Seat No.

Total No. of Pages : 32

M.Sc. Entrance Examination, 2024

Statistics/Applied Statistics and Informatics

Subject Code : 58715

Day and Date : Monday, 29-07-2024 **Total Marks : 100**
Time : 10.30 am to 12.00 pm

Instructions :

1) All questions are compulsory.
2) Each question carries 1 mark.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Follow the instructions given on OMR sheet.
5) Rough work shall be done on the sheet provided at the end of question paper.

Question: Choose most correct alternatives

1 Which of the following measure is not determined for data having a negative observation?

A) AM B) GM

C) Median D) Mode

2 The value of standard deviation of the data set containing negative values will be.....

A) negative B) zero

C) positive D) None of these

3 If Q_1 and Q_3 denotes the first and third quartiles respectively and the Bowley's coefficient of skewness is -1 then the median =.....

A) Q_3 B) Q_1

C) Q_3-Q_1 D) None of these

4 If A and B are two events defined on sample space 0 then P(ACB) =.....

A) 1 - $P(A^C)$ - P(A∩B)

B) P(A)-P(A∩B)

C) 1-$P(B^C)$-P(A∩B)

D) None of these

5 If B⊂A, then P(A|B) = ...

A) P(A) B) 1

C) P(B) D) None of these

6 If the Spearman's rank correlation between X and Y for 4 pairs of observation is 0.4 then the sum of squares of differences between the ranks is.....

A) 4 B) 10

C) 8 D) 6

7 If r_{xy} = -0.8 and b_{yx} =-0.4 then the value of b_{yx} is.....

A) 1.6 B) -1.6

C) 0.16 D) 0.4

8 The cost of living index is always the..... Index.

A) Price index

B) quantity index

C) value index

D) weighted index

9 If X follows one point distribution with X= C, then the mean and variance of X are.....

A) 0 and 1 B) C and 1

C) C and 0 D) C and C

10 For Binomial distribution which of the following is true?

A) Mean ≥ variance

B) Means ≤ variance

C) Mean = variance

D) Mean is negative but variance is positive

11 Moving averages method is not suitable for .....

A) removing rhythmic variations

B) Computing seasonal indices

C) removing cyclic variations

D) none of these

12 If X has N(0, 1) distribution, then $Y=X^2$ has distribution

A) χ_1^2

B) G (1/2, 1/2)

C) both of these

D) None of these

13 Suppose $X_1, X_2, \ldots\ldots, X_n$. is a random sample from $N(\mu, \sigma^2)$ distribution, then the test statistic for testing H_o: $\mu=0$, when σ^2 is known is .....

A) $\frac{\bar{x}-\mu_0}{\sigma/\sqrt{n}}$

B) $\frac{\bar{x}-\mu_0}{s/\sqrt{n}}$

C) $\frac{\bar{x}}{s/\sqrt{n}}$

D) $\frac{\bar{x}}{\sigma/\sqrt{n}}$

14 To test variance of univariate population based on single sample we use test based on ..... distribution

A) Normal

B) Chi square

C) t

D) F

15 If X_1, and X_2 are two independent N(0, 1) variates, then $Y_1 = \frac{(X_1+X_2)^2}{2}$ and $Y_2 = \frac{(X_1-X_2)^2}{2}$ are independent variates

A) Normal

B) Chi square

C) gamma

D) beta

16. For trivariate data on variables X_1, X_2 and X_3 measured from their respective means, the partial correlation coefficient lies between.....

A) 0 and 1

B) -1 and +1

C) -∞ and ∞

D) 0 and ∞

17 The survival rate ∏i always lies between .....

A) 0 and 1

B) -1 and +1

C) -∞ and ∞

D) 0 and ∞

18 In SRSWR, the probability of drawing a sample of size 'n' from population of 'N' units is .....

A) $\binom{N}{n}$

B) $\frac{1}{\binom{N}{n}}$

C) $\frac{n}{N^n}$

D) $\frac{1}{N^n}$

19 If 'X' is symmetric r. v. with E(X)=c, then $E(X-c)^3$ = ...

A) 0 B) 1

C) C D) C

20 If X and Y are two independent Negative Binomial variates with parameters (k_1, p) and 20 (k_2, p) respectively, then the distribution of (X + Y) is ..... distribution

A) Negative binomial

B) Binomial

C) Poisson

D) Geometric

21 If X follows Laplace distribution with parameter (μ, λ) then its third central moment is----

A) (2/λ) log2 B) $2/\lambda^2$

C) 0 D) $2/\mu^2$

22 If X∼LN (25,5), then V(logX) = ...

A) 5 B) $e^{52.5}$

C) e^{30} D) 25

23 If X follows Cauchy distribution with parameter (μ, λ) then coefficient of Q.D. is .....

A) λ / μ

B) $\lambda/(\mu+\lambda)$

C) $\mu/(\mu+\lambda)$

D) $\lambda \log \mu$

24 If X follows Weibull distribution with shape parameter 1 then the distribution of X is .....

A) Exponential

B) Double Exponential

C) Normal

D) Cauchy

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

A) β(1+t, 1-t)

B) β(1-t,1+t)

C) β(1+t,1+t)

D) None of these

26 If X has Pareto distribution with parameters $\propto$ and β then variance of X is .....

A) $\frac{\alpha\beta^2}{(\alpha-1)(\alpha-2)^2}$

B) $\frac{\alpha\beta^2}{(\alpha-2)(\alpha-1)^2}$

C) $\frac{\alpha\beta}{(\beta-1)^2}$

D) none of these

27 Which of the following distribution is not a particular case of power series distribution?

A) Binomial

B) Poisson

C) Normal

D) Geometric

28 If X is truncated normal variate, truncated left at X=a and truncated to the right at X=b then .....

A) P(X <a)=0

B) P(X ≤b)=0

C) P(X > a) = 0.5

D) P(X>a, X>b)=1

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

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

A) λ^{-1}

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

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

D) λ

30 If(X, Y) ~BN (0, 0, 1, 1, 0) then distribution of $\frac{X}{Y}$ is .....

A) Normal

B) Bivariate Normal

C) Cauchy

D) Uniform

31 Let X_1, X_2 be random sample of size 2 from Poisson distribution with parameter λ. Then sufficient statistic for λ is

A) X_1+X_2

B) $X_1^2+X_2$

C) $2X_1+X_2$

D) $2(X_1+X_2)$

32 Let X_1, X_2 be iid from N(θ, 1), then which of the following is not unbiased estimator for θ .

A) $X_1 + X_2$

B) X_2

C) X_1

D) $\frac{2X_1+X_2}{3}$

33 C-R inequality with respect to variance of an estimator gives

A) Lower bound of variance

B) Upper bound of variance

C) Asymptotic variance

D) Constant value

34 The expected value of squared difference between estimator and parameter is known as

A) MLE

B) Sufficiency

C) MSE

D) variance

35 Neyman factorization theorem gives

A) Minimal Sufficient statistics

B) Sufficient statistics

C) Efficient statistics

D) UMVUE

36 When estimator is consistent it is not essential that it will be .....

A) Unbiased

B) MLE

C) Sufficient

D) All of them

37 Suppose $X \sim U(0, \theta)$ the which of following estimator is efficient?

A) Moment estimator

B) MLE

C) Estimator obtained by method of minimum chi square

D) All are equally efficient

38 The MLE is usually..... than the moment estimator

A) Equally efficient

B) Less efficient

C) More efficient

D) None of thom

39 Standard error is the standard deviation of the sampling distribution of.....

A) Estimate

B) Estimator

C) Estimation

D) Error in estimation

40 If X_1, X_2, X_3, ..., Xn is a random sample of size 'n' from Bernoulli Distribution with parameter p with T= ΣXi then the unbiased estimator of p(1-p) is .....

A) T(n-T)/(n(n-1))

B) T/n

C) T/[n(n-1)]

D) T(T-1)/(n-1)

41 While analyzing the data of a k'k Latin square, the error d. f. in analysis of variance is equal to .....

A) k (k-1) (k-2)

B) (k-1) (k-2)

C) k-2

D) k2-k-2

42 The effect, which is confounded in all the blocks in an experimental design

A) is estimated more precisely

B) is estimated less precisely

C) cannot be estimated

D) none of the above

43 In one way classification, with more than two treatments, the equality of treatment means is tested by

A) t-test

B) chi-square test

C) F-test

D) none of the above

44 Randomization is a process in which the treatments are allocated to the experimental units.....

A) in a sequence

B) with equal probability

C) Allocating after every 3 units

D) none of the above

45 With usual notations, the formula for estimating one missing value in a Latin square design having b blocksand k treatments is

A) $\frac{m(R_1' + C_1' + T_1') - 2G'}{(m-1)(m-2)}$

B) $\frac{m(R_1' + C_1' + T_1') - G'}{(m-1)(m-2)}$

C) $\frac{m(R_1' + C_1' + T_1') - 2G'}{(m+1)(m+2)}$

D) $\frac{m(R_1' + C_1' + T_1') - 2G'}{m\,(m-1)}$

46 The total number of possible Latin squares in 4x4 Latin square design is.....

A) 12 B) 576

C) 161280 D) 9

47 What does the length of the 'box' in a box plot represent?

A) Maximum value

B) Median

C) Minimum value

D) Inter quartile range (IQR)

48 What type of data is suitable for analysis using the Kruskal-Wallis test?

A) Ordinal and dependent data

B) Non-normal, independent data

C) Paired data

D) Categorical data

49 Efficiency of LSD over RBD considering columns as blocks is.....

A) $\frac{(r-1)S_R^2+r(k-1)S_E^2}{(rk-2)S_E^2}$

B) $\frac{(r-1)S_T^2+k(r-1)S_E^2}{(rk-1)S_E^2}$

C) $\frac{(r-1)S_B^2+r(k-1)S_E^2}{(rk-1)S_E^2}$

D) $\frac{(r-1)S_C^2+r(k-1)S_E^2}{(r-1)(k-1)S_E^2}$

50 Which graphical method is commonly used to assess the normality of data?

A) Box plot of residuals

B) Pie chart of residuals

C) Bar graph of residuals

D) Normal probability plot of residuals

51 What would be the output of the following R-code?

```
x= 10
y=rep("x",2)
z=c(x,y)
z
```

A) `10 10 10`

B) `"x" "y"`

C) `Error: z can not be combined`

D) `None of the above`

52 What would be the output of the following R-code?

```
x = rep(c(2,3,4), seq(1,3))
y = c (1:6)
sum (y[x>3])
```

A) FALSE FALSE FALSE TRUE TRUE TRUE

B) 3

C) 15

D) Error: Subscript out of range

53 Let X~N(10,1). R-command to compute P(X≥12) is.....

A) pnorm(12,10,1)

B) 1-pnorm(11,10,1)

C) 1-pnorm(12,10,1)

D) 0.5+pnorm(2,10,1)

54 The output of the following R program is

```
x=c(10,30,50,20,25)
t=0
for(i in 1:3){
  while(t<1)
    if(x[i]<40) t=t+1
}
t
```

A) 1 B) 2

C) 3 D) 4

55 The output of the following R program is...

```
x=c(10,25,35,37)
s1=0
for(i in 1:2){
  while(s1%%5==0){
    s1=s1+x[i]/5
  }
}
s1
```

A) 2 B) 7

C) 14 D) None of the above

56 Control chart is..... tool.

A) an on-line process control

B) an off-line process control

C) a product control

D) both a process and product control

57 Which of the following is the correct sequence of steps in Deming's PDCA cycle?

A) Plan, Do. Control, Adjust

B) Plan, Do, Check, Act

C) Prepare, Develop, Correct, Apply

D) Prepare, Decide, Create, Analyze

58 Which of the following roles is responsible for leading Six Sigma projects and ensuring their successful implementation within an organization?

A) Quality inspector

B) Green Belt

C) Project Champion

D) Operations manager

59 In a CUSUM control chart, what does the cumulative sum represent?

A) The total number of defects observed in the process

B) The cumulative deviation from the target value of the parameter

C) The cumulative standard deviation of the process

D) The total number of observations made in the process

60 The maximum number of defective items that can be found in the sample and still lead to acceptance of the lot is called.....

A) upper limit

B) acceptance number

C) acceptance criterion

D) acceptance quality level

61 Let x_1, x_2, xn is order statistic of size n from U (0,1) then mean of 1^{st} order statistic is.....

A) $\frac{n-1}{n+1}$

B) $\frac{1}{n+1}$

C) $\frac{n}{n+1}$

D) $\frac{n+1}{n-1}$

62 Let X_1, X_2 ..... Xn is order statistic of size n then the pdf of n order statistic is.....

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

B) $n[F(x)]^{n-1}$

C) $[F(x)]^{n-1}$

D) $[F(x)]^{n}$

63 A sequence of random variables $\{X_n, n \geq 1\}$is said to converge to X in distribution If

A) $\lim_{n\to\infty} F_n(x) = F(x)$

B) $\lim_{n\to\infty} F_n(x) = 1$

C) $\lim_{n\to\infty} F_n(x) = 0$

D) $\lim_{n\to\infty} F_n(x) = f(x)$

64 If $P(X_n = 0) = 1 - \frac{1}{n}$; $P(X_n = 1) = \frac{1}{n}$, for n = 1, 2, ... Then

A) $X_n \xrightarrow{2} 1$

B) $X_n \xrightarrow{2} 2$

C) $X_n \xrightarrow{2} 0$

D) $X_n \xrightarrow{2} \infty$

65 Let X~N (5,16), then by using Chebyshev's inequality $P(|X-\mu| < 20) \geq$ ---

A) $\frac{1}{25}$

B) $\frac{24}{25}$

C) $\frac{1}{5}$

D) $\frac{4}{5}$

66 Convergence in probability of sample mean to population mean is implied by.....

A) Central Limit Theorem

B) WLLN

C) Convergence in quadratic mean

D) None of the above

67 Let ϕ (x) is structure function, then 1- ϕ (x) can take values.....

A) Only 0

B) Only 1

C) 0 and 1

D) (0,1)

68 Structure function $\varphi(\underline{X})$ for series system of n independent components is given by.....

A) $\varphi(\underline{X}) = \text{Max}\{x_1, x_2, \ldots\ldots, x_i, \ldots\ldots x_n)$

B) $\varphi(\underline{X}) = \prod_{i=1}^{n} xi$

C) $\varphi(\underline{X}) = \text{Min}\{x_1, x_2, \ldots\ldots, x_i, \ldots\ldots x_n)$

D) Both (B) and (C)

69 Hazard rate h(t) is given by.....

A) f(t)/R(t)

B) R(t)/F(t)

C) F'(t)/1-F(t)

D) Both A & C

70 A component has hazard rate 6 then value of density function is.....

A) $e^{-\theta t}$

B) $1 - e^{-\theta t}$

C) $\theta e^{-\theta t}$

D) None of the ABove

71 If the sample size (n) increases, what is the likely effect on the width of the confidence interval?

A) The width of the interval will decrease.

B) The width of the interval will increase.

C) The width of the interval remains constant.

D) It depends on the value of 8.

72 Let X_1, X_2, ... Xn, be random sample of size n from exponential distribution with mean 0. Then the pivotal quantity for θ is.....

A) $\frac{\bar{X}}{\theta}$

B) $\bar{X}$

C) $\theta\bar{X}$

D) $\bar{X} - \theta$

73 Let P (4.4 ≤ μ ≤ 15.7) = 0.90 and based on it let us define

Statement-I: The width of confidence interval is 11.3.

Statement- II: 4.4 and 15.7 are 90% confidence limits of μ.

Which of the following is correct?

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 statement (II) are true

74 Let $X \sim N(\theta, \sigma^2)$, where both θ and o^2 are unknown. Then which of the following is true?

A) $H_0: \theta = \theta_0$ V/S $H_1: \theta = \theta_1$, is hypothesis of type composite v/s composite

B) $H_0: \theta = \theta_0$ V/S $H_1: \theta = \theta_1$, is hypothesis of type simple v/s simple

C) $H_0: \theta = \theta_0$ V/S $H_1: \theta > \theta_1$, is hypothesis of type simple v/s composite

D) $H_0: \theta = \theta_0$ V/S $H_1: \theta = \theta_1$, is hypothesis of type composite v/s simple

75 Which of the following statements about the size of a statistical test is correct?

A) The size of a statistical test refers to the probability of rejecting the null hypothesis when it is true.

B) The size of a statistical test refers to the probability of failing to reject the null hypothesis when it is false.

C) The size of a statistical test is always greater than the level of significance chosen for the test.

D) The size of a statistical test is always set to 0.05.

76 To test a null hypothesis, SPRT Involves partitions the sample space into

A) One region only

B) Two regions only

C) Three regions

D) Four regions

77 Let λ (x) be the test statistic in LRT, then which of the following is true?

A) $\lambda(x) \geq 0$

B) $\lambda(x) \leq 0$

C) $\lambda(x) \in [0,1]$

D) $0.5 \leq \lambda(x) \leq 1$

78 In hypothesis testing, a smaller p-value suggests:

A) Weaker evidence against the null hypothesis

B) Stronger evidence against the null hypothesis

C) Stronger support for the null hypothesis

D) Probability of type 1 error is minimum

79 The sign test is

A) Less powerful than that of the Wilcoxon signed rank test

B) Always more powerful than the paired sample t-test

C) More Powerful than the Wilcoxon signed rank test

D) Equivalent to Mann-Whitney test

80 Run test for one sample is used to test.....

A) Randomness of sample

B) Goodness of fit

C) Median of the distribution is some specified values.

D) None of the above

81 In SRSWOR (N,*n*), the probability of any two specified units being not included in a sample is .....

A) $1-\frac{n(n-1)}{N(N-1)}$

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

C) $\frac{N-n}{N-1}$

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

82 A simple random sample of size a will be drawn from a class of 125 students, and the mean mathematics score of the sample will be computed. If the standard error of the sample mean for "with replacement sampling" is twice as much as the standard error of the sample men for "without replacement" sampling, the value of n is

A) 32

B) 63

C) 79

D) 94

83 Suppose population is divided into 2 strata with $N_1 = 40$, $N_2=30$, $C_1= 4$, $C_2 = 16$, and $S_1=2$, $S_2 =4$. Optimum allocation of sample of size n = 14 is.....

A) $n_1=5$, $n_2=9$

B) $n_1=7$, $n_2=7$

C) $n_1=8$, $n_2=6$

D) $n_1=6$, n2 = 8

84 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) stratum size is unknown

D) Either stratum variability and stratum size is unknown

85 Under SRSWOR, the coefficient of variation of unbiased estimator of population proportion is .....

A) $\sqrt{\frac{Q}{P}.\frac{N-n}{n}}$

B) $\sqrt{\frac{Q}{nP}.\frac{N-n}{N-1}}$

C) $\sqrt{\frac{P}{Q}.\frac{N-n}{Nn}}$

D) $\sqrt{\frac{P}{Q}.\frac{N-1}{Nn}}$

86 A researcher uses systematic random sampling from directory that has 600 employees listed in alphabetical order. If the desired sample size is 30, and the first name to be selected is number 8, which of the following will not be selected?

A) 368 B) 88

C) 558 D) 428

87 Which of the following statement about cluster sampling is true?

A) It guarantees a representative sample of the population

B) It may lead to increased sampling error compared to other sampling methods

C) It requires knowledge of the entire population

D) It is most suitable for homogeneous populations

88 Which of the following is a characteristic of ratio estimation method?

A) It guarantees a representative sample of the population

B) It requires stratification of the population

C) It involves assigning weights to sample units based on auxiliary information

D) It is only applicable to small populations

89 In regression estimation method, what is the relationship between the auxiliary variable and the variable of interest?

A) There is no relationship

B) They are negatively correlated

C) They are positively correlated

D) It varies randomly

90 Consider the following statements

Statement I: Regression estimator is always worst than SRS estimator

Statement II: Regression estimator and ratio estimator are equivalent if regression line parallel to one of the axis.

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

91 The region which satisfies all the constrains of the L.P.P. is called as....

A) Critical region

B) Feasible region

C) Convex region

D) Concave region

92 For the LPP, Min Z = x + y subjected to constraints $5x + 10y \leq 0$, $x + y \geq 1$, $x \leq 4$ and $x, y \geq 0$

A) There is a bounded solution

B) There is no solution

C) There are infinite solutions

D) There is unbounded region

93 When the total of allocations of a transportation problem match with supply and demand values, the solution is called ..... solution.

A) degenerate

B) feasible

C) bounded

D) non-degenerate

94 The smallest quantity is chosen at the corners of the closed path with negative sign to be assigned at unused cell because

A) It improve the total cost

B) It does not disturb rim conditions

C) It ensure feasible solution

D) All of the above

95 Which method guarantees finding the globally optimal solution for the assignment problem?

A) Simplex Method

B) Hungarian method

C) MODI method

D) Vogel's approximation (VAM)

96 What is the main objective of the sequencing problem?

A) Maximizing total completion time

B) Minimizing total completion time

C) Maximizing machine idle time

D) Minimizing machine utilization

97 Which queuing model represents a single-server queue with Poisson arrivals and exponential service times?

A) M/M/1

B) M/M/c

C) M/G/1

D) M/D/1

98 What does the distribution of inter-arrival time specify in a queuing system?

A) The pattern of entities leaving the system

B) The pattern of entities arriving into the system

C) The time between successive arrivals of entities

D) The time taken to serve an entity

99 What are pseudo-random numbers?

A) Numbers that are truly random

B) Numbers generated by deterministic algorithms

C) Numbers generated by physical processes

D) None of the above.

100 To generate the random number from geometric with parameter θ, with $U \sim U[0,1]$

A) $Int[\log(U)/\log(\theta)]$

B) $Int[\log(U)]$

C) $Int[\log(U)/\log(1-\theta)]$

D) $Int[\log(1-\theta)]$

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ROUGH WORK