 4, \{4, 2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1, 1\}]}\ \text{V[0, 3, 4 - i, \{1\}, \{1\}]});$$

$$\text{E2G3[1]} = -\frac{1}{12} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[1, 2, 1]}\ \text{EC[2, 3, 1]}\ \text{ER[1, 1]}^4$$

```
      (V[0, 1, 4 - i, {2, 2, 2, 2, 2}, {1, 1, 1, 1, 1}]
        V[0, 2, i, {1, 3}, {1, 1}] V[0, 3, 4, {2}, {1}]);
```

$$\text{E2G3[2]} = -\frac{1}{12} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[1, 3, 1]}\ \text{EC[3, 1, 1]}\ \text{ER[1, 1]}^4$$

```
      (V[0, 1, 4 - i, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
        V[0, 3, 4, {1, 1}, {1, 1}] V[0, 1, i, {3}, {1}]);
```

$$\text{E2G3[3]} = -\frac{1}{12} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[1, 3, 1]}\ \text{EC[3, 2, 1]}\ \text{ER[1, 1]}^4$$

```
      (V[0, 1, 4 - i, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
        V[0, 3, 4, {1, 2}, {1, 1}] V[0, 2, i, {3}, {1}]);
```

$$E2G3[4] = -\frac{1}{12} * \sum_{i=0}^{4} Binomial[4, i]\, EC[1, 3, 1]\, EC[3, 4, 1]\, ER[1, 1]^4$$
$$(V[0, 1, 4, \{2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]$$
$$V[0, 3, 4 - i, \{1, 4\}, \{1, 1\}]\, V[0, 4, i, \{3\}, \{1\}]);$$

$$E3G3[1] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[2, 1, 1]\, EC[1, 3, 1]\, ER[2, 1]$$
$$ER[1, 1]^3\, (V[0, 2, i, \{1, 1\}, \{1, 1\}]$$
$$V[0, 1, 4 - i, \{2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]\, V[0, 3, 4, \{1\}, \{1\}]);$$

$$E3G3[2] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[2, 1, 1]\, EC[1, 3, 1]$$
$$ER[3, 1]\, ER[1, 1]^3\, (V[0, 2, i, \{1\}, \{1\}]$$
$$V[0, 1, 4 - i, \{2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]\, V[0, 3, 4, \{1, 4\}, \{1, 1\}]);$$

$$E3G3[3] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[3, 1, 1]\, EC[1, 3, 1]\, ER[3, 1]\, ER[1, 1]^3$$
$$(V[0, 3, i, \{1\}, \{1\}]\, V[0, 1, 4, \{3, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]$$
$$V[0, 3, 4 - i, \{1, 4\}, \{1, 1\}]);$$

$$E3G3[4] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[4, 1, 1]\, EC[1, 3, 1]\, ER[3, 1]\, ER[1, 1]^3$$
$$(V[0, 4, i, \{1\}, \{1\}]\, V[0, 1, 4, \{4, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]$$
$$V[0, 3, 4 - i, \{1, 4\}, \{1, 1\}]);$$

$$E4G3[1] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[2, 1, 1]\, EC[1, 3, 1]\, ER[2, 1]^3$$
$$ER[1, 1]\, (V[0, 2, i, \{1, 1, 1, 1\}, \{1, 1, 1, 1\}]$$
$$V[0, 1, 4 - i, \{2, 2, 3\}, \{1, 1, 1\}]\, V[0, 3, 4, \{1\}, \{1\}]);$$

$$E4G3[2] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[2, 1, 1]\, EC[1, 3, 1]\, ER[3, 1]^3$$
$$ER[1, 1]\, (V[0, 2, i, \{1\}, \{1\}]\, V[0, 1, 4 - i, \{2, 2, 3\}, \{1, 1, 1\}]$$
$$V[0, 3, 4, \{1, 4, 4, 4\}, \{1, 1, 1, 1\}]);$$

$$E4G3[3] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[3, 1, 1]\, EC[1, 3, 1]\, ER[3, 1]^3$$
$$ER[1, 1]\, (V[0, 3, i, \{1\}, \{1\}]\, V[0, 1, 4, \{3, 2, 3\}, \{1, 1, 1\}]$$
$$V[0, 3, 4 - i, \{1, 4, 4, 4\}, \{1, 1, 1, 1\}]);$$

$$E4G3[4] = -\frac{1}{3} * \sum_{i=0}^{4} Binomial[4, i]\, EC[4, 1, 1]\, EC[1, 3, 1]\, ER[3, 1]^3$$
$$ER[1, 1]\, (V[0, 4, i, \{1\}, \{1\}]\, V[0, 1, 4, \{4, 2, 3\}, \{1, 1, 1\}]$$
$$V[0, 3, 4 - i, \{1, 4, 4, 4\}, \{1, 1, 1, 1\}]);$$

$$E5G3[1] = \frac{1}{2} * \sum_{i=0}^{4} Binomial[4, i]\, EC[2, 1, 1]^2\, EC[1, 3, 1]\, ER[2, 1]$$
$$ER[1, 1]\, (V[0, 2, i, \{1, 1, 1\}, \{1, 1, 1\}]$$
$$V[0, 1, 4 - i, \{2, 2, 2, 3\}, \{1, 1, 1, 1\}]\, V[0, 3, 4, \{1\}, \{1\}]);$$

$$E5G3[2] = \frac{1}{2} * \sum_{i=0}^{4} Binomial[4, i]\, EC[2, 1, 1]\, EC[1, 3, 1]^2\, ER[3, 1]\, ER[1, 1]$$
$$(V[0, 2, i, \{1\}, \{1\}]\, V[0, 1, 4 - i, \{2, 2, 3, 3\}, \{1, 1, 1, 1\}]$$
$$V[0, 3, 4, \{1, 1, 4\}, \{1, 1, 1\}]);$$

$$E5G3[3] = \frac{1}{2} * \sum_{i=0}^{4} Binomial[4, i]\, EC[3, 1, 1]\, EC[1, 3, 1]^2\, ER[3, 1]\, ER[1, 1]$$
$$(V[0, 3, i, \{1\}, \{1\}]\, V[0, 1, 4, \{3, 2, 3, 3\}, \{1, 1, 1, 1\}]$$

```
        V[0, 3, 4 - i, {1, 1, 4}, {1, 1, 1}]);
E5G3[4] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1]^2 ER[3, 1] ER[1, 1]
      (V[0, 4, i, {1}, {1}] V[0, 1, 4, {4, 2, 3, 3}, {1, 1, 1, 1}]
        V[0, 3, 4 - i, {1, 1, 4}, {1, 1, 1}]);
E6G3[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1]^2 EC[1, 4, 1] (V[0, 2, i, {1},
          {1}] V[0, 1, 4 - i, {2, 4, 3, 3}, {1, 1, 1, 1}] V[0, 3, 4, {1, 1, 2}, {1, 1, 1}]);
E6G3[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1]^2 EC[1, 4, 1]
      (V[0, 3, i, {1}, {1}] V[0, 1, 4, {3, 4, 3, 3}, {1, 1, 1, 1}]
        V[0, 3, 4 - i, {1, 1, 2}, {1, 1, 1}]);
E6G3[3] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1]^2 EC[1, 4, 1]
      (V[0, 4, i, {1}, {1}] V[0, 1, 4, {4, 4, 3, 3}, {1, 1, 1, 1}]
        V[0, 3, 4 - i, {1, 1, 2}, {1, 1, 1}]);
E7G3[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 2, 1]
     ER[3, 1] ER[1, 1] (V[0, 3, 4, {4, 2, 1}, {1, 1, 1}]
        V[0, 1, i, {3, 4, 2, 2}, {1, 1, 1, 1}] V[0, 2, 4 - i, {1}, {1}]);
E7G3[2] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 3, 1]
    ER[3, 1] ER[1, 1] (V[0, 3, i, {4, 2, 1}, {1, 1, 1}]
      V[0, 1, 4, {3, 4, 2, 3}, {1, 1, 1, 1}] V[0, 3, 4 - i, {1}, {1}]);
E8G3[1] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] ER[3, 1]
     ER[1, 1]^3 (V[0, 1, 4 - i, {2, 2, 2, 2}, {1, 1, 1, 1}]
        V[0, 2, i, {1, 3}, {1, 1}] V[0, 3, 4, {2, 4}, {1, 1}]);
E8G3[2] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1]
     ER[1, 1]^3 (V[0, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 1, 1}]
        V[0, 3, 4, {1, 1}, {1, 1}] V[0, 1, i, {3, 2}, {1, 1}]);
E8G3[3] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[2, 1]
     ER[1, 1]^3 (V[0, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 1, 1}]
        V[0, 3, 4, {1, 2}, {1, 1}] V[0, 2, i, {3, 1}, {1, 1}]);
E8G3[4] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[4, 1]
     ER[1, 1]^3 (V[0, 1, 4, {2, 2, 2, 3}, {1, 1, 1, 1}]
        V[0, 3, 4 - i, {1, 4}, {1, 1}] V[0, 4, i, {3, 3}, {1, 1}]);
E9G3[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1]^2 EC[2, 3, 1] ER[3, 1]
     ER[1, 1] (V[0, 1, 4 - i, {2, 2, 2}, {1, 1, 1}]
        V[0, 2, i, {1, 1, 3}, {1, 1, 1}] V[0, 3, 4, {2, 4}, {1, 1}]);
E9G3[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1]^2 EC[3, 1, 1] ER[1, 1]
     ER[1, 1] (V[0, 1, 4 - i, {2, 3, 3}, {1, 1, 1}]
```

```
        V[0, 3, 4, {1, 1, 1}, {1, 1, 1}] V[0, 1, i, {3, 2}, {1, 1}]);
```

$$\text{E9G3[3]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[1, 3, 1]^2\ \text{EC}[3, 2, 1]\ \text{ER}[2, 1]$$

```
      ER[1, 1] (V[0, 1, 4 - i, {2, 3, 3}, {1, 1, 1}]
        V[0, 3, 4, {1, 1, 2}, {1, 1, 1}] V[0, 2, i, {3, 1}, {1, 1}]);
```

$$\text{E9G3[4]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[1, 3, 1]^2\ \text{EC}[3, 4, 1]\ \text{ER}[4, 1]$$

```
      ER[1, 1] (V[0, 1, 4, {2, 3, 3}, {1, 1, 1}]
        V[0, 3, 4 - i, {1, 1, 4}, {1, 1, 1}] V[0, 4, i, {3, 3}, {1, 1}]);
```

$$\text{E10G3[1]} = \frac{1}{4} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[3, 1, 1]\ \text{EC}[1, 2, 1]^2\ \text{EC}[1, 3, 1]$$

```
      (V[0, 3, 4, {1, 1}, {1, 1}] V[0, 1, 4 - i, {3, 2, 2}, {1, 1, 1}]
        V[0, 2, i, {1, 1, 4}, {1, 1, 1}]);
```

$$\text{E10G3[2]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[2, 1, 1]\ \text{EC}[1, 3, 1]^2\ \text{EC}[3, 1, 1]$$

```
      (V[0, 2, i, {4, 1}, {1, 1}] V[0, 1, 4 - i, {2, 3, 3}, {1, 1, 1}]
        V[0, 3, 4, {1, 1, 1}, {1, 1, 1}]);
```

$$\text{E11G3[1]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[1, 2, 1]\ \text{EC}[1, 3, 1]\ \text{EC}[2, 3, 1]$$

```
      ER[1, 1] ER[2, 1] (V[0, 1, i, {2, 2, 3}, {1, 1, 1}]
        V[0, 2, 4 - i, {1, 1, 3}, {1, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]);
```

$$\text{E11G3[2]} = \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[1, 2, 1]\ \text{EC}[1, 3, 1]\ \text{EC}[2, 3, 1]$$

```
     ER[1, 1] ER[3, 1] (V[0, 1, i, {2, 2, 3}, {1, 1, 1}]
       V[0, 2, 4 - i, {1, 3}, {1, 1}] V[0, 3, 4, {1, 2, 4}, {1, 1, 1}]);
```

$$\text{E11G3[3]} = \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[1, 2, 1]\ \text{EC}[1, 3, 1]\ \text{EC}[2, 3, 1]$$

```
     EC[1, 4, 1] (V[0, 1, i, {2, 4, 3}, {1, 1, 1}]
       V[0, 2, 4 - i, {1, 3}, {1, 1}] V[0, 3, 4, {1, 2, 2}, {1, 1, 1}]);
```

$$\text{E12G3[1]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[2, 1, 1]\ \text{EC}[1, 3, 1]^2$$

```
      ER[2, 1] ER[1, 1] (V[0, 2, i, {1, 1}, {1, 1}]
        V[0, 1, 4 - i, {2, 2, 3, 3}, {1, 1, 1, 1}] V[0, 3, 4, {1, 1}, {1, 1}]);
```

$$\text{E12G3[2]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[2, 1, 1]^2\ \text{EC}[1, 3, 1]\ \text{ER}[3, 1]$$

```
      ER[1, 1] (V[0, 2, i, {1, 1}, {1, 1}]
        V[0, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 1, 1}] V[0, 3, 4, {1, 4}, {1, 1}]);
```

$$\text{E12G3[3]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[3, 1, 1]\ \text{EC}[1, 3, 1]^2\ \text{ER}[3, 1]$$

```
      ER[1, 1] (V[0, 3, i, {1, 1}, {1, 1}]
        V[0, 1, 4, {3, 2, 3, 3}, {1, 1, 1, 1}] V[0, 3, 4 - i, {1, 4}, {1, 1}]);
```

$$\text{E12G3[4]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[4, 1, 1]^2\ \text{EC}[1, 3, 1]\ \text{ER}[3, 1]$$

```
      ER[1, 1] (V[0, 4, i, {1, 1}, {1, 1}]
        V[0, 1, 4, {4, 2, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4 - i, {1, 4}, {1, 1}]);
```

$$\text{E13G3[1]} = \frac{1}{4} * \sum_{i=0}^{4} \text{Binomial}[4, i]\ \text{EC}[2, 1, 1]^2\ \text{EC}[1, 3, 1]\ \text{EC}[1, 4, 1]$$

```
(V[0, 2, i, {1, 1}, {1, 1}] V[0, 1, 4 - i, {2, 2, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}]);
```

```
E13G3[2] = 1/2 * Sum[Binomial[4, i] EC[3, 1, 1]^2 EC[1, 3, 1] EC[1, 4, 1] (V[0, 3, i, {1, 1},
      {1, 1}] V[0, 1, 4, {3, 3, 4, 3}, {1, 1, 1, 1}] V[0, 3, 4 - i, {1, 2}, {1, 1}]), {i, 0, 4}];
E14G3[1] = Sum[Binomial[4, i] EC[2, 1, 1] EC[2, 3, 1] EC[1, 4, 1]
    ER[1, 1] ER[3, 1] (V[0, 1, i, {2, 4, 2}, {1, 1, 1}]
      V[0, 2, 4 - i, {1, 3}, {1, 1}] V[0, 3, 4, {2, 2, 4}, {1, 1, 1}]), {i, 0, 4}];
E14G3[2] = 1/2 * Sum[Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 2, 1]
    ER[1, 1] ER[1, 1] (V[0, 1, i, {2, 3, 2}, {1, 1, 1}]
      V[0, 1, 4 - i, {2, 2, 3}, {1, 1, 1}] V[0, 3, 4, {1, 1}, {1, 1}]), {i, 0, 4}];
E15G3[1] = 1/2 * Sum[Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 2, 1]
    ER[3, 1] ER[2, 1] (V[0, 1, i, {4, 3, 2}, {1, 1, 1}]
      V[0, 2, 4 - i, {1, 1}, {1, 1}] V[0, 3, 4, {4, 2, 1}, {1, 1, 1}]), {i, 0, 4}];
E15G3[2] = Sum[Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 3, 1]
    ER[3, 1] ER[3, 1] (V[0, 3, i, {4, 2, 1}, {1, 1, 1}]
      V[0, 3, 4 - i, {1, 4}, {1, 1}] V[0, 1, 4, {4, 3, 3}, {1, 1, 1}]), {i, 0, 4}];
E16G3[1] = 1/2 * Sum[Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 2, 1]
    ER[1, 1] ER[2, 1] (V[0, 1, i, {4, 3, 2, 2}, {1, 1, 1, 1}]
      V[0, 2, 4 - i, {1, 1}, {1, 1}] V[0, 3, 4, {2, 1}, {1, 1}]), {i, 0, 4}];
E16G3[2] = Sum[Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 3, 1]
    ER[1, 1] ER[3, 1] (V[0, 1, 4, {4, 3, 2, 3}, {1, 1, 1, 1}]
      V[0, 3, 4 - i, {1, 4}, {1, 1}] V[0, 3, i, {2, 1}, {1, 1}]), {i, 0, 4}];
E17G3 = 1/4 * Sum[Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 4, 1]
    EC[1, 4, 1] (V[0, 1, 4, {3, 4, 4, 3}, {1, 1, 1, 1}]
      V[0, 3, i, {1, 2}, {1, 1}] V[0, 3, 4 - i, {1, 2}, {1, 1}]), {i, 0, 4}];
GW38Quarter = Factor[Sum[A1G3[j], {j, 1, 3}] + Sum[A2G3[j], {j, 1, 2}] + Sum[B1G3[j], {j, 1, 6}] + Sum[B2G3[j], {j, 1, 8}] +
    Sum[B3G3[j], {j, 1, 8}] + Sum[B4G3[j], {j, 1, 5}] + Sum[B5G3[j], {j, 1, 10}] + Sum[C1G3[j], {j, 1, 13}] + Sum[C2G3[j], {j, 1, 9}] +
    Sum[C3G3[j], {j, 1, 13}] + Sum[C4G3[j], {j, 1, 4}] + Sum[C5G3[j], {j, 1, 5}] + Sum[C6G3[j], {j, 1, 13}] + Sum[C7G3[j], {j, 1, 8}] +
    Sum[C8G3[j], {j, 1, 12}] + Sum[D1G3[j], {j, 1, 2}] + Sum[D2G3[j], {j, 1, 3}] + Sum[D3G3[j], {j, 1, 2}] + Sum[D4G3[j], {j, 1, 4}] +
    Sum[D5G3[j], {j, 1, 2}] + Sum[D6G3[j], {j, 1, 2}] + Sum[E1G3[j], {j, 1, 3}] + Sum[E2G3[j], {j, 1, 4}] + Sum[E3G3[j], {j, 1, 4}] +
    Sum[E4G3[j], {j, 1, 4}] + Sum[E5G3[j], {j, 1, 4}] + Sum[E6G3[j], {j, 1, 3}] + Sum[E7G3[j], {j, 1, 2}] + Sum[E8G3[j], {j, 1, 4}] +
    Sum[E9G3[j], {j, 1, 4}] + Sum[E10G3[j], {j, 1, 2}] + Sum[E11G3[j], {j, 1, 3}] + Sum[E12G3[j], {j, 1, 4}] +
    Sum[E13G3[j], {j, 1, 2}] + Sum[E14G3[j], {j, 1, 2}] + Sum[E15G3[j], {j, 1, 2}] + Sum[E16G3[j], {j, 1, 2}] + E17G3];
GW38Half = Factor[GW38Quarter + (GW38Quarter /. {y → x, x → y})];
GW38 = Simplify[GW38Half + (GW38Half /. {y → -y})]
```

Out[313]= $-\frac{2840}{3}$

In[314]:=
```
A1G5[1] = Sum_{i=1}^{2} EC[1, 3, i] ER[1, 7 - 2 i] ER[1, 1]
    (Sum_{p=0}^{2} V[p, 1, 4, {2, 2, 3}, {1, 7 - 2 i, i}] V[2 - p, 3, 4, {1}, {i}]);
A1G5[2] = -EC[1, 3, 1] ER[1, 3] ER[1, 3]
    (Sum_{p=0}^{2} V[p, 1, 4, {2, 2, 3}, {3, 3, 1}] V[2 - p, 3, 4, {1}, {1}]);
A1G5[3] = 1/2 EC[1, 3, 2] EC[1, 2, 2]
    (Sum_{p=0}^{2} V[p, 1, 4, {2, 2, 3}, {2, 2, 2}] V[2 - p, 3, 4, {1}, {2}]);
A2G5[1] = 1/2 * Sum_{i=1}^{3} Sum_{j=0}^{3-i} EC[1, 3, i] ER[1, 2 j + 1] ER[3, 7 - 2 i - 2 j]
      (Sum_{p=0}^{2} V[p, 1, 4, {2, 3}, {2 j + 1, i}] V[2 - p, 3, 4, {1, 4}, {i, 7 - 2 i - 2 j}]);
A2G5[2] = 1/4 * Sum_{i=1}^{3} EC[1, 3, i] EC[1, 4, 4 - i]
     (Sum_{p=0}^{2} V[p, 1, 4, {4, 3}, {4 - i, i}] V[2 - p, 3, 4, {1, 2}, {i, 4 - i}]);
B1G5[1] = Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] ER[1, 1]
    ER[1, 3] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2, i, {1}, {1}]
        V[q, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 3, 1}] V[2 - p - q, 3, 4, {1}, {1}]);
B1G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] ER[1, 1]
     ER[1, 3] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, i, {1}, {1}]
         V[q, 1, 4, {3, 2, 2, 3}, {1, 1, 3, 1}] V[2 - p - q, 3, 4 - i, {1}, {1}]);
B1G5[3] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1] ER[1, 1]
     ER[1, 3] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 4, i, {1}, {1}]
         V[q, 1, 4, {4, 2, 2, 3}, {1, 1, 3, 1}] V[2 - p - q, 3, 4 - i, {1}, {1}]);
B1G5[4] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] EC[1, 2, 2]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2, i, {1}, {1}]
        V[q, 1, 4 - i, {2, 2, 2, 3}, {1, 2, 2, 1}] V[2 - p - q, 3, 4, {1}, {1}]);
B1G5[5] = 1/4 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 2, 2]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, i, {1}, {1}]
        V[q, 1, 4, {3, 2, 2, 3}, {1, 2, 2, 1}] V[2 - p - q, 3, 4 - i, {1}, {1}]);
```

$$\text{B1G5[6]} = \frac{1}{4} * \sum_{i=0}^{4} \text{Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1] EC[1, 2, 2]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 4, i, \{1\}, \{1\}]}\right.$$
$$\left.\text{V[q, 1, 4, \{4, 2, 2, 3\}, \{1, 2, 2, 1\}] V[2 - p - q, 3, 4 - i, \{1\}, \{1\}]}\right);$$

$$\text{B2G5[1]} = \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] ER[1, 1] ER[1, 3]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4 - i, \{2, 2, 2\}, \{1, 3, 1\}]}\right.$$
$$\left.\text{V[q, 2, i, \{1, 3\}, \{1, 1\}] V[2 - p - q, 3, 4, \{2\}, \{1\}]}\right);$$

$$\text{B2G5[2]} = \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[1, 3]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4 - i, \{2, 2, 3\}, \{1, 3, 1\}]}\right.$$
$$\left.\text{V[q, 3, 4, \{1, 1\}, \{1, 1\}] V[2 - p - q, 1, i, \{3\}, \{1\}]}\right);$$

$$\text{B2G5[3]} = \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[1, 3]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4 - i, \{2, 2, 3\}, \{1, 3, 1\}]}\right.$$
$$\left.\text{V[q, 3, 4, \{1, 2\}, \{1, 1\}] V[2 - p - q, 2, i, \{3\}, \{1\}]}\right);$$

$$\text{B2G5[4]} = \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[1, 1] ER[1, 3]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4, \{2, 2, 3\}, \{1, 3, 1\}]}\right.$$
$$\left.\text{V[q, 3, 4 - i, \{1, 4\}, \{1, 1\}] V[2 - p - q, 4, i, \{3\}, \{1\}]}\right);$$

$$\text{B2G5[5]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] EC[1, 2, 2]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4 - i, \{2, 2, 2\}, \{2, 2, 1\}]}\right.$$
$$\left.\text{V[q, 2, i, \{1, 3\}, \{1, 1\}] V[2 - p - q, 3, 4, \{2\}, \{1\}]}\right);$$

$$\text{B2G5[6]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] EC[1, 2, 2]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4 - i, \{2, 2, 3\}, \{2, 2, 1\}]}\right.$$
$$\left.\text{V[q, 3, 4, \{1, 1\}, \{1, 1\}] V[2 - p - q, 1, i, \{3\}, \{1\}]}\right);$$

$$\text{B2G5[7]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] EC[1, 2, 2]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4 - i, \{2, 2, 3\}, \{2, 2, 1\}]}\right.$$
$$\left.\text{V[q, 3, 4, \{1, 2\}, \{1, 1\}] V[2 - p - q, 2, i, \{3\}, \{1\}]}\right);$$

$$\text{B2G5[8]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] EC[1, 2, 2]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4, \{2, 2, 3\}, \{2, 2, 1\}]}\right.$$
$$\left.\text{V[q, 3, 4 - i, \{1, 4\}, \{1, 1\}] V[2 - p - q, 4, i, \{3\}, \{1\}]}\right);$$

$$\text{B3G5[1]} = \sum_{k=0}^{1} \sum_{i=0}^{4} \text{Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 2 k + 1]}$$

```
      ER[1, 3 - 2 k] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2, i, {1, 1}, {2 k + 1, 1}]
          V[q, 1, 4 - i, {2, 2, 3}, {1, 3 - 2 k, 1}] V[2 - p - q, 3, 4, {1}, {1}]);
B3G5[2] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] ER[3, 2 k + 1]
      ER[1, 3 - 2 k] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, i, {4, 1}, {2 k + 1, 1}]
          V[q, 1, 4, {3, 2, 3}, {1, 3 - 2 k, 1}] V[2 - p - q, 3, 4 - i, {1}, {1}]);
B3G5[3] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1] ER[4, 2 k + 1]
      ER[1, 3 - 2 k] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 4, i, {3, 1}, {2 k + 1, 1}]
          V[q, 1, 4, {4, 2, 3}, {1, 3 - 2 k, 1}] V[2 - p - q, 3, 4 - i, {1}, {1}]);
B3G5[4] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 2, 1] ER[3, 2 k + 1]
      ER[1, 3 - 2 k] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, 4, {4, 1}, {2 k + 1, 1}]
          V[q, 1, i, {3, 2, 2}, {1, 3 - 2 k, 1}] V[2 - p - q, 2, 4 - i, {1}, {1}]);
B3G5[5] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1 + k] EC[1, 3, 2 - k] ER[2, 1]
      ER[1, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2, i, {1, 1}, {1, 1 + k}]
          V[q, 1, 4 - i, {2, 2, 3}, {1 + k, 1, 2 - k}] V[2 - p - q, 3, 4, {1}, {2 - k}]);
B3G5[6] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1 + k] EC[1, 3, 2 - k] ER[3, 1]
      ER[1, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, i, {4, 1}, {1, 1 + k}]
          V[q, 1, 4, {3, 2, 3}, {1 + k, 1, 2 - k}] V[2 - p - q, 3, 4 - i, {1}, {2 - k}]);
B3G5[7] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1 + k] EC[1, 3, 2 - k] ER[4, 1]
      ER[1, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 4, i, {3, 1}, {1, 1 + k}]
          V[q, 1, 4, {4, 2, 3}, {1 + k, 1, 2 - k}] V[2 - p - q, 3, 4 - i, {1}, {2 - k}]);
B3G5[8] = Sum_{k=0}^{1} Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1 + k] EC[1, 2, 2 - k] ER[3, 1]
      ER[1, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, 4, {4, 1}, {1, 1 + k}]
          V[q, 1, i, {3, 2, 2}, {1 + k, 1, 2 - k}] V[2 - p - q, 2, 4 - i, {1}, {2 - k}]);
B4G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 2] EC[1, 3, 1] EC[1, 4, 1]
     (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 2, i, {1}, {2}] V[q, 1, 4 - i, {2, 4, 3}, {2, 1, 1}]
          V[2 - p - q, 3, 4, {1, 2}, {1, 1}]);
B4G5[2] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 2] EC[1, 3, 1] EC[1, 4, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} V[p, 3, i, {1}, {2}] V[q, 1, 4, {3, 4, 3}, {2, 1, 1}]
         V[2 - p - q, 3, 4 - i, {1, 2}, {1, 1}]);
```

```
B4G5[3] = ∑_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 2] EC[1, 4, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 2, i, {1}, {1}] V[q, 1, 4 - i, {2, 4, 3}, {1, 1, 2}]
        V[2 - p - q, 3, 4, {1, 2}, {2, 1}]);
B4G5[4] = ∑_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 2] EC[1, 4, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 3, i, {1}, {1}] V[q, 1, 4, {3, 4, 3}, {1, 1, 2}]
        V[2 - p - q, 3, 4 - i, {1, 2}, {2, 1}]);
B4G5[5] = ∑_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 2] EC[1, 4, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 4, i, {1}, {1}] V[q, 1, 4, {4, 4, 3}, {1, 1, 2}]
        V[2 - p - q, 3, 4 - i, {1, 2}, {2, 1}]);
B5G5[1] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] ER[3, 1] ER[1, 3]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4 - i, {2, 2}, {3, 1}]
        V[q, 2, i, {1, 3}, {1, 1}] V[2 - p - q, 3, 4, {2, 4}, {1, 1}]);
B5G5[2] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[1, 3]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4 - i, {2, 3}, {3, 1}]
        V[q, 3, 4, {1, 1}, {1, 1}] V[2 - p - q, 1, i, {3, 2}, {1, 1}]);
B5G5[3] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[2, 1] ER[1, 3]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4 - i, {2, 3}, {3, 1}]
        V[q, 3, 4, {1, 2}, {1, 1}] V[2 - p - q, 2, i, {3, 1}, {1, 1}]);
B5G5[4] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[4, 1]
    ER[1, 3] (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4, {2, 3}, {3, 1}]
        V[q, 3, 4 - i, {1, 4}, {1, 1}] V[2 - p - q, 4, i, {3, 3}, {1, 1}]);
B5G5[5] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 2, 2] EC[2, 3, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4 - i, {2, 2}, {1, 2}]
        V[q, 2, i, {1, 3}, {2, 1}] V[2 - p - q, 3, 4, {2, 4}, {1, 1}]);
B5G5[6] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 2] EC[3, 1, 1] ER[1, 1] ER[1, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4 - i, {2, 3}, {1, 2}]
        V[q, 3, 4, {1, 1}, {2, 1}] V[2 - p - q, 1, i, {3, 2}, {1, 1}]);
B5G5[7] = ∑_{i=0}^{4} Binomial[4, i] EC[1, 3, 2] EC[3, 2, 1] ER[2, 1] ER[1, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} V[p, 1, 4 - i, {2, 3}, {1, 2}]
        V[q, 3, 4, {1, 2}, {2, 1}] V[2 - p - q, 2, i, {3, 1}, {1, 1}]);
```

$$\text{B5G5[8]} = \sum_{i=0}^{4} \text{Binomial[4, i] EC[1, 3, 2] EC[3, 4, 1] ER[4, 1]}$$
$$\text{ER[1, 1]} \left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 1, 4, \{2, 3\}, \{1, 2\}]} \right.$$
$$\left. \text{V[q, 3, 4 - i, \{1, 4\}, \{2, 1\}] V[2 - p - q, 4, i, \{3, 3\}, \{1, 1\}]} \right);$$

$$\text{B5G5[9]} = \sum_{i=0}^{4} \text{Binomial[4, i] EC[2, 1, 1] EC[1, 3, 2] EC[3, 1, 1]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 2, i, \{4, 1\}, \{1, 1\}]} \right.$$
$$\left. \text{V[q, 1, 4 - i, \{2, 3\}, \{1, 2\}] V[2 - p - q, 3, 4, \{1, 1\}, \{2, 1\}]} \right);$$

$$\text{B5G5[10]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i] EC[3, 1, 1] EC[1, 2, 2] EC[1, 3, 1]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \text{V[p, 3, 4, \{1, 1\}, \{1, 1\}]} \right.$$
$$\left. \text{V[q, 1, 4 - i, \{3, 2\}, \{1, 2\}] V[2 - p - q, 1, i, \{3, 2\}, \{1, 2\}]} \right);$$

$$\text{C1G5[1]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 2, 1]}$$
$$\text{EC[2, 3, 1] ER[1, 1] ER[2, 1]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1\}, \{1\}] V[q, 1, s, \{2, 2, 2\}, \{1, 1, 1\}] V[u,} \right.$$
$$\left. \text{2, 4 - r - s, \{1, 1, 3\}, \{1, 1, 1\}] V[2 - p - q - u, 3, 4, \{2\}, \{1\}]} \right);$$

$$\text{C1G5[2]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[3, 1, 1]}$$
$$\text{EC[1, 2, 1] EC[2, 3, 1] ER[1, 1] ER[2, 1]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{1\}, \{1\}] V[q, 1, s, \{3, 2, 2\}, \{1, 1, 1\}]} \right.$$
$$\left. \text{V[u, 2, 4 - s, \{1, 1, 3\}, \{1, 1, 1\}] V[2 - p - q - u, 3, 4 - r, \{2\}, \{1\}]} \right);$$

$$\text{C1G5[3]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[3, 1, 1]}$$
$$\text{EC[1, 2, 1] EC[2, 4, 1] ER[1, 1] ER[2, 1]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{1\}, \{1\}] V[q, 1, s, \{3, 2, 2\}, \{1, 1, 1\}]} \right.$$
$$\left. \text{V[u, 2, 4 - s, \{1, 1, 4\}, \{1, 1, 1\}] V[2 - p - q - u, 4, 4 - r, \{2\}, \{1\}]} \right);$$

$$\text{C1G5[4]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1]}$$
$$\text{EC[1, 3, 1] ER[1, 1] ER[3, 1]}$$
$$\left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1\}, \{1\}] V[q, 1, s, \{2, 2, 3\}, \{1, 1, 1\}] V[u,} \right.$$
$$\left. \text{3, 4, \{1, 1, 4\}, \{1, 1, 1\}] V[2 - p - q - u, 1, 4 - r - s, \{3\}, \{1\}]} \right);$$

$$\text{C1G5[5]} = \sum_{r=0}^{4} \sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1] EC[2, 3, 1] ER[}$$
$$\text{1, 1] ER[3, 1]} \left(\sum_{p=0}^{2} \sum_{q=0}^{2-p} \sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1\}, \{1\}] V[q, 1, s, \{2, 2, 3\}, \{1, 1, 1\}]} \right.$$
$$\left. \text{V[u, 3, 4, \{1, 2, 4\}, \{1, 1, 1\}] V[2 - p - q - u, 2, 4 - r - s, \{3\}, \{1\}]} \right);$$

$$\text{C1G5[6]} = \frac{1}{2} * \sum_{r=0}^{4} \sum_{s=0}^{4} \text{Binomial[4, r] Binomial[4, s] EC[2, 1, 1]}$$
$$\text{EC[1, 3, 1] EC[4, 3, 1] ER[1, 1] ER[3, 1]}$$

$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1\}, \{1\}]}\ \text{V[q, 1, 4 - r, \{2, 2, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, s, \{1, 4, 4\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 4, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[7]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[3, 1, 1]}$$
$$\text{EC[1, 3, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{1\}, \{1\}]}\ \text{V[q, 1, s, \{3, 2, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, 4 - r, \{1, 4, 1\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 1, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[8]} = \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[3, 1, 1]}$$
$$\text{EC[1, 3, 1]}\ \text{EC[2, 3, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{1\}, \{1\}]}\ \text{V[q, 1, s, \{3, 2, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, 4 - r, \{1, 4, 2\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 2, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[9]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[4, 1, 1]}$$
$$\text{EC[1, 3, 1]}\ \text{EC[2, 3, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 4, r, \{1\}, \{1\}]}\ \text{V[q, 1, s, \{4, 2, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, 4 - r, \{1, 4, 2\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 2, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[10]} = \sum_{r=0}^{4}\sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s]}\ \text{EC[2, 1, 1]}\ \text{EC[1, 4, 1]}\ \text{EC[1, 3, 1]}$$
$$\text{EC[3, 1, 1]}\ \left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1\}, \{1\}]}\ \text{V[q, 1, s, \{4, 2, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, 4, \{1, 1, 2\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 1, 4 - r - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[11]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[3, 1, 1]}\ \text{EC[1, 4, 1]}\ \text{EC[1, 3, 1]}$$
$$\text{EC[3, 2, 1]}\ \left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{1\}, \{1\}]}\ \text{V[q, 1, s, \{4, 3, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, 4 - r, \{1, 2, 2\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 2, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[13]} = \frac{1}{4} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[2, 1, 1]}$$
$$\text{EC[1, 4, 1]}\ \text{EC[1, 3, 1]}\ \text{EC[3, 4, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1\}, \{1\}]}\ \text{V[q, 1, 4 - r, \{4, 2, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, s, \{1, 2, 4\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 4, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C1G5[12]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[3, 1, 1]}\ \text{EC[1, 4, 1]}\ \text{EC[1, 3, 1]}$$
$$\text{EC[3, 1, 1]}\ \left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{1\}, \{1\}]}\ \text{V[q, 1, s, \{4, 3, 3\}, \{1, 1, 1\}]}\right.$$
$$\left.\text{V[u, 3, 4 - r, \{1, 2, 1\}, \{1, 1, 1\}]}\ \text{V[2 - p - q - u, 1, 4 - s, \{3\}, \{1\}]}\right);$$

$$\text{C2G5[1]} = \sum_{r=0}^{4}\sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s]}\ \text{EC[2, 1, 1]}\ \text{EC[1, 2, 1]}$$
$$\text{EC[1, 3, 1]}\ \text{ER[2, 1]}\ \text{ER[1, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 2, r, \{1, 1\}, \{1, 1\}]}\ \text{V[q, 1, s, \{2, 2, 2, 3\}, \{1, 1, 1, 1\}]}\right.$$

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            V[u, 2, 4 - r - s, {1}, {1}] V[2 - p - q - u, 3, 4, {1}, {1}]);

C2G5[2] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
        EC[1, 3, 1] EC[1, 3, 1] ER[2, 1] ER[1, 1]
        (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3, 3},
              {1, 1, 1, 1}] V[u, 3, s, {1}, {1}] V[2 - p - q - u, 3, 4 - s, {1}, {1}]);

C2G5[3] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
        EC[1, 3, 1] EC[1, 4, 1] ER[2, 1] ER[1, 1]
        (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3, 4},
              {1, 1, 1, 1}] V[u, 3, s, {1}, {1}] V[2 - p - q - u, 4, 4 - s, {1}, {1}]);

C2G5[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1]
        EC[1, 2, 1] EC[1, 2, 1] ER[3, 1] ER[1, 1]
        (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, 4, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 2, 3}, {1, 1, 1, 1}]
             V[u, 2, s, {1}, {1}] V[2 - p - q - u, 2, 4 - r - s, {1}, {1}]);

C2G5[5] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 3, 1] EC[1, 2, 1] ER[3, 1] ER[1, 1]
      (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, 4 - s, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 3, 3}, {1, 1, 1, 1}]
           V[u, 3, s, {1}, {1}] V[2 - p - q - u, 2, 4 - r, {1}, {1}]);

C2G5[6] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
      EC[1, 4, 1] EC[1, 2, 1] ER[3, 1] ER[1, 1]
      (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, 4 - s, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 3, 4}, {1, 1, 1, 1}]
           V[u, 4, s, {1}, {1}] V[2 - p - q - u, 2, 4 - r, {1}, {1}]);

C2G5[7] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1]
        EC[1, 3, 1] EC[1, 3, 1] ER[3, 1] ER[1, 1]
        (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 3, 3}, {1, 1, 1, 1}]
             V[u, 3, s, {1}, {1}] V[2 - p - q - u, 3, 4 - r - s, {1}, {1}]);

C2G5[8] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1]
      EC[1, 4, 1] ER[3, 1] ER[1, 1]
      (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 3, 4}, {1, 1, 1, 1}]
           V[u, 3, s, {1}, {1}] V[2 - p - q - u, 4, 4 - r - s, {1}, {1}]);

C2G5[9] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1]
        EC[1, 4, 1] EC[1, 4, 1] ER[3, 1] ER[1, 1]
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      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 4, 4}, {1, 1, 1, 1}]
          V[u, 4, s, {1}, {1}] V[2 - p - q - u, 4, 4 - r - s, {1}, {1}]);
C3G5[1] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 2, 1]
    EC[2, 3, 1] ER[1, 1] ER[2, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2, s, {1, 1}, {1, 1}] V[q, 1, r, {2, 2, 2}, {1, 1, 1}]
        V[u, 2, 4 - r - s, {1, 3}, {1, 1}] V[2 - p - q - u, 3, 4, {2}, {1}]);
C3G5[2] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1]
    EC[1, 3, 1] ER[1, 1] ER[2, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2, s, {1, 1}, {1, 1}] V[q, 1, r, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 1}, {1, 1}] V[2 - p - q - u, 1, 4 - r - s, {3}, {1}]);
C3G5[3] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[1, 3, 1]
    EC[2, 3, 1] ER[1, 1] ER[2, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2, s, {1, 1}, {1, 1}] V[q, 1, r, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 2}, {1, 1}] V[2 - p - q - u, 2, 4 - r - s, {3}, {1}]);
C3G5[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[1, 3, 1] EC[3, 4, 1] ER[1, 1] ER[2, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, s, {1, 4}, {1, 1}] V[2 - p - q - u, 4, 4 - s, {3}, {1}]);
C3G5[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 2, 1]
    EC[2, 1, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, 4, {4, 1}, {1, 1}] V[q, 1, r, {2, 2, 3}, {1, 1, 1}]
        V[u, 2, s, {1, 1}, {1, 1}] V[2 - p - q - u, 1, 4 - r - s, {2}, {1}]);
C3G5[6] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 2, 1] EC[3, 2, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
        V[u, 2, r, {1, 3}, {1, 1}] V[2 - p - q - u, 3, 4 - s, {2}, {1}]);
C3G5[7] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 2, 1] EC[4, 2, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 2, 3}, {1, 1, 1}]
        V[u, 2, r, {1, 4}, {1, 1}] V[2 - p - q - u, 4, 4 - s, {2}, {1}]);
C3G5[8] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 3, 1] EC[3, 1, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
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        V[u, 3, 4 - s, {1, 1}, {1, 1}] V[2 - p - q - u, 1, r, {3}, {1}]);

C3G5[9] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 3, 1] EC[3, 2, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
        V[u, 3, 4 - s, {1, 2}, {1, 1}] V[2 - p - q - u, 2, r, {3}, {1}]);

C3G5[10] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 3, 1]
    EC[3, 4, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 3}, {1, 1, 1}]
        V[u, 3, s, {1, 4}, {1, 1}] V[2 - p - q - u, 4, 4 - r - s, {3}, {1}]);

C3G5[11] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 4, 1] EC[4, 1, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 4}, {1, 1, 1}]
        V[u, 4, 4 - s, {1, 1}, {1, 1}] V[2 - p - q - u, 1, r, {4}, {1}]);

C3G5[12] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1]
    EC[1, 4, 1] EC[4, 2, 1] ER[1, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, s, {4, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 4}, {1, 1, 1}]
        V[u, 4, 4 - s, {1, 2}, {1, 1}] V[2 - p - q - u, 2, r, {4}, {1}]);

C3G5[13] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[1, 4, 1] EC[4, 3, 1]
    ER[1, 1] ER[3, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, r, {4, 1}, {1, 1}] V[q, 1, 4, {2, 3, 4},
        {1, 1, 1}] V[u, 4, s, {1, 3}, {1, 1}] V[2 - p - q - u, 3, 4 - r - s, {4}, {1}]);

C4G5[1] = 1/4 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[2, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1}, {1}] V[q, 2, s, {1}, {1}] V[u, 1,
        4 - r - s, {2, 2, 4, 3}, {1, 1, 1, 1}] V[2 - p - q - u, 3, 4, {1, 2}, {1, 1}]);

C4G5[2] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1}, {1}] V[q, 3, s, {1}, {1}] V[u, 1, 4 - r,
        {2, 3, 4, 3}, {1, 1, 1, 1}] V[2 - p - q - u, 3, 4 - s, {1, 2}, {1, 1}]);

C4G5[3] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 3, r, {1}, {1}] V[q, 3, s, {1}, {1}] V[u, 1, 4,
        {3, 3, 4, 3}, {1, 1, 1, 1}] V[2 - p - q - u, 3, 4 - r - s, {1, 2}, {1, 1}]);

C4G5[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[4, 1, 1] EC[1, 4, 1]
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      EC[1, 3, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, r, {1}, {1}] V[q, 4, s, {1}, {1}] V[u, 1, 4,
            {3, 4, 4, 3}, {1, 1, 1, 1}] V[2 - p - q - u, 3, 4 - r - s, {1, 2}, {1, 1}]);
C5G5[1] = 1/2 * ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1] EC[1, 4, 1]
      EC[1, 3, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2}, {1}] V[q, 2, s, {1, 1}, {1, 1}]
          V[u, 1, 4 - r - s, {2, 4, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4, {1, 2}, {1, 1}]);
C5G5[2] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[2, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 3, r, {2}, {1}] V[q, 2, s, {3, 1}, {1, 1}]
        V[u, 1, 4 - s, {2, 4, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - r, {1, 2}, {1, 1}]);
C5G5[3] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 1, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {3}, {1}] V[q, 3, s, {1, 1}, {1, 1}]
        V[u, 1, 4 - r, {3, 4, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - s, {1, 2}, {1, 1}]);
C5G5[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[3, 2, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 2, r, {3}, {1}] V[q, 3, s, {2, 1}, {1, 1}]
        V[u, 1, 4 - r, {3, 4, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - s, {1, 2}, {1, 1}]);
C5G5[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 4, 1] EC[3, 1, 1] EC[1, 4, 1]
    EC[1, 3, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 4, r, {3}, {1}] V[q, 3, s, {4, 1}, {1, 1}]
        V[u, 1, 4, {3, 4, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - r - s, {1, 2}, {1, 1}]);
C6G5[1] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1]
    EC[1, 3, 1] ER[1, 1] ER[1, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 1}, {1, 1}] V[u,
          1, 4 - r - s, {2, 2, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4, {1}, {1}]);
C6G5[2] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
    EC[1, 3, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
          3, 4, {2, 4, 1}, {1, 1, 1}] V[2 - p - q - u, 1, 4 - r - s, {3}, {1}]);
C6G5[3] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
    EC[2, 3, 1] ER[1, 1] ER[3, 1]
    (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
          3, 4, {2, 4, 2}, {1, 1, 1}] V[2 - p - q - u, 2, 4 - r - s, {3}, {1}]);
C6G5[4] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 2, 1]
    EC[2, 3, 1] EC[4, 3, 1] ER[1, 1] ER[3, 1]
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      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, 4 - r, {1, 3}, {1, 1}]
           V[u, 3, s, {2, 4, 4}, {1, 1, 1}] V[2 - p - q - u, 4, 4 - s, {3}, {1}]);
C6G5[5] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[1, 3, 1]
     EC[1, 2, 1] ER[1, 1] ER[1, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, 4, {1, 1}, {1, 1}] V[u,
          1, s, {2, 2, 3}, {1, 1, 1}] V[2 - p - q - u, 2, 4 - r - s, {1}, {1}]);
C6G5[6] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[1, 3, 1] EC[1, 3, 1] ER[1, 1] ER[1, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 1}, {1, 1}]
           V[u, 1, 4 - r, {2, 3, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - s, {1}, {1}]);
C6G5[7] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[3, 1, 1] EC[1, 4, 1] ER[1, 1] ER[1, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 1}, {1, 1}]
           V[u, 1, 4 - r, {2, 3, 4}, {1, 1, 1}] V[2 - p - q - u, 4, 4 - s, {1}, {1}]);
C6G5[8] = ∑_{r=0}^{4} ∑_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[3, 2, 1]
     EC[2, 1, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, 4, {1, 2}, {1, 1}] V[u,
          2, s, {1, 3, 1}, {1, 1, 1}] V[2 - p - q - u, 1, 4 - r - s, {2}, {1}]);
C6G5[9] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[3, 2, 1] EC[2, 3, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 2}, {1, 1}]
           V[u, 2, 4 - r, {1, 3, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - s, {2}, {1}]);
C6G5[10] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
     EC[3, 2, 1] EC[2, 4, 1] ER[1, 1] ER[2, 1]
      (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 2}, {1, 1}]
           V[u, 2, 4 - r, {1, 3, 4}, {1, 1, 1}] V[2 - p - q - u, 4, 4 - s, {2}, {1}]);
C6G5[11] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
    EC[3, 4, 1] EC[1, 4, 1] ER[1, 1] ER[4, 1]
     (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}] V[
          u, 4, 4 - s, {1, 3, 3}, {1, 1, 1}] V[2 - p - q - u, 1, 4 - r, {4}, {1}]);
C6G5[12] = ∑_{r=0}^{4} ∑_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1] EC[3, 4, 1] EC[2, 4, 1]
    ER[1, 1] ER[4, 1] (∑_{p=0}^{2} ∑_{q=0}^{2-p} ∑_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4},
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        {1, 1}] V[u, 4, 4 - s, {2, 3, 3}, {1, 1, 1}] V[2 - p - q - u, 2, 4 - r, {4}, {1}]];

C6G5[13] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 3, 1] EC[3, 4, 1]
    EC[3, 4, 1] ER[1, 1] ER[4, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, 4, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}] V[u,
        4, r, {3, 3, 3}, {1, 1, 1}] V[2 - p - q - u, 3, 4 - r - s, {4}, {1}]);

C7G5[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1] EC[3, 1, 1]
    EC[2, 1, 1] ER[2, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 4}, {1, 1}] V[2 - p - q - u, 2, s, {1}, {1}]);

C7G5[2] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[3, 1, 1] EC[3, 1, 1] ER[2, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
        V[u, 3, 4 - s, {1, 4}, {1, 1}] V[2 - p - q - u, 3, s, {1}, {1}]);

C7G5[3] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[4, 1, 1] EC[3, 1, 1] ER[2, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 1}, {1, 1}] V[q, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
        V[u, 3, 4 - s, {1, 4}, {1, 1}] V[2 - p - q - u, 4, s, {1}, {1}]);

C7G5[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
     EC[4, 1, 1] EC[3, 1, 1] ER[4, 1] ER[3, 1]
     (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 4, s, {3, 1}, {1, 1}] V[q, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
         V[u, 3, 4 - s, {1, 4}, {1, 1}] V[2 - p - q - u, 2, r, {1}, {1}]);

C7G5[5] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[3, 1, 1] EC[4, 1, 1]
    EC[3, 1, 1] ER[4, 1] ER[3, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 4, s, {3, 1}, {1, 1}] V[q, 1, 4, {3, 4, 3}, {1, 1, 1}]
        V[u, 3, 4 - r - s, {1, 4}, {1, 1}] V[2 - p - q - u, 3, r, {1}, {1}]);

C7G5[6] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[2, 1, 1]
    EC[3, 1, 1] EC[2, 1, 1] EC[2, 4, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {4, 1}, {1, 1}] V[q, 1, 4 - r - s, {2, 2, 3}, {1, 1, 1}]
        V[u, 3, 4, {1, 1}, {1, 1}] V[2 - p - q - u, 2, s, {1}, {1}]);

C7G5[7] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
    EC[3, 1, 1] EC[3, 1, 1] EC[2, 4, 1]
    (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 4}, {1, 1}] V[q, 1, 4 - r, {2, 3, 3}, {1, 1, 1}]
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          V[u, 3, 4 - s, {1, 1}, {1, 1}] V[2 - p - q - u, 3, s, {1}, {1}]];

C7G5[8] = Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[2, 1, 1]
     EC[4, 1, 1] EC[3, 1, 1] EC[2, 4, 1]
     (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 2, r, {1, 4}, {1, 1}] V[q, 1, 4 - r, {2, 4, 3}, {1, 1, 1}]
          V[u, 3, 4 - s, {1, 1}, {1, 1}] V[2 - p - q - u, 4, s, {1}, {1}]);

C8G5[1] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
     EC[3, 1, 1] ER[1, 1] ER[1, 1]
     (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
          3, 4, {2, 1}, {1, 1}] V[2 - p - q - u, 1, 4 - r - s, {3, 2}, {1, 1}]);

C8G5[2] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[4, 3, 1] EC[4, 1, 1] ER[1, 1] ER[1, 1]
      (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}]
          V[u, 4, 4 - s, {3, 1}, {1, 1}] V[2 - p - q - u, 1, 4 - r, {4, 2}, {1, 1}]);

C8G5[3] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 3, 1]
     EC[3, 2, 1] ER[1, 1] ER[2, 1]
     (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 3}, {1, 1}] V[u,
          3, 4, {2, 2}, {1, 1}] V[2 - p - q - u, 2, 4 - r - s, {3, 1}, {1, 1}]);

C8G5[4] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[4, 3, 1] EC[4, 2, 1] ER[1, 1] ER[2, 1]
      (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, r, {2, 3}, {1, 1}] V[q, 3, s, {1, 4}, {1, 1}]
          V[u, 4, 4 - s, {3, 2}, {1, 1}] V[2 - p - q - u, 2, 4 - r, {4, 1}, {1, 1}]);

C8G5[5] = Sum_{r=0}^{4} Sum_{s=0}^{4-r} Multinomial[r, s, 4 - r - s] EC[1, 2, 1] EC[2, 1, 1]
     EC[3, 1, 1] ER[1, 1] ER[3, 1]
     (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, s, {1, 1}, {1, 1}] V[u,
          1, 4 - r - s, {2, 3}, {1, 1}] V[2 - p - q - u, 3, 4, {1, 4}, {1, 1}]);

C8G5[6] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 2, 1]
      EC[2, 4, 1] EC[3, 4, 1] ER[1, 1] ER[3, 1]
      (Sum_{p=0}^{2} Sum_{q=0}^{2-p} Sum_{u=0}^{2-p-q} V[p, 1, r, {2, 2}, {1, 1}] V[q, 2, 4 - r, {1, 4}, {1, 1}]
          V[u, 4, s, {2, 3}, {1, 1}] V[2 - p - q - u, 3, 4 - s, {4, 4}, {1, 1}]);

C8G5[7] = 1/2 * Sum_{r=0}^{4} Sum_{s=0}^{4} Binomial[4, r] Binomial[4, s] EC[1, 3, 1]
      EC[3, 1, 1] EC[3, 1, 1] ER[1, 1] ER[3, 1]
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$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 1, r, \{2, 3\}, \{1, 1\}]}\ \text{V[q, 3, s, \{1, 1\}, \{1, 1\}]}\right.$$
$$\left.\text{V[u, 1, 4 - r, \{3, 3\}, \{1, 1\}]}\ \text{V[2 - p - q - u, 3, 4 - s, \{1, 4\}, \{1, 1\}]}\right);$$

$$\text{C8G5[8]} = \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[1, 3, 1]}$$
$$\text{EC[3, 2, 1]}\ \text{EC[3, 2, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 1, r, \{2, 3\}, \{1, 1\}]}\ \text{V[q, 3, s, \{1, 2\}, \{1, 1\}]}\right.$$
$$\left.\text{V[u, 2, 4 - r, \{3, 3\}, \{1, 1\}]}\ \text{V[2 - p - q - u, 3, 4 - s, \{2, 4\}, \{1, 1\}]}\right);$$

$$\text{C8G5[9]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[1, 4, 1]}$$
$$\text{EC[4, 2, 1]}\ \text{EC[3, 2, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 1, r, \{2, 4\}, \{1, 1\}]}\ \text{V[q, 4, s, \{1, 2\}, \{1, 1\}]}\right.$$
$$\left.\text{V[u, 2, 4 - r, \{4, 3\}, \{1, 1\}]}\ \text{V[2 - p - q - u, 3, 4 - s, \{2, 4\}, \{1, 1\}]}\right);$$

$$\text{C8G5[10]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4-r} \text{Multinomial[r, s, 4 - r - s]}\ \text{EC[3, 2, 1]}\ \text{EC[2, 1, 1]}\ \text{EC[1, 2, 1]}$$
$$\text{EC[2, 4, 1]}\ \left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 3, 4, \{1, 2\}, \{1, 1\}]}\ \text{V[q, 2, r, \{3, 1\}, \{1, 1\}]}\right.$$
$$\left.\text{V[u, 1, s, \{2, 2\}, \{1, 1\}]}\ \text{V[2 - p - q - u, 2, 4 - r - s, \{1, 4\}, \{1, 1\}]}\right);$$

$$\text{C8G5[11]} = \frac{1}{4} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[3, 2, 1]}$$
$$\text{EC[2, 1, 1]}\ \text{EC[1, 3, 1]}\ \text{EC[3, 4, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 3, r, \{4, 2\}, \{1, 1\}]}\ \text{V[q, 2, 4 - s, \{3, 1\}, \{1, 1\}]}\right.$$
$$\left.\text{V[u, 1, s, \{2, 3\}, \{1, 1\}]}\ \text{V[2 - p - q - u, 3, 4 - r, \{1, 4\}, \{1, 1\}]}\right);$$

$$\text{C8G5[12]} = \frac{1}{2} * \sum_{r=0}^{4}\sum_{s=0}^{4} \text{Binomial[4, r]}\ \text{Binomial[4, s]}\ \text{EC[3, 1, 1]}$$
$$\text{EC[3, 1, 1]}\ \text{EC[1, 3, 1]}\ \text{EC[3, 2, 1]}$$
$$\left(\sum_{p=0}^{2}\sum_{q=0}^{2-p}\sum_{u=0}^{2-p-q} \text{V[p, 1, 4 - s, \{4, 3\}, \{1, 1\}]}\ \text{V[q, 3, r, \{1, 1\}, \{1, 1\}]}\right.$$
$$\left.\text{V[u, 1, s, \{3, 3\}, \{1, 1\}]}\ \text{V[2 - p - q - u, 3, 4 - r, \{1, 2\}, \{1, 1\}]}\right);$$

$$\text{D1G5[1]} = -\frac{1}{12} * \text{EC[1, 3, 2]}\ \text{ER[1, 1]}^4\ \left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 2, 2, 3\}, \{1, 1, 1, 1, 2\}]}\right.$$
$$\left.\text{V[1 - p, 3, 4, \{1\}, \{2\}]}\right);$$

$$\text{D1G5[2]} = -\frac{1}{3} * \text{EC[1, 3, 1]}\ \text{ER[1, 3]}\ \text{ER[1, 1]}^3$$
$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 2, 2, 3\}, \{3, 1, 1, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1\}, \{1\}]}\right);$$

$$\text{D2G5[1]} = -\frac{1}{3} * \text{EC[1, 3, 2]}\ \text{ER[1, 1]}^3\ \text{ER[3, 1]}$$
$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 2, 3\}, \{1, 1, 1, 2\}]}\ \text{V[1 - p, 3, 4, \{1, 4\}, \{2, 1\}]}\right);$$

$$\text{D2G5[2]} = -\frac{1}{3} * \text{EC[1, 3, 1]}\ \text{ER[1, 1]}^3\ \text{ER[3, 3]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 2, 3\}, \{1, 1, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 4\}, \{1, 3\}]}\right);$$

$$\text{D2G5[3]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 2, 2]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 2, 3\}, \{2, 2, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 4\}, \{1, 1\}]}\right);$$

$$\text{D3G5[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}^2\ \text{ER[1, 3]}\ \text{ER[1, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 3, 3\}, \{3, 1, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 1\}, \{1, 1\}]}\right);$$

$$\text{D3G5[2]} = \frac{1}{4} * \text{EC[1, 3, 1]}^2\ \text{EC[1, 2, 2]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 3, 3\}, \{2, 2, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 1\}, \{1, 1\}]}\right);$$

$$\text{D4G5[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 3]}\ \text{ER[3, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 3, 3\}, \{3, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{4, 1, 1\}, \{1, 1, 1\}]}\right);$$

$$\text{D4G5[2]} = \frac{1}{2} * \text{EC[1, 3, 2]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 3, 3\}, \{1, 2, 1\}]}\ \text{V[1 - p, 3, 4, \{4, 1, 1\}, \{1, 2, 1\}]}\right);$$

$$\text{D4G5[3]} = \frac{1}{4} * \text{EC[1, 3, 1]}\ \text{EC[1, 3, 1]}\ \text{EC[1, 4, 2]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{4, 3, 3\}, \{2, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{2, 1, 1\}, \{2, 1, 1\}]}\right);$$

$$\text{D4G5[4]} = \frac{1}{2} * \text{EC[1, 3, 2]}\ \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{4, 3, 3\}, \{1, 2, 1\}]}\ \text{V[1 - p, 3, 4, \{2, 1, 1\}, \{1, 2, 1\}]}\right);$$

$$\text{D5G5[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}\ \text{ER[1, 3]}\ \text{ER[3, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 3, 4\}, \{3, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 2, 4\}, \{1, 1, 1\}]}\right);$$

$$\text{D5G5[2]} = \frac{1}{2} * \text{EC[1, 3, 2]}\ \text{EC[1, 4, 1]}\ \text{ER[1, 1]}\ \text{ER[3, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 3, 4\}, \{1, 2, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 2, 4\}, \{2, 1, 1\}]}\right);$$

$$\text{D6G5[1]} = \frac{1}{2} * \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}\ \text{ER[1, 3]}\ \text{ER[1, 1]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 3, 4\}, \{3, 1, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 2\}, \{1, 1\}]}\right);$$

$$\text{D6G5[2]} = \frac{1}{4} * \text{EC[1, 3, 1]}\ \text{EC[1, 4, 1]}\ \text{EC[1, 2, 2]}$$

$$\left(\sum_{p=0}^{1} \text{V[p, 1, 4, \{2, 2, 3, 4\}, \{2, 2, 1, 1\}]}\ \text{V[1 - p, 3, 4, \{1, 2\}, \{1, 1\}]}\right);$$

$$\text{E1G5[1]} = -\frac{1}{12} * \sum_{i=0}^{4} \text{Binomial[4, i]}\ \text{EC[2, 1, 1]}\ \text{EC[1, 3, 1]}\ \text{ER[1, 1]}^4$$

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      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1}, {1}] V[q, 1, 4 - i, {2, 2, 2, 2, 2, 3},
          {1, 1, 1, 1, 1, 1}] V[1 - p - q, 3, 4, {1}, {1}]);
E1G5[2] = -1/24 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] ER[1, 1]^4
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {1}, {1}] V[q, 1, 4, {3, 2, 2, 2, 2, 3}, {1, 1, 1, 1, 1, 1}]
          V[1 - p - q, 3, 4 - i, {1}, {1}]);
E1G5[3] = -1/24 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1] ER[1, 1]^4
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4, i, {1}, {1}] V[q, 1, 4, {4, 2, 2, 2, 2, 3}, {1, 1, 1, 1, 1, 1}]
          V[1 - p - q, 3, 4 - i, {1}, {1}]);
E2G5[1] = -1/12 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] ER[1, 1]^4
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2, 2, 2}, {1, 1, 1, 1, 1}]
          V[q, 2, i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {2}, {1}]);
E2G5[2] = -1/12 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1]^4
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
          V[q, 3, 4, {1, 1}, {1, 1}] V[1 - p - q, 1, i, {3}, {1}]);
E2G5[3] = -1/12 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[1, 1]^4
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
          V[q, 3, 4, {1, 2}, {1, 1}] V[1 - p - q, 2, i, {3}, {1}]);
E2G5[4] = -1/12 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[1, 1]^4
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
          V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 4, i, {3}, {1}]);
E3G5[1] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] ER[2, 1]
     ER[1, 1]^3 (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1, 1}, {1, 1}]
          V[q, 1, 4 - i, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}] V[1 - p - q, 3, 4, {1}, {1}]);
E3G5[2] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1] ER[3, 1] ER[1, 1]^3
      (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1}, {1}] V[q, 1, 4 - i, {2, 2, 2, 2, 3}, {1, 1, 1, 1, 1}]
          V[1 - p - q, 3, 4, {1, 4}, {1, 1}]);
```

$$\text{E3G5[3]} = -\frac{1}{3} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[3, 1, 1]}\, \text{EC[1, 3, 1]}\, \text{ER[3, 1]}\, \text{ER[1, 1]}^3 \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 3, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4, \{3, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4 - i, \{1, 4\}, \{1, 1\}]}\right);$$

$$\text{E3G5[4]} = -\frac{1}{3} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[4, 1, 1]}\, \text{EC[1, 3, 1]}\, \text{ER[3, 1]}\, \text{ER[1, 1]}^3 \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 4, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4, \{4, 2, 2, 2, 3\}, \{1, 1, 1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4 - i, \{1, 4\}, \{1, 1\}]}\right);$$

$$\text{E4G5[1]} = -\frac{1}{3} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[2, 1, 1]}\, \text{EC[1, 3, 1]}\, \text{ER[2, 1]}^3\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 2, i, \{1, 1, 1, 1\}, \{1, 1, 1, 1\}]}\, \text{V[q, 1, 4 - i, \{2, 2, 3\}, \{1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4, \{1\}, \{1\}]}\right);$$

$$\text{E4G5[2]} = -\frac{1}{3} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[2, 1, 1]}\, \text{EC[1, 3, 1]}\, \text{ER[3, 1]}^3\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 2, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4 - i, \{2, 2, 3\}, \{1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4, \{1, 4, 4, 4\}, \{1, 1, 1, 1\}]}\right);$$

$$\text{E4G5[3]} = -\frac{1}{3} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[3, 1, 1]}\, \text{EC[1, 3, 1]}\, \text{ER[3, 1]}^3\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 3, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4, \{3, 2, 3\}, \{1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4 - i, \{1, 4, 4, 4\}, \{1, 1, 1, 1\}]}\right);$$

$$\text{E4G5[4]} = -\frac{1}{3} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[4, 1, 1]}\, \text{EC[1, 3, 1]}\, \text{ER[3, 1]}^3\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 4, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4, \{4, 2, 3\}, \{1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4 - i, \{1, 4, 4, 4\}, \{1, 1, 1, 1\}]}\right);$$

$$\text{E5G5[1]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[2, 1, 1]}^2\, \text{EC[1, 3, 1]}\, \text{ER[2, 1]}\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 2, i, \{1, 1, 1\}, \{1, 1, 1\}]}\, \text{V[q, 1, 4 - i, \{2, 2, 2, 3\}, \{1, 1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4, \{1\}, \{1\}]}\right);$$

$$\text{E5G5[2]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[2, 1, 1]}\, \text{EC[1, 3, 1]}^2\, \text{ER[3, 1]}\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 2, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4 - i, \{2, 2, 3, 3\}, \{1, 1, 1, 1\}]}\, \text{V[1 - p - q, 3, 4, \{1, 1, 4\}, \{1, 1, 1\}]}\right);$$

$$\text{E5G5[3]} = \frac{1}{2} * \sum_{i=0}^{4} \text{Binomial[4, i]}\, \text{EC[3, 1, 1]}\, \text{EC[1, 3, 1]}^2\, \text{ER[3, 1]}\, \text{ER[1, 1]} \left(\sum_{p=0}^{1} \sum_{q=0}^{1-p} \text{V[p, 3, i, \{1\}, \{1\}]}\, \text{V[q, 1, 4, \{3, 2, 3, 3\}, \{1, 1, 1, 1\}]}\right.$$

```
        V[1 - p - q, 3, 4 - i, {1, 1, 4}, {1, 1, 1}]] );

E5G5[4] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1]^2 ER[3, 1] ER[1, 1]
    ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4, i, {1}, {1}] V[q, 1, 4, {4, 2, 3, 3}, {1, 1, 1, 1}]
        V[1 - p - q, 3, 4 - i, {1, 1, 4}, {1, 1, 1}]] );

E6G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1]^2 EC[1, 4, 1]
    ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1}, {1}] V[q, 1, 4 - i, {2, 4, 3, 3}, {1, 1, 1, 1}]
        V[1 - p - q, 3, 4, {1, 1, 2}, {1, 1, 1}]] );

E6G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1]^2 EC[1, 4, 1]
    ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {1}, {1}] V[q, 1, 4, {3, 4, 3, 3}, {1, 1, 1, 1}]
        V[1 - p - q, 3, 4 - i, {1, 1, 2}, {1, 1, 1}]] );

E6G5[3] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1] EC[1, 3, 1]^2 EC[1, 4, 1]
    ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4, i, {1}, {1}] V[q, 1, 4, {4, 4, 3, 3}, {1, 1, 1, 1}]
        V[1 - p - q, 3, 4 - i, {1, 1, 2}, {1, 1, 1}]] );

E7G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 2, 1]
    ER[3, 1] ER[1, 1] ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, 4, {4, 2, 1}, {1, 1, 1}]
        V[q, 1, i, {3, 4, 2, 2}, {1, 1, 1, 1}] V[1 - p - q, 2, 4 - i, {1}, {1}]] );

E7G5[2] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 3, 1] ER[3, 1]
    ER[1, 1] ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {4, 2, 1}, {1, 1, 1}]
        V[q, 1, 4, {3, 4, 2, 3}, {1, 1, 1, 1}] V[1 - p - q, 3, 4 - i, {1}, {1}]] );

E8G5[1] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[2, 3, 1] ER[3, 1]
    ER[1, 1]^3 ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2, 2}, {1, 1, 1, 1}]
        V[q, 2, i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {2, 4}, {1, 1}]] );

E8G5[2] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 1, 1] ER[1, 1]
    ER[1, 1]^3 ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 1, 1}]
        V[q, 3, 4, {1, 1}, {1, 1}] V[1 - p - q, 1, i, {3, 2}, {1, 1}]] );

E8G5[3] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 2, 1] ER[2, 1]
    ER[1, 1]^3 ( Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 1, 1}]
```

```
        V[q, 3, 4, {1, 2}, {1, 1}] V[1 - p - q, 2, i, {3, 1}, {1, 1}]);

E8G5[4] = -1/3 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1] EC[3, 4, 1] ER[4, 1]
    ER[1, 1]^3 (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4, {2, 2, 2, 3}, {1, 1, 1, 1}]
        V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 4, i, {3, 3}, {1, 1}]);

E9G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1]^2 EC[2, 3, 1] ER[3, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 2, 2}, {1, 1, 1}]
        V[q, 2, i, {1, 1, 3}, {1, 1, 1}] V[1 - p - q, 3, 4, {2, 4}, {1, 1}]);

E9G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1]^2 EC[3, 1, 1] ER[1, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 3, 3}, {1, 1, 1}]
        V[q, 3, 4, {1, 1, 1}, {1, 1, 1}] V[1 - p - q, 1, i, {3, 2}, {1, 1}]);

E9G5[3] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1]^2 EC[3, 2, 1] ER[2, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4 - i, {2, 3, 3}, {1, 1, 1}]
        V[q, 3, 4, {1, 1, 2}, {1, 1, 1}] V[1 - p - q, 2, i, {3, 1}, {1, 1}]);

E9G5[4] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 3, 1]^2 EC[3, 4, 1] ER[4, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4, {2, 3, 3}, {1, 1, 1}]
        V[q, 3, 4 - i, {1, 1, 4}, {1, 1, 1}] V[1 - p - q, 4, i, {3, 3}, {1, 1}]);

E10G5[1] = 1/4 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 2, 1]^2 EC[1, 3, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, 4, {1, 1}, {1, 1}] V[q, 1, 4 - i, {3, 2, 2}, {1, 1, 1}]
        V[1 - p - q, 2, i, {1, 1, 4}, {1, 1, 1}]);

E10G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1]^2 EC[3, 1, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {4, 1}, {1, 1}] V[q, 1, 4 - i, {2, 3, 3}, {1, 1, 1}]
        V[1 - p - q, 3, 4, {1, 1, 1}, {1, 1, 1}]);

E11G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[1, 3, 1] EC[2, 3, 1]
    ER[1, 1] ER[2, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 2, 3}, {1, 1, 1}]
        V[q, 2, 4 - i, {1, 1, 3}, {1, 1, 1}] V[1 - p - q, 3, 4, {1, 2}, {1, 1}]);

E11G5[2] = Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[1, 3, 1] EC[2, 3, 1] ER[1, 1]
    ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 2, 3}, {1, 1, 1}]
```

```
        V[q, 2, 4 - i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {1, 2, 4}, {1, 1, 1}]];

E11G5[3] = Sum_{i=0}^{4} Binomial[4, i] EC[1, 2, 1] EC[1, 3, 1] EC[2, 3, 1]
    EC[1, 4, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 4, 3}, {1, 1, 1}]
        V[q, 2, 4 - i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {1, 2, 2}, {1, 1, 1}]);

E12G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[1, 3, 1]^2 ER[2, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1, 1}, {1, 1}]
        V[q, 1, 4 - i, {2, 2, 3, 3}, {1, 1, 1, 1}] V[1 - p - q, 3, 4, {1, 1}, {1, 1}]);

E12G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1]^2 EC[1, 3, 1] ER[3, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1, 1}, {1, 1}]
        V[q, 1, 4 - i, {2, 2, 2, 3}, {1, 1, 1, 1}] V[1 - p - q, 3, 4, {1, 4}, {1, 1}]);

E12G5[3] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1]^2 ER[3, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {1, 1}, {1, 1}]
        V[q, 1, 4, {3, 2, 3, 3}, {1, 1, 1, 1}] V[1 - p - q, 3, 4 - i, {1, 4}, {1, 1}]);

E12G5[4] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[4, 1, 1]^2 EC[1, 3, 1] ER[3, 1]
    ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 4, i, {1, 1}, {1, 1}]
        V[q, 1, 4, {4, 2, 4, 3}, {1, 1, 1, 1}] V[1 - p - q, 3, 4 - i, {1, 4}, {1, 1}]);

E13G5[1] = 1/4 * Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1]^2 EC[1, 3, 1] EC[1, 4, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 2, i, {1, 1}, {1, 1}]
        V[q, 1, 4 - i, {2, 2, 4, 3}, {1, 1, 1, 1}] V[1 - p - q, 3, 4, {1, 2}, {1, 1}]);

E13G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1]^2 EC[1, 3, 1] EC[1, 4, 1]
    (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {1, 1}, {1, 1}] V[q, 1, 4, {3, 3, 4, 3}, {1, 1, 1, 1}]
        V[1 - p - q, 3, 4 - i, {1, 2}, {1, 1}]);

E14G5[1] = Sum_{i=0}^{4} Binomial[4, i] EC[2, 1, 1] EC[2, 3, 1] EC[1, 4, 1] ER[1, 1]
    ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 4, 2}, {1, 1, 1}]
        V[q, 2, 4 - i, {1, 3}, {1, 1}] V[1 - p - q, 3, 4, {2, 2, 4}, {1, 1, 1}]);

E14G5[2] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 2, 1]
    ER[1, 1] ER[1, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {2, 3, 2}, {1, 1, 1}]
```

```
          V[q, 1, 4 - i, {2, 2, 3}, {1, 1, 1}] V[1 - p - q, 3, 4, {1, 1}, {1, 1}]);

E15G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 2, 1]
      ER[3, 1] ER[2, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {4, 3, 2}, {1, 1, 1}]
          V[q, 2, 4 - i, {1, 1}, {1, 1}] V[1 - p - q, 3, 4, {4, 2, 1}, {1, 1, 1}]);

E15G5[2] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 3, 1] ER[3, 1]
     ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 3, i, {4, 2, 1}, {1, 1, 1}]
         V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 1, 4, {4, 3, 3}, {1, 1, 1}]);

E16G5[1] = 1/2 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 2, 1]
      ER[1, 1] ER[2, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, i, {4, 3, 2, 2}, {1, 1, 1, 1}]
          V[q, 2, 4 - i, {1, 1}, {1, 1}] V[1 - p - q, 3, 4, {2, 1}, {1, 1}]);

E16G5[2] = Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[3, 2, 1] EC[1, 3, 1] ER[1, 1]
     ER[3, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4, {4, 3, 2, 3}, {1, 1, 1, 1}]
         V[q, 3, 4 - i, {1, 4}, {1, 1}] V[1 - p - q, 3, i, {2, 1}, {1, 1}]);

E17G5 = 1/4 * Sum_{i=0}^{4} Binomial[4, i] EC[3, 1, 1] EC[1, 3, 1] EC[1, 4, 1]
      EC[1, 4, 1] (Sum_{p=0}^{1} Sum_{q=0}^{1-p} V[p, 1, 4, {3, 4, 4, 3}, {1, 1, 1, 1}]
          V[q, 3, i, {1, 2}, {1, 1}] V[1 - p - q, 3, 4 - i, {1, 2}, {1, 1}]);

F1G5 = 1/45 * EC[1, 3, 1] ER[1, 1]^6 V[0, 1, 4, {2, 2, 2, 2, 2, 2, 3}, {1, 1, 1, 1, 1, 1, 1}]
    V[0, 3, 4, {1}, {1}];

F2G5 = 1/20 * EC[1, 3, 1] ER[1, 1]^5 ER[3, 1] V[0, 1, 4, {2, 2, 2, 2, 2, 3}, {1, 1, 1, 1, 1, 1}]
    V[0, 3, 4, {1, 4}, {1, 1}];

F3G5 = -1/24 * EC[1, 3, 1]^2 ER[1, 1]^4 V[0, 1, 4, {2, 2, 2, 2, 3, 3}, {1, 1, 1, 1, 1, 1}]
    V[0, 3, 4, {1, 1}, {1, 1}];

F4G5 = -1/24 * EC[1, 3, 1] EC[1, 4, 1] ER[1, 1]^4
    V[0, 1, 4, {2, 2, 2, 2, 4, 3}, {1, 1, 1, 1, 1, 1}] V[0, 3, 4, {1, 2}, {1, 1}];

F5G5[1] = 1/18 * EC[1, 3, 1] ER[1, 1]^3 ER[3, 1]^3 V[0, 1, 4, {2, 2, 2, 3}, {1, 1, 1, 1}]
    V[0, 3, 4, {1, 4, 4, 4}, {1, 1, 1, 1}];

F5G5[2] = 1/12 * EC[1, 3, 1]^3 ER[1, 1] ER[3, 1] V[0, 1, 4, {2, 3, 3, 3}, {1, 1, 1, 1}]
    V[0, 3, 4, {1, 1, 1, 4}, {1, 1, 1, 1}];

F5G5[3] = 1/12 * EC[1, 3, 1]^3 EC[1, 4, 1] V[0, 1, 4, {4, 3, 3, 3}, {1, 1, 1, 1}]
```

```
    V[0, 3, 4, {1, 1, 1, 2}, {1, 1, 1, 1}];
F6G5 = -1/6 * EC[1, 3, 1]^2 ER[1, 1]^3 ER[3, 1] V[0, 1, 4, {2, 2, 2, 3, 3}, {1, 1, 1, 1, 1}]
    V[0, 3, 4, {1, 1, 4}, {1, 1, 1}];
F7G5 = -1/6 * EC[1, 3, 1] EC[1, 4, 1] ER[1, 1]^3 ER[3, 1]
    V[0, 1, 4, {2, 2, 2, 4, 3}, {1, 1, 1, 1, 1}] V[0, 3, 4, {1, 2, 4}, {1, 1, 1}];
F8G5 = 1/4 * EC[1, 3, 1]^2 EC[1, 4, 1] ER[1, 1] ER[3, 1]
    V[0, 1, 4, {2, 4, 3, 3}, {1, 1, 1, 1}] V[0, 3, 4, {1, 1, 2, 4}, {1, 1, 1, 1}];
F9G5 = 1/16 * EC[1, 3, 1]^2 EC[1, 4, 1]^2 V[0, 1, 4, {4, 4, 3, 3}, {1, 1, 1, 1}]
    V[0, 3, 4, {1, 1, 2, 2}, {1, 1, 1, 1}];
GW58Quarter = Factor[Sum[A1G5[j], {j, 1, 3}] + Sum[A2G5[j], {j, 1, 2}] + Sum[B1G5[j], {j, 1, 6}] + Sum[B2G5[j], {j, 1, 8}] +
    Sum[B3G5[j], {j, 1, 8}] + Sum[B4G5[j], {j, 1, 5}] + Sum[B5G5[j], {j, 1, 10}] + Sum[C1G5[j], {j, 1, 13}] + Sum[C2G5[j], {j, 1, 9}] +
    Sum[C3G5[j], {j, 1, 13}] + Sum[C4G5[j], {j, 1, 4}] + Sum[C5G5[j], {j, 1, 5}] + Sum[C6G5[j], {j, 1, 13}] + Sum[C7G5[j], {j, 1, 8}] +
    Sum[C8G5[j], {j, 1, 12}] + Sum[D1G5[j], {j, 1, 2}] + Sum[D2G5[j], {j, 1, 3}] + Sum[D3G5[j], {j, 1, 2}] + Sum[D4G5[j], {j, 1, 4}] +
    Sum[D5G5[j], {j, 1, 2}] + Sum[D6G5[j], {j, 1, 2}] + Sum[E1G5[j], {j, 1, 3}] + Sum[E2G5[j], {j, 1, 4}] + Sum[E3G5[j], {j, 1, 4}] +
    Sum[E4G5[j], {j, 1, 4}] + Sum[E5G5[j], {j, 1, 4}] + Sum[E6G5[j], {j, 1, 3}] + Sum[E7G5[j], {j, 1, 2}] + Sum[E8G5[j], {j, 1, 4}] +
    Sum[E9G5[j], {j, 1, 4}] + Sum[E10G5[j], {j, 1, 2}] + Sum[E11G5[j], {j, 1, 3}] + Sum[E12G5[j], {j, 1, 4}] +
    Sum[E13G5[j], {j, 1, 2}] + Sum[E14G5[j], {j, 1, 2}] + Sum[E15G5[j], {j, 1, 2}] + Sum[E16G5[j], {j, 1, 2}] + E17G5 +
    F1G5 + F2G5 + F3G5 + F4G5 + Sum[F5G5[j], {j, 1, 3}] + F6G5 + F7G5 + F8G5 + F9G5];
GW58Half = Factor[GW58Quarter + (GW58Quarter /. {y → x, x → y})];
GW58 = Simplify[GW58Half + (GW58Half /. {y → -y})]
```

Out[508]= $-\frac{1400}{3}$