



SAMPLING AND SAMPLING DISTRIBUTIONS

MULTIPLE CHOICE QUESTIONS

1. How many simple random samples of size 3 can be selected from a population of size 7?
 - a. 7
 - b. 21
 - c. 35
 - d. 343

2. Sampling distribution of \bar{x} is the
 - a. probability distribution of the sample mean
 - b. probability distribution of the sample proportion
 - c. mean of the sample
 - d. mean of the population

3. A population has a standard deviation of 16. If a sample of size 64 is selected from this population, what is the probability that the sample mean will be within ± 2 of the population mean?
 - a. 0.6826
 - b. 0.3413
 - c. -0.6826
 - d. Since the mean is not given, there is no answer to this question.

4. The probability distribution of all possible values of the sample proportion \bar{p} is the
 - a. probability density function of \bar{p}

- b. sampling distribution of \bar{x}
 - c. same as \bar{p} , since it considers all possible values of the sample proportion
 - d. sampling distribution of \bar{p}
5. The point estimator with the smaller variance is said to have
- a. smaller relative efficiency
 - b. greater relative efficiency
 - c. smaller relative consistency
 - d. greater relative consistency
6. Convenience sampling is an example of
- a. probabilistic sampling
 - b. stratified sampling
 - c. non-probabilistic sampling
 - d. cluster sampling
7. Stratified random sampling is a method of selecting a sample in which
- a. the sample is first divided into strata, and then random samples are taken from each stratum
 - b. various strata are selected from the sample
 - c. the population is first divided into strata, and then random samples are drawn from each stratum
 - d. None of these alternatives is correct.
8. A population consists of 500 elements. We want to draw a simple random sample of 50 elements from this population. On the first selection, the probability of an element being selected is
- a. 0.100
 - b. 0.010
 - c. 0.001
 - d. 0.002
9. The closer the sample mean is to the population mean,
- a. the larger the sampling error
 - b. the smaller the sampling error
 - c. the sampling error equals 1
 - d. None of these alternatives is correct.
10. Since the sample size is always smaller than the size of the population, the sample mean
- a. must always be smaller than the population mean
 - b. must be larger than the population mean
 - c. must be equal to the population mean
 - d. can be smaller, larger, or equal to the population mean

11. As the sample size increases, the
- standard deviation of the population decreases
 - population mean increases
 - standard error of the mean decreases
 - standard error of the mean increases
12. In point estimation
- data from the population is used to estimate the population parameter
 - data from the sample is used to estimate the population parameter
 - data from the sample is used to estimate the sample statistic
 - the mean of the population equals the mean of the sample
13. The sample statistic s is the point estimator of
- μ
 - σ
 - \bar{x}
 - \bar{p}
14. The sample mean is the point estimator of
- μ
 - σ
 - \bar{x}
 - \bar{p}
15. If we consider the simple random sampling process as an experiment, the sample mean is
- always zero
 - always smaller than the population mean
 - a random variable
 - exactly equal to the population mean
16. The probability distribution of the sample mean is called the
- central probability distribution
 - sampling distribution of the mean
 - random variation
 - standard error
17. The expected value of the random variable \bar{x} is
- the standard error
 - the sample size
 - the size of the population

- d. None of these alternatives is correct.
18. The standard deviation of all possible \bar{x} values is called the
- standard error of proportion
 - standard error of the mean
 - mean deviation
 - central variation
19. As the sample size becomes larger, the sampling distribution of the sample mean approaches a
- binomial distribution
 - Poisson distribution
 - normal distribution
 - chi-square distribution
20. The sampling error is the
- same as the standard error of the mean
 - difference between the value of the sample mean and the value of the population mean
 - error caused by selecting a bad sample
 - standard deviation multiplied by the sample size
21. From a population of 200 elements, a sample of 49 elements is selected. It is determined that the sample mean is 56 and the sample standard deviation is 14. The standard error of the mean is
- 3
 - 2
 - greater than 2
 - less than 2
22. Which of the following is considered to be a more efficient estimator?
- sample median
 - sample mode
 - sample mean
 - any measure of central location
23. Which of the following sampling methods does not lead to probability samples?
- stratified sampling
 - cluster sampling
 - systematic sampling
 - convenience sampling

24. Which of the following is(are) point estimator(s)?
- a. σ
 - b. μ
 - c. s
 - d. α
25. A probability distribution for all possible values of a sample statistic is known as
- a. a sample statistic
 - b. a parameter
 - c. simple random sampling
 - d. a sampling distribution
- Answer: d
26. A population characteristic, such as a population mean, is called
- a. a statistic
 - b. a parameter
 - c. a sample
 - d. the mean deviation
- Answer: b
27. A property of a point estimator that occurs whenever larger sample sizes tend to provide point estimates closer to the population parameter is known as
- a. efficiency
 - b. unbiased sampling
 - c. consistency
 - d. relative estimation
- Answer: c
28. A sample statistic, such as a sample mean, is known as
- a. a statistic
 - b. a parameter
 - c. the mean deviation
 - d. the central limit theorem
- Answer: a
29. The standard deviation of a point estimator is called the
- a. standard deviation
 - b. standard error
 - c. point estimator
 - d. variance of estimation
- Answer: b
30. A single numerical value used as an estimate of a population parameter is known as
- a. a parameter

- b. a population parameter
- c. a mean estimator
- d. a point estimate

Answer: d

31. The sample statistic, such as \bar{x} , s , or \bar{p} , that provides the point estimate of the population parameter is known as
- a. a point estimator
 - b. a parameter
 - c. a population parameter
 - d. a population statistic

Answer: a

32. A theorem that allows us to use the normal probability distribution to approximate the sampling distribution of sample means and sample proportions whenever the sample size is large is known as the
- a. approximation theorem
 - b. normal probability theorem
 - c. central limit theorem
 - d. central normality theorem

Answer: c

33. A property of a point estimator that occurs whenever the expected value of the point estimator is equal to the population parameter it estimates is known as
- a. consistency
 - b. the expected value
 - c. the estimator
 - d. unbiasedness

Answer: d

34. A simple random sample of 64 observations was taken from a large population. The sample mean and the standard deviation were determined to be 320 and 120 respectively. The standard error of the mean is
- a. 1.875
 - b. 40
 - c. 5
 - d. 15

Answer: d

35. The number of random samples (without replacement) of size 3 that can be drawn from a population of size 5 is
- a. 15
 - b. 10
 - c. 20
 - d. 125

Answer: b

36. Random samples of size 81 are taken from an infinite population whose mean and standard deviation are 200 and 18, respectively. The distribution of the population is unknown. The mean and the standard error of the mean are
- a. 200 and 18
 - b. 81 and 18
 - c. 9 and 2
 - d. 200 and 2

Answer: d

37. A population has a mean of 80 and a standard deviation of 7. A sample of 49 observations will be taken. The probability that the sample mean will be larger than 82 is
- a. 0.5228
 - b. 0.9772
 - c. 0.4772
 - d. 0.0228

Answer: d

38. A population has a mean of 180 and a standard deviation of 24. A sample of 64 observations will be taken. The probability that the sample mean will be between 183 and 186 is
- a. 0.1359
 - b. 0.8185
 - c. 0.3413
 - d. 0.4772

Answer: a

39. Random samples of size 525 are taken from an infinite population whose population proportion is 0.3. The standard deviation of the sample proportions (i.e., the standard error of the proportion) is
- a. 0.0004
 - b. 0.2100
 - c. 0.3000
 - d. 0.0200

Answer: d

40. A sample of 400 observations will be taken from an infinite population. The population proportion equals 0.8. The probability that the sample proportion will be greater than 0.83 is
- a. 0.4332
 - b. 0.9332
 - c. 0.0668
 - d. 0.5668

Answer: c

41. A random sample of 121 bottles of cologne showed an average content of 4 ounces. It is known that the standard deviation of the contents (i.e., of the population) is 0.22 ounces. The standard error of the mean equals
- 0.3636
 - 0.0331
 - 0.0200
 - 4.000
- Answer: c
42. A random sample of 121 bottles of cologne showed an average content of 4 ounces. It is known that the standard deviation of the contents (i.e., of the population) is 0.22 ounces. The point estimate of the mean content of the bottles is
- 0.22
 - 4
 - 121
 - 0.02
- Answer: b
43. A random sample of 121 bottles of cologne showed an average content of 4 ounces. It is known that the standard deviation of the contents (i.e., of the population) is 0.22 ounces. In this problem the 0.22 is
- a parameter
 - a statistic
 - the standard error of the mean
 - the average content of colognes in the long run
- Answer: a
44. From a population of 500 elements, a sample of 225 elements is selected. It is known that the variance of the population is 900. The standard error of the mean is approximately
- 1.1022
 - 2
 - 30
 - 1.4847
- Answer: d
45. A simple random sample of size n from an infinite population of size N is to be selected. Each possible sample should have
- the same probability of being selected
 - a probability of $1/n$ of being selected
 - a probability of $1/N$ of being selected
 - a probability of N/n of being selected
- Answer: a
46. A random sample of 150 people was taken from a very large population. Ninety

of the people in the sample were female. The standard error of the proportion is

- a. 0.0016
- b. 0.2400
- c. 0.1600
- d. 0.0400

Answer: d

47. For a population with any distribution, the form of the sampling distribution of the sample mean is

- a. sometimes normal for all sample sizes
- b. sometimes normal for large sample sizes
- c. always normal for all sample sizes
- d. always normal for large sample sizes

Answer: d

48. A simple random sample of 28 observations was taken from a large population. The sample mean equaled 50. Fifty is a

- a. population parameter
- b. biased estimate of the population mean
- c. sample parameter
- d. point estimate

Answer: d

49. There are 6 children in a family. The number of children defines a population. The number of simple random samples of size 2 (without replacement) which are possible equals

- a. 12
- b. 15
- c. 3
- d. 16

Answer: b

50. A simple random sample of 5 observations from a population containing 400 elements was taken, and the following values were obtained.

12 18 19 20 21

A point estimate of the mean is

- a. 400
- b. 18
- c. 20
- d. 10

Answer: b

51. Random samples of size 49 are taken from a population that has 200 elements, a mean of 180, and a variance of 196. The distribution of the population is unknown. The mean and the standard error of the mean are

- a. 180 and 24.39
- b. 180 and 28
- c. 180 and 2
- d. 180 and 1.74

Answer: d

52. Random samples of size 36 are taken from an infinite population whose mean and standard deviation are 20 and 15, respectively. The distribution of the population is unknown. The mean and the standard error of the mean are

- a. 36 and 15
- b. 20 and 15
- c. 20 and 0.417
- d. 20 and 2.5

Answer: d

53. A sample of 24 observations is taken from a population that has 150 elements.

The sampling distribution of \bar{x} is

- a. approximately normal because \bar{x} is always approximately normally distributed
- b. approximately normal because the sample size is large in comparison to the population size
- c. approximately normal because of the central limit theorem
- d. normal if the population is normally distributed

Answer: d

54. A population has a mean of 84 and a standard deviation of 12. A sample of 36 observations will be taken. The probability that the sample mean will be between 80.54 and 88.9 is

- a. 0.0347
- b. 0.7200
- c. 0.9511
- d. 8.3600

Answer: c

55. A population has a mean of 53 and a standard deviation of 21. A sample of 49 observations will be taken. The probability that the sample mean will be greater than 57.95 is

- a. 0
- b. .0495
- c. .4505
- d. .9505

Answer: b

56. Random samples of size 100 are taken from an infinite population whose

population proportion is 0.2. The mean and standard deviation of the sample proportion are

- a. 0.2 and .04
- b. 0.2 and 0.2
- c. 20 and .04
- d. 20 and 0.2

Answer: a

57. A population of size 1,000 has a proportion of 0.5. Therefore, the proportion and the standard deviation of the sample proportion for samples of size 100 are

- a. 500 and 0.047
- b. 500 and 0.050
- c. 0.5 and 0.047
- d. 0.5 and 0.050

Answer: c

58. A sample of 25 observations is taken from an infinite population. The sampling distribution of \bar{p} is

- a. not normal since $n < 30$
- b. approximately normal because \bar{p} is always normally distributed
- c. approximately normal if $np \geq 5$ and $n(1-P) \geq 5$
- d. approximately normal if $np > 30$ and $n(1-P) > 30$

Answer: c

59. A point estimator will be unbiased if the

- a. expected value of the point estimator equals the value of the population parameter
- b. sample size is greater than 30 or $np \geq 5$ and $n(1-p) \geq 5$
- c. sampling distribution is normally distributed
- d. value of the population parameter is known

Answer: a

60. A finite population correction factor is needed in computing the standard deviation of the sampling distribution of sample means

- a. whenever the population is infinite
- b. whenever the sample size is more than 5% of the population size
- c. whenever the sample size is less than 5% of the population size
- d. The correction factor is not necessary if the population has a normal distribution

Answer: b

61. Doubling the size of the sample will

- a. reduce the standard error of the mean to one-half its current value
- b. reduce the standard error of the mean to approximately 70% of its current value
- c. have no effect on the standard error of the mean
- d. double the standard error of the mean

Answer: b

62. The fact that the sampling distribution of sample means can be approximated by a normal probability distribution whenever the sample size is large is based on the
- a. central limit theorem
 - b. fact that we have tables of areas for the normal distribution
 - c. assumption that the population has a normal distribution
 - d. None of these alternatives is correct.

Answer: a

63. As the sample size increases, the variability among the sample means
- a. increases
 - b. decreases
 - c. remains the same
 - d. depends upon the specific population being sampled

Answer: b

64. As a rule of thumb, the sampling distribution of the sample proportions can be approximated by a normal probability distribution whenever

- a. $np \geq 5$
- b. $n(1 - p) \geq 5$ and $n \geq 30$
- c. $n \geq 30$ and $(1 - p) = 0.5$
- d. None of these alternatives is correct.

Answer: b

65. Random samples of size 17 are taken from a population that has 200 elements, a mean of 36, and a standard deviation of 8. The mean and the standard deviation of the sampling distribution of the sample means are

- a. 8.7 and 1.94
- b. 36 and 1.94
- c. 36 and 1.86
- d. 36 and 8

Answer: c

66. Random samples of size 17 are taken from a population that has 200 elements, a mean of 36, and a standard deviation of 8. Which of the following best describes the form of the sampling distribution of the sample mean for this situation?

- a. approximately normal because the sample size is small relative to the population size
- b. approximately normal because of the central limit theorem

- c. exactly normal
- d. None of these alternatives is correct.

Answer: d

67. The sampling distribution of the sample means
- a. is the probability distribution showing all possible values of the sample mean
 - b. is used as a point estimator of the population mean μ
 - c. is an unbiased estimator
 - d. shows the distribution of all possible values of μ

Answer: a

68. Given two unbiased point estimators of the same population parameter, the point estimator with the smaller variance is said to have
- a. smaller relative efficiency
 - b. greater relative efficiency
 - c. smaller consistency
 - d. larger consistency

Answer: b

69. Whenever the estimation process summarizes all of the information a sample has about a population parameter, the point estimator has the property of
- a. relative consistency
 - b. full consistency
 - c. sufficiency
 - d. insufficiency

Answer: c

70. The number of different simple random samples of size 5 that can be selected from a population of size 8 is
- a. 40
 - b. 336
 - c. 13
 - d. 56

Answer: d

71. The following data was collected from a simple random sample of a population

13 15 14 16 12

The point estimate of the population mean

- a. cannot be determined, since the population size is unknown
- b. is 14
- c. is 4
- d. is 5

Answer: b

72. The following data was collected from a simple random sample of a population.

13 15 14 16 12

The point estimate of the population standard deviation is

- a. 2.500
- b. 1.581
- c. 2.000
- d. 1.414

Answer: b

73. The following data was collected from a simple random sample of a population.

13 15 14 16 12

If the population consisted of 10 elements, how many different random samples of size 6 could be drawn from the population?

- a. 60
- b. 210
- c. 3024
- d. 362880

Answer: b

74. The following data was collected from a simple random sample of a population.

13 15 14 16 12

The mean of the population

- a. is 14
- b. is 15
- c. is 15.1581
- d. could be any value

Answer: d

75. Four hundred people were asked whether gun laws should be more stringent. Three hundred said "yes," and 100 said "no." The point estimate of the proportion in the population who will respond "yes" is

- a. 300
- b. approximately 300
- c. 0.75
- d. 0.25

Answer: c

76. Four hundred people were asked whether gun laws should be more stringent. Three hundred said "yes," and 100 said "no." The point estimate of the proportion

in the population who will respond "no" is

- a. 75
- b. 0.25
- c. 0.75
- d. 0.50

Answer: b

77. The following information was collected from a simple random sample of a population.

16 19 18 17 20 18

The point estimate of the mean of the population is

- a. 18.0
- b. 19.6
- c. 108
- d. sixteen, since 16 is the smallest value in the sample

Answer: a

78. The following information was collected from a simple random sample of a population.

16 19 18 17 20 18

The point estimate of the population standard deviation is

- a. 2.000
- b. 1.291
- c. 1.414
- d. 1.667

Answer: c

79. How many different samples of size 3 can be taken from a finite population of size 10?

- a. 30
- b. 1,000
- c. 720
- d. 120

Answer: d

80. Cluster sampling is

- a. a nonprobability sampling method
- b. the same as convenience sampling
- c. a probability sampling method
- d. None of these alternatives is correct.

Answer: c

81. The set of all elements of interest in a study is

- a. set notation
- b. a set of interest
- c. a sample
- d. a population

Answer: d

82. A subset of a population selected to represent the population is

- a. a subset
- b. a sample
- c. a small population
- d. a parameter

Answer: b

83. The purpose of statistical inference is to provide information about the

- a. sample based upon information contained in the population
- b. population based upon information contained in the sample
- c. population based upon information contained in the population
- d. mean of the sample based upon the mean of the population

Answer: b

84. A population has a mean of 300 and a standard deviation of 18. A sample of 144 observations will be taken. The probability that the sample mean will be between 297 to 303 is

- a. 0.4332
- b. 0.8664
- c. 0.9332
- d. 0.0668

Answer: b

85. The probability distribution of all possible values of the sample mean \bar{x} is

- a. the probability density function of \bar{x}
- b. the sampling distribution of \bar{x}
- c. the grand mean, since it considers all possible values of the sample mean
- d. one, since it considers all possible values of the sample mean

Answer: b

86. The standard deviation of a sample of 100 elements taken from a very large population is determined to be 60. The variance of the population

- a. can not be larger than 60
- b. can not be larger than 3600
- c. must be at least 100
- d. can be any value

Answer: d

PROBLEMS

1. A population of 1,000 students spends an average of \$10.50 a day on dinner. The standard deviation of the expenditure is \$3. A simple random sample of 64 students is taken.
 - a. What are the expected value, standard deviation, and shape of the sampling distribution of the sample mean?
 - b. What is the probability that these 64 students will spend a combined total of more than \$715.21?
 - c. What is the probability that these 64 students will spend a combined total between \$703.59 and \$728.45?

Answers:

- a. 10.5 0.363 normal
- b. 0.0314
- c. 0.0794

2. A simple random sample of 6 recent graduates revealed the following information about their weekly incomes.

Graduates	Weekly Income
A	\$250
B	270
C	285
D	240
E	255
F	290

- a. What is the expected value of the average weekly income of all the recent graduates?
- b. What is the expected value of the standard deviation for the population?

Answers:

- a. \$265
- b. \$20

3. The life expectancy in the United States is 75 with a standard deviation of 7 years. A random sample of 49 individuals is selected.
 - a. What is the probability that the sample mean will be larger than 77 years?
 - b. What is the probability that the sample mean will be less than 72.7 years?
 - c. What is the probability that the sample mean will be between 73.5 and 76 years?
 - d. What is the probability that the sample mean will be between 72 and 74 years?
 - e. What is the probability that the sample mean will be larger than 73.46 years?

Answers:

- a. 0.0228

- b. 0.0107
 - c. 0.7745
 - d. 0.1573
 - e. 0.9389
4. The SAT scores have an average of 1200 with a standard deviation of 60. A sample of 36 scores is selected.
- a. What is the probability that the sample mean will be larger than 1224?
 - b. What is the probability that the sample mean will be less than 1230?
 - c. What is the probability that the sample mean will be between 1200 and 1214?
 - d. What is the probability that the sample mean will be greater than 1200?
 - e. What is the probability that the sample mean will be larger than 73.46?

Answers:

- a. 0.0082
 - b. 0.9986
 - c. 0.4192
 - d. 0.5
 - e. 1.0
5. A simple random sample of 8 employees of a corporation provided the following information.

Employee	1	2	3	4	5	6	7	8
Age	25	32	26	40	50	54	22	23
Gender	M	M	M	M	F	M	M	F

- a. Determine the point estimate for the average age of all employees.
- b. What is the point estimate for the standard deviation of the population?
- c. Determine a point estimate for the proportion of all employees who are female.

Answers:

- a. 34
 - b. 12.57
 - c. 0.25
6. Starting salaries of a sample of five management majors along with their genders are shown below.

Salary		
Employee	(in \$1,000s)	Gender
1	30	F
2	28	M
3	22	F

4	26	F
5	19	M

- What is the point estimate for the starting salaries of all management majors?
- Determine the point estimate for the variance of the population.
- Determine the point estimate for the proportion of male employees.

Answers:

- 25 (thousands)
- 20 (thousands)
- 0.4

- An experimental diet to induce weight loss was followed for one week by a randomly selected group of 12 students with the following results.

Student	Loss in Pounds
1	2.2
2	2.6
3	0.4
4	2.0
5	0.0
6	1.8
7	5.2
8	3.8
9	4.2
10	3.8
11	1.4
12	2.6

- Find a point estimate for the average amount lost after one week on this diet. Is this an unbiased estimate of the population mean? Explain.
- Find a point estimate for the variance of the amount lost on this diet. Is this an unbiased estimate of the population variance? Explain.
- Find a point estimate for the standard deviation of the amount lost on this diet.

Answers:

- 2.5; Yes; $E(\bar{x}) = \mu$
- 2.389; Yes; $E(s^2) = \sigma^2$
- 1.546

- Below you are given the values obtained from a random sample of 4 observations taken from an infinite population.

32 34 35 39

- Find a point estimate for μ . Is this an unbiased estimate of μ ? Explain.
- Find a point estimate for σ^2 . Is this an unbiased estimate of σ^2 ? Explain.
- Find a point estimate for σ .
- What can be said about the sampling distribution of \bar{x} ? Be sure to discuss the expected value, the standard deviation, and the shape of the sampling distribution of \bar{x} .

Answers:

- 35; Yes; $E() = \mu$
 - 8.667; Yes; $E(s^2) = \sigma^2$
 - 2.944
 - $E(\bar{x}) = \mu$, the standard deviation = σ^2/n , and the sampling distribution of \bar{x} is normally distributed if the population is normally distributed.
9. The following information gives the number of days absent from work for a population of 5 workers at a small factory.

Worker	Number of Days Absent
A	5
B	7
C	1
D	4
E	8

- Find the mean and the standard deviation for the population.
- Samples of size 2 will be drawn from the population. Use the answers in part a to calculate the expected value and the standard deviation of the sampling distribution of the sample mean.
- Find all the samples of 2 workers that can be extracted from this population. Choose the samples without replacement.
- Compute the sample mean \bar{x} for each of the samples in Part c.
- Graph the sample means with the values of \bar{x} on the horizontal axis and the corresponding relative frequency on the vertical axis.

Answers:

- 5; 2.449
 - 5; 1.5
 - AB, AC, AD, AE, BC, BD, BE, CD, CE, DE
 - 6, 3, 4.5, 6.5, 4, 5.5, 7.5, 2.5, 4.5, 6
10. MNM Corporation gives each of its employees an aptitude test. The scores on the

test are normally distributed with a mean of 75 and a standard deviation of 15. A simple random sample of 25 is taken from a population of 500.

- a. What are the expected value, the standard deviation, and the shape of the sampling distribution of \bar{x} ?
- b. What is the probability that the average aptitude test in the sample will be between 70.14 and 82.14?
- c. What is the probability that the average aptitude test in the sample will be greater than 82.68?
- d. What is the probability that the average aptitude test in the sample will be less than 78.69?
- e. Find a value, C, such that $P(\bar{x} \geq C) = .015$.

Answers:

- a. 75; 3; normal
- b. 0.9387
- c. 0.0052
- d. 0.8907
- e. 81.51

11. Students of a large university spend an average of \$5 a day on lunch. The standard deviation of the expenditure is \$3. A simple random sample of 36 students is taken.
- a. What are the expected value, standard deviation, and shape of the sampling distribution of the sample mean?
 - b. What is the probability that the sample mean will be at least \$4?
 - c. What is the probability that the sample mean will be at least \$5.90?

Answers:

- a. 5.0; 0.5; normal
- b. 0.9772
- c. 0.0359

12. The average lifetime of a light bulb is 3,000 hours with a standard deviation of 696 hours. A simple random sample of 36 bulbs is taken.
- a. What are the expected value, standard deviation, and shape of the sampling distribution of \bar{x} ?
 - b. What is the probability that the average life in the sample will be between 2,670.56 and 2,809.76 hours?
 - c. What is the probability that the average life in the sample will be greater than 3,219.24 hours?
 - d. What is the probability that the average life in the sample will be less than 3,180.96 hours?

Answers:

- a. 3,000; 116; normal
 - b. 0.0482
 - c. 0.0294
 - d. 0.9406
13. Michael is running for president. The proportion of voters who favor Michael is 0.8. A simple random sample of 100 voters is taken.
- a. What are the expected value, standard deviation, and shape of the sampling distribution of \bar{p} ?
 - b. What is the probability that the number of voters in the sample who will not favor Michael will be between 26 and 30?
 - c. What is the probability that the number of voters in the sample who will not favor Michael will be more than 16?

Answers:

- a. 0.8; 0.04; normal
 - b. 0.0606
 - c. 0.8413
14. In a restaurant, the proportion of people who order coffee with their dinner is .9. A simple random sample of 144 patrons of the restaurant is taken.
- a. What are the expected value, standard deviation, and shape of the sampling distribution of \bar{p} ?
 - b. What is the probability that the proportion of people who will order coffee with their meal is between 0.85 and 0.875?
 - c. What is the probability that the proportion of people who will order coffee with their meal is at least 0.945?

Answers:

- a. 0.9; 0.025; normal
 - b. 0.1359
 - c. 0.0359
15. A random sample of nine telephone calls in an office provided the following information.

Call Number	Duration (In Minutes)	Type of Call
1	3	local
2	8	long distance
3	4	local
4	3	local
5	5	long distance
6	6	local

7	3	local
8	5	local
9	8	local

- Determine the point estimate for the average duration of all calls.
- What is the point estimate for the standard deviation of the population?
- Determine the standard error of the mean.
- What is the point estimate for the proportion of all calls that were long distance?
- Determine the standard error of proportion.

Answers:

- 5
- 2
- 0.67
- 0.222
- 0.138

16. A random sample of ten examination papers in a course that was given on a pass or fail basis showed the following scores.

Paper Number	Grade	Status
1	65	Pass
2	87	Pass
3	92	Pass
4	35	Fail
5	79	Pass
6	100	Pass
7	48	Fail
8	74	Pass
9	79	Pass
10	91	Pass

- What is the point estimate for the mean of the population?
- What is the point estimate for the standard deviation of the population?
- What is the point estimate for the proportion of all students who passed the course?

Answers:

- 75
- 20.48
- 0.8

17. Consider a population of five weights identical in appearance but weighing 1, 3, 5, 7, and 9 ounces.

- a. Determine the mean and the variance of the population.
- b. Sampling without replacement from the above population with a sample size of 2 produces ten possible samples. Using the ten sample mean values, determine the mean of the population and the variance of \bar{x} .
- c. Compute the standard error of the mean.

Answers:

- a. 5 and 8
- b. 5 and 3
- c. 1.732

18. Consider a population of five families with the following data representing the number of pets in each family.

Family	Number of Pets
A	2
B	6
C	4
D	3
E	1

- a. Determine the mean and the variance of the population.
- b. There are ten possible samples of size 2 (sampling without replacement). List the 10 possible samples of size 2, and determine the mean of each sample.
- c. Using the ten sample mean values, compute the mean and the standard error of the mean.

Answers:

- a. 3.2 and 2.96

Possible Samples	Sample Means
AB	4
AC	3
AD	2.5
AE	1.5
BC	5
BD	4.5
BE	3.5
CD	3.5
CE	2.5
DE	2

- c. 3.2 and 1.11

19. The average weekly earnings of bus drivers in a city are \$950 (that is μ) with a standard deviation of \$45 (that is σ). Assume that we select a random sample of 81 bus drivers.

- a. Compute the standard error of the mean.
- b. What is the probability that the sample mean will be greater than \$960?
- c. If the population of bus drivers consisted of 400 drivers, what would be the standard error of the mean?

Answers:

- a. 5
- b. 0.0228
- c. 4.47

20. An automotive repair shop has determined that the average service time on an automobile is 2 hours with a standard deviation of 32 minutes. A random sample of 64 services is selected.

- a. What is the probability that the sample of 64 will have a mean service time greater than 114 minutes?
- b. Assume the population consists of 400 services. Determine the standard error of the mean.

Answers:

- a. 0.9332
- b. 3.67

21. There are 8,000 students at the University of Tennessee at Chattanooga. The average age of all the students is 24 years with a standard deviation of 9 years. A random sample of 36 students is selected.

- a. Determine the standard error of the mean.
- b. What is the probability that the sample mean will be larger than 19.5?
- c. What is the probability that the sample mean will be between 25.5 and 27 years?

Answers:

- a. 1.5
- b. 0.9986
- c. 0.1359

22. In a local university, 10% of the students live in the dormitories. A random sample of 100 students is selected for a particular study.

- a. What is the probability that the sample proportion (the proportion living in the dormitories) is between 0.172 and 0.178?
- b. What is the probability that the sample proportion (the proportion living in the dormitories) is greater than 0.025?

Answers:

- a. 0.0035
- b. 0.9938

23. A department store has determined that 25% of all their sales are credit sales. A random sample of 75 sales is selected.
- a. What is the probability that the sample proportion will be greater than 0.34?
 - b. What is the probability that the sample proportion will be between 0.196 and 0.354?
 - c. What is the probability that the sample proportion will be less than 0.25?
 - d. What is the probability that the sample proportion will be less than 0.10?

Answers:

- a. 0.0359
- b. 0.8411
- c. 0.5
- d. 0.0014

24. Ten percent of the items produced by a machine are defective. A random sample of 100 items is selected and checked for defects.
- a. Determine the standard error of the proportion.
 - b. What is the probability that the sample will contain more than 2.5% defective units?
 - c. What is the probability that the sample will contain more than 13% defective units?

Answers:

- a. 0.03
- b. 0.9938
- c. 0.1587

25. There are 500 employees in a firm, 45% are female. A sample of 60 employees is selected randomly.
- a. Determine the standard error of the proportion.
 - b. What is the probability that the sample proportion (proportion of females) is between 0.40 and 0.55?

Answers:

- a. 0.0603
- b. 0.7482

26. A new soft drink is being market tested. It is estimated that 60% of consumers will like the new drink. A sample of 96 taste tested the new drink.
- a. Determine the standard error of the proportion
 - b. What is the probability that more than 70.4% of consumers will indicate they like the drink?

- c. What is the probability that more than 30% of consumers will indicate they do not like the drink?

Answers:

- a. 0.05
- b. 0.0188
- c. 0.9772

27. A bank has kept records of the checking balances of its customers and determined that the average daily balance of its customers is \$300 with a standard deviation of \$48. A random sample of 144 checking accounts is selected.

- a. What is the probability that the sample mean will be more than \$306.60?
- b. What is the probability that the sample mean will be less than \$308?
- c. What is the probability that the sample mean will be between \$302 and \$308?
- d. What is the probability that the sample mean will be at least \$296?

Answers:

- a. 0.0495
- b. 0.9772
- c. 0.2857
- d. 0.8413

28. In a large university, 20% of the students are business majors. A random sample of 100 students is selected, and their majors are recorded.

- a. Compute the standard error of the proportion.
- b. What is the probability that the sample contains at least 12 business majors?
- c. What is the probability that the sample contains less than 15 business majors?
- d. What is the probability that the sample contains between 12 and 14 business majors?

Answers:

- a. 0.04
- b. 0.9772
- c. 0.1056
- d. 0.044