Statistical Inference and Quality Control - Multiple Choices

Multiple Choice Questions

1. Branch of statistics which study the unknown aspects of a population distribution is
   (a) Estimation
   (b) Hypothesis testing
   (c) Inferential statistics
   (d) Descriptive statistics.
2. Branch of statistical inference which assumes that the underlying population distribution is known is
   (a) Parametric statistical inference
   (b) Non-parametric statistical inference
   (c) Distribution free methods
   (d) All the above.
3. Which of the following is not an assumption of parametric inference methods
   (a) Data is quantitative.
   (b) Population has a known distribution.
   (c) Sample is sufficiently large.
   (d) Data is qualitative.
4. Parameters are constants in
   (a) Sample
   (b) Probability distribution
   (c) Estimators

(d) None of the above

5. The statistic used for estimating a parameter of a population is called

   (a) Estimator
   (b) Estimate
   (c) Both (a) and (b)
   (d) Neither (a) nor (b).

6. An estimator is considered to be best if its distribution is

   (a) Normal
   (b) Continuous
   (c) Discrete
   (d) Concentrated about the true value of the parameter.

7. Mean squared error of an estimator T is equal to

   (a) $V(T) + Bias$
   (b) $V(T) + (Bias)^2$
   (c) $V(T) - Bias$
   (d) $V(T) - (Bias)^2$

8. Let T_n be an estimator of θ. If $E(T_n) = \theta$, then

   (a) T_n is a sufficient estimator of θ
   (b) T_n is an unbiased estimator of θ
   (c) T_n is a consistent estimator of θ
   (d) T_n is an efficient estimator of θ

9. The bias of an estimator can be

   (a) Positive
   (b) Negative
   (c) Zero
   (d) Any value

10. Let $X_1, X_2, \ldots, X_n$ be a random sample of size n from a population. Then for the population variance σ^2,

    (a) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is an unbiased estimator

(b) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is a biased estimator

(c) $\sum_{i=1}^{n}(X_i - \bar{X})^2$ is an unbiased estimator

(d) None of the above.

11. Let T_n be an estimator of θ. If $E(T_n)$ is not equal to θ, then

(a) T_n is a sufficient estimator of θ

(b) T_n is an unbiased estimator of θ

(c) T_n is a consistent estimator of θ

(d) T_n is a biased estimator of θ

12. The estimator $\frac{\sum X_n}{n}$ of population mean is

(a) an unbiased estimator

(b) a consistent estimator

(c) a sufficient estimator

(d) all the above.

13. If $S^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$. The unbiased estimator of population variance is

(a) $\frac{n}{n-1}S^2$

(b) $\frac{1}{n-1}S^2$

(c) $\frac{n-1}{n}S^2$

(d) $\frac{1}{n}S^2$

14. Let T_n be an estimator of θ. If $T_n \xrightarrow{P} \theta$, then

(a) T_n is a sufficient estimator of θ

(b) T_n is an unbiased estimator of θ

(c) T_n is a consistent estimator of θ

(d) T_n is an efficient estimator of θ

15. Let T_n be a consistent estimator of θ. Then

(a) $T_n \xrightarrow{P} \theta$

(b) $P[|T_n - \theta| < \epsilon] \to 1$ as $n \to \infty$

(c) $P[|T_n - \theta| > \epsilon] \to 0$ as $n \to \infty$

(d) All the above.

16. Let T_n be a consistent estimator of θ. Then which of the following is not always true.

    (a) $T_n \xrightarrow{P} \theta$

    (b) $P[|T_n - \theta| < \epsilon] \to 1$ as $n \to \infty$

    (c) $P[|T_n - \theta| > \epsilon] \to 0$ as $n \to \infty$

    (d) $E[T_n] \to \theta$ and $V(T_n) \to 0$.

17. Factorisation theorem for sufficiency is known as

    (a) Rao-Blackwell Theorem

    (b) Fisher-Neymann Theorem

    (c) Cramer-Rao Theorem

    (d) Neymann-Pearson Theorem.

18. Which of the following statements are not correct

    (a) If relative efficiency of T_1 with respect to T_2 is greater than 1, then T_1 is more efficient that T_2.

    (b) If relative efficiency of T_1 with respect to T_2 is less than 1, then T_2 is more efficient that T_1.

    (c) If relative efficiency of T_1 with respect to T_2 is equal to 1, then T_1 and T_2 are equally efficient.

    (d) If relative efficiency of T_1 with respect to T_2 is less than 1, then T_1 is more efficient that T_2.

19. For two unbiased estimators T_1 and T_2, if $V(T_1) > V(T_2)$, then

    (a) T_1 is more efficient than T_2.

    (b) T_2 is more efficient than T_1.

    (c) T_1 and T_2 are equally efficient.

    (d) None of the above.

20. For two unbiased estimators T_1 and T_2, T_1 is more efficient than T_2 if

    (a) $\frac{V(T_1)}{V(T_2)} > 1$

    (b) $\frac{V(T_2)}{V(T_1)} > 1$

    (c) $\frac{V(T_2)}{V(T_1)} < 1$

    (d) None of the above.

21. Cramer - Rao inequality provides an
    (a) upper bound for variance of unbiased estimator
    (b) lower bound for variance of unbiased estimator
    (c) both upper and lower bounds for variance of unbiased estimator
    (d) None of the above.

22. Which of the following statements are true about minimal sufficient statistic
    (a) It cannot be reduced further without loss of information.
    (b) It can be expressed as a function of every other sufficient statistic.
    (c) both (a) and (b).
    (d) neither (a) nor (b).

23. A estimator which provides all the information provided by a sample with respect to the parameter is called
    (a) unbiased
    (b) consistent
    (c) efficient
    (d) sufficient

24. As the sample size increases the expected value of the statistic tends to the parameter and its variance tends to zero is a
    (a) sufficient condition for consistency
    (b) necessary condition for consistency
    (c) necessary and sufficient condition for consistency
    (d) neither necessary nor a sufficient condition for consistency

25. The maximum possible form of reduction of sample values without loss of information will lead to
    (a) sufficient statistic
    (b) minimal sufficient statistic
    (c) maximal sufficient statistic
    (d) efficient statistic

26. The method of estimation which works on the principle of minimising the sum of squares of deviations of observations from their expected value is

(a) method of moment

(b) method of maximum likelihood

(c) method of minimum variance

(d) method of least squares

27. For a complete statistic to be useful, they must be

(a) Sufficient

(b) Unbiased

(c) Consistent

(d) Efficient

28. Let T be the minimum variance unbiased estimator. Then

(a) $V(T) <$ Cramer-Rao lower bound

(b) $V(T) >$ Cramer-Rao lower bound

(c) $V(T) =$ Cramer-Rao lower bound

(d) $V(T) \geq$ Cramer-Rao lower bound

29. Let $X_1, X_2, \ldots, X_n$ be a random sample from Poisson (λ). Then the moment estimator of λ is

(a) $\bar{X}$

(b) $\sum X_i$

(c) $\frac{1}{\bar{X}}$

(d) All the above.

30. Maximum likelihood estimator need not be always

(a) unbiased

(b) consistent

(c) efficient

(d) asymptotically normal

31. Which of the following represents confidence coefficient

(a) α

(b) $\alpha/2$

(c) $1 - \alpha$

(d) $1 - \alpha/2$

32. For a normal population, $\left[\bar{X} - z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}, \bar{X} + z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}\right]$ is the confidence interval for μ when

(a) σ is known

(b) σ is unknown and n is large

(c) σ is unknown and n is small

(d) Both (a) and (b).

33. For a normal population, $\left[\bar{X} - z_{\frac{\alpha}{2}} \frac{S}{\sqrt{n}}, \bar{X} + z_{\frac{\alpha}{2}} \frac{S}{\sqrt{n}}\right]$ is the confidence interval for μ when

(a) σ is known

(b) σ is unknown and n is large

(c) σ is unknown and n is small

(d) Both (a) and (b).

34. For a normal population, $\left[\bar{X} - t_{n-1, \frac{\alpha}{2}} \frac{S}{\sqrt{n}}, \bar{X} + t_{n-1, \frac{\alpha}{2}} \frac{S}{\sqrt{n}}\right]$ is the confidence interval for μ when

(a) σ is known

(b) σ is unknown and n is large

(c) σ is unknown and n is small

(d) Both (a) and (b).

35. The 95% C.I. for population proportion is

(a) $\left[p' - 1.96\sqrt{\frac{p'q'}{n}}, p' + 1.96\sqrt{\frac{p'q'}{n}}\right]$.

(b) $\left[p' - 2.326\sqrt{\frac{p'q'}{n}}, p' + 2.326\sqrt{\frac{p'q'}{n}}\right]$.

(c) $\left[p' - 2.58\sqrt{\frac{p'q'}{n}}, p' + 2.58\sqrt{\frac{p'q'}{n}}\right]$.

(d) $\left[p' - 3.21\sqrt{\frac{p'q'}{n}}, p' + 3.21\sqrt{\frac{p'q'}{n}}\right]$.

36. A hypothesis that completely specifies the distribution is called a

(a) simple hypothesis

(b) composite hypothesis

(c) null hypothesis

(d) alternative hypothesis

37. Suppose $X \sim B(10, p)$. Then which of the following is a simple hypothesis about its parameter?

(a) $H : n = 8, p \neq \frac{1}{4}$

(b) $H : n = 10, p = \frac{1}{4}$

(c) $H : n = 8, p < \frac{2}{3}$

(d) $H : p = \frac{1}{4}$

38. We fail to reject the null hypothesis if the sample data falls in the

(a) critical region

(b) rejection region

(c) acceptance region

(d) None of these

39. The statistic based on whose value the null hypothesis is rejected or accepted is called

(a) the test statistic

(b) the test criterion

(c) both (a) and (b)

(d) Neither (a) nor (b).

40. Rejecting H_0 when it is true is called

(a) level of significance

(b) type I error

(c) type II error

(d) none of these

41. Accepting H_0 when it is false is called

(a) level of significance

(b) type I error

(c) type II error

(d) Power

42. The fixed level of P(Type I error) is called

(a) Power of the test
(b) Level of significance
(c) Both (a) and (b)
(d) Neither (a) nor (b)

43. Among all the tests whose size is less than or equal to α the one for which β is minimum is called one for which

(a) Most powerful test
(b) Best test
(c) Both (a) and (b)
(d) Neither (a) nor (b)

44. Power of a test is denoted by

(a) α
(b) $1 - \alpha$
(c) β
(d) $1 - \beta$

45. Sensitiveness of the test is given by

(a) α
(b) $1 - \alpha$
(c) β
(d) $1 - \beta$

46. The value of the test statistic which separates the critical region and acceptance region is called

(a) test statistic value
(b) level of significance
(c) critical value
(d) None of the above

47. Best critical region for a simple H_0 against a simple H_1 is given by

(a) Rao-Blackwell Theorem

(b) Fisher-Neymann Theorem

(c) Cramer-Rao Theorem

(d) Neymann-Pearson Lemma.

48. The test statistic used in large sample tests is

(a) Z-statistic

(b) t-statistic

(c) F-statistic

(d) χ^2-statistic

49. In the test concerning mean of a normal population t-test is used when

(a) σ is known and n is large.

(b) σ is known and n is small.

(c) σ is unknown and n is large.

(d) σ is unknown and n is small.

50. To test the mean of a normal population when σ is unknown and n is large, the test statistic used is

(a) $\frac{\bar{X}-\mu_0}{\frac{\sigma}{\sqrt{n}}}$

(b) $\frac{\mu_0-\bar{X}}{\frac{\sigma}{\sqrt{n}}}$

(c) $\frac{\bar{X}-\mu_0}{\frac{S}{\sqrt{n}}}$

(d) $\frac{\mu_0-\bar{X}}{\frac{S}{\sqrt{n}}}$

51. Critical value for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$ at 5% level when $n = 38$ is

(a) 1.96

(b) 1.645

(c) 2.145

(d) 1.761

52. Critical value for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu > \mu_0$ at 5% level when $n = 15$ is

(a) 1.96

(b) 1.645

(c) 2.145

(d) 1.761

53. Critical value for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$ at 5% level when $n = 15$ is

(a) 2.145

(b) 1.761

(c) -2.145

(d) -1.761

54. To test $H_0 : \mu_1 = \mu_2$ against $H_1 : \mu_1 \neq \mu_2$ the best critical region for large n is given by

(a) $Z < z_\alpha$

(b) $Z > z_\alpha$

(c) $|Z| \geq z_{\frac{\alpha}{2}}$

(d) $|Z| \leq z_{\frac{\alpha}{2}}$

55. To test $H_0 : \mu_1 = \mu_2$ against $H_1 : \mu_1 > \mu_2$ the best critical region for large n is given by

(a) $Z < z_\alpha$

(b) $Z > z_\alpha$

(c) $|Z| \geq z_{\frac{\alpha}{2}}$

(d) $|Z| \leq z_{\frac{\alpha}{2}}$

56. To test the proportion $H_0 : p = p_0$ against $H_1 : p < p_0$ the best critical region is given by

(a) $Z < -z_\alpha$

(b) $Z > z_\alpha$

(c) $|Z| \geq z_{\frac{\alpha}{2}}$

(d) $|Z| \leq z_{\frac{\alpha}{2}}$

57. To test the proportion $H_0 : p = p_0$, the test statistic is given by

(a) $\frac{p' - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$

(b) $\frac{p_0 - p'}{\sqrt{\frac{p_0 q_0}{n}}}$

(c) $\frac{p' - p_0}{\sqrt{\frac{pq}{n}}}$

(d) $\frac{p_0 - p'}{\sqrt{\frac{pq}{n}}}$

58. In the test for proportion $H_0 : p_1 = p_2$ against $H_1 : p_1 \neq p_2$, the best critical region is given by

(a) $Z > z_\alpha$

(b) $Z > -z_\alpha$

(c) $Z < z_\alpha$

(d) None of the above

59. Which of the following is not an assumption of t-test?

(a) The parent population from which the sample is drawn is normal.

(b) The sample observations are dependent and random.

(c) The sample size should be small (i.e., $n < 30$).

(d) The population standard deviation σ is unknown.

60. To study the effect of a new teaching method, scores on different students are recorded before and after implementing the method. The test used to study the effectiveness of the new method is

(a) dependent sample Z-test

(b) independent sample Z-test

(c) dependent sample t-test

(d) independent sample t-test

61. For testing the correlation coefficient we use

(a) Z-test

(b) t-test

(c) F-test

(d) χ^2-test

62. To test $H_0 : \mu = \mu_0$ we use the test statistic $Z = \frac{\bar{X} - \mu_0}{\frac{S}{\sqrt{n}}}$ when

(a) σ is known and n is small

(b) σ is unknown and n is small

(c) σ is known and n is large

(d) σ is unknown and n is large

63. The test statistic $\frac{\bar{X}-\mu_0}{\frac{S}{\sqrt{n}}}$ for testing the mean of a normal population follows t-distribution when

(a) σ is known and n is small

(b) σ is unknown and n is small

(c) σ is known and n is large

(d) σ is unknown and n is large

64. The statistic $\frac{r\sqrt{(n-2)}}{\sqrt{1-r^2}}$ for testing the correlation coefficient follows

(a) χ^2 distribution with $n-1$ degrees of freedom.

(b) χ^2 distribution with $n-2$ degrees of freedom.

(c) t distribution with $n-1$ degrees of freedom.

(d) t distribution with $n-2$ degrees of freedom.

65. To test if the given normal population has a specified variance we make use of

(a) Z-test

(b) t-test

(c) F-test

(d) χ^2-test

66. The test used for testing the equality of standard deviations of two normal populations is

(a) Z-test

(b) t-test

(c) F-test

(d) χ^2-test

67. In chi-square test for goodness of fit, if the calculated value of the test statistic is 0, we can conclude that

(a) observed frequencies and expected frequencies are equal.

(b) observed frequencies are greater than expected frequencies

(c) observed frequencies are less than expected frequencies

(d) no such conclusions can be obtained.

68. The critical region for χ^2-test for goodness of fit is

(a) $\chi^2 > \chi^2_\alpha$

(b) $\chi^2 < \chi^2_\alpha$

(c) $\chi^2 > \chi^2_{\frac{\alpha}{2}}$

(d) $\chi^2 < \chi^2_{\frac{\alpha}{2}}$

69. The degrees of freedom corresponding to a χ^2-test for independence of attributes having 3 rows and 4 columns is

(a) 12

(b) 7

(c) 6

(d) 5

70. Yate's correction is applied when an

(a) expected cell frequency is less than 5

(b) expected cell frequency is more than 5

(c) observed cell frequency is less than 5

(d) observed cell frequency is more than 5

71. Analysis of variance is used for testing

(a) two population variances

(b) two or more population variances

(c) two population means

(d) two or more population means

72. Which of the following is not an assumption of ANOVA

(a) Observations y_{ij}'s are independent and random.

(b) Parent populations are normal with common variance σ^2

(c) Different effects are additive in nature.

(d) Error component follows $N(0, 1)$

73. In one-way ANOVA, the total variation is partitioned into

(a) 2 components

(b) 3 components

(c) 4 components

(d) can't be partitioned

74. In two-way ANOVA, the total variation is partitioned into

(a) 2 components

(b) 3 components

(c) 4 components

(d) can't be partitioned

75. When is mean sum of squares due to error becomes an unbiased estimator of σ^2

(a) under H_0

(b) under H_1

(c) always

(d) never

76. When is mean sum of squares due to treatment becomes an unbiased estimator of σ^2

(a) always

(b) under H_0

(c) under H_1

(d) never

77. A larger value of F in ANOVA implies that

(a) variation due to assignable causes is equal to that of chance causes.

(b) variation due to assignable causes is less than to that of chance causes.

(c) variation due to assignable causes is more than to that of chance causes.

(d) none of the above is true.

78. Which of the following is not related to non-parametric methods

(a) Easily understandable.

(b) Short calculations.

(c) Assumption of distribution is required.

(d) Applicable to all types of data.

79. Non-parametric tests can be applied

(a) when the population distribution is not known

(b) when the sample size is not large to enough for normal approximation

(c) when the data is qualitative.

(d) All the above cases.

80. Test statistic corresponding to large sample approximation of median test follows

(a) Z-distribution

(b) t-distribution

(c) F-distribution

(d) χ^2-distribution

81. To test the randomness in data, one may use

(a) Sign test

(b) Wald-Wolfowitz test

(c) Wilcoxon test

(d) Mann-Whitnney test

82. To apply sign test, the population should be

(a) continuous, symmetrical and non-normal

(b) continuous, symmetrical and normal

(c) continuous, not-symmetrical and non-normal

(d) discrete, symmetrical and non-normal

83. Which of the following tests cannot be used for testing the equality of two population medians

(a) Median test

(b) Mann-Whitnney U test

(c) Wilcoxon Rank Sum Test

(d) Kruskal-Wallis Test

84. Non-parametric analogue of one - way ANOVA is

(a) Median test

(b) Mann-Whitnney U test

(c) Wilcoxon Rank Sum Test

(d) Kruskal-Wallis Test

85. Kruskal-Wallis Test is used for testing the equality of

(a) several population means

(b) several population variances

(c) several population medians

(d) none of these.

86. Statistical quality control is based on the theory of

(a) probability

(b) sampling

(c) both (a) and (b)

(d) neither (a) nor (b)

87. Variations in the quality characteristic of a product is due to

(a) chance causes

(b) assignable causes

(c) both (a) and (b)

(d) neither (a) nor (b)

88. Chance variation in respect of quality control of a product is

(a) uncontrollable

(b) not effecting the quality of a product

(c) tolerable

(d) all the above

89. Faults due to assignable causes:

(a) can be removed

(b) can't be removed

(c) can sometimes be removed

(d) all the above

90. The proportion of defective items in the manufactured product is not too large is ensured by

(a) process control

(b) product control

(c) both (a) and (b)

(d) neither (a) nor (b)

91. Controlling the quality of the product by critical examination at strategic points is achieved through

(a) Control charts

(b) Specification Limits

(c) Sampling Inspection Plans

(d) Tolerance Limits

92. Control chart consists of

(a) three control lines

(b) upper and lower control limits

(c) the level of the process

(d) all the above

93. Control charts are meant for:

(a) describing the pattern of variation

(b) checking whether the variability of the product is within the tolerance limit or not.

(c) uncovering whether the variability of the product is due to assignable causes or not.

(d) all the above.

94. 3σ Control limits is proposed by

(a) H.F. Dodge

(b) H.C. Romig

(c) W.A. Shewhart

(d) W.Z. Gosset.

95. Which among the following is not a control charts for attributes?

(a) R chart

(b) p chart

(c) d chart

(d) c chart

96. Control chart for fraction defective is called

(a) $\bar{X}$ chart

(b) p chart

(c) d chart

(d) c chart

97. Control chart for number of defective is called

(a) $\bar{X}$ chart

(b) p chart

(c) d chart

(d) c chart

98. Control chart for number of defects is called

(a) $\bar{X}$ chart

(b) p chart

(c) d chart

(d) c chart

99. A production process is said to be in a state of statistical control, if it is governed by

(a) chance cause alone

(b) assignable cause alone

(c) both (a) and (b)

(d) neither (a) nor (b).

100. The upper and lower control limits of $\bar{x}$ chart is $\mu' \pm A\sigma'$ when

(a) mean and variance are known

(b) mean and variance are unknown

(c) mean is known and variance is known

(d) mean is unknown and variance is known

Answers

1) c	2) a	3) d	4) b	5) a	6) d	7) b	8) b	9) d	10) b
11) d	12) d	13) a	14) c	15) d	16) d	17) b	18) d	19) b	20) b
21) b	22) c	23) d	24) a	25) b	26) d	27) a	28) d	29) a	30) a
31) c	32) a	33) b	34) c	35) a	36) a	37) b	38) c	39) c	40) b
41) c	42) b	43) c	44) d	45) d	46) c	47) d	48) a	49) d	50) c
51) a	52) d	53) a	54) c	55) b	56) a	57) a	58) d	59) b	60) c
61) b	62) d	63) b	64) d	65) d	66) c	67) a	68) a	69) c	70) a
71) d	72) d	73) a	74) b	75) c	76) b	77) c	78) c	79) d	80) d
81) b	82) a	83) d	84) d	85) c	86) c	87) c	88) d	89) a	90) a
91) c	92) a	93) d	94) c	95) a	96) b	97) c	98) d	99) a	100) a

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