# UPSC
# IES/ISS

## Previous Year Paper
## (Statistics-II) 2021

IES/ISS Exam,2021

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

**Test Booklet Series**

**A**

**Serial** 1006325

# TEST BOOKLET

# STATISTICS

# Paper II

***Time Allowed : Two Hours*** ***Maximum Marks : 200***

## INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET ***DOES NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **80** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
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6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**

    **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.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for 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 $\lambda'$, the function $\lambda'\beta$ where $\beta' = (\mu, \alpha_1, \alpha_2, \beta_1, \beta_2)$ is ***not*** estimable ?

(a) $(1, 1, 0, 1, 0)$

(b) $(0, 0, 0, -1, 1)$

(c) $(0, -1, 1, 0, 0)$

(d) $(1, 1, 1, 1, 1)$

**2.** For the model $y_{ij} = \mu + \tau_i + \varepsilon_{ij}$, $i = 1, 2; j = 1, 2;$ consider the following statements :

1. $\mu + \tau_1$ is estimable.
2. $\tau_1 + \tau_2$ is estimable.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

**3.** Let $X_i$, $Y_i$ and $Z_i$; $i = 1, 2, 3$ be nine independent observations with common variance $\sigma^2$, 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 $\theta_1$ is given by

(a) $\frac{1}{9}[2X + Y - Z]$

(b) $\frac{1}{9}[X + 2Y - Z]$

(c) $\frac{1}{9}[X + 2Y - 2Z]$

(d) $\frac{1}{9}[X + 3Y - 2Z]$

**4.** In general regression model $Y_{n\times1} = X_{n\times k}\beta_{k\times1} + \varepsilon_{n\times1}$. Further $\varepsilon$ 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

(a) $N(0, \sigma^2 \rho)$

(b) $N(X\beta, \sigma^2)$

(c) $\chi^2_{n-k}$

(d) $\chi^2_{n-1}$

**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

(a) $\frac{1}{3} I_4$

(b) $\frac{1}{2} I_4$

(c) $\frac{1}{5} I_4$

(d) $\frac{1}{4} I_4$

**6.** Consider the following statements :

1. Tukey's test of multiple comparisons reduces the Type-I error in the test.
2. Student-Newman-Keuls test uses stepwise procedure.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

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, ..., p; j = 1, 2, 3, ..., q. Which one of the following parameters is estimable ?

(a) $\alpha$

(b) $\beta$

(c) $\alpha_i - \alpha_u$; i, u = 1, 2, 3, ..., p ($i \neq u$)

(d) $\alpha_1 + \alpha_2$

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

(a) $4 \times 4$

(b) $7 \times 4$

(c) $4 \times 7$

(d) $7 \times 7$

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

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

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 $\theta$.

12. Let $X_1, X_2, \ldots, X_n$ 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 $T = X_{(1)} = \min \{X_1, X_2, \ldots, X_n\}$. Then $E[U \mid T = t]$ will be

(a) independent of $\theta$.

(b) most efficient for $\theta$.

(c) a function of $\theta$.

(d) MVUE for $\theta$.

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 $\theta$ and left tail UMP test is given by X + 2Y < C.

(b) X + 2Y is sufficient for $\theta$ and right tail UMP test is given by X + 2Y > C.

(c) Y + 2X is sufficient for $\theta$ and left tail UMP test is given by Y + 2X < C.

(d) Y + 2X is sufficient for $\theta$ and right tail UMP test is given by Y + 2X < C.

**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, ... where $s_m = \sum_{i=1}^{m} X_i$ ; $a_m = 0{\cdot}90 + 0{\cdot}05\ m$ and $r_m = 2{\cdot}25 + 0{\cdot}05\ m$. On the basis of the data {1, 1, 0, 1, 0, 0} the decision will be

(a) may accept $H_1$ at $6^{th}$ stage.

(b) reject $H_0$ at $4^{th}$ stage.

(c) may accept $H_1$ at $3^{rd}$ stage.

(d) reject $H_1$ at $3^{rd}$ stage.

**15.** Let $X_1, X_2, X_3, ..., X_n$ 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 $\alpha$ is

(a) $n\bar{X}$

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

(c) $\bar{X}$

(d) $\frac{\bar{X}}{n+1}$

**16.** Let $X_1, X_2, X_3, ..., X_n$ be a random sample of size n taken from normal population $N(0, \sigma^2)$. Then a central confidence interval for $\sigma^2$ (i.e., confidence interval with equal tail probabilities) with confidence coefficient 0·95 for large sample is given by

(a) $\left( \frac{\frac{1}{n}\sum_{i=1}^{n} X_i^2}{1 + 1{\cdot}96\sqrt{\frac{2}{n}}}, \frac{\frac{1}{n}\sum_{i=1}^{n} X_i^2}{1 - 1{\cdot}96\sqrt{\frac{2}{n}}} \right)$

(b) $\left( \frac{\frac{1}{n}\sum_{i=1}^{n} X_i^2}{1 + 1{\cdot}96\sqrt{\frac{2}{\pi}}}, \frac{\frac{1}{n}\sum_{i=1}^{n} X_i^2}{1 - 1{\cdot}96\sqrt{\frac{2}{\pi}}} \right)$

(c) $\left( \frac{\sum_{i=1}^{n} X_i^2}{1 + 1{\cdot}96\sqrt{\frac{2}{n}}}, \frac{\sum_{i=1}^{n} X_i^2}{1 - 1{\cdot}96\sqrt{\frac{2}{n}}} \right)$

(d) $\left( \frac{\sum_{i=1}^{n} X_i^2}{1 + 1{\cdot}645\sqrt{\frac{2}{n}}}, \frac{\sum_{i=1}^{n} X_i^2}{1 - 1{\cdot}645\sqrt{\frac{2}{n}}} \right)$

**17.** Consider the following statements in respect of an estimator T for the parameter $\theta$ :

1. T is unbiased for $\theta \Rightarrow T^2$ is unbiased for $\theta^2$.
2. T is consistent for $\theta \Rightarrow T^2$ is consistent for $\theta^2$.
3. T is sufficient for $\theta \Rightarrow T^2$ is sufficient for $\theta$.

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

**18.** If $T_1$ and $T_2$ are two consistent estimators of $\theta_1$ and $\theta_2$ 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 ($\theta$), then $5^x$ is the unbiased estimator of

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

**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

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

The estimator of $\theta$ 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 $x_1, x_2, x_3, \ldots, x_n$ from $N(\theta, 4)$ :

1. MLE of $\theta$ is $\frac{1}{n}\sum_{i=1}^{n} x_i$.
2. MLE of $\theta^2$ 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 $X_1, X_2, X_3, \ldots, X_n$ be i.i.d. random variates from $U(0, \theta)$. If $Y = \max(X_1, X_2, X_3, \ldots, X_n)$, then an unbiased estimator of $\theta^3$ 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 $x_1, x_2, x_3, \ldots, x_n$ be a random sample from $U(0, \theta)$. If $x_{(1)} \le x_{(2)} \le x_{(3)} \le \ldots, \le x_{(n)}$ are the order statistics, then which of the following statements is/are correct ?

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

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

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

1. $\frac{1}{n}\sum_{i=1}^{n} x_i$ is the maximum likelihood estimator of $\theta$.

2. $\frac{1}{n}\sum_{i=1}^{n} x_i$ is sufficient for estimating $\theta$.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

**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 $x_1, x_2, x_3, ..., x_n$ 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 $\theta$ is

(a) $\theta^2$

(b) $\frac{\theta^2}{n}$

(c) $n\theta^2$

(d) $\frac{\theta^2}{n^2}$

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

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

$x = 0, 1$ 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 $\theta$.

2. $\frac{T^2 - T}{2n(2n-1)}$ is an UMVUE of $\theta^2$.

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 $x_1, x_2, x_3, \ldots, x_n$ be a random sample of size 64 drawn from Poisson ($\lambda$). If it is given that $\sum_{i=1}^{n} x_i = 256$, then 95% confidence interval of $\lambda$ is

(a) (3·51, 4·49)

(b) (0·08, 7·92)

(c) (3·76, 4·25)

(d) (3·02, 4·98)

**29.** For a likelihood ratio $\lambda$, consider the following statements :

1. $0 \leq \lambda \leq 1$.
2. $(-2 \log \lambda)$ follows asymptotic Chi-square distribution.
3. Likelihood ratio test is consistent.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

**30.** Let $x_1, x_2, x_3, \ldots, x_n$ be a random sample from normal population with pdf

$$f(x, \mu) = \frac{1}{2\sqrt{\pi}} \exp\left[-\frac{1}{4}(x-\mu)^2\right]; -\infty < x < \infty.$$

The S.P.R.T. for rejecting $H_0 = \mu = 4$ against $H_1 = \mu = 6$ for $\alpha = \beta = 0{\cdot}05$ is

(a) $\sum_{i=1}^{n} x_i \geq 5n + \log 19$

(b) $\sum_{i=1}^{n} x_i \geq 5n$

(c) $\sum_{i=1}^{n} x_i \geq n$

(d) $\sum_{i=1}^{n} x_i \geq n + \log 19$

**31.** Let the random variable X have N(0, 1). Then $E(|X|)$ is equal to

(a) $\sqrt{2\pi}$

(b) $\frac{\sqrt{\pi}}{\sqrt{2}}$

(c) $\frac{\sqrt{2}}{\sqrt{\pi}}$

(d) $\frac{\sqrt{2}}{\pi}$

**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

(a) $\frac{X+b}{a+b}$

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

(c) $\frac{(b-a)X+a}{a+b}$

(d) $\frac{(b-a)X+b}{a+b}$

**33.** Consider the following statements :

1. An unbiased estimator is always unique.
2. Sufficient statistic is always a function of MLE.
3. Consistent estimator need not be unique.
4. UMP test is not unique.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 3 and 4 only

(c) 1, 3 and 4 only

(d) 1 and 4 only

**34.** Every similar test for testing under $H_0$ has a Neyman structure under which one of the following conditions ?

(a) Sufficient statistic

(b) Consistent statistic

(c) Boundedly complete

(d) Boundedly complete sufficient statistic

**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 $\theta$, it need not be consistent.
2. If t is a consistent estimator of $\theta$, it will also be an unbiased estimator of $\theta$.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

**37.** Let $x_1, x_2, x_3, \ldots, x_n$ 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 $\theta$ 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 $x_1, x_2, x_3, \ldots, x_n$ be a random sample from Poisson distribution with parameter $\theta$. Then the unbiased estimate of $e^{-\theta}$ which doesn't attain C – R lower bound is

(a) $\Sigma x_i$

(b) $2^{\Sigma x_i}$

(c) $\left(1 - \frac{1}{n}\right)^{\Sigma x_i}$

(d) $2\Sigma x_i$

**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 $X_1, X_2, X_3, ..., X_n$ be a random sample from a distribution with pdf

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

For the sufficient statistic for the parameter $\theta$, consider the following statements :

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

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

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

(a) $T(X) = X_{(1)} - n$

(b) $T(X) = X_{(1)} + 1$

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

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

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

(a) $\Sigma x_i$ and $\Sigma x_i^2$

(b) $\Pi x_i$ and $\Pi x_i^2$

(c) $\min (x_1, x_2, x_3, ..., x_n)$ and $\max (x_1, x_2, x_3, ..., x_n)$

(d) $\frac{x_{(n)} - x_{(1)}}{2}$ and $\frac{x_{(n)} + x_{(1)}}{2}$

**44.** Consider the following statements :

1. A minimum variance bound unbiased estimator (MVBUE) is always uniformly minimum variance unbiased estimator (UMVUE).
2. An MVBUE of a parameter $\theta$ must be sufficient statistic for $\theta$.
3. A UMVUE is always MVBUE.

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

**45.** Let $x_1, x_2, x_3, ..., x_n$ 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 :

1. Sample mean is a sufficient estimator of $\theta$.
2. Sample mean is a minimum variance bound estimator for $\theta$.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

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

(a) $\bar{x} \pm 1{\cdot}96 \frac{\bar{x}}{n}$

(b) $\bar{x} \pm 1{\cdot}96 \frac{\sqrt{x}}{n}$

(c) $\bar{x} \pm 1{\cdot}96 \frac{\bar{x}}{\sqrt{n}}$

(d) $\bar{x} \pm 1{\cdot}96 \sqrt{\frac{\bar{x}}{n}}$

**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 $\alpha$ and $\beta$ 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 $\left\{\frac{X}{Y} > 0{\cdot}65\right\}$ 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 $\lambda$. 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) $1{\cdot}5e^{-24}$

(b) $1{\cdot}5e^{-12}$

(c) $(1{\cdot}5)^{\sum_{i=1}^{12} x_i} e^{-12}$

(d) $(1{\cdot}5)^{\sum_{i=1}^{24} x_i} e^{-24}$

***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 $L(\theta) = \frac{A^{h(\theta)} - 1}{A^{h(\theta)} - B^{h(\theta)}}$; $\alpha$ and $\beta$ 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) $\frac{\theta_1 - \theta_0 + 2\theta}{\theta_0 - \theta_1}$

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

Let X be a binomial random variable with parameters n and $\theta$. The prior distribution of $\theta$ is beta distribution of first kind with parameters $\alpha$ and $\beta$. 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 $\mu$ ?

(a) $x_{(1)}$

(b) $x_{(1)} + x_{(n)}$

(c) $[x_{(1)} + x_{(n)}]/2$

(d) $2[x_{(1)} + x_{(n)}]$

**56.** What is the MLE estimator of $\sigma$ ?

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

**57.** What is UMVUE of $\theta_1$ 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 $\theta_2$ 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 $X_1, X_2, X_3, \ldots, X_n$ be i.i.d. random variables with $N(\mu, \mu)$. In this case, mean = variance = $\mu$ ($\mu > 0$).

**59.** Consider the following statements :

1. $\Sigma x_i^2$ is sufficient for $\mu$.

2. MLE of $\mu$ is $\frac{-1 + \sqrt{1 + 4m_2}}{2}$, where $m_2 = \frac{\Sigma x_i^2}{n}$.

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 :

1. $(\Sigma x_i, x_n)$ is sufficient for $\mu$.

2. Moment estimator of $\mu$ 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

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

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

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 × productivity × 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

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

## SPACE FOR ROUGH WORK

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