

IES/ISS Exam, 2021

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T.B.C. : SDT-S-STT

Serial

1006325



Test Booklet Series



TEST BOOKLET
STATISTICS
Paper II

Time Allowed : Two Hours

Maximum Marks : 200

INSTRUCTIONS

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THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
 - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
 - (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
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1. Consider the model $y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij}$, $i = 1, 2; j = 1, 2$. For which one of the following choices of λ' , the function $\lambda'\beta$ where $\beta' = (\mu, \alpha_1, \alpha_2, \beta_1, \beta_2)$ is **not** estimable?
- (1, 1, 0, 1, 0)
 - (0, 0, 0, -1, 1)
 - (0, -1, 1, 0, 0)
 - (1, 1, 1, 1, 1)
2. For the model $y_{ij} = \mu + \tau_i + \varepsilon_{ij}$, $i = 1, 2; j = 1, 2$; consider the following statements :
- $\mu + \tau_1$ is estimable.
 - $\tau_1 + \tau_2$ is estimable.
- Which of the above statements is/are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
3. Let X_i, Y_i and Z_i ; $i = 1, 2, 3$ be nine independent observations with common variance σ^2 , and $E(X_i) = \theta_1, E(Y_i) = \theta_2, E(Z_i) = \theta_1 - \theta_2$; $i = 1, 2, 3$. If $X = \sum_{i=1}^3 x_i, Y = \sum_{i=1}^3 y_i$ and $Z = \sum_{i=1}^3 z_i$, then the BLUE of θ_1 is given by
- $\frac{1}{9} [2X + Y - Z]$
 - $\frac{1}{9} [X + 2Y - Z]$
 - $\frac{1}{9} [X + 2Y - 2Z]$
 - $\frac{1}{9} [X + 3Y - 2Z]$
4. In general regression model $Y_{n \times 1} = X_{n \times k} \beta_{k \times 1} + \varepsilon_{n \times 1}$. Further ε is $N(0, \sigma^2 I)$. The $n \times 1$ vector of ordinary residuals is denoted by $e = Y - \hat{Y}$. The distribution of $\frac{e'e}{\sigma^2}$ is
- $N(0, \sigma^2 \rho)$
 - $N(X\beta, \sigma^2)$
 - χ_{n-k}^2
 - χ_{n-1}^2
5. Consider a model
- $$Y_1 = A + B + C + D + e_1;$$
- $$Y_2 = A + C - B - D + e_2;$$
- $$Y_3 = A + B - C - D + e_3;$$
- $$Y_4 = A + D - B - C + e_4.$$
- If this model is equivalent to $Y = X\beta + e$, then the matrix $(X'X)^{-1}$ is equal to
- $\frac{1}{3} I_4$
 - $\frac{1}{2} I_4$
 - $\frac{1}{5} I_4$
 - $\frac{1}{4} I_4$
6. Consider the following statements :
- Tukey's test of multiple comparisons reduces the Type-I error in the test.
 - Student-Newman-Keuls test uses stepwise procedure.
- Which of the above statements is/are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2

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(2 - A)

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7. Consider the following statements in respect of a symmetric matrix X :

1. Generalized inverse of X is not necessarily symmetric.
2. Symmetric inverse of X can always be determined.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

8. Five methods of packing frozen foods were compared by taking six observations for each of the methods used. The response variable was ascorbic acid (mg/100 g). The degrees of freedom for error sum of squares are

- (a) 26
- (b) 25
- (c) 24
- (d) 20

9. Consider a two-way classification with one observation per cell. The model is

$$y_{ij} = \mu + \alpha_i + \beta_j + e_{ij}; i = 1, 2, 3, \dots, p; \\ j = 1, 2, 3, \dots, q. \text{ Which one of the following parameters is estimable ?}$$

- (a) α
- (b) β
- (c) $\alpha_i - \alpha_u; i, u = 1, 2, 3, \dots, p (i \neq u)$
- (d) $\alpha_1 + \alpha_2$

10. Let A be matrix of order 4×7 , then any generalized inverse of A is of order

- (a) 4×4
- (b) 7×4
- (c) 4×7
- (d) 7×7

11. Let X be a discrete random variable with probability distribution

$$P(X = x) = \begin{cases} \theta & \text{if } x = -1 \\ (1 - \theta)^2 \theta^x & \text{if } x = 0, 1, 2, 3, \dots \end{cases}$$

where $0 < \theta < 1$. Then

- (a) X is minimal sufficient and complete.
- (b) X is minimal sufficient only.
- (c) X is complete only.
- (d) X is unbiased estimator for θ .

12. Let $X_1, X_2, \dots, X_n$ be a random sample from uniform distribution $U(0, \theta)$, $\theta > 0$.

Define $U = 2\bar{X}$, such that $\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$ and $T = X_{(1)} = \min \{X_1, X_2, \dots, X_n\}$. Then $E[U | T = t]$ will be

- (a) independent of θ .
- (b) most efficient for θ .
- (c) a function of θ .
- (d) MVUE for θ .

13. Let $X \sim f(x, \theta) = \frac{1}{\theta} e^{-\frac{x}{\theta}}; x > 0, \theta > 0$ and

$Y \sim f(y, \theta) = \frac{1}{2\theta} e^{-\frac{y}{2\theta}}; y > 0, \theta > 0$. Which one of the following statements is correct ?

- (a) $X + 2Y$ is sufficient for θ and left tail UMP test is given by $X + 2Y < C$.
- (b) $X + 2Y$ is sufficient for θ and right tail UMP test is given by $X + 2Y > C$.
- (c) $Y + 2X$ is sufficient for θ and left tail UMP test is given by $Y + 2X < C$.
- (d) $Y + 2X$ is sufficient for θ and right tail UMP test is given by $Y + 2X < C$.

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14. Consider a Sequential Probability Ratio Test (SPRT) to test $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$ and continue taking observations as long as $a_m < s_m < r_m$; $m = 1, 2, 3, \dots$ where $s_m = \sum_{i=1}^m X_i$; $a_m = 0.90 + 0.05 m$ and $r_m = 2.25 + 0.05 m$. On the basis of the data $\{1, 1, 0, 1, 0, 0\}$ the decision will be

(a) may accept H_1 at 6th stage.

(b) reject H_0 at 4th stage.

(c) may accept H_1 at 3rd stage.

(d) reject H_1 at 3rd stage.

15. Let $X_1, X_2, X_3, \dots, X_n$ be i.i.d. random variables from the density function $f(x) = \frac{1}{\alpha} e^{-\frac{x}{\alpha}}$, $x > 0, \alpha > 0$. Then the uniformly minimum variance unbiased estimator of the parameter α is

(a) $n\bar{X}$

(b) $\frac{\bar{X}}{n}$

(c) $\bar{X}$

(d) $\frac{\bar{X}}{n+1}$
16. Let $X_1, X_2, X_3, \dots, X_n$ be a random sample of size n taken from normal population $N(0, \sigma^2)$. Then a central confidence interval for σ^2 (i.e., confidence interval with equal tail probabilities) with confidence coefficient 0.95 for large sample is given by

(a) $\left(\frac{\frac{1}{n} \sum_{i=1}^n X_i^2}{1 + 1.96 \sqrt{\frac{2}{n}}}, \frac{\frac{1}{n} \sum_{i=1}^n X_i^2}{1 - 1.96 \sqrt{\frac{2}{n}}} \right)$

(b) $\left(\frac{\frac{1}{n} \sum_{i=1}^n X_i^2}{1 + 1.96 \sqrt{\frac{2}{\pi}}}, \frac{\frac{1}{n} \sum_{i=1}^n X_i^2}{1 - 1.96 \sqrt{\frac{2}{\pi}}} \right)$

(c) $\left(\frac{\sum_{i=1}^n X_i^2}{1 + 1.96 \sqrt{\frac{2}{n}}}, \frac{\sum_{i=1}^n X_i^2}{1 - 1.96 \sqrt{\frac{2}{n}}} \right)$

(d) $\left(\frac{\sum_{i=1}^n X_i^2}{1 + 1.645 \sqrt{\frac{2}{n}}}, \frac{\sum_{i=1}^n X_i^2}{1 - 1.645 \sqrt{\frac{2}{n}}} \right)$

17. Consider the following statements in respect of an estimator T for the parameter θ :

1. T is unbiased for $\theta \Rightarrow T^2$ is unbiased for θ^2 .

2. T is consistent for $\theta \Rightarrow T^2$ is consistent for θ^2 .

3. T is sufficient for $\theta \Rightarrow T^2$ is sufficient for θ .

Which of the above statements is/are correct ?

(a) 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

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(4 - A)

18. If T_1 and T_2 are two consistent estimators of θ_1 and θ_2 respectively, then consider the following statements :

1. $(T_1 + T_2)$ is also consistent estimator for $(\theta_1 + \theta_2)$.
2. $(T_1 \times T_2)$ is also consistent estimator for $(\theta_1 \times \theta_2)$.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

19. If x is a random sample of size 1 from Poisson (θ), then 5^x is the unbiased estimator of

- (a) 5^θ
- (b) $e^{5\theta}$
- (c) $e^{4\theta}$
- (d) θ^5

20. Let 4, 3, 6, 3, 6, 2, 3, 4, 4, 3, 5 and 5 be a sample of size 12 from the geometric population having pdf

$$f(x) = \theta(1 - \theta)^{x-1}; x = 1, 2, 3, \dots$$

The estimator of θ using the method of moment

- (a) is 0.25.
- (b) is 4.
- (c) is 48.
- (d) does not exist.

21. Consider the following statements in respect of a random sample $x_1, x_2, x_3, \dots, x_n$ from $N(\theta, 4)$:

1. MLE of θ is $\frac{1}{n} \sum_{i=1}^n x_i$.
2. MLE of θ^2 is $\frac{1}{n} \sum_{i=1}^n x_i^2$.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

22. Let $X_1, X_2, X_3, \dots, X_n$ be i.i.d. random variates from $U(0, \theta)$. If $Y = \max(X_1, X_2, X_3, \dots, X_n)$, then an unbiased estimator of θ^3 will be

- (a) y^3
- (b) $\left(\frac{n+3}{n}\right) y^3$
- (c) $\frac{y^3}{n}$
- (d) $\left(\frac{n}{n+3}\right) y^3$

23. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from $U(0, \theta)$. If $x_{(1)} \leq x_{(2)} \leq x_{(3)} \leq \dots, \leq x_{(n)}$ are the order statistics, then which of the following statements is/are correct ?

1. $x_{(n)}$ is the MLE for θ .
2. $x_{(n)}$ is the consistent estimator of θ .

Select the correct answer using the code given below :

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

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24. If $x_1, x_2, x_3, \dots, x_n$ is a random sample from Poisson (θ), then consider the following statements :

- 1. $\frac{1}{n} \sum_{i=1}^n x_i$ is the maximum likelihood estimator of θ .
- 2. $\frac{1}{n} \sum_{i=1}^n x_i$ is sufficient for estimating θ .

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

25. Consider the following statements :

- 1. Cramer-Rao inequality provides a lower bound to the variance of a sufficient estimator for $\gamma(\theta)$.
- 2. A minimum variance bound (MVB) estimator for $\gamma(\theta)$ exists if and only if there exists a sufficient estimator for $\gamma(\theta)$.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

26. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from the population with pdf

$$f(x, \theta) = \begin{cases} \frac{1}{\theta} \exp\left(-\frac{x}{\theta}\right); & 0 < x < \infty \\ 0; & \text{otherwise} \end{cases}$$

The Cramer-Rao lower bound to the variance of an unbiased estimator of θ is

- (a) θ^2
- (b) $\frac{\theta^2}{n}$
- (c) $n\theta^2$
- (d) $\frac{\theta^2}{n^2}$

27. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from the pmf

$$P[X = x] = \binom{2}{x} (1 - \theta)^{2-x} \theta^x; 0 \leq \theta \leq 1;$$

$x = 0, 1$ and 2 and $T = \sum_{i=1}^n x_i$. Which of the following statements is/are correct ?

- 1. T is a complete sufficient statistic for θ .
- 2. $\frac{T^2 - T}{2n(2n - 1)}$ is an UMVUE of θ^2 .

Select the correct answer using the code given below :

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

28. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample of size 64 drawn from Poisson (λ). If it is given that $\sum_{i=1}^n x_i = 256$, then 95% confidence interval of λ is
- (3.51, 4.49)
 - (0.08, 7.92)
 - (3.76, 4.25)
 - (3.02, 4.98)
29. For a likelihood ratio λ , consider the following statements :
- $0 \leq \lambda \leq 1$.
 - $(-2 \log \lambda)$ follows asymptotic Chi-square distribution.
 - Likelihood ratio test is consistent.
- Which of the above statements are correct ?
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2 and 3
30. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from normal population with pdf
- $$f(x, \mu) = \frac{1}{\sqrt{2\pi}} \exp \left[-\frac{1}{2} (x - \mu)^2 \right]; -\infty < x < \infty.$$
- The S.P.R.T. for rejecting $H_0 = \mu = 4$ against $H_1 = \mu = 6$ for $\alpha = \beta = 0.05$ is
- $\sum_{i=1}^n x_i \geq 5n + \log 19$
 - $\sum_{i=1}^n x_i \geq 5n$
 - $\sum_{i=1}^n x_i \geq n$
 - $\sum_{i=1}^n x_i \geq n + \log 19$
31. Let the random variable X have $N(0, 1)$. Then $E(|X|)$ is equal to
- $\sqrt{2\pi}$
 - $\frac{\sqrt{\pi}}{\sqrt{2}}$
 - $\frac{\sqrt{2}}{\sqrt{\pi}}$
 - $\frac{\sqrt{2}}{\pi}$
32. Let $X \sim b(1, p)$, $p \in \left[\frac{a}{a+b}, \frac{b}{a+b} \right]$; $a > 0$, $b > 0$. Then MLE of p is
- $\frac{X+b}{a+b}$
 - $\frac{(b-a)X-1}{a+b}$
 - $\frac{(b-a)X+a}{a+b}$
 - $\frac{(b-a)X+b}{a+b}$
33. Consider the following statements :
- An unbiased estimator is always unique.
 - Sufficient statistic is always a function of MLE.
 - Consistent estimator need not be unique.
 - UMP test is not unique.
- Which of the above statements are correct ?
- 1 and 2 only
 - 3 and 4 only
 - 1, 3 and 4 only
 - 1 and 4 only
34. Every similar test for testing under H_0 has a Neyman structure under which one of the following conditions ?
- Sufficient statistic
 - Consistent statistic
 - Boundedly complete
 - Boundedly complete sufficient statistic

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35. Consider the following statements :
1. Unbiased estimators may not always exist.
 2. Unbiased estimators are always unique if they exist.
- Which of the above statements is/are correct ?
- (a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

36. Consider the following statements :
1. If t is an unbiased estimator of θ , it need not be consistent.
 2. If t is a consistent estimator of θ , it will also be an unbiased estimator of θ .
- Which of the above statements is/are correct ?
- (a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

37. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from the population with pdf
- $$f(x, \theta) = \frac{x}{\theta} \exp \left(-\frac{x^2}{2\theta} \right); x > 0 \text{ and } \theta > 0.$$
- The estimator of θ using the method of moments is
- (a) $\bar{x}$
(b) $\bar{x}^2$
(c) $\frac{2\bar{x}}{\pi}$
(d) $\frac{2\bar{x}^2}{\pi}$

38. Consider the following statements :
1. An MLE is always unique.
 2. An MLE may not be consistent.
 3. An MLE may not be unbiased.
- Which of the above statements are correct ?
- (a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

39. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from Poisson distribution with parameter θ . Then the unbiased estimate of $e^{-\theta}$ which doesn't attain C - R lower bound is
- (a) $\sum x_i$
(b) $2^{\sum x_i}$
(c) $\left(1 - \frac{1}{n}\right)^{\sum x_i}$
(d) $2^{\sum x_i}$

40. A random sample of size n is taken from $N(\theta, 100)$ and probability of accepting H_0 when H_1 is true is 0.01. If critical region of size 0.05 is used for testing $H_0 : \theta = 90$ against $H_1 : \theta = 100$, then the sample size n to be taken, is
- (a) 14
(b) 15
(c) 16
(d) 17

41. Let $X_1, X_2, X_3, \dots, X_n$ be a random sample from a distribution with pdf

$$f(x, \theta) = \begin{cases} \frac{1}{\theta}; & -\frac{\theta}{2} \leq x \leq \frac{\theta}{2}, & \theta > 0 \\ 0; & \text{otherwise} \end{cases}$$

For the sufficient statistic for the parameter θ , consider the following statements :

- Order statistic $(X_{(1)}, X_{(2)}, X_{(3)}, \dots, X_{(n)})$ is sufficient for θ .
- Order statistic $(X_{(1)}, X_{(n)})$ is sufficient for θ .

Which of the above statements is/are correct ?

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

42. Let $X_1, X_2, X_3, \dots, X_n$ be i.i.d. with probability density function $f(x, \theta) = e^{-(x-\theta)}$, $x > \theta$. Let $X_{(1)} = \min(X_1, X_2, X_3, \dots, X_n)$. Define the class of estimators $T(X) = X_{(1)} + k$; $k \in \mathbb{R}$. The estimator that has smallest mean squared error (MSE) is

- $T(X) = X_{(1)} - n$
- $T(X) = X_{(1)} + 1$
- $T(X) = X_{(1)} + \frac{1}{n}$
- $T(X) = X_{(1)} - \frac{1}{n}$

43. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from $U(\alpha, \beta)$. The MLE of α and β are respectively :

- $\sum x_i$ and $\sum x_i^2$
- $\prod x_i$ and $\prod x_i^2$
- $\min(x_1, x_2, x_3, \dots, x_n)$ and $\max(x_1, x_2, x_3, \dots, x_n)$
- $\frac{x_{(n)} - x_{(1)}}{2}$ and $\frac{x_{(n)} + x_{(1)}}{2}$

44. Consider the following statements :

- A minimum variance bound unbiased estimator (MVBUE) is always uniformly minimum variance unbiased estimator (UMVUE).
- An MVBUE of a parameter θ must be sufficient statistic for θ .
- A UMVUE is always MVBUE.

Which of the above statements are correct ?

- 1 and 2 only
- 2 and 3 only
- 1 and 3 only
- 1, 2 and 3

45. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample from Cauchy's population having pdf

$$f(x, \theta) = \frac{1}{\pi[1 + (x - \theta)^2]}; -\infty < x < \infty$$

Consider the following statements :

- Sample mean is a sufficient estimator of θ .
- Sample mean is a minimum variance bound estimator for θ .

Which of the above statements is/are correct ?

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

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46. If $x_1, x_2, x_3, \dots, x_n$ be a random sample from a population following Poisson distribution with parameter λ , then 95% confidence interval for λ (for large n) is

- (a) $\bar{x} \pm 1.96 \frac{\bar{x}}{n}$
 (b) $\bar{x} \pm 1.96 \frac{\sqrt{\bar{x}}}{n}$
 (c) $\bar{x} \pm 1.96 \frac{\bar{x}}{\sqrt{n}}$
 (d) $\bar{x} \pm 1.96 \sqrt{\frac{\bar{x}}{n}}$

47. For testing a simple null hypothesis against the simple alternative hypothesis, the test is unbiased if

- (a) $\alpha \leq \beta$
 (b) $\alpha + \beta < 1$
 (c) $\alpha + \beta > 1$
 (d) $\alpha \geq \beta$

where α and β have their usual meaning.

48. Let X and Y be two independent random variables with $U(0, \theta)$. We are testing $H_0 : \theta = 1$ against $H_1 : \theta = 2$. The probability of type-I error and power of the test for the critical region $\left\{ \frac{X}{Y} > 0.65 \right\}$ are respectively

- (a) (0.675, 0.675)
 (b) (0.625, 0.625)
 (c) (0.675, 0.625)
 (d) (0.625, 0.675)

49. For testing standard normal distribution against double exponential distribution, the critical region C is given by

- (a) $C = \{x : k_1 < x < k_2\}$
 (b) $C = \{x : k_1 < x \text{ or } k_2 > x\}$
 (c) $C = \{x : |x| \geq k_1 \text{ or } |x| \leq k_2\}$
 (d) $C = \{x : |x| > k_1 \text{ or } |x| < k_2\}$

where k_1 and k_2 are some constants.

50. Suppose the number of failed satellite launches have a Poisson distribution with parameter λ . Failure counts for past 12 months are observed in order to test $H_0 : \lambda = 2$ against $H_1 : \lambda = 3$. What is the Likelihood Ratio ?

- (a) $1.5e^{-24}$
 (b) $1.5e^{-12}$
 (c) $(1.5)^{\sum_{i=1}^{12} x_i} e^{-12}$
 (d) $(1.5)^{\sum_{i=1}^{24} x_i} e^{-24}$

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Consider the following for the next two (02) items that follow :

The OC function for testing $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1 (> \theta_0)$ using SPRT for a sampling from $N(\theta, 1)$ is $L(\theta) = \frac{A^{h(\theta)} - 1}{A^{h(\theta)} - B^{h(\theta)}}$; α and β are the probabilities of type-I and type-II errors respectively.

51. What are A and B respectively equal to ?

- (a) $\frac{1-\beta}{\alpha}, \frac{\beta}{1-\alpha}$
- (b) $\frac{1-\alpha}{\beta}, \frac{\alpha}{1-\beta}$
- (c) $\frac{\alpha}{1-\beta}, \frac{1-\alpha}{\beta}$
- (d) $\frac{\beta}{1-\alpha}, \frac{1-\beta}{\alpha}$

52. What is $h(\theta)$ equal to ?

- (a) $\frac{\theta_1 - \theta_0 - 2\theta}{\theta_1 - \theta_0}$
- (b) $\frac{\theta_1 + \theta_0 - 2\theta}{\theta_1 - \theta_0}$
- (c) $\frac{\theta_1 - \theta_0 + 2\theta}{\theta_1 - \theta_0}$
- (d) $\frac{\theta_1 - \theta_0 + 2\theta}{\theta_0 - \theta_1}$

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Consider the following for the next two (02) items that follow :

Let X be a binomial random variable with parameters n and θ . The prior distribution of θ is beta distribution of first kind with parameters α and β . Let the posterior distribution of $\theta|X = x$ be beta distribution with parameters p_1 and p_2 .

53. What is p_1 equal to ?

- (a) $n - \alpha - \beta$
- (b) $x + \alpha$
- (c) $n - x + \beta$
- (d) $x - \alpha$

54. What is p_2 equal to ?

- (a) $n + \alpha + \beta$
- (b) $x - \alpha$
- (c) $n + x - \beta$
- (d) $x + \alpha$

Consider the following for the next two (02) items that follow :

Let a random variable X have a uniform distribution with density function

$$f(x; \mu, \sigma) = \frac{1}{2\sqrt{3}\sigma},$$

where $\mu - \sqrt{3}\sigma < x < \mu + \sqrt{3}\sigma$,

where $-\infty < \mu < \infty, \sigma > 0$.

55. What is the MLE estimator of μ ?

- (a) $x_{(1)}$
- (b) $x_{(1)} + x_{(n)}$
- (c) $[x_{(1)} + x_{(n)}]/2$
- (d) $2[x_{(1)} + x_{(n)}]$

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56. What is the MLE estimator of σ ?

- (a) $x_{(n)}$
 (b) $x_{(n)} - x_{(1)}$
 (c) $[x_{(n)} - x_{(1)}]/(2\sqrt{3})$
 (d) $[x_{(n)} - x_{(1)}]/2$

Consider the following for the next two (02) items that follow :

Let $X_1, X_2, X_3, \dots, X_n$ be i.i.d. random variables from $U(\theta_1, \theta_2)$, $f(x) = \frac{1}{\theta_2 - \theta_1}$; $\theta_1 < x < \theta_2$; $\theta_1 > 0$; $i = 1, 2$.

57. What is UMVUE of θ_1 equal to?

- (a) $\frac{n\hat{X}_{(n)} - \hat{X}_{(1)}}{n-1}$
 (b) $\frac{n\hat{X}_{(1)} - \hat{X}_{(n)}}{n}$
 (c) $\frac{n\hat{X}_{(1)} - \hat{X}_{(n)}}{n-2}$
 (d) $\frac{n\hat{X}_{(1)} - \hat{X}_{(n)}}{n-1}$

where $\hat{X}_{(i)} = E(X_{(i)})$; $i = 1, n$.

58. What is UMVUE of θ_2 equal to?

- (a) $\frac{n\hat{X}_{(n)} - \hat{X}_{(1)}}{n-1}$
 (b) $\frac{n\hat{X}_{(n)} - \hat{X}_{(1)}}{n}$
 (c) $\frac{n\hat{X}_{(1)} - \hat{X}_{(n)}}{n-2}$
 (d) $\frac{n\hat{X}_{(1)} - \hat{X}_{(n)}}{n-1}$

Consider the following for the next two (02) items that follow :

Let $X_1, X_2, X_3, \dots, X_n$ be i.i.d. random variables with $N(\mu, \mu)$. In this case, mean = variance = μ ($\mu > 0$).

59. Consider the following statements :

- $\sum x_i^2$ is sufficient for μ .
- MLE of μ is $\frac{-1 + \sqrt{1 + 4m_2}}{2}$,
 where $m_2 = \frac{\sum x_i^2}{n}$.

Which of the above statements is/are correct?

- (a) 1 only
 (b) 2 only
 (c) Both 1 and 2
 (d) Neither 1 nor 2

60. Consider the following statements :

- $(\sum x_i, x_n)$ is sufficient for μ .
- Moment estimator of μ is $\bar{X}$.

Which of the above statements is/are correct?

- (a) 1 only
 (b) 2 only
 (c) Both 1 and 2
 (d) Neither 1 nor 2

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61. Which survey being conducted by MOSPI in 2019 will be an important tool for measuring paid and unpaid work of both men and women in a society ?
- (a) Periodic Labour Force Survey
 - (b) Time Use Survey
 - (c) Employment and Unemployment Survey of NSSO
 - (d) Population Census

62. Which of the following are major sources of health indicators in India ?
- 1. National Family Health Survey
 - 2. Periodic Labour Force Survey
 - 3. Population Census
 - 4. NSSO 71st Round – Social Consumption : Education and Health

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1, 2 and 3 only
- (d) 1, 3 and 4 only

63. Consider the following statements :
- 1. Most of the index compilers use Laspeyres' Index Formula for index compilation even though it has inherent upward bias.
 - 2. It is advised that Base Period of an index should be revised as frequently as possible.
- Which of the above statements is/are correct ?
- (a) 1 only
 - (b) 2 only
 - (c) Both 1 and 2
 - (d) Neither 1 nor 2

64. Which of the following statements are correct about Sustainable Development Goals (SDGs) ?
- 1. United Nations Development Programme (UNDP) formulated these goals.
 - 2. There are 17 goals.
 - 3. These are intended to be completed by 2030.

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

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- 65.** 'Wages and salaries' earned by a resident of country 'A' from a resident enterprise of country 'B' is included in

 - (a) GDP of country A.
 - (b) GDP of country B.
 - (c) GNI of country A.
 - (d) GNI of country B.
- 66.** Which one of the following is **not** a component of United Nations' Human Development Index (HDI) ?

 - (a) Life expectancy at birth
 - (b) Infant mortality rate
 - (c) Expected and mean years of schooling
 - (d) Per capita income
- 67.** Gross Domestic Product reflects the

 - (a) industrial growth scenario of the country.
 - (b) trend in agricultural growth in the country.
 - (c) size of country's economy at market price.
 - (d) unduplicated output of the economy at basic price.
- 68.** Poverty line in India was based on the data from which of the following ?

 - 1. Consumer Expenditure Surveys of National Sample Survey Office (NSSO)
 - 2. Health Surveys of NSSO
 - 3. National Family Health Survey

Select the correct answer using the code given below :

 - (a) 1 and 3 only
 - (b) 2 and 3 only
 - (c) 1 only
 - (d) 3 only
- 69.** The statement "Growth rate of the quarterly estimate of GDP is 10%" means

 - (a) economy has grown by 10% from the last month of the year.
 - (b) economy has grown by 10% over the same month in the previous year.
 - (c) economy has grown by 10% over the same quarter in the previous year.
 - (d) economy has grown by 10% over the previous quarter in the same year.
- 70.** Which are the divisions of National Sample Survey Office ?

 - 1. Survey Design and Research Division (SDRD)
 - 2. Field Operations Division (FOD)
 - 3. Data Processing Division (DPD)
 - 4. Survey Coordination Division (SCD)

Select the correct answer using the code given below :

 - (a) 1 and 2 only
 - (b) 3 and 4 only
 - (c) 1, 2 and 3 only
 - (d) 1, 2, 3 and 4

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71. Merchandise Trade Statistics as collected by Directorate General of Commercial Intelligence and Statistics (DGCI&S) is compiled from bills submitted by importers and exporters. Thus, it is an example of
- (a) statistics collected through Survey.
 - (b) administrative statistics.
 - (c) statistics collected through Census.
 - (d) statistics collected through mixed mode.

72. In Indian official statistics, the output of agriculture crops is estimated using which one of the following approaches ?
- (a) Market arrivals + Farmers retention
 - (b) Area under crop $\times$ productivity $\times$ prices
 - (c) Sample surveys of farmers production
 - (d) Compilation of village level statistics

73. Which one of the following is **not** correctly matched ?

Index	Base Year
(a) CPI-IW	2016
(b) CPI (R and U)	2012
(c) CPI-AL/RL	2015
(d) WPI	2011 – 12

74. Which one of the following measures is known as National Income ?
- (a) GDP at market price
 - (b) GVA at basic price
 - (c) GNI at basic price
 - (d) NNI at basic price

75. Consider the following :
- 1. GDP
 - 2. IMR
 - 3. Dropout rate
 - 4. CPI
 - 5. WPI
- Which of the above are official statistics ?
- (a) 2, 4 and 5 only
 - (b) 1, 2, 4 and 5 only
 - (c) 1 and 3 only
 - (d) 1, 2, 3, 4 and 5

76. Who are authorised to compile official statistics in India ?
- 1. Central Government
 - 2. State Government
 - 3. Panchayat Raj Institutions/Urban Local Bodies
- Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

77. Collection of statistics for different subject specific areas (such as Agriculture, Labour, Health, Commerce) vests with which one of the following agencies ?
- (a) Ministry of Statistics and Programme Implementation
 - (b) NITI Aayog
 - (c) Ministry of Finance
 - (d) Corresponding Administrative Ministry

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78. The National Statistical Commission (NSC) was set up in 2005 through
- (a) a Constitutional Amendment.
 - (b) a Government Resolution.
 - (c) an executive order.
 - (d) an internal notification of the Ministry of Statistics and Programme Implementation.

79. For which of the following purpose is NSSO data **not** used ?
- (a) Poverty estimations and fixing poverty line
 - (b) Estimation of contribution of unorganised sector
 - (c) Fixing minimum support price of major crops
 - (d) Employment and unemployment scenario

80. Consider the following statements with regard to Consumer Price Index (CPI) :
- 1. It is a measure of the average change in prices over time that consumers pay for a basket of goods and services.
 - 2. It is calculated using prices of a sample of representative items whose prices are collected periodically.
 - 3. It may be interpreted as a measure of both inflation and deflation.

Which of the above statements are correct ?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

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