Mth 102 – General Education Statistics – Practice Exam 3

NOTE: This exam should not be taken as a complete list of possible problems. It is merely intended to be an example of the length and difficulty level of the regular exam. To best utilize it as a *practice* exam, give yourself 55 minutes with no distractions. Try to emulate the classroom environment as much as possible.

Standard deviation of a random variable: $\sigma = \sqrt{\sum (x-\mu)^2 P(X=x)} = \sqrt{\sum x^2 P(X=x) - \mu^2}$

Binomial probability

$$P(X=x) = \binom{n}{x} p^x (1-p)^{n-x}$$

$$\mu = np,\ \sigma = \sqrt{np(1-p)}$$

1. Data on people arrested are published by the U.S. Federal Bureau of Investigation in *Crime in the United States*. Records for one year showed that 79.6% of the people arrested were male, 18.3% were under 18 years of age, and 13.5% were males under 18 years of age. If a person arrested that year is selected at random, what is the probability that the person obtained is either male or under 18?

2. Suppose a fair coin is flipped three times. What is the probability that all three flips were heads?

3. Suppose a fair die is rolled once. Give an example of two mutually exclusive events. (Describe or list the outcomes of those two events.)

4. As reported by the Federal Bureau of Investigation in *Crime in the United States*, the age distribution of murder victims between 20 and 59 years old is as shown in the following table.

Age	Frequency
20–24	2916
25–29	2175
30–34	1842
35–39	1581
40–44	1213
45–49	888
50–54	540
55–59	372

A murder case in which the person murdered was between 20 and 59 years old is selected at random. (There were 11,527 murders total.) Find the probability that the murder victim was

a. between 40 and 44 years old, inclusive.

b. at least 25 years old.

c. under 30 or over 54.

5. Suppose $P(E) = 0.25$. Find $P(\text{not } E)$.

6. Consider a standard 52-card deck of playing cards. A single card is drawn at random, with the following events defined:

   A = a diamond is drawn
   B = a Queen is drawn
   C = a face card is drawn (*face cards* are Jacks, Queens, or Kings)

   Describe or list the outcomes constituting each of the following events:

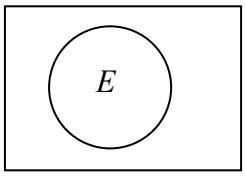
   a. (not C)

   b. (A or B)

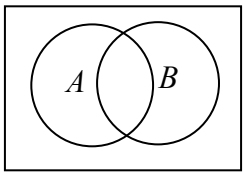
   c. (A and C)

7. Shade the area representing each event in the given Venn diagram.

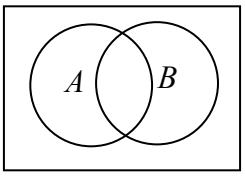
   a. (not E)



   b. (A or B)



   c. (A & B)



8. Consider again a deck of standard playing cards, where one card is drawn at random. Define events C and D as follows:

   C = a spade is drawn
   D = a face card is drawn (again, a *face card* is any Jack, Queen, or King)

   Find $P(C \text{ or } D)$.

9. Could the following be a probability distribution? Why or why not?

x	$P(X = x)$
1	0.2
2	0.3
3	0.1
4	0.5
5	0.2

10. The Illinois Lottery has several different games, one of which is the "Little Lotto". The game is played by picking six numbers from 1-39 on the play-slip, and there are four different ways to win. The prizes are shown below, along with their respective probabilities. Use the table provided to calculate the expected value of a $1 "Little Lotto" ticket.

    (Hint: Let X = amount won, and don't forget about the times you lose.)

prize	probability
$100,000	0.000 002
$100	0.000 3
$10	0.0096
$1	0.091

11. A town of 1000 households is surveyed about the number of cars in the household. (See the table below.) A household is then selected at random.

Cars	Households
0	125
1	428
2	256
3	108
4	83

a. Construct a probability distribution for the random variable X representing the number of cars in the randomly selected household.

b. Graph the probability histogram for X.

c. Find the mean of X.

12. Suppose you are given a 40-question multiple-choice test (4 choices each) of which you have no knowledge. Your only option is to guess on every question. Each question can be treated as a Bernoulli trial (since your guess is either right or wrong), so the number of correct answers on the exam follows a Binomial distribution. Find n and p.

13. A basketball player makes 80% of her free throws. Suppose she shoots 10 free throws and counts the number of made baskets. Let X = the number of made baskets. Use the fact that X follows a Binomial distribution to answer the following questions.

    a. Find $P(X = 1)$.

    b. Find $P(X \leq 1)$.

    c. Find $P(X > 1)$.

    d. Find the mean and standard deviation of X.