Name:		
Date: 3	3/18/2025	

Math 130 Exam 2

## Please show ALL your work on the problems below. No more than 1 point will be given to problems if you only provide the correct answer and insufficient work.

1. (24 points) Suppose you are going to make a bet with your friend on the result of drawing a single card from a standard poker deck. Specifically, you will win \$50 if you draw a red face card, you will lose \$10 if you draw any other red card, and you will lose \$5 is you draw any other card. Let *X* denote the amount of money you will win when playing this game once.

a) Find the probability distribution of X

b) Find the expected value of *X* 

c) Find the standard deviation of X

d) Explain the meaning of your answer from part (b)

2. (2, 3, 5, 6, 3 points) Stella the cook is good at burning the meals she prepares. In fact, the probability that she burns a meal is 28%. Assume that Stella burning a given meal is independent of the other times she burns a meal. Let X denote the number meals Stella burns among the next 21 meals she prepares.

a) What distribution does *X* have?

b) Find the other 6 things you are supposed to list when solving problems for this kind of random variable.

c) What is the probability that Stella burns exactly 7 meals?

d) What is the probability that Stella burns between 7 and 9 meals (inclusive)?

e) What is the expected value, standard deviation, and variance of *X*?

- 3. (5, 3, 5 points) Suppose the random variable *X* has a uniform distribution on the interval [9, 22].
- a) Find the value of c that makes this a probability distribution

b) Find P(X = 18)

c) Find P(2 < X < 18)

4. (3, 7 points) Suppose *X* is a random variable whose density curve is given below.



a) What are the possible values of *X*?

b) Find P(-5 < X < 21)

5. (28 points) The time it takes me to grade a stack of stats quizzes has a normal distribution with a mean of 30 minutes and a standard deviation of 6 minutes.

a) What is the probability that the next time I grade a stack of stats quizzes it will take me at most 20 minutes?

b) What is the probability that the next time I grade a stack of stats quizzes it will take me more than 45 minutes?

c) What is the probability that the next time I grade a stack of stats quizzes it will take me between 25 minutes and 32 minutes?

d) What does the probability you found in part (b) mean?

6. (7, 10 points) A randomly selected lottery ticket has a 43% chance of being a winning ticket. Suppose you go to the store and buy 200 lottery tickets. Let *X* denote the total number of tickets you purchased that are winning tickets. Assuming that a ticket being a winning ticket is independent of if any other ticket is a winning ticket, use the normal approximation to the binomial distribution to answer the following questions:

a) What is the probability that less than 80 of your tickets will be winning tickets?

b) What is the probability that between 85 and 100 of your tickets will be winning tickets (excluding 85 and including 100)?

7. (3, 7 points) Consider the experiment where in order to complete the experiment once you have to first flip a single coin then roll a single die.

a) What is the sample space?

b) Define a random variable on this experiment.

Some formulas you may need:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \qquad P(A \cup B) = P(A) + P(B)$$
$$P(A \cap B) = P(A) \cdot P(B \mid A) \qquad P(A \cap B) = P(A) \cdot P(B)$$

$$P(\overline{A}) = 1 - P(A)$$
  $P(at \ least \ one) = 1 - P(none)$ 

$$EV = \mu = \sum xp(X = x)$$
$$Var = \left[\sum x^2 p(X = x)\right] - \mu^2$$
$$\sigma = \sqrt{\left[\sum x^2 p(X = x)\right] - \mu^2}$$

 $P(X = x) = {}_{n}C_{x}p^{x}q^{n-x}$   $\mu = np$   $\sigma^{2} = npq$   $\sigma = \sqrt{npq}$ 

$$Z = \frac{X - \mu}{\sigma}$$