Chapter 7: RVs & Probability Distributions

Name ___________________________

1. Professor Mean is planning the big Statistics Department Super Bowl party. Statisticians take pride in their variability, and it is not certain what kinds of chips people will choose. Professor Mean takes a 4-sided die to the grocery store, starts at one end of the chips aisle, and travels to the other end. For each different kind of chips, Dr. Mean rolls the die. If it comes up a 4, she purchases a bag of those chips for the party. There are 40 different kinds of chips in the aisle. Define random variable $x = \text{number of types of chips purchased out of the 40 types available.}$

a) Random variable $x$ is a binomial random variable. What is the mean of the random variable $x$?

b) What is the standard deviation of the random variable $x$?
2. From your own experience, give an example of one continuous random variable and one discrete random variable. In a few sentences, explain why each is continuous or discrete.

3. Fifty-five percent of the lunches at a very large high school are purchased using "lunch cards" rather than cash. We assume that the method of payment (cash or lunch card) for one student is independent of the method of payment for the next student in line. What is the probability of observing the following sequence of purchase methods for the first five students through the lunch line?

    Cash, Card, Cash, Card, Cash
4. For a variable that has a standard normal distribution,

a) What is the probability that $z < -1.34$?

b) What is the probability that $z < 2.56$?

c) What is the probability that $z$ is between $-1.5$ and $+1.5$?

d) What value of $z$ separates the smaller 5% of the standard normal distribution from the larger 95%?

e) What values of $-z$ and $+z$ separate the middle 90% of the standard normal distribution from the extreme 10%?
5. In a study performed by the statistics classes at Washington High School, city parking spaces were examined for compliance with the requirement to put money in the parking meters. Overall, the students found that 76% of metered parking places had meters that were not expired, and 24% had meters that were expired. If the traffic officer in charge of ticketing checks meters at random, what is the probability he or she will find an expired meter before the 3rd one checked?

6. In a study of left- and right-handers' reaction times to tones delivered to the right ear, the right-handers' reaction times were approximately normally distributed with a mean of 210 milliseconds and standard deviation of 40 milliseconds. The mean reaction time for left-handers was 240 ms.

a) Sketch a normal distribution that describes right-handers' reaction times, and locate the mean reaction time for left-handers in this distribution.

b) What proportion of right-handers reaction times would be faster than the mean reaction time for left-handers?
7. The Department of Transportation (D.O.T.) in a very large city has organized a new system of bus transportation. In an advertising campaign, citizens are encouraged to use the new “GO-D.O.T!” system. Suppose that at one of the bus stops the length of time (in minutes) that a commuter must wait for a bus is a uniformly distributed random variable, \( T \). The possible values of \( T \) are from 0 minutes to 20 minutes.

a) Sketch the probability distribution of \( T \).

b) What is the probability that a randomly selected commuter will spend more than 7 minutes waiting for GO-D.O.T?
8. At the last home football game of the season, the senior football players walk through a specially constructed welcoming arch, 2 abreast. The arch is 50” wide. It is considered unseemly to bump each other on the way through, so the arch must be wide enough for two players to go through. The distribution of widths of football players with shoulder pads is approximately normal with a mean of 30 inches, and standard deviation of 5 inches. Let random variable \( w \) = width in inches of a randomly selected padded football player.

a) The carpenter who will be constructing the arch has only metric measuring tools, and must convert all the information above to metric measures. Let random variable \( m \) = width in centimeters of a randomly selected padded football player. What are the mean and standard deviation of \( m \)? (Note: 1 inch = 2.54 centimeters)

b) Suppose the football players are paired randomly to go through the arch. Define random variable \( v = w_1 + w_2 \) to be the collective width -- in inches -- of two randomly selected football players. What are the mean and standard deviation of \( v \)?
c) The original specifications of the arch specified a 10 inch separation of the players so that they have room to avoid each other. Define the random variable, “amount” of room needed for two football players: \( a = 10 + w_1 + w_2 \). How does the mean and standard deviation in part (b) differ from the mean and standard deviation of the random variable, \( a \)? Do not recalculate the mean and standard deviation.

d) The school safety committee is concerned about the amount of “wiggle” room in the arch. The wiggle room is the amount of space left over when two players go through the arch. Using your results from (b) and (c) above, define a random variable, \( g \), which the committee could use in their analysis of the amount of wiggle room.