MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine whether the Normal model may be used to describe the distribution of the sample proportions. If the Normal model may be used, list the conditions and explain why each is satisfied. If Normal model may not be used, explain which condition is not satisfied.

1. In a large statistics class, the professor has each student toss a coin 12 times and calculate the proportion of tosses that come up tails. The students then report their results, and the professor plots a histogram of these several proportions. May a Normal model be used here?
   A. A Normal model should not be used because the 10% condition is not satisfied: the sample size, 12, is larger than 10% of the population of all coins flips.
   B. A Normal model should not be used because the sample size is not large enough to satisfy the success/failure condition. For this sample size, \( np = 6 = nq = 6 \) which are both less than 10.
   C. A Normal model may be used:
      Coin flips are independent of each other – no need to check the 10% condition
      Success/Failure condition is satisfied: \( np = nq = 12 \) which are both greater than 10
   D. A Normal model may not be used because the population distribution is not Normal.
   E. A Normal model may be used:
      Coin flips are independent of each other – no need to check the 10% condition
      Success/Failure condition is satisfied: \( np = nq = 6 \) which are both less than 10

2. A candy company claims that 25% of the jelly beans in its spring mix are pink. Suppose that the candies are packaged at random in small bags containing about 300 jelly beans. A class of students opens several bags, counts the various colors of jelly beans, and calculates the proportion that are pink in each bag. Is it appropriate to use a Normal model to describe the distribution of the proportion of pink jelly beans?
   A. A Normal model is not appropriate because the success/failure condition is not satisfied: \( np = 75 \) and \( nq = 225 \) neither of which is less than 10
   B. A Normal model is not appropriate because the randomization condition is not satisfied: the 300 jelly beans in the bag are not a simple random sample and cannot be considered representative of all jelly beans.
   C. A Normal model is not appropriate because the population distribution is not Normal.
   D. A Normal model is not appropriate because the 10% condition is not satisfied: the sample size, 300, is larger than 10% of the population of all jelly beans.
   E. A Normal model is appropriate:
      Randomization condition is satisfied: the 300 jelly beans in the bag are selected at random and can be considered representative of all jelly beans
      10% condition is satisfied: the sample size, 300, is less than 10% of the population of all jelly beans.
      success/failure condition is satisfied: \( np = 75 \) and \( nq = 225 \) are both greater than 10

1.

2.
3. A health worker believes that 10% of students at a certain college suffer from depression. She sets up a booth outside the student union building and selects 100 students at random from those leaving the building. She asks the selected students to complete a questionnaire. May the Normal model be used to describe the distribution of the proportion of students in the sample who suffer from depression? The college has roughly 7000 students.

A. Normal model may not be used to describe distribution of sample proportions.
   Distribution of population is not normal

B. Normal model may not be used to describe distribution of sample proportions.
   Randomization condition is not satisfied: the students were selected at random but only from those students leaving the student union building, not from the whole student body. Those leaving the student union building may not be representative of all students at the college—those suffering from depression are more likely to stay in their rooms and may not be out as much, participating in activities at the student union building.

C. Normal model may not be used to describe distribution of sample proportions.
   Success/failure condition is not satisfied: \( np = 10 \) and \( nq = 90 \) are both greater than 10.

D. Normal model may be used to describe distribution of sample proportions.
   Randomization condition is satisfied: the students were selected at random and are therefore representative of all students at the college
   10% condition is satisfied: the 100 students are less than 10% of all students at the college
   Success/failure condition is satisfied: \( np = 10 \) and \( nq = 90 \) are both greater than 10.

E. Normal model may not be used to describe distribution of sample proportions.
   10% condition is not satisfied: the 100 students are less than 10% of all students at the college

Find the mean of the sample proportion.

4. Assume that 25% of students at a university wear contact lenses. We randomly pick 200 students. What is the mean of the proportion of students in this group who may wear contact lenses?
   A. \( \mu = 12.5\% \)  
   B. \( \mu = 3.06\% \)  
   C. \( \mu = 50\% \)  
   D. \( \mu = 25\% \)  
   E. \( \mu = 7.07\% \)

Find the standard deviation of the sample proportion.

5. Based on past experience, a bank believes that 5% of the people who receive loans will not make payments on time. The bank has recently approved 300 loans. What is the standard deviation of the proportion of clients in this group who may not make timely payments?
   A. \( \sigma = 3.77\% \)  
   B. \( \sigma = 1.29\% \)  
   C. \( \sigma = 3.87\% \)  
   D. \( \sigma = 1.26\% \)  
   E. \( \sigma = 1.58\% \)

In a large class, the professor has each person toss a coin several times and calculate the proportion of his or her tosses that come up heads. The students then report their results, and the professor plots a histogram of these proportions. Use the 68–95–99.7 Rule to provide the appropriate response.

6. If each student tosses the coin 200 times, about 95% of the sample proportions should be between what two numbers?
   A. 0.495 and 0.505  
   B. 0.429 and 0.571  
   C. 0.2375 and 0.7375  
   D. 0.071 and 0.106  
   E. 0.025 and 0.975
Find the specified probability, from a table of Normal probabilities. Assume that the necessary conditions and assumptions are met.

7. A candy company claims that its jelly bean mix contains 15% blue jelly beans. Suppose that the candies are packaged at random in small bags containing about 200 jelly beans. What is the probability that a bag will contain more than 10% blue jelly beans?

A. 0.9227  
B. 0.0239  
C. 0.9544  
D. 0.9761  
E. 0.0478

8. Researchers believe that 7% of children have a gene that may be linked to a certain childhood disease. In an effort to track 50 of these children, researchers test 950 newborns for the presence of this gene. What is the probability that they find enough subjects for their study?

A. 0.0179  
B. 0.9216  
C. 0.0358  
D. 0.9581  
E. 0.9821

Answer the question.

9. A national study reported that 74% of high school graduates pursue a college education immediately after graduation. A private high school advertises that 155 of their 196 graduates last year went on to college. Does this school have an unusually high proportion of students going to college?

A. This school cannot boast an unusually high proportion of students going to college. Their proportion is only 0.97 standard deviations above the mean.
B. This school cannot boast an unusually high proportion of students going to college. Their proportion is only 1.62 standard deviations above the mean.
C. This school can boast an unusually high proportion of students going to college. Their proportion is 2.61 standard deviations above the mean.
D. This school cannot boast an unusually high proportion of students going to college. Their proportion is only 1.30 standard deviations above the mean.
E. This school can boast an unusually high proportion of students going to college. Their proportion is 1.30 standard deviations above the mean.

Determine whether the Normal model may be used to describe the distribution of the sample means. If the Normal model may be used, list the conditions and explain why each is satisfied. If Normal model may not be used, explain which condition is not satisfied.

10. The weights of men in a certain city are normally distributed with a mean of 153 lb and a standard deviation of 22 lb. Suppose a sample of 3 men is selected at random from the city and the mean weight, \( \bar{x} \) is determined for the men in the sample. May the Normal model be used to describe the sampling distribution of the mean, \( \bar{x} \)?

A. No, Normal model may not be used:
   
   Large enough sample condition is not satisfied: since the sample size is only 3
B. Randomization condition is not satisfied: The men in the sample do not represent a simple random sample and may not be representative of all men in the city
C. Independence assumption is not satisfied: Since the men may be related, the chance of selecting a heavy man depends on who has already been selected.
D. No, Normal model may not be used:
   10% condition: is not satisfied since the 3 men in the sample represent less than 10% of men in the city.
E. Yes, Normal model may be used.
   
   Randomization condition: The men were selected at random
   Independence assumption: It is reasonable to think that weights of randomly selected men are mutually independent.
   Large enough sample condition: Since the original population is normally distributed, a sample of 3 is large enough, in fact any sample would be large enough.
   10% condition: the 3 men in the sample certainly represent less than 10% of men in the city.
11. The mean annual income for women in one city is $28,520 and the standard deviation of the incomes is $5600. The distribution of incomes is skewed to the right. Suppose a sample of 12 women is selected at random from the city and the mean income, $x$, is determined for the women in the sample. May the Normal model be used to describe the sampling distribution of the mean, $\bar{x}$?

A. No, Normal model may not be used since incomes of women in the city are not normally distributed but are skewed to the right
B. No, Normal model may not be used: Independence assumption is not satisfied; since the women in the sample may live in the same neighborhood, the chance of picking a woman with a high income depends on who has already been selected.
C. Yes, Normal model may be used.
   Randomization condition: The women were selected at random
   Independence assumption: It is reasonable to think that incomes of randomly selected women are mutually independent.
   Large enough sample condition: a sample of 12 is large enough for the Central Limit Theorem to apply
   10% condition is satisfied since the 12 women in the sample certainly represent less than 10% of women in the city
D. No, Normal model may not be used:
   10% condition is not satisfied since the 12 women in the sample represent less than 10% of women in the city
E. No, Normal model may not be used:
   Large enough sample condition is not satisfied: since the distribution of incomes in the original population is skewed, a sample of 12 is not large enough

Describe the indicated sampling distribution.

12. The heights of people in a certain population are normally distributed with a mean of 67 inches and a standard deviation of 3.9 inches. Describe the sampling distribution of the mean for samples of size 41. In particular, state whether the distribution of the sample mean is normal or approximately normal and give its mean and standard deviation.
   A. Normal, mean = 67 inches, standard deviation = 0.1 inches
   B. Approximately normal, mean = 67 inches, standard deviation = 0.61 inches
   C. Normal, mean = 67 inches, standard deviation = 0.61 inches
   D. Normal, mean = 67 inches, standard deviation = 3.9 inches
   E. Approximately normal, mean = 67 inches, standard deviation = 0.1 inches

13. For the population of one town, the distribution of the number of siblings, $x$, is skewed to the right. The mean number of siblings is 1.1 and the standard deviation is 1.5. Let $\bar{x}$ denote the mean number of siblings for a random sample of size 38. Determine the sampling distribution of the mean, $\bar{x}$. In particular, state whether the distribution of the sample mean is normal or approximately normal and give its mean and standard deviation.
   A. Approximately normal, mean = 1.1, standard deviation = 0.24
   B. Approximately normal, mean = 35.2, standard deviation = 1.5
   C. Normal, mean = 1.1, standard deviation = 1.5
   D. Approximately normal, mean = 1.1, standard deviation = 1.5
   E. Normal, mean = 1.1, standard deviation = 0.24
At a large university, students have an average credit card debt of $2500, with a standard deviation of $1200. A random sample of students is selected and interviewed about their credit card debt. Use the 68–95–99.7 Rule to answer the question about the mean credit card debt for the students in this sample.

14. If we imagine all the possible random samples of 250 students at this university, 68% of the samples should have means between what two numbers?
   A. $2272.33 and $2727.67  
   B. $1300 and $3700  
   C. $2348.22 and $2651.78  
   D. $2424.11 and $2651.78  
   E. $2424.11 and $2575.89

Find the specified probability, from a table of Normal probabilities. Assume that the necessary conditions and assumptions are met.

15. The weight of crackers in a box is stated to be 16 ounces. The amount that the packaging machine puts in the boxes is believed to have a Normal model with mean 16.15 ounces and standard deviation 0.3 ounces. What is the probability that the mean weight of a 10-box case of crackers is below 16 ounces?
   A. 0.8858  
   B. 0.1142  
   C. 0.0571  
   D. 0.9429  
   E. 0.2273

16. A restaurant's receipts show that the cost of customers' dinners has a skewed distribution with a mean of $54 and a standard deviation of $18. What is the probability that the next 100 customers will spend a total of at least $5800 on dinner?
   A. 0.5879  
   B. 0.4121  
   C. 0.0562  
   D. 0.0132  
   E. 0.9868

Find the margin of error for the given confidence interval.

17. In a survey of 280 adults over 50, 80% said they were taking vitamin supplements. Find the margin of error for this survey if we want a 99% confidence in our estimate of the percent of adults over 50 who take vitamin supplements.
   A. 13.8%  
   B. 10.5%  
   C. 17.2%  
   D. 6.16%  
   E. 4.69%

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion.

18. A survey of 865 voters in one state reveals that 408 favor approval of an issue before the legislature. Construct a 95% confidence interval for the percentage of all voters in the state who favor approval.
   A. (42.3%, 52.0%)  
   B. (44.4%, 50.0%)  
   C. (43.1%, 51.2%)  
   D. (46.9%, 47.5%)  
   E. (43.8%, 50.5%)

19. A survey of 300 union members in New York State reveals that 112 favor the Republican candidate for governor. Construct a 98% confidence interval for the percentage of all New York State union members who favor the Republican candidate.
   A. (30.1%, 44.5%)  
   B. (30.8%, 43.8%)  
   C. (31.9%, 42.8%)  
   D. (26.7%, 47.9%)  
   E. (17.8%, 56.8%)
20. Of 92 adults selected randomly from one town, 60 have health insurance. Construct a 90% confidence interval for the percentage of all adults in the town who have health insurance.

A. (57.7%, 72.7%)
B. (57.0%, 73.4%)
C. (55.5%, 74.9%)
D. (53.6%, 76.8%)
E. (52.4%, 78.0%)

21. A study involves 638 randomly selected deaths, with 27 of them caused by accidents. Construct a 98% confidence interval for the percentage of all deaths that are caused by accidents.

A. (2.18%, 6.29%)
B. (2.67%, 5.79%)
C. (2.92%, 5.55%)
D. (2.37%, 6.09%)
E. (3.0%, 5.4%)

Solve the problem.

22. A researcher wishes to estimate the proportion of fish in a certain lake that is inedible due to pollution of the lake. How large a sample should be tested in order to be 99% confident that the true proportion of inedible fish is estimated to within 7%?

A. 339
B. 139
C. 196
D. 277
E. Not enough information is given.

23. A political action committee is interested in finding out what kind of popular support they might expect on an environmental initiative. Similar issues have gotten 94% support. The committee will set up a polling program to assure 95% confidence that the margin of error is less than 4%. What sample size will suffice?

A. 408
B. 95.7
C. 5
D. 121
E. 136

What confidence level did the pollsters use?

24. A poll of 2017 likely voters indicated that 70% would vote in favor of a proposed constitutional amendment. The margin of error for this poll was 2%.

A. 90%
B. 98%
C. 95%
D. 99%
E. Not enough information is given.

Provide an appropriate response.

25. In a survey of 1,000 television viewers, 40% said they watch network news programs. For a 99% confidence level, the margin of error for this estimate is 3.99%. If we only want to be 95% confident, how will the margin of error change?

A. Since less confidence allows a narrower interval, the margin of error will be smaller.
B. Since less confidence allows a wider interval, the margin of error will be smaller.
C. Since less confidence allows a wider interval, the margin of error will be larger.
D. Since less confidence allows a narrower interval, the margin of error will be larger.
E. There is not enough information to determine the effect on the margin of error.
Answer Key
Testname: CHAPTER 18 AND 19 MULTIPLE-CHOICE QUESTIONS

1. B
2. E
3. B
4. D
5. D
6. B
7. D
8. E
9. B
10. E
11. E
12. C
13. A
14. E
15. C
16. D
17. D
18. E
19. B
20. B
21. D
22. A
23. E
24. C
25. A