

NAME:

Statistics 111 Summer Session II

Homework One

You are allowed to discuss problems with other students, but the final answers must be your own work.

For all problems that require calculation, YOU MUST ATTACH SEPARATE PAGES, NEATLY WRITTEN, THAT SHOW YOUR WORK.

Please mark your answer in the space provided. As a general rule, each blank counts for one point unless otherwise specified. If necessary work is not shown, or if that work is substantially wrong, then you will not get credit even if the answer is correct. (The obvious purpose of this is to prevent students from mindlessly copying each other's answers.)

Report all numerical answers to at least two correct decimal places.

DUE DATE: START of class on TUESDAY, July 10, 2018.

1. **(Set and Probability)** On space shuttle, there is a device called O-ring, that could cause accident by a combustion gas leak, if it does not seal properly at low temperatures. Assume the probability of the incident of thermal distress for O-ring A is 0.5, the probability the failing incident for O-ring B is 0.2, and the probability that both O-ring A and O-ring B will fail is 0.1.

(a) What is the probability that at least one of these two O-rings will fail in a launch test?

(b) What is the probability that neither O-ring A nor O-ring B will fail in a launch test?

(c) What is the probability that exactly one of the two O-rings will fail the test?

2. **(Counting Methods)** The rivalry between UNC and Duke is not limited to College Sports. Suppose that three teams from Duke Fuqua and three teams from UNC Kenan-Flagler participating in a Duke/UNC National Case Competition. If all 6 teams have equal ability and there are no ties, what is the probability that the 3 teams from Duke Fuqua will finish 1st, 2nd, and 3rd, and the 3 teams from UNC Kenan-Flagler will finish 4th, 5th, and 6th?
3. **(Combinatorial Methods)** Suppose that two students from our class completed a Libraries Survey and have the chance to win a \$75 gift card. Assume that the raffle select 10 winners of the gift certificate from the 24 participants at random, without replacement. What is the probability that both two students from our class will be selected?
4. **(Conditional Probability)** Suppose 80% of people like peanut butter, 89% like jelly, and 78% like both. Given that a randomly sampled person likes peanut butter, what's the probability that he also likes jelly?

5. **(Multiplication)** Each time a shopper purchases a tube of toothpaste, he chooses either brand A or brand B . Suppose that for each purchase after the first, the probability is $1/3$ that he will choose the same brand that he chose on his preceding purchase and the probability is $2/3$ that he will switch brands. If he is equally likely to choose either brand A or brand B on his first purchase,
- (a) What is the probability that both his first and second purchases will be brand B ?

 - (b) What is the probability that both his first and second purchases will be brand A and both his third and fourth purchase will be brand B ?
6. **(Independent Events)** Suppose two guest food trucks — American Meltdown and MaMa Dukes — are included in the Durham Central Park's Food Truck Rodeo schedule. Assume that American Meltdown shows up 80 percent of the time on Sunday afternoons, MaMa Dukes shows up 60 percent of the time, and the absence of the two food trucks are independent.
- (a) What is the probability that at least one of the two food trucks will shows up on a given Sunday afternoon?

- (b) If at least one of the two food trucks shows up in the park on a given Sunday afternoon, what is the probability that American Meltdown is there?

7. (**Law of Total Probability**) A machine produces defective parts with three different probabilities depending on its state of repair. If the machine is in good working order, it produces defective parts with probability 0.02. If it is wearing down, it produces defective parts with probability 0.1. If it needs maintenance, it produces defective parts with probability 0.3. The probability that the machine is in good working order is 0.8, the probability it is wearing down is 0.1, and the probability it needs maintenance is 0.1. Compute the probability that a randomly selected part will be defective. (2 points)

8. (**Bayes' Theorem**) A new test has been devised for detecting a particular type of cancer. If the test is applied to a person who has this type of cancer, the probability that the person will have a positive reaction is 0.95 and the probability that the person will have a negative reaction is 0.05. If the test is applied to a person who does not have this type of cancer, the probability that the person will have a positive reaction is 0.05 and the probability that the person will have a negative reaction is 0.95. Suppose that in the general population, one person out of every 100,000 people has this type of cancer. If a person selected at random has a positive reaction to the test, what is the probability that he has this type of cancer? (3 points)

How hard was this homework assignment and how many hours did it take you to finish it? What would you like us to do differently in class?
