Graph IV : Hamilton paths and circuits

Recall Hamilton path.

= Path passing through all vertices and each exactly once.

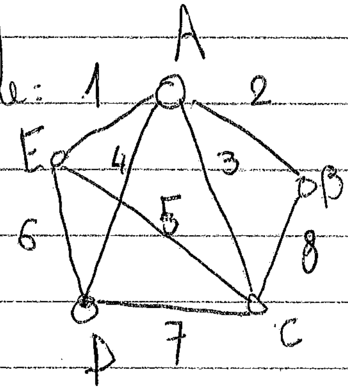
Our quest: find such an optimal Hamilton path

The straightforward method.

[A] * We list all Hamilton paths
[B] * We find the optimal one

A Listing all Hamilton paths.

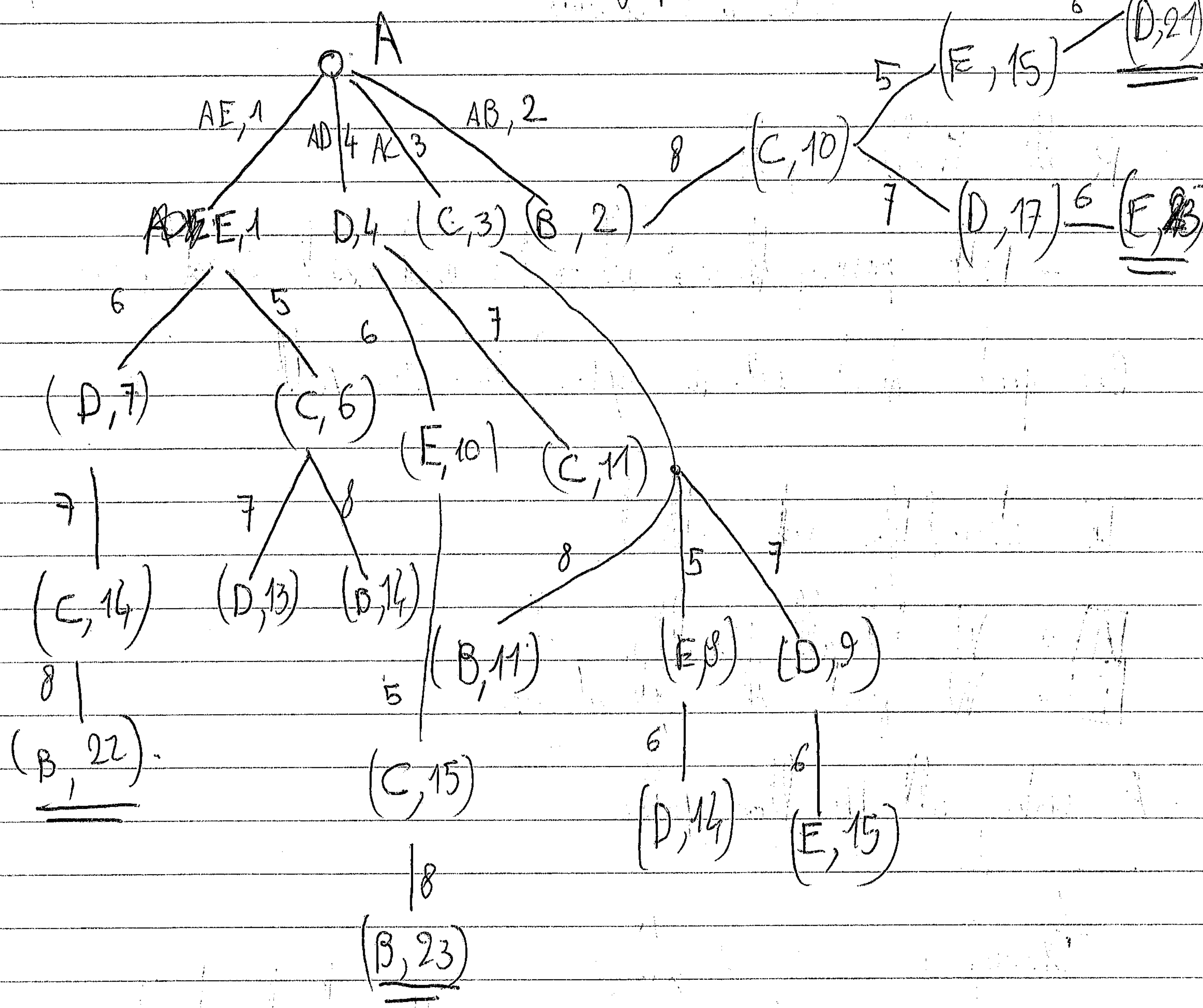
Through an example:



How to do it?

Build a tree.

Hamilton path starting from A.

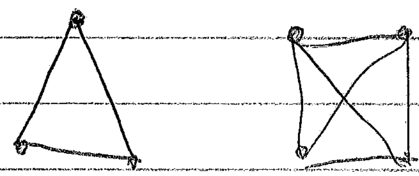


The problem with this method:

we kind of list all the paths

and this takes time.

Example



If I take a graph which is complete (any two vertex are connected via an edge)

then there are N! Hamilton paths.

1 character 1 byte in memory.

1 path = N characters ⇒ N bytes.

N! paths ⇒ N! x N bytes to store

Fastest computer 10^{16} x ~~10~~ Bytes of memory.

Now say we want to understand a graph between the capitals of each country

195 countries (more or less).

$$195! \times 195 \geq$$

$$\underbrace{195}_{\geq 10} \times 195 \times 194 \times \ldots \times \underbrace{10}_{\geq 10} \times 9 \times 8 \times \ldots \times 1$$

$$\geq 10^{186} \text{ Bytes}.$$

Fastest computer 10^{16} Bytes
We need to store 10^{186} Bytes.

$\Rightarrow$ we need $\frac{10^{186}}{10^{16}} = 10^{170}$ of those fastest computer.

Conclusion: The straightforward method is bad for large graphs