AP Statistics Chapter 9 Review

Multiple Choice Questions 1-14

1. Suppose you roll a die 10 times and record the proportion of sixes. Suppose you then conduct a simulation of this experiment, first 100 times, then 1000 times.
Which of the following is true regarding the mean of the proportions of sixes from each simulation?
(A) Which of the proportions of sixes for the 100 simulations will equal the mean of the proportion of sixes for the 1,000 simulations.
(B) The mean of the proportion of sixes for the 1,000 simulations will be a better estimator of the theoretical probability of rolling a six than the mean of the proportion of sixes for the 100 simulations.
(C) The mean of the proportion of sixes for the 100 simulations will be less than the mean of the proportion of sixes for the 1,000 simulations.
(D) The mean of the proportions of sixes for both simulations will not estimate the theoretical probability of rolling six since they are finite samples from a infinite population.
(E) None of these is true.

2. Two simple random samples of 50 undergraduates each from two universities are taken to determine the proportion of students who approve of the food service at their respective schools. The first university has an enrollment of 5,000 undergraduates while the second university has an enrollment of 35,000 undergraduates. Which of the following is the most accurate statement regarding these samples?
(A) The variability of the sample from the larger university will be greater than the variability of the sample from the smaller university.
(B) The proportion of students who approve of the foodservice will be the same since the sample size are the same.
(C) The enrollment figures from the two universities are not relevant to whether the sample statistics obtained are unbiased estimates of the parameters of the two populations.
(D) If a university with 100,000 undergraduates conducted a simple random sample of 50 of its students, the results would be less accurate than either sample referenced above.
(E) None of these is an accurate statement.

3. Which of the following is true regarding the variation of a sampling distribution of a sample proportion?
(A) Variation depends on population size as well as sample size.
(B) The variance of a sampling distribution of a sample proportion for all sample size is 1 is 0.
(C) As the size of the sample increases, the variation of the sampling distribution approaches the variation of the population.
(D) For a given sample size, the maximum variation in the sampling distribution of a sample proportion occurs when the sample proportions is .5.
(E) None of these is true.

4. Records at a large university indicated that 20% of all freshmen are place on academic probation at the end of their first semester. A random sample of 100 of this year's freshmen indicated that 25% of them were placed on academic probation at the end of the first semester. The results of this sample:
(A) Are surprising since it indicates that 5% more of these freshmen were place on academic probation that was expected.
(B) Are surprising since SAT scores have been increasing over the past few years.
(C) Are not surprising since the standard deviation of the sampling distribution is 4%.
(D) Are surprising since the standard deviation of the sampling distribution is .4%
(E) Are biased since the increase of 5% could not happen without injecting bias into the sample.

5. 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 distribution of sample means?
(A) $\mu = 9, \sigma = 2$ (B) $\mu = 63, \sigma = .286$ (C) $\mu = 63, \sigma = 2$ (D) $\mu = 1.286, \sigma = 3.5$ (E) $\mu = 9, \sigma = 14$

6. The Central Limit theorem for a sample mean is a critical result because
(A) it states that for large sample sizes, the population distribution is approximately normal.
(B) it states that for large sample sizes, the sample is approximately normal.
(C) it states that for any population, the sampling distribution is normal regardless of sample size.
(D) it states that for large sample sizes, the sampling distribution is approximately normal regardless of the population distribution.
(E) it states that for any sample size, the sampling distribution is normal.

7. Following a dramatic drop of 500 points in the Dow Jones Industrial Average in September 1998, a poll conducted for the Associated Press found that 92% of those polled said that a year from now their family financial situation will be as good as it is today or better. The number 92% is a
(a) Statistic (b) Sample (c) Parameter (d) Population (e) None of the above.

8. In a large population, 46% of the households own VCR's. A simple random sample of 100 households is to be contacted and the sample proportion computed. The mean of the sampling distribution of the sample proportion is
(a) 46 (b) 0.46 (c) About 0.46, but not exactly 0.46 (d) 0.00248
(e) The answer cannot be computed from the information given

9. If a population has a standard deviation σ, then the standard deviation of the mean of 100 randomly selected items from this population is
(a) σ (b) 100 σ (c) $\sigma/10$ (d) $\sigma/100$ (e) 0.1

10. The distribution of values taken by a statistic in all possible samples of the same size from the same population is
(a) The probability that the statistic is obtained (b) The population parameter (c) The variance of the values
(d) The sampling distribution of the statistic (e) None of the above. The answer is _____.

11. If a statistic used to estimate a parameter is such that the mean of its sampling distribution is equal to the true value of the parameter being estimated, the statistic is said to be
(a) Random (b) Biased (c) A proportion (d) Unbiased (e) None of the above. The answer is

12. A simple random sample of 1000 Americans found that 61% were satisfied with the service provided by the dealer from which they bought their car. A simple random sample of 1000 Canadians found that 58% were satisfied with the service provided by the dealer from which they bought their car. The sampling variability associated with these statistics is
a) Exactly the same.
b) Smaller for the sample of Canadians because the population of Canada is smaller than that of the United States, hence the sample is a larger proportion of the population.
c) Smaller for the sample of Canadians because the percentage satisfied was smaller than that for the Americans.
d) Larger for the Canadians because Canadian citizens are more widely dispersed throughout the country than in the United States, hence they have more variable views.
e) About the same.

13. Statistics from Cornell's Northeast Regional Climate Center indicate that Ithaca, NY gets an average of 35.4" of rain each year, with a standard deviation of 4.2". Assume that a normal model applies.
a) During what percentage of years does Ithaca get more than 40" of rain?
b) Less than how much rain falls in the driest 20% of all years?
c) A Cornell University student is in Ithaca for 4 years. Let $\bar{x}$ represent the mean amount of rain for those 4 years. Describe the sampling distribution model of this sample mean, $\bar{x}$.
d) What is the probability that those 4 years average less than 30" of rain?

14. The distribution of the population of the millions of household incomes in California is skewed to the right. Which of the following best describes what happens to the sampling distribution of the sample mean when the size of a random sample increases from 10 to 100?
a) Its mean gets closer to the population mean, its standard deviation gets closer to the population standard deviation, and its shape gets closer to the population's shape.
b) Its mean gets closer to the population mean, its standard deviation gets smaller, and its shape gets closer to normal.
c) Its mean stays constant, its standard deviation gets closer to the population standard deviation, and its shape gets closer to the population's shape.
d) Its mean stays constant, its standard deviation gets smaller, and its shape gets closer to normal.
e) None of the above.

Free Response Questions 15-21

15. Best known for its testing program, ACT, Inc., also compiles data on a variety of issues in education. In 2004 the company reported that the national college freshmen-to-sophomore retention rate held steady at 74% over the previous four years. Does a college where 522 of their 603 freshmen returned the next year as sophomores have a right to brag that it has an unusually high retention rate? Justify your answer.

16. The Gallup poll asked a probability sample of 1785 adults whether they attended church or synagogue during the past week. Suppose that 40% of the adult population did attend. We would like to know the probability that an SRS of size 1785 would come within plus or minus 3 percentage points of this true value.
a) If p is the proportion of the sample who did attend church or synagogue, what is the mean of p?
b) What is the standard deviation of p? Explain. c) Is the distribution of p approximately normal?
d) Find the probability that p takes a value between 0.37 and 0.43.
e) Will an SRS of size 1785 usually give a result p within plus or minus 3 percentage points of the true proportion? Explain.

17. Using a computer to play 89 simulated games of Scrabble, researcher Charles Robinove found that the letter "A" occurred in 54% of the hands. This study had a margin of error of $\pm$10%.
a) Explain what the margin of error means in this context. b) Why might the margin of error be so large?
c) Probability theory predicts that the letter "A" should appear in 63% of the hands. Does this make you concerned that the simulation might be faulty? Justify your answer.

18. While he was a prisoner of the Germans during World War II, the British mathematician John Kerrich tossed a coin 10,000 times. He got 5067 heads. Take Kerrich's tosses to be an SRS from the population of all possible tosses of his coin. If the coin is perfectly balanced, p = .5. is there reason to think that Kerrich's coin gave too many heads to be balanced? To answer this question, find the probability that a balanced coin would give 5067 or more heads in 10,000 tosses. What do you conclude?

19. A manufacturer of cold medicine claims that 60% of all adults suffer at least one cold during every winter. What is the probability that a simple random sample of 200 adults will report that 65% of more of the subjects had at least one cold last winter? Would you be surprised to find such a sample result? Explain your answer.

20. About 68% of the people in China live in rural areas. Suppose a random sample of 200 Chinese people is taken.
a) Describe the shape, center, and standard error of the sampling distribution of $\hat{p}$, the proportion of people in the sample who live in rural areas.
b) What is the probability that 75% or more in the sample live in rural areas?
c) What values of $\hat{p}$ would be rare events?
d) What is the probability that 130 or more in the sample live in rural areas?

21. You estimate that the people using an elevator in an office building have an average weight of roughly 150 lb with a standard deviation of approximately 20 lb. The elevator is designed for a 2000-lb weight maximum. This maximum can be exceeded on occasion but should not be exceeded on a regular basis. Your job is to post a sign in the elevator stating the maximum number of people to ensure safe use. Keep in mind that it is inefficient to make this number too small but dangerous to make it too large.
a) What number would you use for maximum occupancy? Explain your reasoning and assumptions.
b) Otis Elevator Company sells the Holed Hydraulic Elevator, which lists a capacity of 2000lb, or 14 people in the United States and 12 people in Canada. Are these numbers close to the number you decided on in part (a)? Explain why you would or would not expect that to be the case.