Seat No.	

ENT - 09

Total No. of Pages : 16

M. SC. ENTRANCE EXAMINATION, 2025
STATISTICS/APPLIED STATISTICS AND INFORMATICS
Subject Code : 58715

Day and Date : Tuesday, 13-05-2025 **Total Marks : 100**

Time : 10.30 a.m. to 12.00 p.m.

Instructions :

1. All questions are compulsory.
2. n 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.

1 If G_1 and G_2 be the geometric mean of two data sets of sizes n_1 and n_2 respectively, then the geometric mean of pooled data set is....

A) $\text{Antilog}\left[\frac{n_1 \log(G_1)+n_2 \log(G_2)}{n_1+n_2}\right]$

B) $\log\left[\frac{\log(G_1)+\log(G_2)}{n_1+n_2}\right]$

C) $\text{Antilog}\left[\frac{\log(G_1)+\log(G_2)}{n_1+n_2}\right]$

D) $\log\left[\frac{n_1 \log(G_1)+n_2 \log(G_2)}{n_1+n_2}\right]$

2 Which measure of dispersion is affected most by extreme values?

A) Standard deviation
B) Range
C) Mean deviation
D) Quartile deviation

3 For negatively skewed distribution, which of the following is true?

A) Median < Mean < Mode
B) Mode < Median < Mean
C) Mean < Median < Mode
D) Mode < Mean < Median

4 In a leap year, the probability of getting 5 Sundays in the month of March is.....

A) 1/7
B) 2/7
C) 5/7
D) 3/7

5 If A and B are independent events and P(A) = 0.2, P(B) = 0.6 then $P(A^c \cup B^c) = ...$

A) 0.98
B) 0.6
C) 0.88
D) 0.32

6 If the correlation coefficient between two random variable X and Y is 0.35 then the correlation coefficient between (2X – 5) and (3 – Y) is.....

A) -0.70
B) -0.35
C) 0.35
D) 0.70

7 Which of the following relation between coefficient of association (Q) and coefficient of colligation (Y) is true?
A) $|Q| = |Y|$
B) $|Q| \geq |Y|$
C) $|Q| \leq |Y|$
D) None of these

8 Gross reproduction rate (GRR) considers only:
A) Male births
B) Total number of children
C) Number of births per thousand
D) Female births

9 If X follows binomial distribution with parameters n = 7 and p = 1/3 then the value of mode is
A) 2
B) 3
C) 4
D) 1

10 If X has Poisson distribution with parameter λ then its probability generating function is...
A) $e^{-\lambda(s-1)}$
B) $e^{\lambda(s-1)}$
C) $e^{-\lambda s}$
D) $e^{\lambda s}$

11 If an random variable X has p.d.f. $f(x) = \frac{3x^2}{2}, |x| < 1$ then p.d.f. of $-X$ is
A) $f(-x)$
B) $-f(-x)$
C) $1/f(x)$
D) $f(x)$

12 If $X \sim \exp(1)$ then ----------
A) E(x) = Median
B) Mean=Variance
C) Median=0
D) All the above are correct

13 If $f(x) = 1;\ 3 < x < 4$ and $f(y) = 1;\ 5 < x < 6$ then ----------
A) E(X) < E(Y)
B) E(X) > E(Y)
C) E(X) ≥ E(Y)
D) E(X) ≤ E(Y)

14 If $R_{1.23}$ is multiple correlation coefficient, then .....
A) $r_{12} \geq R_{1.23}$
B) $r_{13} \geq R_{1.23}$
C) $max\{|r_{12}|, |r_{13}|\} \leq R_{1.23}$
D) $|r_{12}| \geq R_{1.23}$

15 Laspeyres index number suffers from
A) upward bias
B) downward bias
C) either upward or downward bias
D) no bias

16 Normal distribution having $Q_1 = 32.5$ and $Q_3 = 63.5$ then its mean is .....
A) 22.5
B) 0
C) 48
D) can't say

17 If X and Y are two independent variables and their expected values are 1 and 2 respectively then E[(X−1)(Y-2)] = ...
A) 1
B) 0
C) 2
D) ½

18 If X and Y are i.i.d gamma variates then distribution of $\frac{X}{X+Y}$ is...
A) Gamma distribution
B) Exponential distribution
C) Beta distribution of 1st Kind
D) Beta distribution of 2st Kind

19 Which of the following is an example of time series problem?
1. Estimating number of hotel rooms booking in next 6 months.
2. Estimating the total sales in next 3 years of an insurance company.
3. Estimating the number of calls for the next one week.
A) Only 3
B) B) 1 and 2
C) 2 and 3
D) 1,2 and 3

20 Let $X \sim N(\mu, 25)$, Consider testing $H_0 : \mu = 0$ against $H_1: \mu = 1$. Then
A) Both H_0 and H_1 are composite hypothesis
B) Both H_0 and H_1 are simple hypothesis
C) H_0 is simple and H_1 is composite
D) H_0 is composite and H_1 is simple

21 Let X follows Rayleigh distribution with parameter λ. What is the distribution of X^2?
A) Exponential
B) Weibull
C) Gamma
D) Cauchy

22 If a random variable X follows a log-normal distribution with parameters μ and σ^2, and $Y = \log_e(X)$, then what is the third central moment of Y?
A) σ^2
B) 3
C) μ
D) 0

23 If X and Y are i.i.d. N(0, 1) then X/Y follows ----------
A) $C(0, 2)$
B) N(0, 1)
C) N(0, 2)
D) $C(0, 1)$

24 Let X follows Weibull distribution with parameter(α, λ). What is the distribution of X^λ?
A) Linear Failure Rate
B) Rayleigh
C) Exponential
D) Cauchy

25 Let $X \sim$ Logistic(10,10). What are the mean and mode of the distribution of X, respectively?

A) 10 and 10
B) 10 and 100
C) 100 and 10
D) 100 and 100

26 If X has Pareto distribution with parameters 3 and 5 then mean of X is -------

A) 15/2
B) 15
C) 3/2
D) 5/2

27 If $(X_1, X_2, ..., X_k)$ follows Multinomial distribution with parameters $(n, p_1, p_2, ..., p_k)$ then $(X_1 + X_2)$ follows------ distribution.

A) Bernoulli
B) Binomial
C) Trinomial
D) None of these

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) $P(X \leq b) = 0$
C) $P(X > a) = 0.5$
D) $P(X > a, X > b) =$

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

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

A) λ^{-1}
B) $1 - e^{-\lambda}$
C) $(1 - e^{-\lambda})^{-1}$
D) λ

30 If $(X, Y) \sim BN(0, 0, 1, 1, 0)$ then distribution of $2X + 3Y + 7$ is ------.

A) N(5,13)
B) N(7,13)
C) N(7,20)
D) N(12,13)

31 Let $T = T(x_1, x_2, \ldots x_n)$ be a sufficient statistic based on sample of size n from $f(x, \theta), \theta \in \Theta$. If, nI_θ and $I_\theta(T)$ denotes information contained in sample and in statistic T respectively about parameter θ, then we have .....

A) $nI_\theta = I_\theta(T)$
B) $nI_\theta \leq I_\theta(T)$
C) $nI_\theta \geq I_\theta(T)$
D) $nI_\theta = I_\theta(T) = 0$

32 The derivative of $f = f(x, \theta)$ can be written as.....

A) $\left[\frac{1}{f(x,\theta)} \frac{\partial f(x,\theta)}{\partial \theta}\right] f(x, \theta)$
B) $\left[\frac{\partial log\, f(x,\theta)}{\partial \theta}\right] f(x, \theta)$
C) Both A) and B)
D) None of A) and B)

33 The Cramer-Rao inequality provides ..... for the variance of statistic 'T'

A) Upper bound
B) Lower bound
C) Both A) and B)
D) None of A) and B)

34 Which of the following is the condition required for an unbiased statistic T of parameter Φ(θ) to be MVBUE?

A) $V(T) < \frac{\Phi' \theta}{nI_\theta}$
B) $V(T) > \frac{\Phi' \theta}{nI_\theta}$
C) $V(T) = \frac{[\Phi' \theta]^2}{nI_\theta}$
D) $V(T) > \frac{\Phi' \theta}{I_\theta}$

35 If 'T' is MVBUE of parameter θ, then information contained in T is same as information contained in .....

A) Population
B) Sample
C) Either population or sample
D) None of these

36 Let $T = T(x_1, x_2, \ldots x_n)$ be a sufficient statistic based on sample of size n from $f(x, \theta), \theta \in \Theta$. If information contained in sample is same as information contained in T, then T is..... statistic.

A) Unbiased
B) Consistent
C) Efficient
D) Sufficient

37 The point estimator of the parameter is a.....

A) constant value
B) integer value
C) fraction value
D) function of sample observations

38 If $x_1, x_2, \ldots x_n$ is the sample of size n is from U(0, θ) distribution, then m. l. e. of parameter θ is.....

A) Sample median
B) Sample mean
C) $X_{(1)}$
D) $X_{(n)}$

39 If sample of size n is taken from $N(\mu, \sigma^2)$ distribution, then sample mean square (S^2) is MVBUE of .....

A) μ
B) σ^2
C) Both A) and B)
D) None of A) and B)

40 Let $x_1, x_2, \ldots x_n$ be a sample of size n from Poisson distribution with parameter θ, then most appropriate moment estimator of parameter θ is.....

A) Sample mean
B) Sample variance
C) Any one of A) and B)
D) None of A) and B)

41 Standard error of sample mean without replacement is ..... standard error of sample mean with replacement.

A) Equal to
B) 2 times
C) More than
D) Less than

42 Suppose population is divided in two strata with $N_1 = 60$, $N_2 = 50$, $S_1^2 = 25$, $S_2^2 = 16$. Then, Neyman allocation of sample size n = 20 is .....

A) $n_1 = 12, n_2 = 8$
B) $n_1 = 11, n_2 = 9$
C) $n_1 = 9, n_2 = 11$
D) None of these

43 Stratified sampling means.....

A) Arbitrary divide population into k groups and selecting samples randomly from each group,
B) Divide population into homogeneous k exclusive groups and selecting samples randomly from each group.
C) Divide population into homogeneous k groups and selecting groups randomly and enumerating all observations.
D) Arbitrary divide population in k groups and selecting groups randomly and enumerating all observations.

44 How can non-sampling error be minimized?

A) By increasing the sample size
B) By using a probability sampling method
C) By ensuring accurate measurement instruments and data collection procedures
D) By reducing the survey period

45 If V $(\bar{y}_n)_{SRSWOR}$ = 3, Population means square (S^2) = 10, Population size (N) = 5 then sample size n is .....

A) 2
B) 3
C) 1
D) 4

46 What is the primary purpose of ratio estimation in sampling?

A) To estimate the population mean
B) To improve estimation using auxiliary information
C) To estimate the population total
D) To reduce sampling error

47 What is the main advantage of regression estimation over ratio estimation?

A) Simplicity of calculation
B) Ability to handle non-linear relationships
C) Reduced bias
D) Improved precision when the relationship is not strictly proportional

48 Two-stage sampling is often used when:

A) The population is homogeneous
B) The population is spread over a large geographic area
C) The population is small
D) The sampling frame is well-defined

49 The method of linear systematic sampling is superior to stratified random sampling if intra class correlation coefficient ρ is

A) High
B) Low
C) Moderate
D) All of the above

50 In cluster sampling with clusters of equal sizes is more efficient than corresponding SRSWOR if intra class correlation coefficient ρ is

A) Greater than zero
B) Less than zero
C) Equal to zero
D) Less than or equal to zero

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

```
x= c("a", "b", "c", "c", "d", "a");
sum(x=="a" | x!="d" )
```

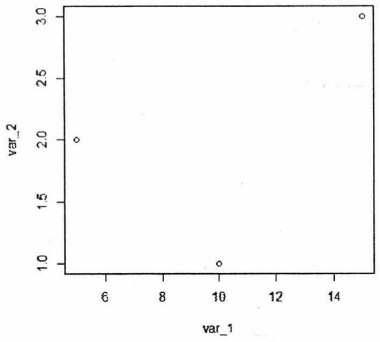
A) 2
B) 5
C) TRUE FALSE FALSE FALSE FALSE TRUE
D) Error:.....

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

```
x=c(10,20,30)
y=c(1,2,3)
sum(x+2*y+10)
```

A) 82
B) 182
C) 102
D) Error:.....

53 Which of the following command in R will generate following plot?



A)
```
x=c(1,2,3)
y=c(10,5,15)
plot(x,y,xlab="var_1",ylab="var_2",type="p")
```
B)
```
x=c(1,2,3)
y=c(10,5,15)
plot(y,x,xlab="var_1",ylab="var_2",type="p")
```
C)
```
x=c(1,2,3)
y=c(10,5,15)
plot(x,y,xlab="var_2",ylab="var_1",type="p")
```
D)
```
x=c(1,2,3)
y=c(10,5,15)
plot(y,x,xlab="var_2",ylab="var_1",type="p")
```

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

```
x=seq(1,10,2);y=2;t=-3
for(y in x){
  t=t+1
  if(y<6) t=t+1
  t=t-1
}
t
```

A) 2
B) 5
C) 3
D) 0

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

```
x=c(20,40,35)
s1=0;s2=10;y=2
for(i in x){
 if(y%%2==0){
   s1=s2+1
   s2=s1+2
 }
}
c(s1,s2)
```

A) 17 19
B) 14 16
C) 15 16
D) 13 14

56 Which of the following charts is most sensitive to large shifts in the process parameter?
A) Shewhart chart
B) CUSUM chart
C) EWMA chart
D) Moving average chart

57 A key parameter λ in an EWMA chart .....
A) sets the width of control limits
B) determines the sample size
C) controls the weighting of recent vs past data
D) represents the number of subgroups

58 The moving average control chart is suitable when ....
A) data is normally distributed
B) there is a need to smooth short-term fluctuations
C) there are many assignable causes
D) only attribute data is available

59 The consumer's risk in a single sampling plan is the probability of ....
A) rejecting a good lot
B) accepting a bad lot
C) accepting a good lot
D) rejecting a bad lot

60 In a single sampling plan, the sample size n and acceptance number c are usually determined based on ....
A) lot size and cost
B) producer's risk and consumer's risk
C) average production rate
D) standard deviation of the lot

61 Let $X_1, X_2, \ldots, X_n$ be a sequence of independent and identically distributed random variables with mean 4 and variance 16. Which of the following statement is true?
A) $\bar{X}_n \xrightarrow{p} 16$
B) $\frac{1}{n}\sum_{i=1}^{n} X_i^2 \xrightarrow{p} 2$
C) $\sqrt{n}\left(\frac{\bar{X}_n - 4}{4}\right) \xrightarrow{d} N(0,1)$
D) $E\left[\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X}_n)\right] = 16$

62 Let X_1, X_2, X_3 be a random sample from the uniform distribution on [0, 1]. What is the value of $P(X_{(1)} > 0.2)$?
A) 0.216
B) 0.512
C) 0.800
D) 0.488

63 If $X_{(1)}$ is the smallest order statistic from a sample of size n from a continuous distribution with cumulative distribution function (CDF) $F(x)$, then the CDF of $X_{(1)}$ is.....
A) $[F(x)]^n$
B) $1 - [1 - F(x)]^n$
C) $f(x) \cdot [F(x)]^n$
D) $n[F(x)]^{n-1}[1 - F(x)]$

64 Let $X_1, X_2, \ldots, X_n$ are independent and identically distributed Poisson variates with common mean 2, then $\frac{1}{n}\sum_{1=1}^{n} X_i^2$ converges in probability to.....
A) 2
B) 4
C) 6
D) 8

65 Let X be any random variable with mean μ and variance 9. Then, the smallest value of m such that $P[|X-\mu| < m] \geq 0.99$, is.....

A) 90
B) $\sqrt{90}$
C) $\sqrt{\frac{100}{11}}$
D) 30

66 Consider the 3 components (c_1, c_2, c_3) system with equal probability (p) of the functioning for each component. The system functions if at least one of c_1 or c_2 and c_3 works. What is the system reliability?

A) p^3
B) $p(1-p)^2$
C) $p^2(2-p)$
D) $p(2-p)$

67 If the failure rate function r of a component is $r(t) = \frac{t}{1+t}; t \geq 0$, then the survival function is.....

A) e^{-t}
B) te^{-t}
C) $1-e^{-t}$
D) $(1+t)e^{-t}$

68 A component has an exponential lifetime with failure rate λ =0.02. What is probability that the component survives at least 50 hours?

A) e^{-2}
B) 0
C) e^{-1}
D) 1

69 What is the failure rate function of the series system of two independent components when the failure rate functions of the 2 components are $r_1(t)$ and $r_2(t)$, respectively.

A) $\min(r_1(t),\ r_2(t))$
B) $r_1(t) + r_2(t)$
C) $r_1(t) \times r_2(t)$
D) $\max(r_1(t),\ r_2(t))$

70 For series system with 3 components: A, B, and C, the number of minimal cut sets.....

A) 1
B) 2
C) 3
D) Depends on failure rate

71 If Λ denotes the likelihood ratio test statistic, then under certain regularity conditions which of the following is the asymptotic distribution of -2logΛ?

A) Chi square distribution
B) Normal distribution
C) Gamma distribution
D) t-distribution

72 The LR-test for testing $H_0: \mu = \mu_0$ against $H_1: \mu \neq \mu_0$ based on sample from normal population leads to....

A) One tailed t- test
B) Two tailed t-test
C) Two tailed F- test
D) One tailed F- test

73 The most preferred confidence interval for a parameter θ should be an interval .....
A) with shortest width and largest confidence coefficient
B) with largest width and largest confidence coefficient
C) based on sufficient statistics
D) All of the above

74 In SPRT of strength $(\alpha = 0.02, \beta = 0.03)$, the stopping bounds (A, B) are given by....
A) $\left(\frac{97}{3}, \frac{2}{98}\right)$
B) $\left(\frac{97}{2}, \frac{3}{98}\right)$
C) $\left(\frac{98}{3}, \frac{2}{98}\right)$
D) $\left(\frac{98}{2}, \frac{3}{97}\right)$

75 The likelihood ratio test statistic for testing H_0: $\sigma^2 = \sigma_0^2$ against H_1: $\sigma^2 \neq \sigma_0^2$ based on a sample of size n from normal population $N(\mu, \sigma^2)$ leads to....
A) χ^2_{n-1} distribution
B) χ^2_{n-2} distribution
C) t_{n-1} distribution
D) t_{2n-1} distribution.

76 The LR-test for testing H_0: $\mu_1=\mu_2$ against H_1:$\mu_1\neq\mu_2$ based on two independent random samples from $N(\mu_1, \sigma^2)$ and $N(\mu_2, \sigma^2)$ of sizes n_1 and n_2 respectively leads to....
A) t-test with (n_1+n_2) d.f.
B) χ^2-test with (n_1+n_2-2) d.f.
C) t-test with (n_1+n_2-2) d.f.
D) F-test with (n_1, n_2) d.f.

77 The critical region of two sample Run test is....
A) Two tailed
B) Right tailed
C) Left tailed
D) Either (A) or (B) or (C)

78 K-S test for single sample is referred to as....
A) Test of randomness
B) A test of goodness of fit
C) Test for correlation
D) None of these

79 Consider a normal population with mean μ and variance $\sigma^2 = 4$. We wish to test the null hypothesis H_0: $\mu = \mu_0$ against the alternative hypothesis H_1: $\mu = \mu_1$, where $\mu_1 > \mu_0$. Based on a random sample of size n, determine the value of K such that the critical region for the test is $\mu >$ K. What is the value of K if significance level is $\alpha = 0.05$.?
A) $\mu_0 + 1.645/\sqrt{n}$
B) $\mu_0 + 3.290/\sqrt{n}$
C) $\mu_0 + 3.92/\sqrt{n}$
D) $\mu_0 + 1.96/\sqrt{n}$

80 If there are 16 observations, What are the minimum possible numbers of runs?
A) 2
B) 1
C) 6
D) 8

81 In Completely Randomized Design (CRD), the experimental units are assumed to be
A) Homogeneous
B) Structured
C) Heterogeneous
D) Stratified

82 Which of the following is used to visually inspect treatment effects?
A) Histogram
B) Piechart
C) Box-plot
D) Line chart

83 The F-test in ANOVA is justified by
A) T-test
B) Central Limit Theorem
C) Chochran's Theorem
D) Law of Large Numbers

84 In RBD, blocking is used to control:
A) Treatment effect
B) Random variation
C) Known sources of variability
D) Sample size

85 In LSD, rows and columns represent
A) Blocks
B) Treatments
C) Experimental units
D) Random factors

86 Which test is applied for non-normal data to compare multiple groups?
A) t-test
B) Kruskal-Wallis test
C) Z-test
D) F-test

87 The standard error of the difference between two treatment means in RBD with t treatments and r replications and mean error sum of square S_E^2 will be .....
A) $\sqrt{\frac{2S_E^2}{t}}$
B) $\sqrt{\frac{2S_E^2}{r}}$
C) $S_E^2\sqrt{\frac{2}{r}}$
D) $S_E^2\sqrt{\frac{2}{t}}$

88 If the interaction effect ABC is confounded completely in 2^3experiments then d.f. for error is.....
A) 6(r-1)
B) 7(r-1)
C) 8(r-1)
D) (7r-1)

89 .....transformation is useful for count data.
A) $sin^{-1}(.)$
B) $tan^{-1}(.)$
C) square root
D) square

90 In one-way ANOVA with total number of observations is 15 with 5 treatments then total degrees of freedom is
A) 75
B) 3
C) 10
D) 14

91 Which of the following is a basic component of a Linear Programming Problem?
A) Non-linear constraints
B) Objective function
C) Random variables
D) All of these

92 In simplex method, which condition indicates an unbounded solution?
A) All entries in key column are positive
B) All entries in key column are zero or negative
C) Artificial variable has positive value
D) Objective function increases indefinitely

93 Which method is used to get IBFS using penalties in transportation problem?
A) Least cost method
B) North West Corner Rule
C) Vogel's Approximation Method
D) MODI method

94 Consider the cost matrix = $\begin{bmatrix} 8 & 6 & 10 \\ 9 & 7 & 4 \end{bmatrix}$ and supply = [20,30], demand = [15,25,10], Using the North West Corner Rule, what is total cost?
A) 400
B) 330
C) 520
D) 445

95 In sequencing, the goal is to
A) Minimize transportation cost
B) Minimize total elapsed time
C) Maximize jobs
D) Equal distribution

96 Which describes a single-server queue?
A) M/M/1
B) M/M/c
C) M/D/1
D) M/G/1

97 M/M/1 with $\lambda = 3$, $\mu = 5$. Traffic intensity ρ?
A) 0.6
B) 1.2
C) 0.4
D) 2.0

98 Monte Carlo simulation is based on
A) Deterministic events
B) Exact calculation
C) Random sampling
D) Optimization methods

99 Which of the following is not a property of random numbers?
A) Uniformity
B) Independence
C) Predictability
D) Reproducibility

100 Which of the following is not a decision criterion under uncertainty?
A) Criterion of regret
B) Criterion of optimism
C) Criterion of probability
D) Criterion of pessimism

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