Name_____

SHORT ANSWER. Write your answer in the space provided or on a separate sheet of paper.

Provide an appropriate response.

1) Anna uses the letter X to represent the possible sequences of heads and tails that can be obtained when a coin is flipped three times. The possible sequences together with their probabilities are listed below:

X	Probability of sequence X
HHH	1/8
HHT	1/8
HTH	1/8
HTT	1/8
THH	1/8
THT	1/8
TTH	1/8
TTT	1/8

Is X a random variable? Why or why not? If it is not, which associated variable is a random variable? Give the probability distribution of the associated random variable.

Determine whether the following is a probability distribution. If not, identify the requirement that is not satisfied.

2)

x	P(x)
0	0.157
1	0.221
2	-0.060
3	0.084
4	0.166
5	0.432

Provide an appropriate response.

3) In a game, you have a 1/20 probability of winning $76 and a 19/20 probability of losing $9. What is your expected value?

4) Helene claimed that the expected value when rolling a fair die was 3.5. Steve said that wasn't possible. He said that the expected value was the most likely value in a single roll of the die, and since it wasn't possible for a die to turn up with a value of 3.5, the expected value couldn't possibly be 3.5. Who is right?

5) List the four requirements for a binomial distribution. Describe an experiment which is binomial and discuss how the experiment fits each of the four requirements.

6) Suppose that in one town 10% of people are left handed. Suppose that you want to find the probability of getting exactly 2 left-handed people when 4 people are randomly selected. Can the answer be found as follows: Use the multiplication rule to find the probability of getting two left handers followed by two right handers, which is (0.1)(0.1)(0.9)(0.9)? If not, explain why not and show how the required probability can be found.

Answer the question.

7) Focus groups of 11 people are randomly selected to discuss products of the Famous Company. It is determined that the mean number (per group) who recognize the Famous brand name is 5.7, and the standard deviation is 0.50. Would it be unusual to randomly select 11 people and find that greater than 9 recognize the Famous brand name?

Determine whether the given procedure results in a binomial distribution. If not, state the reason why.

8) Rolling a single "loaded" die 11 times, keeping track of the numbers that are rolled.

9) Spinning a roulette wheel 6 times, keeping track of the occurrences of a winning number of "16".

Find the indicated probability. Round to three decimal places.

10) The participants in a television quiz show are picked from a large pool of applicants with approximately equal numbers of men and women. Among the last 10 participants there have been only 2 women. If participants are picked randomly, what is the probability of getting 2 or fewer women when 10 people are picked?

Find the indicated probability.

11) Suppose that 10% of people are left handed. If 6 people are selected at random, what is the probability that exactly 2 of them are left handed?

Solve the problem.

12) On a multiple choice test with 11 questions, each question has four possible answers, one of which is correct. For students who guess at all answers, find the mean for the number of correct answers.

Provide an appropriate response.

13) Describe the difference between z scores and area scores. Specifically, each score's relationship to the graph of the standard normal distribution and the possible sign values for each score.

14) Suppose you are asked to find the 20th percentile and the 80th percentile for a set of scores. These two problems are solved almost exactly the same. Draw the diagram for each and discuss the part of the solution that would be different in finding the requested probabilities.

Assume that the weight loss for the first month of a diet program varies between 6 pounds and 12 pounds, and is spread evenly over the range of possibilities, so that there is a uniform distribution. Find the probability of the given range of pounds lost.

15) More than 10 pounds

16) Between 7 pounds and 10 pounds

Find the indicated value.

17) $z_{0.36}$

If z is a standard normal variable, find the probability.

18) The probability that z lies between -1.10 and -0.36

Solve the problem.

19) For a standard normal distribution, find the percentage of data that are more than 1 standard deviation away from the mean.

Solve the problem. Round to the nearest tenth unless indicated otherwise.

20) Scores on a test are normally distributed with a mean of 68.9 and a standard deviation of 11.6. Find P_{81}, which separates the bottom 81% from the top 19%.

Find the indicated probability.

21) The volumes of soda in quart soda bottles are normally distributed with a mean of 32.3 oz and a standard deviation of 1.2 oz. What is the probability that the volume of soda in a randomly selected bottle will be less than 32 oz?

Solve the problem.

22) Scores on a test have a mean of 62 and Q_3 is 83. The scores have a distribution that is approximately normal. Find the standard deviation. Round your answer to the nearest tenth.

Provide an appropriate response.

23) State the central limit theorem.

Solve the problem.

24) The scores on a certain test are normally distributed with a mean score of 53 and a standard deviation of 5. What is the probability that a sample of 90 students will have a mean score of at least 53.527?

25) Assume that women's heights are normally distributed with a mean of 63.6 inches and a standard deviation of 2.5 inches. If 90 women are randomly selected, find the probability that they have a mean height between 62.9 inches and 64.0 inches.

1) No, X is not a random variable because it does not have numerical values. A random variable is a variable that has a single numerical value, determined by chance for each outcome of a procedure. Let Y represent the number of heads (or the number of tails) when a coin is flipped three times. Then Y is a random variable with the distribution shown below.

Y (number of heads)	Probability
0	1/8
1	3/8
2	3/8
3	1/8

2) Not a probability distribution. One of the P(x)'s is negative.
3) -$4.75
4) Helene is right. The expected value is not the most likely value in a single trial, it is the mean value obtained from infinitely many trials. The expected value is the mean we would expect to get if the die could be rolled infinitely many times, which is 3.5.
5) The four requirements are:
   1) The experiment must have a fixed number of trials.
   2) The trials must be independent.
   3) Each trial must have all outcomes classified into two categories.
   4) The probabilities must remain constant for each trial.

   Answers will vary for the experiment.
6) (0.1)(0.1)(0.9)(0.9) gives the probability of a particular sequence containing two left handers among 4 randomly selected people, namely the sequence LLRR. There are many possible sequences which contain two left handers among 4 randomly selected people and the probabilities of all of these sequences must be added. The possible sequences are:

   LLRR
   LRLR
   LRRL
   RLLR
   RLRL
   RRLL

   Each of the 6 sequences has probability $(0.1)^2(0.9)^2$, so the probability of getting two left handers when 4 people are randomly selected is $6(0.1)^2(0.9)^2$.
7) Yes
8) Not binomial: there are more than two outcomes for each trial.
9) Procedure results in a binomial distribution..
10) 0.055
11) 0.0984
12) 2.8
13) z scores measure the number of SD above or below the mean, and thus they can be either positive or negative. Area scores refer to the area under the curve between the mean and the corresponding z score. Area scores are always positive.
14) For the 20th percentile, you would use an area score of 0.2000 and your z score would be negative. For the 80th percentile, you would use an area score of 0.8000 and your z score would be positive.
15) $\frac{1}{3}$
16) $\frac{1}{2}$

17) 0.36
18) 0.2237
19) 31.74%
20) 79.1
21) 0.4013
22) 31.3
23) Assume that the random variable x has a distribution (which may or may not be normal) with mean μ and standard deviation σ. Samples of size n are randomly selected from this population.

    1) The distribution of sample means $\bar{x}$ will, as the sample size increases, approach a normal distribution.
    2) The mean of the sample means will be the population mean μ.
    3) The standard deviation of the sample means will be $\frac{\sigma}{\sqrt{n}}$.

    For both the uniform and the normal distribution, the distribution of the sample means is bell-shaped. As n gets larger, the distribution approaches the normal distribution. In the case where the original population is uniform, the distribution of the sample means is approximately normal for n > 30.
24) 0.1587
25) 0.9318