Chapter 6: The Normal Distribution

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

1) In its standardized form, the normal distribution   1) _____
    A) has an area equal to 0.5.
     B) has a mean of 0 and a standard deviation of 1.
    C) has a mean of 1 and a variance of 0.
    D) cannot be used to approximate discrete probability distributions.

2) If a particular set of data is approximately normally distributed, we would   2) _____
    find that approximately
    A) 4 of every 5 observations would fall between ± 1.28 standard deviations
       around the mean.
     B) 19 of every 20 observations would fall between ± 2 standard deviations
       around the mean.
    C) 2 of every 3 observations would fall between ± 1 standard deviation
       around the mean.
    D) All the above.

3) For some value of Z, the value of the cumulative standardized normal   3) _____
    distribution is 0.2090. The value of Z is
    A) -0.31   B) 1.96   C) -0.81   D) 0.31

4) The value of the cumulative standardized normal distribution at Z is 0.6255.   4) _____
    The value of Z is
    A) 0.40   B) 0.99   C) 0.16   D) 0.32

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

5) Given that X is a normally distributed variable with a mean of 50 and   5) _____
    a standard deviation of 2, find the probability that X is between 47
    and 54.

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

6) True or False: The probability that a standard normal variable, Z, is between 1.50 and 2.10 is the same as the probability Z is between -2.10 and -1.50. 6) _____
   A) True   B) False

7) True or False: The probability that a standard normal variable, Z, is between 1.00 and 3.00 is 0.1574. 7) _____
   A) True   B) False

8) True or False: The probability that a standard normal variable, Z, is less than 5.0 is approximately 0. 8) _____
   A) True   B) False

9) True or False: Any set of normally distributed data can be transformed to its standardized form. 9) _____
   A) True   B) False

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

10) The probability that a standard normal variable Z is positive is _____. 10) _____

11) Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. The probability that Z is more than 0.77 is _____. 11) _____

12) Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. The probability that Z is more than -0.98 is _____. 12) _____

13) Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. The probability that Z is between -2.89 and -1.03 is _____. 13) _____

14) Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. The probability that Z values are larger than _____ is 0.3483.

14) _____

15) Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. So 27% of the possible Z values are smaller than _____.

15) _____

16) Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. So 96% of the possible Z values are between _____ and _____ (symmetrically distributed about the mean).

16) _____

17) The owner of a fish market determined that the mean weight for a catfish is 3.2 pounds. He also knew that the probability of a randomly selected catfish that would weigh more than 3.8 pounds is 20% and the probability that a randomly selected catfish that would weigh less than 2.8 pounds is 30%. The probability that a randomly selected catfish will weigh between 2.6 and 3.6 pounds is _____.

17) _____

18) A company that sells annuities must base the annual payout on the probability distribution of the length of life of the participants in the plan. Suppose the probability distribution of the lifetimes of the participants is approximately a normal distribution with a mean of 68 years and a standard deviation of 3.5 years. What proportion of the plan recipients would receive payments beyond age 75?

18) _____

19) A company that sells annuities must base the annual payout on the probability distribution of the length of life of the participants in the plan. Suppose the probability distribution of the lifetimes of the participants is approximately a normal distribution with a mean of 68 years and a standard deviation of 3.5 years. Find the age at which payments have ceased for approximately 86% of the plan participants.

19) _____

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

20) If we know that the length of time it takes a college student to find a parking   20) _____
   spot in the library parking lot follows a normal distribution with a mean of
   3.5 minutes and a standard deviation of 1 minute, find the probability that a
   randomly selected college student will take between 2 and 4.5 minutes to
   find a parking spot in the library parking lot.
   A) 0.0919   B) 0.7745   C) 0.4938   D) 0.2255

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

21) The owner of a fish market determined that the average weight for a   21) _____
   catfish is 3.2 pounds with a standard deviation of 0.8 pound.
   Assuming the weights of catfish are normally distributed, the
   probability that a randomly selected catfish will weigh more than 4.4
   pounds is _____.

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

22) The owner of a fish market determined that the average weight for a catfish   22) _____
   is 3.2 pounds with a standard deviation of 0.8 pound. A citation catfish
   should be one of the top 2% in weight. Assuming the weights of catfish are
   normally distributed, at what weight (in pounds) should the citation
   designation be established?
   A) 1.56 pounds   B) 5.20 pounds
   C) 7.36 pounds   D) 4.84 pounds

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

23) The owner of a fish market determined that the average weight for a   23) _____
   catfish is 3.2 pounds with a standard deviation of 0.8 pound.
   Assuming the weights of catfish are normally distributed, the
   probability that a randomly selected catfish will weigh less than 2.2
   pounds is _____.

24) A food processor packages orange juice in small jars. The weights of the filled jars are approximately normally distributed with a mean of 10.5 ounces and a standard deviation of 0.3 ounce. Find the proportion of all jars packaged by this process that have weights that fall above 10.95 ounces.

24) _____

25) The amount of tea leaves in a can from a particular production line is normally distributed with μ = 110 grams and σ = 25 grams. What is the probability that a randomly selected can will contain between 100 and 110 grams of tea leaves?

25) _____

26) The amount of tea leaves in a can from a particular production line is normally distributed with μ = 110 grams and σ = 25 grams. What is the probability that a randomly selected can will contain at least 100 grams of tea leaves?

26) _____

27) The amount of tea leaves in a can from a particular production line is normally distributed with μ = 110 grams and σ = 25 grams. What is the probability that a randomly selected can will contain less than 100 grams of tea leaves?

27) _____

28) The amount of tea leaves in a can from a particular production line is normally distributed with μ = 110 grams and σ = 25 grams. Approximately 83% of the can will have at least how many grams of tea leaves?

28) _____

29) The true length of boards cut at a mill with a listed length of 10 feet is normally distributed with a mean of 123 inches and a standard deviation of 1 inch. What proportion of the boards will be over 125 inches in length?

29) _____

30) You were told that the amount of time lapsed between consecutive trades on a foreign stock exchange market followed a normal distribution with a mean of 15 seconds. You were also told that the probability that the time lapsed between two consecutive trades to fall between 16 to 17 seconds was 13%. The probability that the time lapsed between two consecutive trades would fall below 13 seconds was 7%. What is the probability that the time lapsed between two consecutive trades will be longer than 17 seconds?

30) _____

31) You were told that the amount of time lapsed between consecutive trades on a foreign stock exchange market followed a normal distribution with a mean of 15 seconds. You were also told that the probability that the time lapsed between two consecutive trades to fall between 16 to 17 seconds was 13%. The probability that the time lapsed between two consecutive trades would fall below 13 seconds was 7%. What is the probability that the time lapsed between two consecutive trades will be between 15 and 16 seconds?

31) _____

32) You were told that the amount of time lapsed between consecutive trades on a foreign stock exchange market followed a normal distribution with a mean of 15 seconds. You were also told that the probability that the time lapsed between two consecutive trades to fall between 16 to 17 seconds was 13%. The probability that the time lapsed between two consecutive trades would fall below 13 seconds was 7%. What is the probability that the time lapsed between two consecutive trades will be between 13 and 16 seconds?

32) _____

33) You were told that the amount of time lapsed between consecutive trades on a foreign stock exchange market followed a normal distribution with a mean of 15 seconds. You were also told that the probability that the time lapsed between two consecutive trades to fall between 16 to 17 seconds was 13%. The probability that the time lapsed between two consecutive trades would fall below 13 seconds was 7%. The probability is 20% that the time lapsed will be shorter how many seconds?

33) _____

34) You were told that the amount of time lapsed between consecutive trades on a foreign stock exchange market followed a normal distribution with a mean of 15 seconds. You were also told that the probability that the time lapsed between two consecutive trades to fall between 16 to 17 seconds was 13%. The probability that the time lapsed between two consecutive trades would fall below 13 seconds was 7%. The middle 60% of the time lapsed will fall between which two numbers?

34) _____

35) You were told that the mean score on a statistics exam is 75 with the scores normally distributed. In addition, you know the probability of a score between 55 and 60 is 4.41% and that the probability of a score greater than 90 is 6.68%. What is the probability of a score between 90 and 95?

35) _____

36) You were told that the mean score on a statistics exam is 75 with the scores normally distributed. In addition, you know the probability of a score between 55 and 60 is 4.41% and that the probability of a score greater than 90 is 6.68%. What is the probability of a score lower than 55?

36) _____

37) You were told that the mean score on a statistics exam is 75 with the scores normally distributed. In addition, you know the probability of a score between 55 and 60 is 4.41% and that the probability of a score greater than 90 is 6.68%. What is the probability of a score between 60 and 75?

37) _____

38) You were told that the mean score on a statistics exam is 75 with the scores normally distributed. In addition, you know the probability of a score between 55 and 60 is 4.41% and that the probability of a score greater than 90 is 6.68%. What is the probability of a score between 55 and 90?

38) _____

39) You were told that the mean score on a statistics exam is 75 with the scores normally distributed. In addition, you know the probability of a score between 55 and 60 is 4.41% and that the probability of a score greater than 90 is 6.68%. The middle 86.64% of the students will score between which two scores?

39) _____

40) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. The probability is _____ that a product is assembled in less than 12 minutes.

40) _____

41) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. The probability is _____ that a product is assembled in between 10 and 12 minutes.

41) _____

42) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. The probability is _____ that a product is assembled in between 16 and 21 minutes.

42) _____

43) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. The probability is _____ that a product is assembled in more than 19 minutes.

43) _____

44) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. So, 15% of the products require more than _____ minutes for assembly.

44) _____

45) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. So, 60% of the products would be assembled within _____ and _____ minutes (symmetrically distributed about the mean).

45) _____

46) The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. So, 70% of the products would be assembled within _____ minutes.

46) _____

SCENARIO 6-1

The number of column inches of classified advertisements appearing on Mondays in a certain daily newspaper is normally distributed with population mean of 320 and population standard deviation of 20 inches.

47) Referring to Scenario 6-1, for a randomly chosen Monday, what is the probability there will be less than 340 column inches of classified advertisement?

47) _____

48) Referring to Scenario 6-1, for a randomly chosen Monday, what is the probability there will be between 280 and 360 column inches of classified advertisement?

48) _____

49) Referring to Scenario 6-1, for a randomly chosen Monday the probability is 0.1 that there will be less than how many column inches of classified advertisements?

49) _____

8

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

50) Referring to Scenario 6-1, a single Monday is chosen at random. State in which of the following ranges the number of column inches of classified advertisement is most likely to be

   A) 320 - 340.   B) 300 - 320.   C) 330 - 350.   D) 310 - 330.

50) _____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

SCENARIO 6-5

A company producing orange juice buys all its oranges from a large orange orchard. The amount of juice that can be squeezed from each of these oranges is approximately normally distributed with a mean of 4.7 ounces and some unknown standard deviation. The company's production manager knows that the probability is 30.85% that a randomly selected orange will contain less than 4.5 ounces of juice. Also the probability is 10.56% that a randomly selected orange will contain more than 5.2 ounces of juice. Answer the following questions without the help of a calculator, statistical software or statistical table.

51) Referring to Scenario 6-5, what is the probability that a randomly selected orange will contain between 4.5 and 5.2 ounces of juices?

51) _____

52) Referring to Scenario 6-5, what is the probability that a randomly selected orange will contain between 4.2 and 4.9 ounces of juices?

52) _____

53) Referring to Scenario 6-5, what is the probability that a randomly selected orange will contain at least 4.9 ounces of juices?

53) _____

54) Referring to Scenario 6-5, what is the probability that a randomly selected orange will contain no more than 4.9 ounces of juices?

54) _____

55) Referring to Scenario 6-5, what is the probability that a randomly selected orange will contain no more than 4.2 ounces of juices?

55) _____

56) Referring to Scenario 6-5, what is the probability that a randomly selected orange will contain more than 4.2 ounces of juices?

56) _____

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

57) True or False: A normal probability plot may be used to assess the assumption of normality for a particular set of data.

    A) True   B) False

57) _____

58) True or False: If a data set is approximately normally distributed, its normal probability plot would be S-shaped.

    A) True   B) False

58) _____

1) B
2) D
3) C
4) D
5) 0.9104
6) A
7) A
8) B
9) A
10) 0.50
11) 0.2206
12) 0.8365
13) 0.1496
14) 0.39
15) -0.61
16) -2.05 and 2.05 or -2.06 and 2.06
17) 50% or 0.5
18) 0.0228
19) 71.78 years old
20) B
21) 0.0668
22) D
23) 0.1056
24) 0.0668
25) 0.1554
26) 0.6554
27) 0.3446
28) 86.15 using Excel or 86.25 using Table E.2
29) 0.0228
30) 7% or 0.07
31) 30% or 0.30
32) 73% or 0.73
33) 14 seconds
34) 14 seconds and 16 seconds
35) 4.41% or 0.0441
36) 2.27% or 0.0227
37) 43.32% or 0.4332
38) 91.05% or 0.9105
39) 60 and 90
40) 0.0668
41) 0.0606
42) 0.30719
43) 0.0228
44) 17.0729 using Excel or 17.08 using Table E.2
45) 13.32 and 16.68 or 13.31 and 16.69

46) 16.0488 using Excel or 16.04 using Table E.2
47) 0.8413
48) 0.9545 using Excel or 0.9544 using Table E.2
49) 294.4
50) D
51) 0.5859 or 58.59%
52) 0.5859 or 58.59%
53) 0.3085 or 30.85%
54) 0.6915 or 69.15%
55) 0.1056 or 10.56%
56) 0.8944 or 89.44%
57) A
58) B