AP STATISTICS **Name: _____ Period: ____**
Review Unit V – Probability

Show all work and reasoning. Round probabilities to the nearest ten-thousandths when appropriate.

1. _____ If the occurrence of event A does not change the probability of event B, then events A and B are

   A) dependent B) disjoint C) correlated D) independent E) a trial

2. _____ Which two events are most likely to be mutually exclusive?

   A) being on a diet; owning a car
   B) having a driver's license; having black hair
   C) doing all of your homework this semester; passing this class
   D) not getting any sleep last night; being tired today
   E) being a current student at Round Rock High School; being a current student at Westwood High School

3. _____ The probability of winning a fair coin landing "heads" is 0.5. If at least 70 percent of the coin flips in a series of *n* flips are "heads", the player wins a prize. If the possible choices for *n* (the number of coin flips) are

   $n = 10$, $n = 20$, and $n = 100$,

   which value of *n* should the player choose in order to maximize the probability of winning a prize?

   A) *n*=10 only B) *n*=20 only C) *n*=100 only
   D) *n*=10 or *n*=20 only; the probabilities are the same.
   E) *n*=10 or *n*=20 or *n*=100 ; the probabilities are the same.

4. _____ The weights of a population of adult male gray whales are approximately normally distributed with a mean weight of 18,000 kilograms and a standard deviation of 4,000 kilograms. The weights of a population of adult male humpback whales are approximately normally distributed with a mean weight of 30,000 kilograms and a standard deviation of 6,000 kilograms. A certain adult male gray whale weighs 24,000 kilograms. This whale would have the same standardized weight (*z*-score) as an adult male humpback whale whose weight, in kilograms, is equal to which of the following?

   A) 21,000
   B) 24,000
   C) 30,000
   D) 36,000
   E) 39,000

5. _____ If A and B are independent events with $P(A^c) = 0.7$ and $P(B) = 0.5$, then $P(A \cup B)$ is

   A) 0.15 B) 0.8 C) 0.85 D) 0.65
   E) it cannot be determined

6. _____ If A and B are disjoint events with $P(A) = 0.3$ and $P(B) = 0.5$, then $P(A \cup B)$ is

   A) 0.15 B) 0 C) 0.8 D) 0.65
   E) it cannot be determined

7. _____ Which of the following is true about disjoint events?

   A) $P(A|B) = 0$ B) $P(A|B) = B$ C) $P(A|B) = A$ D) $P(A|B) = 1$

8. According to a study conducted by the American Community Survey, 73% of U.S. households had broadband internet access in 2013.

   a) What is the probability that four randomly selected U.S. households all had broadband internet access in 2013?

   b) What is the probability that at least one of four randomly selected U.S. households had broadband internet access in 2013?

   c) What is the probability that the first randomly selected household with broadband internet access is the fourth household selected?

9. Police reports about the traffic accidents they investigated last year indicated that 40% of the accidents involved speeding, 25% involved alcohol, and 10% involved both risk factors.

   a) What is the probability that an accident involved alcohol, but not speeding?

   b) What proportion of accidents last year involved neither speeding nor alcohol?

   c) Given that an accident involved speeding, what is the probability that it involves alcohol?

10. In your sock drawer you have 4 blue socks, 5 grey socks, and 3 black ones. Half asleep one morning, you grab 2 socks at random and put them on. Find the probability you end up wearing…

    a) 2 blue socks
    b) no grey socks
    c) matching socks

11. **GASP!** Your car battery has died in the school parking lot and you need a "jump" using jumper cables in order to get your car started. Magically, mystically, we know that 18% of the students who drive to school carry jumper cables. You will stop students (randomly selected, of course!) to find the needed jumper cables. Obviously, you will not ask any more students once you find someone with jumper cables.

    a) What is the probability that the 4^{th} student you stop is the first to have jumper cables?

    b) On average how many students would you expect to stop in order to find jumper cables?

12. In a new game of skill and wit, you play two games against the same opponent. The probability that you win the first game is 0.6. If you win the first game, the probability you also win the second is 0.3. If you lose the first game, the probability that you win the second is 0.2. Find the probability that you win at least one game.

13. An advertising agency in a large city is conducting a survey of adults to investigate whether there is an association between highest level of educational achievement and primary source for news. The company takes a random sample of 2,500 adults in the city. The results are shown in the table below.

	HIGHEST LEVEL OF EDUCATIONAL ACHIEVEMENT			
Primary Source for News	Not High School Graduate	High School Graduate But Not College Graduate	College Graduate	Total
Newspapers	49	205	188	442
Local television	90	170	75	335
Cable television	113	496	147	756
Internet	41	401	245	687
None	77	165	38	280
Total	370	1,437	693	2,500

a) If an adult is to be selected at random from this sample, what is the probability that the selected adult is a college graduate or obtains news primarily from the internet?

b) If an adult who is a college graduate is to be selected at random from this sample, what is the probability that the selected adult obtains news primarily from the internet?

c) When selecting an adult at random from the sample of 2,500 adults, are the events “is a college graduate” and “obtains news primarily from the internet” independent? Justify your answer.

14. Each Spring, students in the fictitious realm of Podunk take the Comic Design* AP Exam. Scores on this exam range from a 1 (lowest) to a 5 (highest), with most colleges and universities granting college credit for an introductory Comic Design course for a score of at least a 3 or 4. The following probability model summarizes the results for the 2012 Comic Design AP Exam:

score (x)	1	2	3	4	5
P(X = x)	0.214	0.197	0.241	0.224	0.124

Using the probability model, answer the following questions:

a) What is the probability that a randomly selected student earned a score of at least a 3?

b) If eight students are selected randomly, what is the probability that all of them scored at least a 3?

c) If five students are randomly selected, what is the probability that at least one of them earned a score of at least a 3?

d) Find the expected value and standard deviation of the global score on the Comic Design AP Exam.

**before you ask: NO – there is no "Comic Design" AP class.*

15. In the last problem, we established that the probability that a randomly selected student from this group earned a score of a 3 or above was 0.589. Use that probability to answer the following questions.

a) In a random sample of 8 students, what is the probability that exactly 4 of them score at least a 3?

b) In a random sample of 8 students, what is the probability that fewer than half of them score a 3 or above?

c) In a random sample of 8 students, what is the probability that at least 6 of them score a 3 or above?

d) On average, how many students would you expect to have to randomly sample from this group until you found one that scored a 3 or above on this exam?

e) If we take a random sample of 150 students to see how many of them scored a 3 or above, would this meet the requirements of a Binomial model?

f) In a random sample of 150 students who took the AP Comic Design Exam, what are the mean and standard deviation for the expected number of students who score a 3 or above?

16. In 2013, 96 students from Podunk High School took the Comic Design AP Exam, and the results – which were MUCH better than the previous year's national results! – are summarized by the following probability model:

score (x)	1	2	3	4	5
P(X = x)	0.010	0.083	0.240	0.417	0.250

A student is generally considered to have earned a "passing" score if their AP Exam score is a 3 or higher.

a) If one of these 96 students is selected at random, what is the probability that that student "passed" the Comic Design AP Exam?

b) Given that a randomly selected student "passed" the Comic Design AP Exam, what is the probability that this student earned a score of a "4" or "5"?

17. A piñata is a container filled with toys and candy and is broken open by hitting it with a stick. At a birthday party, Savannah will hit the piñata with a stick until it breaks. Let the random variable "*X*" represent the number of hits required to break the piñata. The probability model for "*X*" is shown below. *(This particular brand of piñata is only designed to withstand up to 2 hits, so even if the piñata does not break after two hits, it is guaranteed to break by the 3rd hit)*

x	1	2	3
P(*x*)	0.70	0.24	0.06

a) Calculated the expected value of *X*.

b) Interpret the meaning of the expected value of *X* in context. *(Hint: Expected value is a long-run average.)*

c) Calculated the variance and the standard deviation of *X*.

18. A large corporation sponsors bowling leagues for its employees. The mean score for men was 154 pins with a standard deviation of 9 pins, while the women had mean score 144 pins and standard deviation 12 pins. The scores of men and women are thought to be independent. At the end of the season the league holds a tournament that randomly pairs men and women as opponents in the first round.

    a) On average, how much do you *expect* the man to win by?

    b) Calculate the standard deviation of the differences in the competitor's scores.

    c) If the distribution of differences in bowling scores is approximately normal, what is the probability that the man scores more points than the woman?

    d) If the distribution of differences in bowling scores is approximately normal, what is the probability that the woman outscores the man by at least 15 points?

AP STATISTICS
Review Unit V – Probability – ANSWERS

1. D
2. E
3. A
4. E
5. D
6. C
7. A
8. a) 0.2840
   b) 0.9947
   c) 0.0144

9. a) 0.15
   b) 0.45
   c) 0.25

10. a) 1/11 or 0.0909
    b) 7/22 or 0.3182
    c) 19/66 or 0.2879

11. a) 0.0992
    b) 5.556 (don't round expected values to an integer!!!)

12. 0.68

13. a) 0.454
    b) 0.3535
    c) No… *[the test is P(A) = P(A|B)]*

14. a) 0.589
    b) 0.0145
    c) 0.9883
    d) E(X) = 2.847, SD(X) = 1.3227

15. a) 0.2404
    b) 0.1912
    c) 0.2928
    d) 1.6987
    e) Two outcomes, each score is independent of each other, probability of success is the same for each trial
    f) Mean = 88.35, SD = 6.0259

16. a) 0.907
    b) 0.735

17. a) 1.36
    b) In the long run, this is the mean number of hits required to break the piñata.
    c) Var(X) = 0.3504, SD(X) = 0.5919

18. a) 10
    b) 15
    c) 0.7475
    d) 0.0475