# Math 13 - Homework 7

**Name:** _____ **Class Number:** _____

**1)** The number of accidents that occur on a busy stretch of highway is a random variable.

a. What are the possible values of this random variable?
b. Are the values countable?
c. Is there a finite number of values?
d. Is the random variable discrete or continuous?

**2)** The distance a car travels on a tank of gasoline is a random variable.

a. What are the possible values of this random variable?
b. Are the values countable?
c. Is there a finite number of values?
d. Is the random variable discrete or continuous?

**3)** Determine whether each of the following is a valid probability distribution:

a.

| x | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| P(x) | 0.1 | 0.3 | 0.4 | 0.1 |

b.

| x | 5 | -6 | 10 | 0 |
|---|---|---|---|---|
| P(x) | 0.01 | 0.01 | 0.01 | 0.97 |

c.

| x | 14 | 12 | -7 | 13 |
|---|---|---|---|---|
| P(x) | 0.25 | 0.46 | 0.04 | 0.24 |

**4)** In a game of craps, you roll two fair dice. Whether you win or lose depends on the sum of the numbers appearing on the tops of the dice. Let $X$ be the random variable that represents the sum of the numbers on the tops of the dice.

a. What values can $X$ take on?
b. What is the probability distribution of these $X$ values (that is, what is the probability that $X = 2$, 3, etc.)?

**5)** A survey of Amazon.com shoppers reveals the following probability distribution of the number of books purchased per hit.

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| P(x) | 0.35 | 0.25 | 0.20 | 0.08 | 0.06 | 0.03 | 0.02 | 0.01 |

a. What is the probability that an Amazon.com visitor will buy four books?
b. What is the probability that an Amazon.com visitor will buy eight books?
c. What is the probability that an Amazon.com visitor will not buy any books?

d. What is the probability that an Amazon.com visitor will buy at least one book?

**6)** A shopping mall center estimates the probability distribution of the number of stores mall customers actually enter, as shown in the table:

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| P(x) | 0.04 | 0.19 | 0.22 | 0.28 | 0.12 | 0.09 | 0.06 |

a. Find the mean of the number of stores entered.
b. Find the standard deviation of the number of stores entered.

**7)** It costs one dollar to buy a lottery ticket, which has five prizes. The prizes and the probability that a player wins the prize are listed in the following table. Calculate the expected value of the payoff.

| Prize | Probability |
|---|---|
| 1 million | 1/10 million |
| 200,000 | 1/1 million |
| 50,000 | 1/500,000 |
| 10,000 | 1/50,000 |
| 1,000 | 1/10,00 |

**8)** A designer makes a profit of $30 on each item that is produced in perfect condition, and suffers a loss of $6 on each item that is produced in less-than-perfect condition. If each item produced is in perfect condition with probability 0.4, what is the designer's expected profit per item?

**9)** 2 people are randomly chosen from a group of 10 men and 20 women. Let $X$ denote the number of men chosen, and let $Y$ denote the number of women chosen.

a. Find E(X) =
b. Find E(Y) =
c. Find E(X + Y) =

**10)** You have been given the choice of receiving $500 in cash or receiving a gold coin that has a face value of $100. However, the actual value of the gold coin depends on its gold content. You are told that the coin has a 40% probability of being worth $400, a 30% probability of being worth $900, and a 30% probability of being worth its face value. Basing your decision on expected value, should you choose the coin?

**11)** A small taxi company has 4 taxis. In a month's time, each taxi will get 0 traffic tickets with probability 0.3, 1 traffic ticket with probability 0.5, or 2 traffic tickets with probability 0.2.

a. What is the expected number of tickets per month amassed by the fleet of 4 taxis?
b. What is the standard deviation of thr number of tickets?

**12)** Larry reads that one out of four eggs contains salmonella bacteria. He decides to never use more than three eggs in cooking. If eggs do or don't contain salmonella independent of each other, the number of contaminated eggs when Larry uses three chosen at random has the distribution:

a. binomial with $n = 4$ and $p = 1/4$
b. binomial with $n = 3$ and $p = 1/4$
c. binomial with $n = 3$ and $p = 1/3$

**13)** From the previous question, the probability that at least one of Larry's three eggs contains salmonella is about:

a. 0.681.
b. 0.578.
c. 0.305.

**14)** In a group of 10 college students, four are business majors. You select three of the 10 students at random (first, second, and third) and ask their major. The distribution of the number of business majors you choose is:

a. binomial with $n = 10$ and $p = 0.4$.
b. binomial with $n = 3$ and $p = 0.4$.
c. Not binomial.

**15)** When an opinion poll calls landline telephone numbers at random, approximately 30% of the numbers are working residential phone numbers. The remainder are either non-residential, non-working, or computer/fax numbers. You watch the random dialing machine make 20 calls.

a. What is the probability that exactly three calls reach working residential numbers?
b. What is the probability that at most three calls reach working residential numbers?
c. What is the probability that at least three calls reach working residential numbers?
d. What is the probability that fewer than three calls reach working residential numbers?
e. What is the probability that more than three calls reach working residential numbers?

**16)** A fair coin is tossed independently 5 times. P(heads) = P(tails) = 0.5. Compute:

a. probability of all heads =
b. probability of no heads =
c. probability of at least one heads =
d. probability of more heads than tails =
e. probability of less than three heads =
f. Expected value of number of heads =
g. Standard Deviation