PID:	
Last Name, First Name:	
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Approximate time spent to complete this assignment:	hour(s)

# Homework 3 Math 11, UCSD, Winter 2018 Due on Tuesday, 6th February

Readings: Chapters 13, 14, 15 (but skip the section on correlation and covariance), 16-1 and 16-2.

#### Exercise 1

Although it's hard to be definitive in classifying people as right- or left-handed, some studies suggest that about 14% of people are left-handed. Since  $0.14 \times 0.14 = 0.0196$ , the Multiplication Rule might suggest that there's about a 2% chance that a brother and a sister are both lefties. What's wrong with that reasoning?

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In a large Introductory Statistics lecture hall, the professor reports that 55% of the students enrolled have never taken a Calculus course, 32% have taken only one semester of Calculus, and the rest have taken two or more semesters of Calculus. The professor randomly assigns students to groups of three to work on a project for the course. What is the probability that the first groupmate you meet has studied:

1. two or more semesters of Calculus?

#### 2. some Calculus?

3. no more than one semester of Calculus?

The American Red Cross says that about 45% of the U.S. population has Type O blood, 40% Type A, 11% Type B, and the rest Type AB. Among four potential donors, what is the probability that:

1. All are Type O?

2. No one is Type AB?

3. They are not all Type A?

4. At least one person is Type B?

Suppose the probability that a U.S. resident has traveled to Canada is 0.18, to Mexico is 0.09, and to both countries is 0.04. What's the probability that an American chosen at random has:

1. traveled to Canada but not Mexico?

2. traveled to either Canada or Mexico?

3. not traveled to either country?

Employment data at a large company reveal that 72% of the workers are married, that 44% are college graduates, and that half of the college grads are married. What's the probability that a randomly chosen worker:

1. is neither married nor a college graduate?

2. is married but not a college graduate?

3. is married or a college graduate?

In its monthly report, the local animal shelter states that it currently has 24 dogs and 18 cats available for adoption. Eight of the dogs and 6 of the cats are male. Find each of the following conditional probabilities if an animal is selected at random:

1. The pet is male, given that it is a cat.

2. The pet is a cat, given that it is female.

3. The pet is female, given that it is a dog.

Twenty percent of cars that are inspected have faulty pollution control systems. The cost of repairing a pollution control system exceeds \$100 about 40% of the time. When a driver takes her car in for inspection, what's the probability that she will end up paying more than \$100 to repair the pollution control system?

## Exercise 8

Fifty-six percent of all American workers have a workplace retirement plan, 68% have health insurance, and 49% have both benefits. We select a worker at random.

1. What's the probability he has neither employer-sponsored health insurance nor a retirement plan?

2. What's the probability he has health insurance if he has a retirement plan?

3. Are having health insurance and a retirement plan independent events? Explain.

4. Are having these two benefits mutually exclusive? Explain.

A private college report contains these statistics:

- 70% of incoming freshmen attended public schools.
- 75% of public school students who enroll as freshmen eventually graduate.
- 90% of other freshmen eventually graduate.

1. Is there any evidence that a freshman's chances to graduate may depend upon what kind of high school the student attended? Explain.

2. What percent of freshmen eventually graduate?

An airline offers discounted "advance- purchase" fares to customers who buy tickets more than 30 days before travel and charges "regular" fares for tickets purchased during those last 30 days. The company has noticed that 60% of its customers take advantage of the advance-purchase fares. The "no-show" rate among people who paid regular fares is 30%, but only 5% of customers with advance-purchase tickets are no-shows.

1. What percent of all ticket holders are no-shows?

2. What's the probability that a customer who didn't show had an advance-purchase ticket?

Lie detectors are controversial instruments, barred from use as evidence in many courts. Nonetheless, many employers use lie detector screening as part of their hiring process in the hope that they can avoid hiring people who might be dishonest. There has been some research, but no agreement, about the reliability of polygraph tests. Based on this research, suppose that a polygraph can detect 65% of lies, but incorrectly identifies 15% of true statements as lies. A certain company believes that 95% of its job applicants are trustworthy. The company gives everyone a polygraph test, asking, "Have you ever stolen anything from your place of work?" Naturally, all the applicants answer "No," but the polygraph identifies some of those answers as lies, making the person ineligible for a job. What's the probability that a job applicant rejected under suspicion of dishonesty was actually trustworthy?

You roll a die. If it comes up a 6, you win \$100. If not, you get to roll again. If you get a 6 the second time, you win \$50. If not, you lose.

1. Find the expected amount you'll win.

2. Find the standard deviation of the amount you might win rolling a die.

Exercise 13		Mean	SD
	X	80	12
	Y	12	3

Given independent random variables with means and standard deviations as shown, find the mean and standard deviation of:

1. 2Y + 20

#### 2. 3X

#### 3. 0.25X + Y

#### 4. X - 5Y

5.  $X_1 + X_2 + X_3$ , where  $X_1, X_2, X_3$  are independent copies of X.

Do these situations involve Bernoulli trials? Explain.

1. You are rolling 5 dice and need to get at least two 6's to win the game.

2. We record the distribution of eye colors found in a group of 500 people.

3. A manufacturer recalls a doll because about 3% have buttons that are not properly attached. Customers return 37 of these dolls to the local toy store. Is the manufacturer likely to find any dangerous buttons?

4. A city council of 11 Republicans and 8 Democrats picks a committee of 4 at random. What's the probability they choose all Democrats?

5. A 2002 Rutgers University study found that 74% of high school students have cheated on a test at least once. Your local high-school principal conducts a survey in homerooms and gets responses that admit to cheating from 322 of the 481 students.

Justine works for an organization committed to raising money for Alzheimer's research. From past experience, the organization knows that about 20% of all potential donors will agree to give something if contacted by phone. They also know that of all people donating, about 5% will give \$100 or more. On average, how many potential donors will she have to contact until she gets her first \$100 donor?

## Exercise 16

At a certain college, 6% of all students come from outside the United States. Incoming students there are assigned at random to freshman dorms, where students live in residential clusters of 40 freshmen sharing a common lounge area. How many international students would you expect to find in a typical cluster? With what standard deviation?

About 8% of males are color-blind. A researcher needs some color-blind subjects for an experiment and begins checking potential subjects.

1. On average, how many men should the researcher expect to check to find one who is color-blind?

2. What's the probability that she won't find anyone color-blind among the first 4 men she checks?

3. What's the probability that the first color-blind man found will be the sixth person checked?

4. What's the probability that she finds someone who is color-blind before checking the 10th man?

Two stores sell watermelons. At the first store the melons weigh an average of 22 pounds, with a standard deviation of 2.5 pounds. At the second store the melons are smaller, with a mean of 18 pounds and a standard deviation of 2 pounds. You select a melon at random at each store.

1. What's the mean difference in weights of the melons?

2. What's the standard deviation of the difference in weights?