SHIVAJI UNIVERSITY, KOLHAPUR

M.Sc. Statistics / Applied Statistics & Information Entrance Examination 2023

Sub. Code : 58715

Day and Date : Tuesday, 08-08-2023
Time : 01.00 p.m. To 02.30 p.m.

Total Marks : 100

Instructions: 1) All questions are compulsory.
2) All questions carry equal marks

1. **Which of the following is not a disadvantage of using mean?**

   A. It is affected by extreme values

   B. It cannot be computed in grouped data with open-ended class intervals

   C. It does not possess the desired algebraic property

   D. None of the above

2. **Mode refers to the value within a series that occurs .... number of times.**

   A. Maximum   B. Minimum

   C. Zero   D. Infinite

3. **The values of extreme items do not influence the average for ....**

   A. Mean   B. Mode

   C. Median   D. None of the above

4. **A fair die is tossed twice, and then what is probability that sum of outcomes are 10?**

   A. 1/12   B. 1/9

   C. 1/6   D. 1/3

5. **If $T_{xy} = 0.8$ and if $u = 2x + 1$, $v = 3 - y$, then $_{uv} =$ ....**

   A. 0.8.   B. -0.8

   C. 0.64   D. -0.64

6. **If 2x + 3y = 0 holds for all values of random variables X and Y, then the coefficient of correlation (r) between X and Y is ...**

   A. -0.6

   B. 1

   C. -1

   D. 0.6

7. **In Paasche's quantity index number......are used as weights.**

   A. current year quantities

   B. base year quantities

   C. base year prices

   D. current year prices

8. **The distribution function of a continuous random variable is....**

   A. logarithmic function

   B. step function

   C. exponential function

   D. constant function

9. **The conditional mean E(X | Y=y) is a function of ....**

   A. x

   B. y

   C. x and y

   D. None of these

10. **Which of the following is not true?**

    A. Range is measure of dispersion

    B. Standard deviation is measure of dispersion

    C. Mean deviation is measure of dispersion

    D. None of these

11. **If X is a Poisson distributed random variable with $\frac{P[X=0]}{P[X=1]} = 5$, then mean of X is..............**

    A) 2

    B) 3

    C) 5

    D) 4

12. **The cumulant generating function (c.g.f.) of a continuous r. v. X is-log(1-2t) then E(X) is...**

    A) 2

    B) 5

    C) 3

    D) 0.5

13. If $E(E(Y|X)) = 10$ then...

   A) $E(X) = 10$ B) $E(Y) = 10$

   C) $V(Y) = 10$ D) $V(X) = 10$

14. If $R_{2.13} = 0$ then all total and partial correlation coefficients involving X2 are........

   A) 1   B) 0

   C) -1   D) 0.5

15. If NRR>1 then the total population

   A) decreases   B) increases

   C) double   D) remain as it is

16 Mean of random variable having β_1 (1,2) distibution?

   A) 1   B) 1/2

   C) 1/3   D) 2/3

17. Let $X-N(0,5)$, then $P(X>0) = $ ....

   A) 0.32   B) 0.5

   C) 0.68   D) 0.95

18. Control chart in statistical quality control is not meant for checking the ...

   A) pattern of variation

   B) variability in the product is within the tolerance limit or not

   C) variability in the product is due to assignable causes or not

   D) linear trend

19. The control chart for number of defects per item is........

   A) p-chart   B) R-chart

   C) c-chart   D) X chart

20. In testing of hypothesis, type I error is......................

   A) reject H_0 when it is true   B) reject H_0 when it is false

   C) accept H_0 when it is true   D) accept H_0 when it is false

21. **If X follows Normal distribution with parameter (μ, σ^2) then its second central moment is ....**

A) μ^2

B) σ^2

C) $\mu^2 + \sigma^2$

D) None of these

22. **If a r.v. X has log-normal distribution with parameters (5, 4), then its mean is ------**

A) e^{-7}

B) e^{-9}

C) e^{-2}

D) 5

23. **If X follows Cauchy distribution with parameter (μ, λ) then mean of the distribution is**

A) μ

B) λ

C) $\dfrac{\mu}{\mu + \lambda}$

D) Mean does not exists

24. **If X follows Gamma distribution with parameter (1, 1) then cdf of X is .....**

A) e^{-x}

B) $1-e^{-x}$

C) $1-e^{x}$

D) $1 + e^{x}$

25. **The M.G.F. My (t) of standard logistic distribution is ....**

A) $\beta(1+t, 1-t)$

B) $\beta(1-t, 1+t)$

C) $\beta(1+t, 1+t)$

D) None of these

26. **If X has Pareto distribution with parameters a and β then variance of X is ....**

A) α

B) β

C) β^2

D) None of the above

27. **Which of the following distribution is a particular case of power series distribution?**

A) Exponential

B) Poisson

C) Normal

D) Uniform

28. If (X,Y) follows trinomial distribution with joint pmf

$$P(x, y) = \frac{n!}{x!\, y!\,(n - x - y)!} p^x q^y (1 - p - q)^{n-x-y} \qquad x, y = 0,1,2,\ldots, n$$

$$x + y \leq n,\, p + q < 1,\, 0 < p, q < 1$$

Then correlation coefficient between X and Y is --------

A) $\dfrac{-pq}{(1 - p)(1 - q)}$

B) $-\left[\dfrac{pq}{(1 - p)(1 - q)}\right]^{\frac{1}{2}}$

C) $\dfrac{pq}{(1 - p)(1 - q)}$

D) None of these

29. Following is the pmf of truncated Poisson variate truncated at 0,

$$P(X = k) = C \frac{e^{-\lambda} \lambda^k}{k!} \quad k = 1,2,\ldots \text{ then the value of C is } \ldots\ldots\ldots\ldots$$

A) λ^{-1}

B) $1 - e^{-\lambda}$

C) $(1 - e^{-\lambda})^{-1}$

D) λ

30. Let X and Y be two independent gamma random variables with parameters (shape 1, scale 1) and (shape 2, scale 1) respectively then distribution of $\frac{X}{Y}$ is

A) Beta distribution of first kind with parameters (1,1)

B) Beta distribution of second kind with parameters (1,1)

C) Beta distribution of first kind with parameters (1,2)

D) None of these

31. If 4, 1, 3, 2, 5 are observations on X, where X has a Binomial distribution (5,P) then the moment estimator of θ is

A) 2.5

B) 3

C) 4

D) 3.5

32. If $X_1, X_2, \ldots\ldots\ldots\ldots X_n$ is random sample from B(1, p) then the statistic T(x) = $\sum_i X_i$ is

A) unbiased for p

B) Sufficient for p

C) Consistent for p

D) none of these.

33. If X_1, X_2, ..., X_n be a random sample from U(θ-1, θ+ 1) then which of the following is not the unbiased estimator of θ?

A) $\bar{X}$

B) X_1

C) $\dfrac{(X_1 + X_2)}{2}$

D) $X_{\left(\frac{m}{2}\right)}$

34. T_n is a consistent estimator of $\psi(\theta)$ if

A) T_n converges to θ with probability one.

B) $\lim\limits_{n \to \infty} P(|T_n - \psi(\theta)| < \epsilon) \to 0$

C) $\lim\limits_{n \to \infty} P(|T_n - \psi(\theta)| > \epsilon) \to 1$

D) None of the above

35. Let $s^2 = \dfrac{1}{n-1}\Sigma(x_i - \bar{x})^2$, then an unbiased estimator of population variance σ^2 is

A) (n - 1) s²/n

B) S²

C) ns²/ (n -1)

D) None of the above

36. Cramer-Rao inequality with regard to the variance of an estimator provides

A) Upper bound of the variance

B) Lower bound of the variance

C) Asymptotic variance of an estimator

D) None of these.

37 If a statistic T is unbiased estimator of parameter 8 then unbiased estimator of aθ-b is

A) aT

B) aT+b

C) aT-b

D) T+b

38. If T_n is a sufficient statistic of θ then $\dfrac{d\log L}{d\theta}$ is function of only

A) T_n

B) T_n and θ

C) θ

D) Neither T_n nor θ

39. A one-dimensional statistic that best estimates the parameter is known as

A) Point Estimator

B) Interval Estimator

C) Interval Estimate

D) Point Estimate

40. Mean square error of an estimator T of a parameter θ is

A) $E(T^2)\,\theta^2$

B) $E(T)-\theta$

C) $E(T-\theta)^2$

D) $E(T^2)+\theta^2$

41. In factorial designs, if the difference between responses produced when the level of one factor is fixed while the levels of other factor change is significantly large, is indicative of presence of

A. main effect

B. confounding

C. interaction

D. None of these alternatives is correct

42. In a one-way ANOVA, if the observed value of the F test statistic is greater critical F value, you: than the

A. reject HO because there is evidence that all the means differ

B. reject HO because there is evidence that at least one of the means differs from the others

C. do not reject HO because there is no evidence of a difference in the means

D. do not reject HO because one mean is different from the others

43. A car rental company wants to select a computer software package for its reservation system. Three software packages (A, B, and C) are commercially available. The car rental company will choose the package that has the lowest mean number of renters for whom a car is not available at the time of pickup. An experiment is set up in which each package is used to make reservations for five randomly selected weeks. How should the data be analyzed?

A. Chi-square test

B. One-way ANOVA F test

C. t test for the differences in means

D. Likelihood ratio test

44. A 2 X 2 factorial design

A. is a one-way ANOVA.

B. results in four orthogonal treatment contrasts

C. contains significant interaction effects.

D. can be viewed as two-way ANOVA with interaction 45. For fast-food restaurants, the drive-through window is an increasing source of revenue. The chain that offers that fastest service is considered most likely to attract additional customers. In a study of 20 drive-through times (from menu board to departure) at 5 fast-food chains, the following ANOVA table was developed.

Source	DF	Sum of Squares	Mean Squares	F
Among Groups (Chains)		6,536	1,634.0	12.51
Within Groups (Chains)	95		130.6	
....		....		
Total	99	18,943		

The degrees of freedom associated with the F statistics in the last column are:

A. (5,95)   B) (4,95)

C. (4,99)   D. (5,99)

46. Which of the following is correct?

A. If there are no main effects, there can be no interactions.

B. Whenever interactions are found, there must be main effects.

C. Whenever main effects are found, there must be at least one interaction,

D. When both interactions and main effects are found, the interactions are interpreted first.

47. How would an interaction be indicated in a graphical representation?

A. as parallel lines   B. as intersecting lines

C. as overlapping lines   D. as diagonal lines

48. Which of the following is not a basic principle of experimental design?

A. Randomization

B. Replication

C. Local Control

D. Normality of random errors

49. The model (in usual notation) $Y_{ijk} = \mu + \alpha_i + \beta_j + \tau_k + \epsilon_{ijk}$, $i=1,...,p; j=1,2...,q;$ **k=1, 2,..n$_{ij}$ where at least two of nu are distinct is a set up corresponding to......**

A. RBD

B. Factorial experiment

C. LSD

D. None of these

50. The Kruskal-Wallis test is the nonparametric alternative to the.......

A. One way ANOVA

B. Two way ANOVA

C. x^2 - test for independence

D. x^2 - test for goodness of fit

51. If X$_1$, X$_2$, X$_3$, X$_n$ is random sample from the p.d.f. f(x) and c.d.f. F(x) then pdf of nth order statistic (Y) is ....

A. $n[F(y)]^{n-1} f(y)$

B. $n[fty)]^{n-1} 'F(y)$

C. $n[F(y)]^n f(y)$

D. $n[1-F(y)]^{n-1}f(y)$

52. Let X$_1$, X$_2$, X$_3$............... X$_n$ be a random sample drawn from U(0, 1). Then the p.d.f. of the largest order statistics is ....

A. $\beta_1 (1, n)$

B. $\beta_1 (n, 1)$

C. $\beta_1 (1, 1)$

D. None of these

53. Which of the following represents the pdf of ith order statistic based on a random sample of size n drawn from pdf f(x) having cdf F(x)?

A. $[f(x)]^{n-1}$

B. $^n c, f(x) [F(x)]^{i-1}[1-F(x)]^{n-1}$

C. $\frac{n!}{[(n-i)!)(i-1)!]} f(x) [F(x)]^{i-1}[1-F(x)]^{n-1}$

D. none of the above

54. If X$_1$ X$_2$ ....X$_2$ is random sample from U(0, 1) then what is the distribution of the sample range?

A. $\beta_1 (2,2)$

B. $\beta_1 (n-1,2)$

C. $\beta_2 (n-1,n)$.

D. $\beta_1 (n,n-1)$

55. If $X_1, X_2, \ldots \ldots \ldots X_n$ is random sample from the U(0,1) then 5th order statistic is.........

   A. $\beta_1(5, n-4)$

   B. $\beta_1(n-4, 5)$

   C. $\beta_2(5, n-4)$

   D. $\beta_2(n-4, 5)$

56. If Xn P ?X then........

   A. $X_n^2 \xrightarrow{p}$

   B. $X_n^2 \xrightarrow{a.s.} x^2$

   C. $X_n^2 \xrightarrow{2} x^2$

   D. $X_n^2 \xrightarrow{D} x^2$

57. If $X_n \sim U\left(-\frac{1}{n}, \frac{1}{n}\right)$ n = 1,2,... then ....

   A. $V(X_n) \nrightarrow 0$

   B. $X_n \nrightarrow 0$ in probability but $X_n \nrightarrow 0$ weakly

   C. $X_n \nrightarrow 0$ weakly

   D. $X_n \longrightarrow 0$ probability

58. Which of the following may not hold true for sequences of random variables?

   A. $X_n \xrightarrow{p} X \Longrightarrow X_n \xrightarrow{d} X$

   B. $X_n \xrightarrow{p} X \Longrightarrow X_n \xrightarrow{d} X$

   C. $X_n \xrightarrow{a.s} X \Longrightarrow X_n \xrightarrow{d} X$

   D. $X_n \xrightarrow{a.s.} X \Longrightarrow X_n \xrightarrow{p} X$

59. Convergence in probability of sample mean to population mean under certain regularity conditions is known as

   A. Weak law of large numbers

   B. Central limit theorem

   C. Both (A) and (B)

   D. None of these

60. Let $X_1, X_2 \ldots \ldots \ldots \ldots$ be a sequence of independent and identically distributed Chi-square random variables, each having 4 degrees of freedom. Define $S_n = \sum X_i^2$ n = 1,2,,... . If $\frac{S_n}{n} \xrightarrow{p} \mu$, as $n \to \infty$ then μ is equal to............

   A. 8

   B. 16

   C. 24

   D. 32

61. In a SRSWR, the probability that a specified element is not included in a sample of size n drawn from the population of size N is

   A) $\frac{1}{N}$

   B) $\frac{n}{N}$

   C) $\left(1 - \frac{1}{N}\right)^n$

   D) $1 - \left(1 - \frac{1}{N}\right)^n$

62. In which sampling, the sample units are dependent?

A) With replacement scheme

B) Without replacement scheme

C) In both with replacement and without replacement

D) None of these

63 In SRSWOR scheme, which of the following is correct?

A) Every unit in the population has same chance being selected in sample

B) The number of ways to the unit selected in sample is "C

C) The number of ways to the unit selected in sample is N

D) Units in the sample are independent.

64. With usual notations ratio estimator of population mean defined as

A) $\bar{y}_R = \bar{y} - b * \bar{X}$

B) $\bar{y}_R = \left(\frac{\bar{x}}{\bar{y}}\right) * \bar{X}$

C) $\bar{y}_R = \left(\frac{\bar{y}}{\bar{x}}\right) * \bar{X}$

D) $\bar{y}_R = \bar{y} - b * (\bar{x} - \bar{X})$

65. When Ratio estimator is used?

A) The study variable is correlated with auxiliary variable

B) The study variable is correlated with auxiliary variable and aggregate information auxiliary variable is available.

C) Sampling frame is not available

D) Anytime we can used ratio estimator

66. With usual notations, in cluster sampling with equal cluster size, which of the following is true?

Statement I : An unbiased estimator of population mean is $\bar{\bar{y}} = \sum_{i=1}^{N}\sum_{j=1}^{M} y_{ij}$

Statement II: The variance of $\bar{\bar{y}}$ is $(1 - f)S^2 \frac{[1+(M-1)\rho_{cl}]}{Mn}$

A) Only statement I is true

B) Only statement II is true

C) Both statements I and II are true

D) Neither statement I nor II is true

67. **In stratified sampling, equal allocation is used when..........**

A) Sampling per unit cost is high

B) stratum variability is unknown but stratum size is known

C) Both stratum variability and stratum size is unknown

D) Either stratum variability and stratum size is unknown

68. **Consider the following statements**

Statement I : Regression estimator is always better than SRS estimator

Statement II : Regression estimator and ratio estimator are equivalent if regression line passing through origin.

A) Only statement (I) is true

B) Only statement (II) is true

C) Both statements I and II are true

D) Neither statement I nor II is true

69. **A researcher intends to study the adjustment problem of students who are slum dwellers. What should be the sampling procedure used for such a study?**

A) Simple random sampling   B) Stratified random sampling

C) Systematic random sampling: D) Cluster sampling

70. **Suppose there are k strata of N = kM units each with size M. Draw a sample of size ith, with replacement from it stratum and denote by $\bar{y}^1$ the sample mean of the study variable selected in the ith stratum, i= 1, 2,...,k. Define**

$$y\,\bar{y}_s = \frac{1}{k}\sum_{i=1}^{k}\bar{y}_i \text{ and } \bar{y}_w = \frac{\sum_{i=1}^{k}n_i\bar{y}_i}{n}$$

Which of the following is necessarily true?

A) $\bar{y}_s$ is unbiased but $\bar{y}_w$ is not unbiased for the population mean

B) $\bar{y}_s$ is not unbiased but $\bar{y}_w$ is unbiased for the population mean

C) Both $\bar{y}_s$ and $\bar{y}_w$ are unbiased for the population mean

D) Neither $\bar{y}_s$ nor $\bar{y}_w$ is unbiased for the population mean

71. Which of the following event is considered as type I error?

    A. Accept H_0 when H_1 true   B. Reject H_0 when H_1 true

    C. Reject H_0 when H_0 true   D. Accept H_0 when H_0 true

72. The power of the test is related with........

    A. Type-l error   B. Type-II error

    C. Size of test   D. None of these

73. SPRT was invented by:

    A. R.A.Fisher   B. Abraham Wald

    C. Karl-Pearson   D. None of these

74. In SPRT sample size is

    A. Fixed   B. Random

    C. Constant   D. None of these

75. The decision in a sequentional Probability ratio test depends on:

    A. P(type I error)

    B. P(type II error)

    C. P(type I error) and P(type II error)

    D. None of these

76. Which of the following is used as at test for goodness of fit?

    A. t-test.   B. F-test

    C. sign test   D. K-S Test

77. If following is the arrangement of male (M) and female (F) in a queue as MMFMFFMFFMFFFMMMFFFM

    Then total number of runs is....

    A. 11   B. 20

    C. 15   D. 17

78. **Randomness of given sample can be tested by use of**

   A. Run test

   B. Sign test

   C. K.S. test

   D. Median test

79. **Neyman Pearson Lemma Provides:**

   A. An unbiased Test

   B. A Most Powerful test

   C. an admissible test

   D. Sufficient test

80. **In the statement $P[T_1 \leq \theta \leq T_2] = 1 - \alpha$ Then the quantity $(T_2\text{-}T_1)$ is called as:**

   A. confidence coefficient

   B. length of confidence interval

   C. Both (A) & (B)

   D. None of these

81. **Dimensions of quality contains**

   A. Performance

   B. Reliability

   C. Conformance

   D. All the above

82. **Which type of chart uses the rule of 20:80?**

   A. cause and effect chart

   B. Pareto chart

   C. fish bone diagram

   D. control chart

83. **DMAIC stands for**

   A. Define, measure, analysis, improve, check

   B. Define, measure, accept, improve, check

   C. Do, measure, analyse, improve, check

   D. Define, measure, analyse, improve, control

84. **PDCA cycle D stands for**

   A. Define

   B. Defective

   C. Defect

   D. none of these

85. **How many points did Deming give to elaborate methods for quality improvement?**

   A. 10

   B. 12

   C. 23

   D. 14

86. Cause and Effect Diagram is used to identify ....

    A. Actual Causes   B. Sub Causes

    C. Root Causes   D. Probable Causes

87. .... is not a seven SPC tool.

    A. histogram   B. Check sheet

    C. Sampling Inspection plan   D. Pareto Chart

88. Quality is .... proportional to variability.

    A. directly   B. inversely

    C. both (A) and (B)   D. none of these

89. R is an .... programming language?

    A. Closed   B. GPL

    C. Open Source   D. Definite source

90. Probaility of accepting bad lot is call as .... risk.

    A. Producers   B. Consumers

    C. Both (A) and (B)   D. None of these

91. Which of the following is not correct about LPP?

    A. All constraints must be linear relationships.

    B. Objective function must be linear.

    C. All the constraints and decision variables must be of either '$\leq$' or '$\geq$' type.

    D. All decision variables must be non-negative.

92. A constrains in an LPP is expressed as

    A. an equation with = sign

    B. inequality with $\geq$ sign

    C. inequality with $\leq$ sign

    D. any of the above

93. A feasible solution to an LPP

    A. must satisfy all of the problem's constraints simultaneously.

    B. must be a corner point of the feasible region.

    C. need not satisfy all of the constraints, only some of them

    D. must optimize the value of the objective function.

94. The general linear programming problem is in standard form, if

    A. the constraints are strict equations.

    B. the constraints are inequalities of '$\leq$' type.

    C. the constraints are inequalities of '$\geq$' type.

    D. the decision variables are unrestricted in sign.

95. If dual has an unbounded solution, primal has

    A. an unbounded solution

    B. an infeasible solution

    C. a feasible solution

    D. none of the above.

96. The solution to a transportation problem with m-sources and n-destinations is feasible, if the number of allocation are

    A. m + n -1   B. m + n + 1

    C. m + n   D. m x n

97. The method used for solving an assignment problem is called

    A. MODI method   B. reduced matrix method

    C. Hungarian method   D. none of the above

98. Queue can form only when

    A. arrivals exceed service capacity

    B. arrivals equals service capacity

    C. service facility is capable to serve all the arrivals at a time

    D. There are more than one service facilities

99. When there are more than one servers, customer behaviour in which he moves from one queue to another is known as

A. Balking

B. Jockeying

C. Reneging

D. Alternating

100. Simulation is

A. Descriptive in nature

B. Useful to analyse problems where analytical solution is difficult.

C. A statistical experiment as such its results are subject to statistical errors

D. All of the above.