ENT - 16

Seat No.	

Total No. of Pages : 20

P.G. Entrance Examination, July - 2023

M.Sc. STATISTICS/APPLIED STATISTICS & INFORMATION

Sub. Code : 58715

Day and Date : Tuesday, 18-07-2023 **Total Marks : 100**

Time : 10.30 a.m. to 12.00 noon

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.**

Choose most correct alternative

1) Shoe size of most of the Indians is 8. Which measures of central tendency value does it represent?
   A) A.M.
   B) G.M.
   C) Mode
   D) Median

2) Mean deviation is minimum when calculated from _____ .
   A) Mean
   B) Median
   C) Mode
   D) GM

3) In the case of n attributes, the total number of ultimate class frequencies is
   A) $3n$
   B) $2n$
   C) 3^n
   D) 2^n

4) If a fair coin is tossed and a fair die is thrown simultaneously, then probability of getting head on coin and a number less than 3 on die is _____

A) 1/2
B) 1/4
C) 1/6
D) 1/8

5) $P(A \cap B^c) =$ _____

A) $P(A) - P(A \cup B)$
B) $P(A) - P(A \cap B)$
C) $P(B) - P(A \cap B)$
D) $P(B) - P(A \cup B)$

6) If $r_{xy} = -0.7$ and if $u = 3 - 2x$, $v = y + 1$, then r_{uv} = _____

A) 0.7
B) – 0.7
C) 0.14
D) – 0.14

7) If $r = +1$ or -1 then the angle between two lines of regression is _____

A) 0
B) 90
C) 45
D) None of these

8) In Laspeyre's quantity index number _____ are used as weights.

A) current year quantities
B) base year quantities
C) current year prices
D) base year prices

9) Which of the following distribution always have mean < variance?

A) Bernoulli
B) Binomial
C) Poisson
D) None of the above

10) If X has H(N, M, n) distribution and $M \leq n$ then what is the maximum value of X?

A) N
B) M
C) n
D) N-M

11) If X~ Geometric distribution with parameter p and $P(X > 8/X > 3) = 0.7$ then $P(X > 5)$ is _____

A) 0.7
B) 0.3
C) 0.1
D) 0

12) A continuous r.v.X has pdf

$$f(x) = \begin{cases} 6x(1-x) & \text{if } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Then mode of the r.v.X is ...

A) 0.5
B) 6
C) 0
D) 0.25

13) If $r_{12} = r_{13} = r_{23} = r \neq 1$ then $r_{12.3}$ is equal to _____

A) 1
B) –1
C) r/(1+r)
D) (1+r)/r

14) Which of the following does not take into account the age and sex distribution?

A) SDR
B) GFR
C) CDR
D) ASFR

15) In SRSWR, total number of samples of size 4 drawn from population of size 6 is _____

A) 1296
B) 24
C) 30
D) 15

16) If $X \sim exp\ (1)$, then the distribution of $Y = 1 - e^{-x}$ is _____

A) $exp\ (1)$
B) $exp\left(\frac{1}{2}\right)$
C) U (0, 1)
D) U (0, 2)

17) Suppose X_1 and X_2 are independent standard normal variates. Probability distribution of $X_1 - X_2$ is _____

A) N (0, 1)
B) N (1, 0)
C) N (1, 1)
D) N (0, 2)

18) Which of the following is not a method of measuring Trend?

A) moving averages
B) simple averages
C) least square
D) progressive average

19) The control chart for number of defects per item is _____

A) p - chart
B) R - chart
C) c - chart
D) $\overline{X}$ 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 Laplace distribution with parameter (μ, λ) then its third central moment is _____

A) λ
B) $\mu + \lambda$
C) 0
D) None of these

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

A) 4
B) e
C) e^{-1}
D) 5

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 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. $M_x(t)$ 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 α 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 not a particular case of power series distribution?

A) Binomial
B) Poisson
C) Normal
D) Geometric

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

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

Then correlation coefficient between X and Y is _____

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

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

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

D) None of these

29) Following is the pmf of truncated Poisson variate truncated at 0, $P(X=k)=C\frac{e^{-\lambda}\lambda^k}{k!}k=1,2,....$ 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 (1, 2, 9, 16, 0.5) then $P(X \ge 3)$ = _____ (Given : $\Phi(0.67) = 0.74867$)

A) 0.25133
B) 0.74867
C) 0.74537
D) 0.24537

31) A one-dimensional statistic that best estimates the parameter is known as
   A) Point Estimator
   B) Interval Estimator
   C) Interval Estimate
   D) Point Estimate

32) Which of the following is false statement?
   A) Unbiased estimators are not unique.
   B) Sample variance is an unbiased estimator of population variance.
   C) Sample mean is unbiased estimator of population mean.
   D) Invariance property does not hold for unbiasedness.

33) If $X_1, X_2, \ldots\ldots, X_n$ is a random sample from U(–θ, 0) then the unbiased estimator of θ is
   A) $\overline{X}$
   B) $\frac{\overline{X}}{2}$
   C) $X_{(n)}$
   D) $-2\overline{X}$

34) T_n is a consistent estimator of θ if
   A) T_n converges to θ with probability one
   B) $\lim_{n\to\infty} P\left(|T_n - \theta| > \in\right) \to 0$
   C) $\lim_{n\to\infty} P\left(|T_n - \theta| < \in\right) \to 1$
   D) None of the above

35) If T_n is a consistent estimator of θ then
   A) T_n is a consistent estimator of θ^2
   B) T_n^2 is a consistent estimator of θ^2
   C) T_n is unbiased estimator of θ
   D) None of these

36) If $X_1, X_2, \ldots, X_n$ be random sample of size n from $Exp\left(\text{Mean}\frac{1}{\theta}\right)$ then unbiased estimator of θ is _____

A) $\overline{X}$

B) $\frac{(X_1 + X_2)}{2}$

C) $\frac{1}{X_1 + X_2}$

D) None of these

37) If a statistic T is sufficient estimator of θ then

A) T is sufficient for θ^2

B) T is sufficient for $\sqrt{\theta}$

C) T is sufficient for 2θ

D) None of these

38) If 9.19, 9.09, 9, 9, 9.99, 9.91 are observations from U(0, θ) then the MLE of θ is

A) 9.91

B) 9.99

C) 9.09

D) None of these

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

40) The Minimum Variance Bound Estimator of the parameter μ of normal distribution based on sample $X_1, X_2, \ldots, X_n$ is

A) $\overline{x}$

B) $2\overline{x}$

C) $\overline{x}^2$

D) s^2

41) If the interaction effect ABC is confounded completely in 2^3 factorial experiments with *r* replicates, then d.f. for error is ____

A) 6(r–1)
B) 7(r–1)
C) 8(r–1)
D) (7r–1)

42) Which of the following is a contrast?

A) $3T_1 + T_2 - 3T_3 + T_4$
B) $T_1 + 3T_2 - 3T_3 + T_4$
C) $-3T_1 - T_2 + T_3 + 3T_4$
D) $T_1 + T_2 + T_3 - T_4$

43) In the analysis of data of a RBD with *b* blocks and *v* treatments, the error degrees of freedom are _____

A) $b(v - 1)$
B) $v(b - 1)$
C) $(b - 1)(v - 1)$
D) None of the above

44) In Latin square design, number of rows, number of columns and number of treatments are _____

A) all different
B) always equal
C) not necessarily equal
D) none of the above

45) The analysis of variance of an experimental data is based on the assumptions that _____

i) the response variable is distributed normally
ii) the errors are independent
iii) the errors are homoscedastic

A) Only (i)
B) Only (i) and (ii)
C) Only (i) and (iii)
D) All (i), (ii) and (iii)

46) In 2^3 factorial experiments the arrangement of replicate with two blocks each of four plots is shown below. Which interaction effect is confounded in given replicate.

Block 1	(1)	b	ac	abc
Block 2	ab	bc	a	c

A) ab is confounded
B) bc is confounded
C) ac is confounded
D) abc is confounded

47) The Kruskal Wallis test is the nonparametric alternative to the _____
A) One way ANOVA
B) Two way ANOVA
C) χ^2– test for independence
D) χ^2– test for goodness of fit

48) The effect, which is confounded in all the blocks in the experimental design ____
A) is estimated more precisely
B) is estimated less precisely
C) cannot be estimated
D) none of the above

49) Missing observation in an RBD is to be _____ before analysis
A) estimated
B) deleted
C) guessed
D) none of the above

50) Randomization is a process in which the treatments are allocated to the experimental units _____
A) in a sequence
B) with equal probability
C) with unequal probability
D) none of the above

51) _____ is helpful in searching the root-cause of a problem
A) Flow chart
B) Control chart
C) Check sheet
D) Fishbone diagram

52) _____ control is solely based on sampling inspection.
A) Product
B) Process
C) Both product and process
D) None

53) _____ variability is unavoidable.
A) Chance-cause
B) Assignable cause
C) Both chance and assignable cause
D) None of chance and assignable cause

54) CUSUM charts are developed specially for detecting _____ shifts efficiently.
A) small
B) large
C) both small and large
D) none of (A), (B), and (C)

55) AQL stands for _____
A) average quality limit
B) average quality level
C) acceptable quality limit
D) acceptance quality level

56) What would be the output of the following code?
x = *c* ("*a*", "*b*", "*c*", "*c*", "*d*", "*a*") ; *x*[rep (3, 2)]
A) "*b*" "*c*"
B) "*b*" "*b*"
C) "*c*" "*c*"
D) None of the above

57) dpois (4, 2) command in R returns _____
A) $P(X \leq 4)$ where X~P(2)
B) $P(X = 4)$ where X~P(2)
C) $P(X \leq 2)$ where X~P(4)
D) $P(X = 2)$ where X~P(4)

58) The output of the following R-command is _____

```
x = c (10, 20, 30)
x [–1]
```

A) 30
B) –10
C) 20 30
D) Index out of bound

59) The output of the following R program is

```
x = {}; t = 1
for ( j in c (100,155, 200)) {
if ( j %% 2 = = 0) x [t] = j
}
x[1]
```

A) 100
B) 150
C) 200
D) NA

60) The output of the following R statements is ____

```
s = 10
i = 4
for (i in 1:5){
s = s + i
}
s
```

A) 5
B) 9
C) 15
D) 25

61) Let $X_1, X_2, ..., X_n$ is i.i.d. random variables with pdf $f(x)$ and distribution function $F(x)$ then p.d.f. of $X_{(1)}$ is _____

A) $1–[1–F(x)]^n$
B) $n\, f(x)\, [1–F(x)]^{n–1}$
C) $n\, [F(x)]^{n–1}\, f(x)$
D) $n\, [1–F(x)]^{n–1}$

62) Let $X_1, X_2, \ldots\ldots, X_n$ is the random sample of size n from U (0,1), then expected value of first order statistic is _____

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

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

63) If X_1, X_2, X_3 is a random sample form U (0,1) distribution then p.d.f. of $X_{(3)}$ order statistic is _____

A) x^3 B) $3x^2$

C) $3(1-x^2)$ D) $(1-x)^3$

64) If $X_n \xrightarrow{p} X$ as $n \to \infty$ then,

A) $X_n^2 \xrightarrow{p} X$ B) $kX_n^2 \xrightarrow{p} kX$

C) $(X_n^2 - X) \xrightarrow{p} X$ D) $X_n^2 \xrightarrow{p} X^2$

65) A sequence of random variables $\{X_n, n \geq 1\}$ with CDF $F_n(x)$, is said to converges in distribution to random variable X with CDF $F(x)$ if,

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

C) $\lim_{n\to\infty} F_n(x) = x$ D) None of these

66) If X is a r.v. with mean μ and variance σ^2 then, $P[|X-\mu| \geq k\sigma]$ is _____

A) $\geq k^2$ B) $\leq \frac{1}{k^2}$

C) $\text{at least } \frac{1}{k^2}$ D) None of these

67) The sequence of a random variable $\{X_n\}$ is said to be convergence in probability to constant c if _____

A) $\lim_{n\to\infty}[|X_n| \geq \varepsilon] = 1$ B) $\lim_{n\to\infty}[|X_n - c| \leq \varepsilon] = 0$

C) $\lim_{n\to\infty}[|X_n - c| \geq \varepsilon] = 0$ D) None of the above

68) Structure function for series system of 3 independent components is .....
A) $1-(1-X_1)(1-X_2)(1-X_3)$
B) $X_1 X_2 X_3$
C) $1-(1-X_1 X_2 X_3)$
D) $X_1 X_2$

69) If ϕ (X) is binary coherent structure function of a system of n components then _____
A) $\phi(X) \geq \phi(Y) \ \forall \ X \geq Y$
B) $\phi(1_i, X) \geq \phi(0_i, X)$ for $i = 1, 2,....n$ & some X
C) $\phi(X) \geq \coprod_{i=1}^{n} Xi$
D) Both (A) & (B) are true

70) For a series system of two components having 0.7 reliability each, the reliability of a system is _____
A) 0.49 B) 0.51
C) 0.35 D) 0.64

71) Which of the following statements about SPRT is/are true?
I) Sample size (n) is Not fixed
II) P (Type I error) = α and P(Type II error) = β are fixed
III) P (Type II error) = β is minimized for fixed α
A) Only statement (I) is true
B) Only statement (II) is true
C) Only statement (III) is true
D) Only statement (I) & (II) is true

72) If $X_1, X_2,...., X_n$ is a random sample of size 20 from $N(\mu, \sigma^2)$ with unknown σ^2 then interval estimate of μ can be obtained by use of _____
A) Normal distribution B) t-distribution
C) F-distribution D) Chi-square distribution

73) If we increase the confidence level, then the length of confidence interval will _____
A) Decreases
B) Increases
C) Remains same
D) May increase or decrease depending on data

74) If random variable X has N (μ, σ^2)-distribution then which of the following is simple null hypothesis if σ^2 is known?
A) $|\mu| = 4$
B) $\mu > 10$
C) $\mu < 10$
D) None of the above

75) Power curve is a curve obtained by plotting $\theta_1 \in \Theta$, (the parameter space) verses _____
A) 1-Probability of Type I error
B) Probability of Type II error
C) Probability of rejecting the null hypothesis at θ_1
D) Probability of accepting the null hypothesis at θ_1

76) Let $X_1, X_2, X_3, ...X_n$ be a random sample of size *n* taken from N (θ,100) population. Then UMP test exists for $H_0 : \theta \leq \theta_0$ against
A) $H_1 : \theta \neq \theta_0$
B) $H_1 : \theta > \theta_0$
C) $H_1 : \theta < \theta_0$
D) None of the above

77) The likelihood ratio test statistic for testing single mean $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$ based on a sample from normal population N(μ, σ^2) leads to _____
A) χ^2_{n-1} distribution
B) t_{n-1} distribution
C) t_n distribution
D) Normal distribution

78) If following is the arrangement of male (M) and female (F) in a queue MMFMFFMFFMFFFMMMFFFM then the total number of runs is _____
A) 10 B) 11
C) 12 D) 13

79) Which one of the following tests can be used as a one sample goodness of fit test for continuous distribution?
A) Mann Whitney Test B) KS- Test
C) Sign - test D) Student's t- Test

80) For Large sample Run Test, Test statistics will follow _____
A) Normal Distribution B) t- Distribution
C) Binomial Distribution D) Chi-Square Distribution

81) Which of the following statements are true?
Statement I : Aggregate of all units under study is called population.
Statement II : List of all sampling unit is called population.
A) Only statement I B) Only statement II
C) Both statements I and II D) None

82) Which of the following is not true in stratified random sampling with proportional allocation?
A) $V(\bar{y}_{st}) = \frac{1-f}{n}\sum_{i=1}^{k} W_i S_i^2$, Where $W_i = \frac{N_i}{N}$
B) $\frac{n_1}{N_1} = \frac{n_2}{N_2}$
C) $n_i \propto N_i$
D) $n_i \propto N_i S_i$

83) Which of the following statements are true?
Statement I : In SRSWOR, sample mean square is unbiased estimator of population mean square.
Statement II : In SRSWR, sample mean square is biased estimator of population mean square.
A) Only statement I B) Only statement II
C) Both statements I and II D) None

84) Which of the following is true?
A) Sample size is directly proportional to sample mean
B) Sample size is directly proportional to standard error
C) Sample size is inversely proportional to standard error
D) Sample size is not affected by sample mean as well as standard error

85) With usual notations, in stratified sampling _____
Statement I : $\frac{\Sigma_{i=1}^{k} n_i \bar{y}_i}{n}$ is biased estimator of population mean $\bar{Y}$.
Statement II : $\frac{\Sigma_{i=1}^{k} N_i \bar{y}_i}{N}$ is unbiased estimator of population mean $\bar{Y}$.
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

86) Suppose population is divided into 3 strata with $N_1 = 50$, $N_2 = 30$, $N_3 = 20$. Suppose sample of size n = 20 is to be selected using proportion allocation, then _____

A) $n_1 = 10, n_2 = 6, n_3 = 4$
B) $n_1 = 9, n_2 = 6, n_3 = 5$
C) $n_1 = 8, n_2 = 7, n_3 = 5$
D) $n_1 = 10, n_2 = 5, n_3 = 5$

87) With usual notations, in circular systematic sampling _____

A) the total number of possible samples is N
B) the total number of possible samples is $k \approx \frac{n}{\mathrm{N}}$
C) sample mean is biased estimator of population mean
D) inclusion probability is $\frac{1}{k}$

88) With usual notations, in cluster sampling with equal cluster size

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 $(1-f)\mathrm{S}^2 \frac{\{1+(\mathrm{M}-1)\rho_{cl}\}}{\mathrm{M}n}$

Which of the following is not true?

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

89) 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

90) When is the Ratio estimator used?
A) The study variable is uncorrelated with auxiliary variable.
B) The study variable is correlated with auxiliary variable and aggregate information about auxiliary variable is available.
C) Sampling frame is not available
D) Anytime we can used ratio estimator

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) While solving an LPP by Big-M method, which of the following is/are added to L.H.S of constraints in order to convert " $\geq$ " sign into " = " sign?
A) Slack Variable
B) Surplus Variable
C) Surplus as well as artificial variable
D) Artificial variable

93) For the transportation problem with *'m'* sources and *'n'* destinations, the condition of optimality test is
A) The allocations must be independent
B) The number of allocation must be '$(m + n)$'
C) The number of allocation must be '$(m + n - 1)$'
D) The allocations must be independent and the number of allocations must be exactly equal to '$(m + n - 1)$'

94) In case of assignment problem, if there are 'N' workers and 'N' jobs, then there would be _____
A) N-solutions
B) (N-1)-solutions
C) (N-1)! Solutions
D) N!-solutions

95) Customers arrive at a reception counter at an average rate of 10 minutes and receptionist takes an average 6 minutes for one customer. Then, the average queue length is
A) 3/10
B) 7/10
C) 9/10
D) 16/10

96) A sequencing problem involving six jobs and three machines required evaluation of
   A) (6 + 6 + 6) sequences
   B) (6! + 6! + 6!) sequences
   C) (6 × 6 × 6) sequences
   D) $(6!)^3$ sequences

97) The dummy source or destination in a transportation problem (TP) is introduced to _____
   A) Prevent solution to become degenerate
   B) To satisfy rim conditions
   C) Ensure that total cost does not exceed a limit
   D) Solve the balanced TP

98) Random observation from Uniform distribution (*a, b*) with random number *r* (0 < r < 1) can be generated using the expression
   A) $r = a + x\ (b - a)$
   B) $X = a + r\ (b - a)$
   C) $X = a + r\ (a - b)$
   D) $X = b + r\ (b - a)$

99) In a single server queuing system, if arrival rate is '*x*' and service time is '*y*' then the expected number of customers in the system is _____
   A) x/y
   B) y/x
   C) $x/(y - x)$
   D) $y/(x - y)$

100) Which of the following statistical test is used for Testing Uniformity?
   A) t-test
   B) Paired t-test
   C) ANOVA
   D) Kolmogorov-Smirnov Test

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Rough Work