AP Statistics
Chapter 18 – 19 Review

Part I (#1 – 6) – Multiple Choice

___ 1. Create a sample of students by randomly selecting the first student of the first 20 students in the student directory and then selecting every 20th name after that. This process is a…

A) simple random sampling
B) cluster sampling
C) stratified sampling
D) systematic sampling
E) convenience sampling

___ 2. A sample of size 49 is drawn from a normal population with a mean of 63 and a standard deviation of 14. What are the mean and standard deviation of the sampling model of sample means ($\overline{x}$)?

A) $\mu = 9, \sigma = 2$
B) $\mu = 1.286, \sigma = 3.5$
C) $\mu = 63, \sigma = 2$
D) $\mu = 9, \sigma = 14$
E) $\mu = 63, \sigma = 0.286$

___ 3. In general, how does multiplying the sample size by 9 affect the width of a confidence interval?

A) The width becomes three times as large.
B) The width of the interval becomes two times as large.
C) The width of the interval becomes half as large.
D) The width of the interval becomes one-third as large.
E) We need to know the sample size to be able to determine the effect.

___ 4. A researcher plans a study to examine the depth of belief in God among the adult population. He obtains a simple random sample of 100 adults as they leave church one Sunday morning. All but one of them agrees to participate in the survey. Which of the following are true statements?

I. Proper use of chance as evidenced by the simple random sample makes this a well-designed survey.
II. The high response rate makes this a well-designed survey.
III. Selection bias makes this a poorly designed survey.

A) I only B) II only C) III only D) I and II E) None of these is true

___ 5. A 95% confidence interval for *the proportion of female athletes in college programs* is constructed based on data from 30 randomly selected coeducational colleges. If the confidence interval is (0.38, 0.52), we can say

A) 95% of the time, colleges have between 38% and 52% female athletes.
B) 95% of colleges have an average of 45% female athletes.
C) If 100 samples were taken and a 95% confidence interval was computed for each, 5 of the intervals would be between 38% and 52%.
D) If this procedure were repeated *many* times, 95% of the sample proportions would be between 38% and 52%.
E) If this procedure were repeated *many* times, 95% of the resulting confidence intervals would contain the true proportion of female athletes in coeducational colleges.

___ 6. The population {2, 3, 5, 7} has mean $\mu = 4.25$ and standard deviation $\sigma = 1.92$. When sampling with replacement, there are 16 different possible ordered samples of size 2 that can be selected from this population. The mean of each of these 16 samples is computed. For example, 1 of the 16 samples is (2, 5), which has a mean of 3.5. The distribution of the 16 sample means has its own mean $\mu_{\overline{x}}$ and its own standard deviation $\sigma_{\overline{x}}$. Which of the following statements is true?

A) $\mu_{\overline{x}} = 4.25$ and $\sigma_{\overline{x}} = 1.92$
B) $\mu_{\overline{x}} = 4.25$ and $\sigma_{\overline{x}} > 1.92$
C) $\mu_{\overline{x}} = 4.25$ and $\sigma_{\overline{x}} < 1.92$
D) $\mu_{\overline{x}} > 4.25$
E) $\mu_{\overline{x}} < 4.25$

Part II (#7 – 13) – Free Response (mostly) – PLEASE WORK THESE OUT ON SEPARATE PAPER!

7. A production factory in Singapore produces thousands of widgets each day, which have a mean weight of 100 ounces and a standard deviation of 15 ounces. The distribution of weights of these widgets is strongly skewed to the lower weights. A quality control engineer selects a random sample of widgets and measures their weights.

   a) If a random sample of 12 widgets is selected, describe the likely shape of the distribution of weights for that sample.
   b) If quality control were to select a large number of samples (read: maaaaaaaaaaaany samples) of size 12, describe the sampling distribution of sample means for the mean weights of the widgets, including the mean, standard deviation, and likely shape.
   c) If a random sample of 80 widgets is selected, describe the likely shape of the distribution of weights for that one sample.
   d) If quality control were to select a large number of samples (again: maaaaaaaaaaaany samples) of size 80, describe the sampling distribution of sample means for the mean weights of the widgets, including the mean, standard deviation, and likely shape.

8. Big Town Fisheries recently stocked a new lake in a city park with 2,000 fish of various sizes. The distribution of the lengths of these fish is approximately normal.

   Big Town Fisheries claims that the mean length of the fish is 8 inches. If the claim is true, which of the following would be more likely? Justify your answer. *(You may wish to use drawings/diagrams to help justify your answer)*

   i. A random sample of 15 fish having a mean length that is greater than 10 inches

   or

   ii. A random sample of 50 fish having a mean length that is greater than 10 inches

9. The distribution of scores for persons over 26 years of age on the Wechsler Adult Intelligence Scale (WAIS) is approximately symmetric and unimodal with mean 100 and standard deviation of 15. The WAIS is one of the most common "IQ" tests for adults.

   a) What score does an individual need to score to be in the top 15% of adults taking this test?
   b) What is the probability that a randomly chosen <u>individual</u> has a WAIS score of 102 or higher?
   c) What is the probability that the average WAIS score of a *random sample* of 60 adults who take the WAIS test is 102 or higher?
   d) Would your answer to part (C) be significantly affected if the distribution of WAIS scores in an adult population were strongly skewed to the left? Clearly explain your answer.

10. Providence Memorial Hospital is conducting a blood drive because its supply of group O blood is low, and it needs donors of group O blood.

    a) Suppose the Greater New York Blood Program wishes to estimate the true proportion of area adults that have type O blood by using a confidence interval based on the results of a survey. What is the minimum number of adults that must be surveyed in order to guarantee that their margin of error is no more than 4.5% with a confidence level of 98%?
    b) If 400 volunteers donate blood, estimate the probability that the number with group O blood is at least 177. According to data provided by the Greater New York Blood Program, forty-five percent have group O blood.

11. A local news organization wishes to estimate the proportion of all Austin households that have experienced some sort of crime by constructing a 95% confidence interval based on survey data.

    a) In the context of this situation, interpret the 95% confidence level. *(interpret the LEVEL!)*
    b) In a random sample of 300 Austin households, 68 report that they had experienced some sort of crime. Construct and interpret a 95 confidence interval to estimate the proportion of Austin households that have experienced some sort of crime.
    c) The Gallup Organization conducted a national study on crime victimizations and reports that 25% of all households experience some sort of crime. Based on this interval, is there evidence to suggest that the proportion of Austin households who experienced some sort of crime is less than the national proportion?
    d) Suppose that another media organization wishes to conduct a similar survey in Austin. What is the minimum number of households that they would need to survey in order to guarantee a margin of error of no more than ±2% with a confidence level of 93%?

12. In the most recent reading, Gallup found 44% in favor of stricter laws. For their results, one can say with 95% confidence that the maximum margin of sampling error is ±4 percentage points. Are these statements regarding the Gallop poll about the laws governing the sale of firearms true?

    a) In the sample of 1018 U.S. adults, somewhere between 40% and 48% of them were in favor of stricter laws governing the sale of firearms.
    b) We are 95% confident that 44% of all U.S. adults are in favor of stricter laws governing the sale of firearms.
    c) We are 95% confident that between 40% and 48% of all U.S. adults are in favor of stricter laws governing the sale of firearms.
    d) We know that between 40% and 48% of all U.S. adults are in favor of stricter laws governing the sale of firearms.
    e) 95% of all U.S. adults are in favor of stricter laws governing the sale of firearms.

___ 13. What is a sampling distribution?

    A) A distribution of all the statistics that can be found in a given sample
    B) A histogram, or other such visual representation, showing the distribution of a sample
    C) A normal distribution of some statistic
    D) A distribution of all the values taken by a statistic from all possible samples of a given size
    E) All of the above

Part III – Additional Practice

14. Trains carry bauxite ore from a mine in Canada to an aluminum processing plant in northern New York state in hopper cars. Filling equipment is used to load ore into the hopper cars. When functioning properly, the actual weights of ore loaded into each car by the filling equipment at the mine are approximately normally distributed with a mean of 70 tons and standard deviation of 0.9 ton. If the mean is greater than 70 tons, the loading mechanism is overfilling.

    a) If the filling equipment is functioning properly, what is the probability that the weight of the ore in a randomly selected car will be 70.7 tons or more? Show your work.
    b) Suppose that the weight or ore in a randomly selected car is 70.7 tons (or more). Would that fact make you suspect that the loading mechanism is overfilling the cars? Justify your answer.
    c) If the filling equipment is functioning properly, what is the probability a random sample of 10 cars will have a mean ore eight of 70.7 tons or more? Show your work.
    d) Based on your answer in part (c), if a random sample of 10 cars had a mean ore weight of 70.7 tons, would you suspect that the loading mechanism was overfilling the cars? Justify your answer.

15. The new downtown Hilton has documented that the average amount of time for room-service delivery is 24.2 minutes with a standard deviation of 8.7 minutes. For quality control, 30 random deliveries were monitored and their room-service delivery times were recorded. What is the probability that the mean delivery time for a sample of 30 is below 21 minutes? If this were to occur, should the manager be impressed?

16. A manufacturer of computer printers purchases plastic ink cartridges from a vendor. When a large shipment is received, a random sample of 200 cartridges is selected, and each is inspected. If the sample proportion of defectives is more than 0.02, the entire shipment will be returned to the vendor. What is the approximate probability that the shipment will be returned if the true proportion of defectives in the shipment is 0.05?

17. The Joint Center for Political and Economic Studies conducted a random national opinion poll in 1999 and posed the following question:

    "The U.S. Bureau of the Census and the Clinton Administration has proposed using statistical sampling to correct for an expected undercount of minorities and the poor in the 2000 Census. Republicans in the U.S. House of Representatives strongly oppose such an effort. How do you feel about census sampling—is it a good idea, is it a bad idea, or are you uncertain about its merits?"

    a) Based on the results of this poll, Senator Veri Kluless is interested in estimating the population proportion for people who feel that using census sampling is a good idea by using a 90% confidence interval. Interpret the 90% confidence **level** in this context.

    850 adults are randomly selected to participate in the poll, and the most common response was that the respondent was uncertain about the issue (42%). Only 40% responded that it was a good idea.

    b) Using the information from the poll, **construct a 90% confidence interval** for the true proportion of U.S. adults who feel that census sampling is a good idea. **Be sure to check the necessary conditions!**
    c) An independent news organization conducts their own poll in the state of Oklahoma, and claims that 48% of Oklahoma adults feel that census sampling is a good idea. Does your confidence interval from part (b) provide evidence that the proportion of adults that agree with census sampling in the state of Oklahoma is different from the proportion in the rest of the nation? Explain.

18. In January 2002, two students made worldwide headlines by spinning a Belgian euro 250 times and getting 140 heads – that's 56%. That makes the 90% confidence interval (51%, 61%). What does this mean? Are these conclusions correct? Explain.

    a) Between 51 % and 61% of all euros are unfair.
    b) We are 90% sure that in this experiment this euro landed heads on between 51 % and 61% of the spins.
    c) We are 90% sure that spun euros will land heads between 51% and 61 % of the time.
    d) If you spin a euro many times, you can be 90% sure of getting between 51% and 61 % heads.
    e) 90% of all spun euros will land heads between 51% and 61% of the time.