

Math 102: Section 3

Stephen Taylor

Final

Directions: Write directly on this exam. Use the back of the page if you need more room. Use a calculator. Express all solutions to at least three significant digits. Answer all questions to the best of your ability. Circle your final solution if applicable. You are free to use any resources you can find to aide you in completing this test except other people. **If you consult with others about questions on this test, you are cheating. Those caught cheating will receive a 0 on this test and their names will be submitted to the honor code office.**

1. You find a four sided die with faces labeled 1,2,3, and 4. You decide you want to create your own game, where you try to predict the value of the sum of three consecutive roles of the die.

a) Create a list of all possible outcomes of the game.

b) Create a list of all possible events of the game.

c) Find the probability of each event occurring.

d) What is the expected value of the game?

e) (**Optional 3pts extra**) Create an actual four sided die out of four triangles. Play the game 20 times and list the scores you get below. Comment on the empirical probabilities you generated in relation to the theoretical expected value. Make sure to turn in your die with this test.

2. You place 50 slips of paper in a bag labeled 1 through 50.

a) If you draw out 5 pieces of paper one at a time, what is the probability of drawing all even numbers?

b) If you draw out 7 pieces of paper one at a time, what is the probability of drawing all odd numbers?

c) What is the probability of drawing an even number or a 4,5,6, or 7 in one draw?

d) (Harder Question) What is the probability of drawing an odd number and a 4,6, and 8 in five draws?

3. You are an auto insurance agent. You know from experience that in one year the following accidents occur:

- i) 21% of cars incur minor damage with an average value of \$430.
- ii) 11% of cars incur moderate damage with an average value of \$1371.
- iii) 3% of cars incur major damage with an average value of \$5432.

a) If you insure 1461 cars, what amount of money would you expect to pay to those you insure each year?

b) If you wanted to keep \$100,000 a year for yourself, how much should you charge those you insure each year so you do not lose money? How much should you charge each month?

4. There are ten athletes competing for the gold, silver, and bronze medals in a swimming competition. How many possible ways can different athletes be awarded the medals? (Hint: Does order matter?)

5. You go to the store to buy cereal and notice there are 21 different kinds on the shelf. If you are going to buy only 5 boxes, how many different ways can you do this?

6. Classify the following as either linear or exponential growth:

a) The consumer price index (CPI)

b) The population of Earth

c) The total amount of money in your saving if you deposit \$300 each month at an interest rate of 0%

d) The total amount of money in your saving if you deposit \$300 each month at an interest rate of 3%

7. Suppose that 50 ants enter your apartment and increase their population size at a rate of 24% each week. Assuming no ants die, how many will you have in your home in 1 month? in 1 year?

8. Carbon-14 has a half life of 5700 years, and it is known to collect in organisms only while they are alive. Once they die, it only decays.

a) What fraction of carbon-14 is in an animal bone that remains 6800 years after the animal has died?

b) What fraction of carbon-14 is in an animal bone that remains 10371 years after the animal has died?

c) (Harder Question) If we determine an animal bone has 47.51% of carbon-14 left, about when did the animal die?

9. If a population is decaying at a rate of 6.8% each year, what is its half life?

10. Speaker system A produces sound at 68 decibels, and speaker system B produces sound at 34 decibels. How much more intense is system A than system B?