

Part A: Multiple choice problems. Please answer these on the OMR sheet.

Name: _____ Date: _____

1. Which of the following is a quantitative variable?
 - A) The make of a TV
 - B) A person's gender
 - C) Fuel efficiency of a car
 - D) Whether a person is an university graduate or not
 - E) Whether a person has a charge account

2. The two types of quantitative variables are:
 - A) Ordinal and ratio
 - B) Interval and ordinal
 - C) Nominative and ordinal
 - D) Interval and ratio
 - E) Nominative and interval

3. If there are 130 values in a data set, how many classes should be created for a frequency histogram?
 - A) 4
 - B) 5
 - C) 6
 - D) 7
 - E) 8

4. If the random variable X has a mean of μ and a standard deviation σ , then $(X - \mu)/\sigma$ has a mean and standard deviation respectively:
 - A) μ and σ
 - B) \bar{X} and s
 - C) 1 and 0
 - D) 0 and 1

Use the following to answer questions 5-6:

The fuel efficiency rating for a mid-size car is normally distributed with a mean of 32 and a standard deviation of .8. What is the probability that the rating for a selected mid-size car would be:

5. Less than 33.2?

- A) 43.32%
- B) 6.68%
- C) 93.32%
- D) 86.64%
- E) 13.36%

6. More than 33.2?

- A) 43.32%
- B) 6.68%
- C) 93.32%
- D) 86.64%
- E) 13.36%

Use the following to answer questions 7-10:

A CFO is looking at how much of a company's resources are spent on computing. The CFO samples companies in the pharmaceutical industry and developed the following stem-and-leaf graph.

5	269
6	255568999
7	11224557789
8	001222458
9	02455679
10	1556
11	137
12	
13	255

7. What is the approximate shape of the distribution of the data?

- A) Normal
- B) Skewed to the right
- C) Skewed to the left
- D) Bimodal
- E) Uniform

8. What is the smallest percent spent?
- A) 5.9
 - B) 5.6
 - C) 5.2
 - D) 5.02
 - E) 50.2
9. If a frequency histogram were to be created using these data, how many classes would you create?
- A) 4
 - B) 5
 - C) 6
 - D) 7
 - E) 8
10. What would be the class length that would be used in creating a frequency histogram?
- A) 1.4
 - B) 8.3
 - C) 1.2
 - D) 1.7
 - E) 0.9

Use the following to answer questions 11-13:

The numbers of rooms for 15 homes recently sold were:
8, 8, 8, 5, 9, 8, 7, 6, 6, 7, 7, 7, 7, 9, 9

11. What is the mean?
- A) 8.0
 - B) 7.0
 - C) 6.0
 - D) 9.0
 - E) 7.4
12. What is the median?
- A) 8.0
 - B) 7.0
 - C) 6.0
 - D) 9.0
 - E) 7.4

13. What is the mode?
- A) 8.0
 - B) 7.0
 - C) 6.0
 - D) 9.0
 - E) 7.4
14. As the sample size _____ the variation of the sampling distribution of \bar{X} _____.
- A) Decreases, decreases
 - B) Increases, remains the same
 - C) Decreases, remains the same
 - D) Increases, decreases
 - E) None of the above are correct
15. Consider a sampling distribution formed based on $n = 3$. The standard deviation of the population of all sample means $\sigma_{\bar{X}}$ is _____ less than the standard deviation of the population of individual measurements σ .
- A) Always
 - B) Sometimes
 - C) Never
16. The mean life of pair of shoes is 40 months with a standard deviation of 8 months. If the life of the shoes is normally distributed, how many pairs of shoes out of one million will need replacement before 36 months?
- A) 500,000
 - B) 808,500
 - C) 191,500
 - D) 308,500
 - E) 705,100
17. A standard normal distribution has a mean of _____ and standard deviation of _____.
- A) zero, zero
 - B) zero, one
 - C) one, one
 - D) one, zero
 - E) none of the above are correct

18. The area under the standard normal curve between $z = 0$ and $z = 1$ is _____ the area under the normal curve between $z = 1$ and $z = 2$.
- A) Less than
 - B) Greater than
 - C) Equal to
 - D) A, B, or C above dependent on the value of the mean
 - E) A, B, or C above dependent on the value of the standard deviation
19. If the wages of workers for a given company are normally distributed with a mean of \$15 per hour, then the proportion of the workers earning more than \$13 per hour:
- A) Is greater than the proportion earning less than \$13 per hour.
 - B) Is greater than the proportion earning less than \$18 per hour.
 - C) Is less than 50%.
 - D) Is less than the proportion earning more than the mean wage.
 - E) None of the above are correct
20. A student's grade on an examination was transformed to a z value which is negative. Therefore, we know that he scored:
- A) Higher than 16% of the class
 - B) Higher than 45% of the class
 - C) Above the first quartile
 - D) Lower than 16% of the class
 - E) Below the mean
21. The relationship between the standard normal random variable Z and normal random variable X is that:
- A) Only the normal random variable X is continuous.
 - B) Only the standard normal variable Z is continuous.
 - C) The standard normal variable Z counts the number of standard deviations that the value of the normal random variable X is away from its mean.
 - D) The values of the standard normal random variable Z can not be negative.
 - E) The values of the normal random variable X can not be negative.
22. The central limit theorem states that as the sample size increases the distribution of the sample _____ approach the normal distribution.
- A) medians
 - B) modes
 - C) standard deviations
 - D) variances
 - E) means

23. Consider two population distributions labelled A and B. Distribution A is highly skewed and non-normal, while the distribution B is slightly skewed and near normal. In order for the sampling distributions of A and B to achieve the same degree of normality:
- A) Population A will require a larger sample size.
 - B) Population B will require a larger sample size.
 - C) Population A and B will require the same sample size.
 - D) Both (B) and (C) are correct
 - E) None of the above (A, B, or C) are correct
24. If the sampled population has a mean 48 and standard deviation 16, then the mean and the standard deviation for the sampling distribution of \bar{X} for $n = 16$ are:
- A) 4 and 1
 - B) 12 and 4
 - C) 48 and 4
 - D) 48 and 1
 - E) 48 and 16
25. If we have a sample size of 100 and the estimate of the population proportion is .10, the standard deviation of the sampling distribution of the sample proportion is:
- A) .0009
 - B) .03
 - C) 3
 - D) 9
 - E) .10
26. For non-normal populations, as the sample size (n) _____, the distribution of sample means approaches a(n) _____ distribution.
- A) Decreases, Uniform
 - B) Increases, Normal
 - C) Decreases, Normal
 - D) Increases, Uniform
 - E) Increases, Exponential

Use the following to answer questions 27-29:

In a manufacturing process a machine produces bolts that have an average length of 3 cm with a variance of .03. If we randomly select three bolts from this process:

27. What is the standard deviation of the sample mean?
- A) .03
 - B) .01
 - C) .1732
 - D) .0577
 - E) .10
28. What is the probability the mean length of the bolts is at least 3.16 cm?
- A) 97.72 %
 - B) 5.48 %
 - C) 94.52 %
 - D) 44.52 %
 - E) 2.28 %
29. What is the probability the mean length of the bolts is at most 3.1 cm?
- A) 84.13%
 - B) 100 %
 - C) 71.57 %
 - D) 28.43 %
 - E) 15.87 %
30. Which percentile describes the first quartile, Q1?
- A) 25th
 - B) 50th
 - C) 75th
 - D) 100th
 - E) 125th
31. Which of the following is influenced the least by the occurrence of extreme values in a sample?
- A) Mean
 - B) Median
 - C) Mode
 - D) Geometric mean
 - E) Weighted mean

32. If there are 62 values in a data set, how many classes should be created for a frequency histogram?
- A) 4
 - B) 5
 - C) 6
 - D) 7
 - E) 8
33. Ratio variables have the following unique characteristic:
- A) meaningful order
 - B) an inherently defined zero value
 - C) categorical in nature
 - D) predictable
 - E) equal distance between points

Use the following to answer questions 34-35:

In a statistic class, 10 scores were randomly selected with the following results were obtained:
74, 73, 77, 77, 71, 68, 65, 77, 67, 66

34. What is the mean?
- A) 71.5
 - B) 72.0
 - C) 77.0
 - D) 71.0
 - E) 73.0
35. What is the median?
- A) 71.5
 - B) 72.0
 - C) 77.0
 - D) 71.0
 - E) 73.0

Use the following to answer questions 36-37:

According to a survey of the top 10 employers in a major city, a worker spends an average of 413 minutes a day on the job. Suppose the standard deviation is 26.8 minutes and the time spent is approximately a normal distribution.

36. What are the times that approximately 68.26% of all workers will fall?

- A) [394.8 431.2]
- B) [386.2 439.8]
- C) [372.8 453.2]
- D) [359.4 466.6]
- E) [332.6 493.4]

37. What are the times that approximately 95.44% of all workers will fall?

- A) [387.5 438.5]
- B) [386.2 439.8]
- C) [372.8 453.2]
- D) [359.4 466.6]
- E) [332.6 493.4]

Use the following to answer questions 38-40:

A local airport keeps track of the percentage of flights arriving within 15 minutes of their scheduled arrivals. The stem-and-leaf plot of the data for one year is below:

76	9
77	114
78	
79	07
80	88
81	2
82	1
83	88

38. What is the sample size?

- A) 7
- B) 9
- C) 10
- D) 11
- E) 12

39. In developing a histogram of these data, how many classes would be used?

- A) 4
- B) 5
- C) 6
- D) 7
- E) 8

40. What would be the class length for creating the frequency histogram?

- A) 1.4
- B) 0.8
- C) 2.7
- D) 1.7
- E) 2.3

Answer Key

1. C
2. D
3. E
4. D
5. C
6. B
7. B
8. C
9. C
10. A
11. E
12. B
13. B
14. D
15. A
16. D
17. B
18. B
19. A
20. E
21. C
22. E
23. A
24. C
25. B
26. B
27. E
28. B
29. A
30. A
31. B
32. C
33. B
34. A
35. B
36. B
37. D
38. E
39. A
40. D

Part B: Short answer problems. Please answer these in the space provided at the end of the exam paper.

Name: _____ Date: _____

1. The population of lengths of aluminum-coated steel sheets is normally distributed with a mean of 30.05 cm and a standard deviation of 0.3 cm. What is the probability that average length of steel sheets from a sample of 9 units is more than 29.95 cm long?
2. The time of travel from a person's apartment to the bus station follows a uniform distribution over the interval from 20 to 30 minutes. If they leave home at 9:05 AM, what is the probability that they will get to the station between 9:25 and 9:30 AM?

Use the following to answer questions 3-4:

The chief chemist for a major oil/gasoline production company claims that the regular unleaded gasoline produced by the company contains on average 4 grams of a certain ingredient. The chemist further states that the distribution of this ingredient per L of regular unleaded gasoline is normal and has a standard deviation of 1.2 grams.

3. What is the probability of finding an average in excess of 4.3 grams of this ingredient from randomly inspected 100L of regular unleaded gasoline?
4. What is the probability of finding an average less than 3.85 grams of this ingredient from randomly inspected 64L of regular unleaded gasoline?

Use the following to answer question 5:

Suppose that the times required for a cable company to fix cable problems in its customers' homes are uniformly distributed between 40 minutes and 65 minutes.

5. What is the probability that a randomly selected cable repair visit will take at least 50 minutes?

Use the following to answer questions 6-7:

An insurance company will insure a \$75,000 Hummer for its full value against theft at a premium of \$1500 per year. Suppose that the probability that the Hummer will be stolen is 0.0075.

6. Calculate the insurance company's expected net profit.
7. Find the premium that the insurance company should charge if it wants its expected net profit to be \$2000?

Use the following to answer questions 8-9:

In the upcoming students' council election, the most recent poll based on 900 students predicts that the incumbent will be re-elected with 55% of the votes.

8. From the 900 students, how many indicated that they would not vote for the current students' council president or indicated that they were undecided?
9. For the sake of argument, assume that 51% of the actual student voters in the university support the incumbent council president ($p = 0.51$). Calculate the probability of observing a sample proportion of voters 0.55 or higher supporting the incumbent council president.
10. A machine is made up of 3 components: an upper part, a mid part, and a lower part. The machine is then assembled. 5 percent of the upper parts are defective; 4 percent of the mid parts are defective; 1 percent of the lower parts are defective. What is the probability that a machine is non-defective?

Use the following to answer questions 11-12:

X has the following probability distribution $P(x)$:

x	1	2	3	4
P(x)	.1	.5	.2	.2

11. Compute the expected value of X.

12. Compute the variance value of X.

Use the following to answer questions 13-14:

It is very common for a television series to draw a large audience for special events or for cliff-hanging story lines. Suppose that on one of these occasions, the special show drew viewers from 38.2% of all TV-viewing households. Suppose that three TV-viewing households are randomly selected.

13. What is the probability that all three households viewed this special show?

14. What is the probability that none of the three households viewed this special show?

Use the following to answer questions 15-17:

A survey is made in a neighbourhood of 80 voters. 65 were Liberal and 15 were Conservative (none claimed to support another political party). Of the Liberals, 35 are women, while 5 of the Conservatives are women. If one subject from the group is randomly selected, find the probability:

15. The individual is either a woman or a Liberal.

16. A male Conservative

17. A Liberal or a Conservative.

Use the following to answer question 18:

A random sample of size 1,000 is taken from a population where $p = .20$.

18. Find $P(\hat{p} < .18)$.

19. Three candidates run for different offices in different counties. Each has a one in three chance of being elected in his/her county. What is the probability that at least one of them will be elected?
20. Packages of sugar bags for Sweeter Sugar Inc. have an average weight of 16 grams and a standard deviation of 0.2 grams. The weights of the sugar bags are normally distributed. What is the probability that 16 randomly selected packages will have an average weight in excess of 16.075 grams?

Answer Key

1. 0.8413

$$P\left(Z > \frac{29.95 - 30.05}{\frac{.3}{\sqrt{9}}}\right) = P(Z > -1) = .3413 + .5 = .8413$$

2. .5

$$\frac{25 \text{ min.} - 20 \text{ min.}}{10 \text{ min.}} = .5$$

3. .0062

$$Z = \frac{4.3 - 4}{\frac{1.2}{\sqrt{100}}} = \frac{.3}{.12} = 2.5$$

$$P(\bar{X} > 4.3) = .5 - .4938 = .0062$$

4. .1587

$$Z = \frac{3.85 - 4}{\frac{1.2}{\sqrt{64}}} = \frac{-0.15}{.15} = -1.0$$

$$P(\bar{X} < 3.85) = .5 - .3413 = .1587$$

5. .60

$$p(x > 50) = \frac{65 - 50}{65 - 40} = \frac{15}{25} = .6$$

6. \$937.50

$$\mu_x = (-73500)(.0075) + (1500)(.9925) = -551.25 + 1488.75 = 937.50$$

7. \$2,562.50

$$2000 = (x - 75000)(.0075) + x(.9925) = .0075x - 562.5 + .9925x = 2562.5$$

8. 405

$$(.45)(900) = 405$$

9. .0082

$$\sigma_p = \sqrt{\frac{(.51)(.49)}{900}} = .0167$$

$$Z = \frac{.55 - .51}{.0167} = 2.4$$

$$P(\hat{p} > .55) = .5 - .4918 = .0082$$

10. .9029

$$(.95)(.96)(.99) = .9029$$

11. 2.5

$$E[X] = (1)(.1) + (2)(.5) + (3)(.2) + (4)(.2) = 2.5$$

12. .9125

$$E[X] = (1)(.1) + (2)(.5) + (3)(.2) + (4)(.2) = 2.5$$

$$\sigma_x^2 = (1 - 2.5)^2 (.1) + (2 - 2.5)^2 (.5) + (3 - 2.5)^2 (.2) + (4 - 2.5)^2 (.2) = .9125 - 0.85$$

13. .056

$$(.382)(.382)(.382) = .05574$$

14. .236

$$(.618)(.618)(.618) = .236$$

15. .875

$$P(W \cap D) = P(W) + P(D) - P(W \cup D)$$

$$(40/80) + (65/80) - (35/80) = .875$$

16. .125

$$(10/80) = .125$$

17. 1.00

18. .0571

$$Z = \frac{.18 - .20}{\sqrt{\frac{(.2)(.8)}{1000}}} = \frac{-.2}{.01265} = -1.581$$

$$P(\hat{p} < .18) = .5 - .4429 = .0571$$

19. .7037

$$P(X \geq 1) = 1 - P(X = 0)$$

$$P(X = 0) = \binom{3!}{3!} \left(\frac{1}{3}\right)^0 \left(\frac{2}{3}\right)^3 = \frac{8}{27}$$

$$P(X \geq 1) = 1 - \frac{8}{27} = \frac{19}{27} = .7037$$

20. 0.0668

$$P\left(Z > \frac{16.075 - 16}{\frac{.2}{\sqrt{16}}}\right) = P(Z > 1.5) = .5 - .4332 = .0668$$