

Seat No.

Total No. of Pages : 26

P.G. Entrance Examination, 2024

M.Sc. Statistics/Applied Statistics and Information

Subject Code : 58715

Day and Date : Thursday, 16-05-2024

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 For any two positive observations, which of the following is true?
A) $G. M. \leq A.M. \leq H. M.$ B) $A.M. \leq G. M. \leq H. M.$
C) $G. M. \geq A.M. \geq H. M.$ D) $A.M. \geq G. M. \geq H. M.$
- 2 Coefficient of quartile deviation of non-negative observations always lies between...
A) 0 and ∞ B) 0 and 1
C) -1 and 1 D) None of these
- 3 For consistency of data, $(B) = 30$, $(A) = 40$, $(\alpha \beta) = 45$, $N = 100$, the value of $(\alpha B) = \dots\dots\dots$
A) 55 B) 60
C) 15 D) 25

- 4 For any two events A and B defined on sample space Ω , which of the following is true?
- A) $P(A) \geq P(A \cap B)$
- B) $P(A) \leq P(A \cap B)$
- C) $P(A) \geq P(A \cup B)$
- D) $P(A) + P(B) \leq P(A \cup B)$
- 5 If A and B are two independent events defined on sample space Ω and $P(A) = 0.2$, $P(A \cup B) = 0.4$ then $P(B) = \dots\dots$
- A) 0.50
- B) 0.4
- C) 0.75
- D) 0.25
- 6 If $r_{xy} = -0.3$ and if $u = 3 - 5x$, $v = 3 + y$, then $r_{uv} = \dots\dots\dots$
- A) -0.3
- B) 0.3
- C) 0
- D) 0.09
- 7 If $r = 0$, then the angle between two lines of regression is.....
- A) 0
- B) 90
- C) 45
- D) 180
- 8 Which type of average is best for construction of an index number?
- A) Arithmetic mean
- B) Harmonic mean
- C) Geometric mean
- D) Weighted arithmetic mean

28 If X is truncated normal variate, right truncated at X=b then

$$g(x) = C e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} \quad -\infty \leq X \leq b, \quad -\infty \leq \mu \leq \infty$$

A) $\frac{1}{\sigma\sqrt{2\pi} \Phi\left(\frac{b-\mu}{\sigma}\right)}$

B) $\frac{1}{\sigma\sqrt{2\pi} \left(1-\Phi\left(\frac{b-\mu}{\sigma}\right)\right)}$

C) $\frac{1}{\sigma \Phi\left(\frac{b-\mu}{\sigma}\right)}$

D) $\frac{1}{\sqrt{2\pi}\sigma}$

29 If X follows left truncated exponential distribution with parameter 6, then V(X) is..... ,

A) 6^{-1}

B) 6^{-2}

C) 6

D) 36

30 IF(X,Y)~BN(0, 0, 1, 1, ρ) then r(x², y²)

A) ρ^2

B) $\rho^{0.5}$

C) ρ

D) ρ^{-1}

31 The Fisher's information contained in a parameter θ supplied by the sample size n is

A) $E\left(\frac{\partial \log L}{\partial \theta^2}\right)^2$

B) $E\left(\frac{\partial L}{\partial \theta}\right)^2$

C) $E\left(\frac{\partial^2 \log L}{\partial \theta^2}\right)^2$

D) $E\left(\frac{\partial^2 \log L}{\partial \theta^2}\right)$

- 32 Which of the following is always true?
- A) An unbiased estimator is always unique.
 - B) Every Sufficient Statistic is complete
 - C) MLE is function of sufficient statistics.
 - D) MLE is always unbiased.
- 33 If for two unbiased estimators T_1 and T_2 of a certain parameter we have $V(T_1) < V(T_2)$ then
- A) T_1 is more efficient than T_2
 - B) T_1 is less efficient than T_2
 - C) T_1 and T_2 are equally efficient.
 - D) T_1 is more efficient than T_2
- 34 A real valued function of sample observation is known as
- A) Parameter
 - B) Statistic
 - C) Constant
 - D) Moment estimator
- 35 If population mean exists, the sample mean is always..... estimator of population mean.
- A) Unbiased
 - B) Consistence
 - C) Unbiased and consistence
 - D) Biased

- 36 Which of the following statement is correct?
- A) a point estimate is an estimate of the range of a population parameter
 - B) a point estimate is an unbiased estimator if its standard deviation is the same as the actual value of the population Standard deviation.
 - C) a point estimate is a single value estimate of the value of a population parameter
 - D) a point estimate is average estimate of the value of a population parameter
- 37 In the context of estimators, what does the term "unbiased" mean?
- A) The estimator always provides the true parameter value
 - B) The expected value of the estimator equals the true parameter value
 - C) The estimator provides estimates with zero variance
 - D) The estimator always provides the largest possible estimates
- 38 If r. v. X has $N(\theta, \theta)$ distribution then, the parameter space of the distribution is
- A) $\{\theta : -\infty < \theta < \infty\}$
 - B) $\{\theta : \theta \geq 0\}$
 - C) $\{\theta : \theta \leq 0\}$
 - D) $\{\theta : \theta > 1\}$
- 39 Let X_1, X_2, \dots, X_n be random sample of size n from Exponential distribution with mean θ then, the mle of $P(X > t)$ is
- A) \bar{X}
 - B) $e^{-\frac{t}{\bar{X}}}$
 - C) $1 - e^{-\frac{t}{\bar{X}}}$
 - D) $\frac{1}{\bar{X}}$

- 45 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) $T_1+T_2+T_3-T_4$
- 46 The total sum of squares due to all orthogonal contrasts in 2ⁿ factorial experiment is equal to
- A) replication S.S.
 - B) treatment S.S.
 - C) total S.S.
 - D) error S.S.
- 47 Two types of effects measured in a factorial experiment are
- A) main and interaction effects
 - B) simple and complex effects
 - C) both (A) and (B)
 - D) neither (A) nor (B)
- 48 The method of confounding is a device to reduce the size of
- A) experiments
 - B) replications
 - C) blocks
 - D) all of the above

49 Efficiency of LSD over RBD considering rows as blocks is

A) $\frac{S_C^2 + mS_E^2}{(m+1)S_E^2}$

B) $\frac{S_B^2 + mS_E^2}{(m+1)S_E^2}$

C) $\frac{S_R^2 + mS_E^2}{(m+1)S_E^2}$

D) $\frac{S_C^2 + mS_E^2}{(m-1)S_E^2}$

50 The main effect due to factor A is

A) $\frac{1}{2} (a - 1)(b + 1)$

B) $\frac{1}{2} (a + 1)(b - 1)$

C) $\frac{1}{2} (a - 1)(b - 1)$

D) $\frac{1}{2} (a + 1)(b + 1)$

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

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

```
x [x=="a"]
```

A) "a" "a"

B) 2

C) TRUE FALSE FALSE FALSE FALSE TRUE

D) 1 6

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

```
x1= x2 = x3 = c (5,10,20)
```

```
sum(x1+x2)
```

A) 15

B) 70

C) 10 20 40

D) None of the above

53 Let $X \sim P(3)$. The R-command to compute $P(1 < X \leq 5)$ is.....

A) `ppois (4,3) – ppois (0,3)`

B) `ppois (5,3) – ppois (2,3)`

C) `ppois (5,3) – ppois (1,3)`

D) `ppois (5,3) – ppois (0,3)`

54 The output of the following R program is

```
x=c ( 5, 3, 2, 4, 1)
t=0
for(i in x){
  t=1
  if (x[i]<4) t=t+1
}
t
```

A) 4

B) 3

C) 2

D) 1

64 $X_n \xrightarrow{p} a$ as $n \rightarrow \infty$. Where $X_n > 0, a > 0$ then,

A) $X_n^2 \xrightarrow{p} a^2$

B) $\frac{1}{X_n} \xrightarrow{p} \frac{1}{a}$

C) $(X_n - a) \xrightarrow{p} 0$

D) All of the Above

65 Chebyshev's inequality can be applicable for..... random variable.

A) Discrete

B) Continuous

C) Both Discrete and Continuous

D) Neither Discrete nor Continuous

66 Convergence of sample mean to normal distribution, this result is given by.

A) Chebychev's inequality

B) Weak law of large Number

C) Central limit theorem

D) Chapman kolmogorav equation.

67 Structure function can take values.....

A) Only 1

B) Only 0

C) 0 and 1

D) 2

- 68 Structure function $\varphi(\underline{X})$ for series system of n independent components is given by
- A) $\varphi(\underline{X}) = \text{Max} \{ x_1, x_2, \dots, x_i, \dots, x_n \}$
 - B) $\varphi(\underline{X}) = \prod (1 - x_i)$
 - C) $\varphi(\underline{X}) = 1 - \prod (1 - x_i)$
 - D) $\varphi(\underline{X}) = \text{Min} \{ x_1, x_2, \dots, x_i, \dots, x_n \}$
- 69 The reliability function at t is function
- A) constant
 - B) decreasing
 - C) increasing
 - D) Non increasing
- 70 A component has hazard rate 2 then value of distribution function is.....
- A) e^{-2t}
 - B) $2e^{-2t}$
 - C) $1 - e^{-2t}$
 - D) None of the Above
- 71 The most preferred confidence interval for a parameter should be.....
- A) The wider the interval, the higher the precision of the estimate
 - B) The narrower the interval, the higher the precision of the estimate
 - C) Confidence intervals cannot be used to estimate population parameters
 - D) Confidence intervals only work with small sample sizes

- 72 A confidence level of 90% means:
- A) We are 90% confident that the sample mean is the true population mean.
 - B) We are 10% confident that the sample mean is the true population mean.
 - C) We expect the true population parameter to fall within the confidence interval 90% of the time in repeated sampling.
 - D) We expect the sample mean to fall within the confidence interval 90% of the time.
- 73 A sample of size 144 from $N(\theta, \sigma^2)$ gives the sample mean $\bar{X} = 10$ and sample variance $s^2 = 36$. Which of the following is the 95% lower confidence interval for θ ? (Given: $Z_{0.05} = -1.64$)
- A) (9.02, 10.98)
 - B) (9.18, 10.82)
 - C) (9.18, Inf)
 - D) (-Inf, 10.82)
- 74 If random variable X has $N(\mu, \sigma^2)$ distribution. Then which of the following is simple null hypothesis.
- A) $H_0: \mu = 5, \sigma = 1$
 - B) $H_0: \mu = 5$
 - C) $H_0: \sigma^2 = 1$
 - D) $H_0: \sigma^2 = 1, \text{ when } \mu \neq 0$
- 75 Let $X \sim \text{Exp}(\text{mean } \theta)$ and Hypothesis of testing is $H_0: \mu = 1$ against $H_1: \mu = 2$. The test Reject H_0 if $X > 3$. What is the size of test?
- A) 0.05
 - B) $\exp(-3)$
 - C) $\exp(-1.5)$
 - D) $\log(-1)$

76 Consider the following statements:

Statement-I : Most powerful test is unique

Statement-II : Uniformly most power test is always most powerful

- A) Only Statement-I is true
- B) Only Statement-II is true
- C) Both Statement-I and Statement-II is true
- D) Neither Statement-I nor Statement-II is true

77 The likelihood ratio test statistic for testing $H_0: \sigma_1^2 = \sigma_2^2$ against $H_1: \sigma_1^2 \neq \sigma_2^2$ based on a sample of size n_1 and n_2 form two normal populations with mean 0 and standard deviation σ_1 , and σ_2 respectively leads to.....

- A) χ^2 distribution n_1+n_2 degrees of freedom
- B) χ^2 distribution $n_1+n_2 -1$ degrees of freedom.
- C) F distribution with $n_1 - 1$ and n_2-1 degrees of freedom
- D) F distribution with n_1 and n_2 degrees of freedom

78. Wald's Sequential Probability Ratio Test (SPRT) is designed for:

- A) Testing complex null hypotheses
- B) Testing hypotheses with multiple alternatives
- C) Testing simple null hypotheses against simple alternatives
- D) Testing hypotheses with continuous outcomes only

- 79 To determine whether the median difference between paired observations is significantly different from zero, which of the following non-parametric test is used
- A) Chi-square test
 - B) Wilcoxon's Signed Rank Test
 - C) Kolmogorov Smirnov test
 - D) Run Test
- 80 Which of the following Non-parametric test utilizes the empirical distribution function?
- A) Median test
 - B) Wilcoxon's signed rank test
 - C) Wald-Wolfowitz run test
 - D) Kolmogorov -Smirnov test
- 81 In SWSWR, Which of the following is an estimator of the variance of the population total?
- A) σ^2/n
 - B) $N^2\sigma^2/n$
 - C) s^2/n
 - D) N^2s^2/n

82 In SRSWOR (N, n), the probability of two specified units being not selected at any two given draws is

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

83 A statistician has drawn a simple random sample of size 2 with replacement from 4 boys with distinct heights. Let \bar{x}_1 be the sample mean of their heights. Then another statistician has drawn a simple random sample of size 2 without replacement from those 4 boys. Let \bar{x}_2 be the sample mean of their heights. Which of the following statement is correct?

- A) $\frac{\bar{x}_1}{2}$ has larger variance than that of \bar{x}_2
- B) $\sqrt{2} \bar{x}_1$ and $\sqrt{3} \bar{x}_2$ has equal variance.
- C) $\sqrt{2} \bar{x}_1$ has larger variance than that of $\sqrt{3} \bar{x}_2$
- D) None of the above

84 Under SRSWOR, what is the required sample size to draw inference about the population for large N with $S^2 = 20$, Margin of error = 2 and 95% confidence coefficient? (Given: $Z_{0.025} = 1.96$)

- A) 19
- B) 384
- C) 16
- D) 365

- 85 Suppose population is divided into 3 strata with $N_1 = 40$, $N_2 = 30$, $N_3 = 15$ and $S_1 = 2$, $S_2 = 3$, $S_3 = 2$. what is Neyman allocation of sample of size $n = 20$?
- A) $n_1 = 8, n_2 = 9, n_3 = 3$
 - B) $n_1 = 9, n_2 = 6, n_3 = 5$
 - C) $n_1 = 8, n_2 = 7, n_3 = 5$
 - D) $n_1 = 10, n_2 = 5, n_3 = 5$
- 86 In a survey of a population of $N = nk$ units, a sample of n units is to be drawn by systematic sampling with a random start between 1 and k and selecting every k^{th} units. Then
- A) The sample mean is a biased estimate of the population mean.
 - B) The variance of the sample mean cannot be estimated under this design.
 - C) If the N population units have been arranged at random, then the sample is equivalent to a simple random sample with replacement.
 - D) If the N population units have been arranged at random, then the sample is equivalent to a simple random sample without replacement.
- 87 It is helpful to use a multi-stage sampling when
- A) The population is widely dispersed geographically.
 - B) You have limited time and money available for travelling.
 - C) You want to use a probability sample in order to generalize the results.
 - D) All of the above.

- 95 What is the main objective of the assignment problem?
- A) Maximizing the total cost
 - B) Minimizing the total cost
 - C) Maximizing the number of tasks
 - D) None of the above
- 96 What is idle time in the context of machine scheduling?
- A) Time taken to complete a job
 - B) Time during which a machine remains idle
 - C) Total processing time of all jobs
 - D) Time taken by a machine to switch tasks
- 97 Which of the following is NOT an essential feature of a queuing system?
- A) Service mechanism
 - B) Queue length
 - C) Arrival rate
 - D) System capacity
- 98 What is the steady-state distribution in queuing theory?
- A) The distribution of entities in the queue at any given time
 - B) The distribution of entities arriving into the system
 - C) The distribution of service times
 - D) The distribution of entities leaving the system

99 Which of the following is an advantage of simulation?

- A) Requires minimal computational resources.
- B) Always provides accurate results
- C) Can handle complex systems
- D) Cannot mimic real-world systems

100 What is the inverse CDF method used for in random variate generation?

- A) To generate random numbers from a normal distribution
- B) To test for randomness
- C) To assess uniformity distribution
- D) To transform uniform random numbers into variates of desired distributions

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