AP Statistics Name ______________________

Review Ch. 6

1. Which of the following data sets is not continuous?
   a. The gallons of gasoline in a car.
   b. The time it takes to commute in a car.
   c. Number of goals scored by a hockey team
   d. Distance travelled daily in a police cruiser
   e. Hours of life expectancy in AAA batteries

2. Mrs. Burns teaches two calculus classes. Her morning class has a mean average of 78 and standard deviation of 6 points at the end of the first semester. Her afternoon class has a mean average of 83 with a standard deviation of 9 points. Assuming both classes are independent of each other, what is the new standard deviation for these combined classes?

a. 15 b. 10.8 c. 7.5 d. 3.9 e. 3

3. Two random variables X and Y are independent. Find the mean and standard deviation of 2X + Y if:

	μ	σ
X	6	0.5
Y	8	0.6

a. $\mu_{2X+Y}=14,\ \sigma_{2X+Y}=1.17$ b. $\mu_{2X+Y}=14,\ \sigma_{2X+Y}=0.28$ c. $\mu_{2X+Y}=20,\ \sigma_{2X+Y}=1.1$

d. $\mu_{2X+Y}=20,\ \sigma_{2X+Y}=0.28$ e. $\mu_{2X+Y}=20,\ \sigma_{2X+Y}=1.17$

4. A marketing survey compiled data on the number of cars in households. If X = the number of cars in a randomly selected household, and we omit the rare case of more than 5 cars, then X has the following probability distribution.

X	0	1	2	3	4	5
P(X)	0.24	0.37	0.20	0.11	0.05	0.03

What is the probability that a randomly selected household has at least two cars?
a. 0.19 b. 0.20 c. 0.29 d. 0.39 e. 0.61

5. Using the probability distribution in #4, what is the expected value of the number of cars in a randomly selected household?
a. 2.5 b. 0.1167 c. 1.45 d. 1 e. Can not be determined

6. A dealer in Las Vegas selects 10 cards from a standard deck of 52 cards. Let Y be the number of diamonds in the 10 cards selected. Which of the following best describes the setting?

a. Y has a binomial distribution with n = 10 observations and probability of success p = 0.25
b. Y has a binomial distribution with n = 10 observations and probability of success p = 0.25, provided the deck is shuffled well.
c. Y has a binomial distribution with n = 10 observations and probability of success p = 0.25, provided that after selecting a card it is replaced in the deck and the deck is shuffled well before the next card is selected.
d. Y has a normal distribution with mean = 2.5 and standard deviation = 1.37
e. Not enough information to tell what type of probability distribution it is.

7. In the town of Lakeville, the number of cell phones in a household is a random variable W with the following probability distribution.

W	0	1	2	3	4	5
P(W)	0.1	0.1	0.25	0.3	0.2	0.05

The standard deviation of the number of cell phones in a randomly selected house is
a. 1.7475 b. 1.87 c. 2.5 d. 1.32 e. 2.9575

8. A random variable Y has the following probability distribution:

Y	-1	0	1	2
P(Y)	4C	2C	0.07	0.03

The value of the constant C is:
a. 0.10 b. 0.15 c. 0.20 d. 0.25 e. 0.75

9. The variance of the sum of two random variables X and Y is
a. $s_x + s_y$ b. $(s_x)^2 + (s_y)^2$ c. $s_x + s_y$, but only if X and Y are independent

d. $(s_x)^2 + (s_y)^2$, but only if X and Y are independent e. None of these

10. It is known that about 90% of the widgets made by Buckley Industries meet specifications. Every hour a sample of 18 widgets is selected at random for testing and the number of widgets that meet specifications is recorded. What is the approximate mean and standard deviation of the number of widgets meeting specifications?
a. $m=1.62; s=1.414$ b. $m=1.62; s=1.265$ c. $m=16.2; s=1.62$

d. $m=16.2; s=1.273$ e. $m=16.2; s=4.025$

11. A raffle sells tickets for \$10 and offers a prize of \$500, \$1000, or \$2000. Let C be a random variable that represents the prize in the raffle drawing. The probability distribution of C is given below.

C	\$0	\$500	\$1000	\$2000
P(C)	0.60	0.05	0.13	0.22

The expected **profit** when playing the raffle is

a. \$145 b. \$585 c. \$865 d. \$635 e. \$485

12. Let the random variable X represent the amount of money Carl makes tutoring statistics students in the summer. Assume X is normal with mean \$240 and standard deviation \$60. The probability is approximately 0.6 that, in a randomly selected summer, Carl will make less than about

a. \$144 b. \$216 c. \$255 d. \$30 e. \$360

Free Response:

13. Patients receiving artificial knees often experience pain after surgery. The pain is measured on a subjective scale with possible values of 1 to 5. Assume that X is a random variable representing the pain score for a randomly selected patient. The following table gives part of the probability distribution for X.

X	1	2	3	4	5
P(X)	0.1	0.2	0.3	0.3	?

(a) Find *P*(X = 5).

(b) Find the probability that the pain score is less than 3.

(c) Find the mean μ for this distribution.

(d) Find the variance for this distribution.

(e) Find the standard deviation for this distribution.

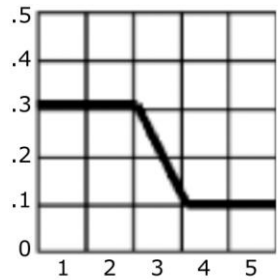
(f) Suppose the pain scores for two randomly selected patients are recorded. Let Y be the random variable representing the sum of the two scores. Find the mean of Y.

(g) Find the standard deviation of Y.

14. If a player rolls two dice and gets a sum of 2 or 12, he wins \$20. If the person gets a 7, he wins \$5. The cost to play the game is \$3. Find the expectation of the game.

15. Here is the probability distribution function for a continuous random variable.

(a) Show that this defines a legitimate probability density function.



Determine the following probabilities: (Note: On the horizontal axis each line = 1)

(b) $P(0 \leq X \leq 3) =$

(c) $P(2 \leq X \leq 3) =$

16. A manufacturer produces a large number of toasters. From past experience, the manufacturer knows that approximately 2% are defective. In a quality control procedure, we randomly select 20 toasters for testing. We want to determine the probability that no more than one of these toasters is defective.

(a) Is a binomial distribution a reasonable probability model for the random variable X? State your reasons clearly.

(b) Determine the probability that exactly one of the toasters is defective.

(c) Define the random variable. X = _______________. Then find the mean and standard deviation for X.

(d) Find the probability that at most two of the toasters are defective. (Include enough details so that it can be understood how you arrived at your answer.)

17. Draw a card from a standard deck of 52 playing cards, observe the card, and replace the card within the deck. Count the number of times you draw a card in this manner until you observe a jack. Is a binomial distribution a reasonable probability model for the random variable X? State your reasons clearly.

In problems 18 and 19, indicate whether a binomial distribution is a reasonable probability model for the random variable X. Give your reasons in each case.

18. The pool of potential jurors for a murder case contains 100 persons chosen at random from the adult residents of a large city. Each person in the pool is asked whether he or she opposes the death penalty. X is the number who say "Yes."

19. Joey buys a Virginia lottery ticket every week. X is the number of times in a year that he wins a prize.

20. A fair coin is flipped 20 times.

    (a) Determine the probability that the coin comes up tails exactly 15 times.

    (b) Find the probability that the coin comes up tails at least 15 times. (Include enough details so that it can be understood how you arrived at your answer.)

    (c) Find the mean and standard deviation for the random variable X in this coin-flipping problem.

    (d) Find the probability that X takes a value within 2 standard deviations of its mean.

21. A headache remedy is said to be 80% effective in curing headaches caused by simple nervous tension. An investigator tests this remedy on 100 randomly selected patients suffering from nervous tension.

(a) Define the random variable being measured. X =

(b) What kind of distribution does X have?

(c) Calculate the mean and standard deviation of X.

(d) Determine the probability that exactly X is within 1 standard deviation of the mean.

(e) Use the normal approximation to find the area between X = 72 and X = 88.

(f) Your result in (e) should be close to the empirical rule, why is this true?

22. A recent study revealed that a new brand of mp3 player may need to be repaired up to 3 times during its ownership. Let R represent the number of repairs necessary over the lifetime of a randomly selected mp3 player of this brand. The probability distribution of the number of repairs necessary is given below.

R	0	1	2	3
P(R)	0.4	0.3	0.2	0.1

a. Compute and interpret the mean and standard deviation of R.

b. Suppose we also randomly selected a phone that may require repairs over its lifetime. The mean and standard deviation of the number of repairs for this brand of phone are 2 and 1.2 respectively. Assuming that the phone and mp3 player break down independently of each other, compute and interpret the mean and standard deviation of the total number of repairs necessary for the two devices.

c. Each mp3 costs \$15 and each phone repair costs \$25. Compute the mean and standard deviation of the total amount you can expect to pay in repairs over the life of the devices.

23. Mr. Voss and Mr. Cull bowl every Tuesday night. Over the past few years, Mr. Voss's scores have been approximately Normally distributed with a mean of 212 and a standard deviation of 31. During the same period, Mr. Cull's scores have also been approximately Normally distributed with a mean of 230 and a standard deviation of 40. Assuming their scores are independent, what is the probability that Mr. Voss scores higher than Mr. Cull on a randomly-selected Tuesday night?

More Multiple Choice

24. Binomial and geometric probability situations share many conditions. Identify the choice that is not shared.

(a) The probability of success on each trial is the same.
(b) There are only two outcomes on each trial.
(c) The focus of the problem is the number of successes in a given number of trials.
(d) The probability of a success equals 1 minus the probability of a failure.
(e) The mean depends on the probability of a success.

25. A set of 10 cards consist of 3 red cards and 7 black cards. The cards are shuffled thoroughly and you turn cards over, one at a time, beginning with the top card. Let Y be the number of cards you turn over until you observe the first red card. The random variable Y has which of the following probability distribution.

a. the Normal distribution with mean 3
b. the binomial distribution with $p = 0.3$
c. the geometric distribution with probability of success 0.3
d. the uniform distribution that takes value 1 on the interval 0 to 3
e. none of the above

26. Which of the following is a true statement?

a. The binomial setting requires that there are only two possible outcomes for each trial, while the geometric setting permits more than two outcomes.
b. A geometric random variable takes on integer values from 0 to n.
c. If X is a geometric random variable and the probability of success is 0.85, then the probability distribution of X will be skewed left, since 0.85 is closer to 1 than to 0.
d. An important difference between binomial and geometric random variables is that there is a fixed number of trials in a binomial setting, and the number of trial varies in a geometric setting.
e. The distribution of every binomial random variable is skewed right.

27. A college basketball player makes 80% of her free throws. Suppose this probability is the same for each free throw she attempts, and free throw attempts are independent. The probability that she makes all of her first four free throws and then misses her fifth attempt this season is

a) 0.32768. b) 0.08192. c) 0.06554. d) 0.00128. e) 0.00032.

28. A college basketball player makes 80% of her free throws. Suppose this probability is the same for each free throw she attempts, and free throw attempts are independent. The expected number of free throws required until she makes her first free throw of the season is

a) 2. b) 1.25. c) 0.80. d) 0.31. e) 0.13

Use the following information for numbers 29 & 30:
Suppose that 40% of the cars in a certain town are white. A person stands at an intersection waiting for a white car. Let X = the number of cars that must drive by until a white one drives by.

29. $P(X < 5) =$

a) 0.0518 b) 0.1296 c) 0.2592 d) 0.8704 e) 0.9482

30. The expected value of X is:

a) 1 b) 1.5 c) 2 d) 2.5 e) 3

Use the following information for numbers 31 & 32:
A poll shows that 60% of the adults in a large town are registered Democrats. A newspaper reporter wants to interview a local democrat regarding a recent decision by the City Council.

31. If the reporter asks adults on the street at random, what is the probability that he will find a Democrat by the time he has stopped three people?

a) 0.936 b) 0.216 c) 0.144 d) 0.096 e) 0.064

32. On average, how many people will the reporter have to stop before he finds his first Democrat?

a) 1 b) 1.33 c) 1.67 d) 2 e) 2.33

Use the following information for numbers 33 & 34:
You are stuck at the Vince Lombardi rest stop on the New Jersey Turnpike with a dead battery. To get on the road again, you need to find someone with jumper cables that connect the batteries of two cars together so you can start your car again. Suppose that 16% of drivers in New Jersey carry jumper cables in their trunk. You begin to ask random people getting out of their cars if they have jumper cables.

33. On average, how many people do you expect you will have to ask before you find someone with jumper cables?

a) 1.6 b) 2 c) 6 d) 6.25 e) 16

34. You're going to give up and call a tow truck if you don't find jumper cables by the time you've asked 10 people. What's the probability you end up calling a tow truck?

a) 0.8251 b) 0.1749 c) 0.1344 d) 0.0333 e) 0.0280

35. Which of the following are true statements?

I. The histogram of a binomial distribution with $p = .5$ is always symmetric.
II. The histogram of a binomial distribution with $p = .9$ is skewed to the right.
III. The histogram of a geometric distribution is always decreasing.

(a) I and II (b) I and III (c) II and III (d) I, II, and III (e) None of the above.