IES/ISS EXAM,2018

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T.B.C. : YLO–B–DTSS

Test Booklet Series

Serial No. 0008509

TEST BOOKLET

STATISTICS

PAPER—II

A

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 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.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
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

$$Y_1 = \beta_1 + \beta_2 + e_1$$
$$Y_2 = \beta_1 + \beta_3 + e_2$$
$$Y_3 = \beta_1 + \beta_2 + e_3$$

Then $\lambda_1\beta_1 + \lambda_2\beta_2 + \lambda_3\beta_3$ is estimable if and only if

(a) $\lambda_1 + \lambda_3 = \lambda_2$

(b) $\lambda_1 + \lambda_2 = \lambda_3$

(c) $\lambda_2 + \lambda_3 = \lambda_1$

(d) $\lambda_1 + \lambda_2 + \lambda_3 = C$

2. Consider the model

$$y_i = \beta_0 + \beta_1 x_i + e_i \ (i = 1, 2, 3)$$

where $x_1 = -1$, $x_2 = 0$ and $x_3 = 1$. The best linear unbiased estimate of β_0 and β_1 is

(a) $\left(\bar{y}, \dfrac{y_3 - y_1}{2}\right)$

(b) $\left(\dfrac{y_2 - y_1}{2}, \dfrac{y_3 - y_1}{2}\right)$

(c) $\left(\bar{y}, \dfrac{y_2 - y_1}{2}\right)$

(d) $\left(\dfrac{y_1 + y_2}{2}, \bar{y}\right)$

where $\bar{y} = \dfrac{y_1 + y_2 + y_3}{3}$.

3. Consider the following statements :

1. If multicollinearity exists, $(\mathbf{X}'\mathbf{X})^{-1}$ cannot be computed.
2. The method of least squares is a statistical method.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

4. Consider the following statements :

1. The g-inverse of a matrix, if it exists, is unique.
2. The problem of multicollinearity can be tackled by increasing sample size.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

5. In the context of the linear model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \varepsilon$, consider the following statements :

1. If $\mathbf{X}$ is a full rank matrix, then all linear parametric functions are estimable.
2. Each estimable linear parametric function is of the form $\mathbf{c}'\mathbf{X}\boldsymbol{\beta}$ for some vector $\mathbf{c}$.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

6. For a two-way ANOVA with 6 rows, 4 columns and 3 observations per cell, the degrees of freedom for interaction and residual are respectively

(a) 15 and 45

(b) 15 and 48

(c) 24 and 45

(d) 24 and 48

7. As the variability due to chance in an analysis of variance decreases, the *F*-statistic in the ANOVA

(a) will always increase

(b) will always decrease

(c) will remain constant

(d) requires additional information to claim any change

8. When k population means in an ANOVA are truly different from each other, it is likely that the average error deviation, for a significant *F*-statistic,

(a) is relatively large compared to the average treatment deviations

(b) is relatively small compared to the average treatment deviations

(c) is equal to the average treatment deviations

(d) differs significantly between at least two of the populations

9. Independent observations are drawn from the model

$$y_1 = \beta_0 + \beta_1 x_i + \mu_i;\ i = 1, 2, 3, \ldots, 10$$

It is given that the errors in the model are independent with mean 0 and variance unity. It is also given that the sum of regressors in the model equals 50 and their sum of squares is 260. The possible covariance between the least squares estimates of β_0 and β_1 would be

(a) 0

(b) 5

(c) − 0·5

(d) 0·5

10. Let

$$A = \begin{pmatrix} 3 & 2 & 2 \\ 1 & 0 & 1 \\ 4 & 2 & 3 \end{pmatrix}$$

Consider the following matrices :

$$P = \begin{pmatrix} 0 & 1 & 0 \\ \frac{1}{2} & -\frac{3}{2} & 0 \\ 0 & 0 & 0 \end{pmatrix},\quad Q = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ -2 & \frac{1}{2} & 0 \end{pmatrix}$$

and $$R = \begin{pmatrix} 0 & \frac{1}{2} & -1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$

Which one of the following is correct?

(a) P only does not give generalized inverse of A.

(b) Q only does not give generalized inverse of A.

(c) P and R only do not give generalized inverse of A.

(d) None of the options is correct

11. Consider the following statements :

1. Scheffe's test of multiple comparisons tests all simple and complex contrasts.
2. Bartlett's test of multiple comparisons tests simple contrasts.
3. Tukey's test of multiple comparisons reduces the Type–I error in the test.

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

12. Consider the following statements for multiple comparison tests conducted after a significant result is obtained in ANOVA :

1. The *t*-test on all pairwise comparisons inflates Type–I error.
2. Scheffe's test requires equal group sizes for multiple comparisons.
3. Newman-Keuls test reduces the risk of Type–II error.

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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13. Consider the model

$$E(Y_{ij}) = \mu_i,\ \text{var}(Y_{ij}) = \sigma^2$$

$j = 1, 2, 3, \ldots, n_i;\ i = 1, 2, 3, \ldots, p$

Which of the following is/are correct?

1. Any linear parametric function is estimable.
2. $\hat{\mu}_i = \dfrac{\sum_{j=1}^{n_i} Y_{ij}}{n_i}$

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

14. Let A be an $n \times p$ matrix and A^- be the generalized inverse of A. Then which of the following statements are correct?

1. The order of A^- is $p \times n$.
2. (A^-A) and (AA^-) are symmetric matrices.
3. If the rank of the matrix A is n, then $A^- = (A'A)^{-1}A'$.
4. If A is non-singular, then $A^{-1} = A^-$.

Select the correct answer using the code given below.

(a) 1, 2 and 3

(b) 1, 3 and 4

(c) 1, 2 and 4

(d) 2, 3 and 4

15. Consider a two-way classification with r observations per cell and interaction present

$$y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_{ij} + e_{ijk}$$

$i = 1, 2, 3, \ldots, p;\ j = 1, 2, 3, \ldots, q;$

$k = 1, 2, 3, \ldots, r$

Then the total number of parameters in this model is

(a) $1 + p + q + pq$

(b) $p + q + pq$

(c) pq

(d) $p + q + 1$

16. For a sample of unit size from a population with the p.d.f.

$$f(x, \alpha) = \frac{2}{\alpha^2}(\alpha - x)\ ;\quad 0 < x < \alpha$$

consider the following statements :

1. $2x$ is the maximum likelihood estimator of α.
2. $2x$ is the unbiased estimator of α.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

17. Let $X_1, X_2, X_3, \ldots, X_n$ be i.i.d. Bernoulli (p) random variables and $S_n = \sum_{i=1}^{n} X_i$. Then the unbiased estimator of p^3 is

(a) $\frac{S_n^3}{n^3}$

(b) $\frac{S_n(S_n - 1)(S_n - 2)}{n(n-1)(n-2)}$

(c) $\frac{(S_n - 1)(S_n - 2)(S_n - 3)}{(n-1)(n-2)(n-3)}$

(d) None of the above

18. A sample of n independent observations $X_1, X_2, X_3, \ldots, X_n$ is taken from $N(\mu, \sigma^2)$. For what value of k will

$$T = \frac{k}{(n-1)} \sum_{i=1}^{n-1} (X_{i+1} - X_i)^2$$

be an unbiased estimator of σ^2?

(a) 1

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

(c) $\frac{1}{3}$

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

19. Let $(X_1, X_2, X_3, \ldots, X_n)$ be a random sample from an exponential population with mean $\frac{1}{\theta}$. If $Z = nX_{(1)}$, where $X_{(1)} = \min(X_1, X_2, X_3, \ldots, X_n)$, then which of the following is/are correct?

1. Z is an unbiased estimator of $\frac{1}{\theta}$.

2. Z is consistent estimator of $\frac{1}{\theta}$.

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

20. Let t_1 be a most efficient estimator and t_2 be a less efficient estimator with efficiency e and let ρ be the correlation coefficient between the two estimators t_1 and t_2. Which one of the following is correct?

(a) $\rho = e$

(b) $\rho = 2e - 1$

(c) $\rho = \sqrt{e}$

(d) $\rho = e^2$

21. A random sample $(X_1, X_2, X_3, ..., X_n)$ is drawn from a Poisson distribution with parameter λ. Which one of the following is an unbiased estimator of λ^2?

(a) $\frac{1}{n}\sum_{i=1}^{n} x_i$

(b) $\frac{1}{n}\sum_{i=1}^{n} x_i^2$

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

(d) $\frac{1}{n}\sum_{i=1}^{n} x_i(x_i + 1)$

22. Let (X_1, X_2, X_3) be a random sample from binomial $(1, p)$. Which one of the following statistics is ***not*** sufficient for p?

(a) $X_1 + X_2 + X_3$

(b) $(X_1, X_2 + X_3)$

(c) $(X_1 + X_2, X_3)$

(d) $X_1 - X_2 + X_3$

23. Suppose a random sample of size 2 was selected from a population with the p.d.f.

$$f_\theta(x) = \frac{2}{\theta^2}(\theta - x); \; 0 < x < \theta$$

The maximum likelihood estimator of θ will be

(a) $\frac{(x_1 + x_2) + \sqrt{(x_1 - x_2)^2 + 4x_1x_2}}{4}$

(b) $\frac{(x_1 + x_2) + \sqrt{9(x_1 - x_2)^2 + 4x_1x_2}}{4}$

(c) $\frac{3(x_1 + x_2) + \sqrt{(x_1 - x_2)^2 + 4x_1x_2}}{4}$

(d) $\frac{3(x_1 + x_2) + \sqrt{9(x_1 - x_2)^2 + 4x_1x_2}}{4}$

24. If T is unbiased for θ and $\text{var}(T) \to 0$ as the sample size tends to ∞, then T is consistent for θ. This result follows from

(a) central limit theorem

(b) Cramer-Rao inequality

(c) Rao-Blackwell theorem

(d) Tchebychev's inequality

25. If one observation from Bernoulli distribution with parameter $p \in \left[\frac{1}{3}, \frac{2}{3}\right]$ is obtained, then the MLE of p is

(a) x

(b) $(2x + 1) / 3$

(c) $(x - 1) / 3$

(d) $(x + 1) / 3$

26. Let $X_i \sim N(\mu, \sigma^2)$, where $i = 1, 2, 3, \ldots, n$ and $\Theta = \{(\mu, \sigma^2) : -\infty < \mu < \infty, \sigma^2 > 0\}$ such that μ is known. Then the MLE of σ^2 is

(a) $\dfrac{\sum_{i=1}^{n}(X_i - \mu)^2}{n}$

(b) $\dfrac{\sum_{i=1}^{n-1}(X_i - \mu)^2}{n-1}$

(c) $\dfrac{n-1}{n^2}\sum_{i=1}^{n}(X_i - \mu)^2$

(d) $\dfrac{n-1}{n}\sum_{i=1}^{n}(X_i - \mu)^2$

27. Let $(X_1, X_2, X_3, \ldots, X_n)$ be a random sample of size n from uniform distribution with the p.d.f.

$$f(x) = \begin{cases} \dfrac{1}{\theta_2 - \theta_1}, & \theta_1 < x < \theta_2 \\ 0, & \text{otherwise} \end{cases}$$

Let T_1 and T_2 be the estimates of θ_1 and θ_2 respectively obtained by method of moments. Which one of the following is correct?

(a) $T_1 = \overline{X} + \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$ and

$T_2 = \overline{X} - \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$

(b) $T_1 = \overline{X} - \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$ and

$T_2 = \overline{X} + \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$

(c) $T_1 = \overline{X} + \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$ and

$T_2 = \overline{X} + \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$

(d) $T_1 = \overline{X} - \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$ and

$T_2 = \overline{X} - \sqrt{\frac{3}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2}$

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28. Let $(X_1, X_2, X_3, ..., X_n)$ be i.i.d. random variables with the density function

$$f(x, \mu) = e^{-(x-\mu)}, \quad x \geq \mu$$

The MLE of μ is given by

(a) $X_{(1)}$

(b) $X_{(n)}$

(c) $\frac{X_{(1)} + X_{(n)}}{2}$

(d) None of the above

29. If T is an MLE of θ and $\phi(\theta)$ is one-to-one function of θ, then $\phi(t)$ is the MLE of $\phi(\theta)$. This property is known as

(a) invariance property of MLE

(b) asymptotic property of MLE

(c) consistency property of MLE

(d) regularity conditions of MLE

30. Which of the following statements are correct?

1. MLEs are consistent.
2. MLEs are always unbiased.
3. MLEs follow asymptotically normal distribution.
4. MLE need not be a unique estimator.

Select the correct answer using the code given below.

(a) 1 and 3 only

(b) 1, 3 and 4

(c) 1, 2 and 3

(d) 2, 3 and 4

31. In sampling from a normal population $N(\theta, 1)$ with $\overline{X}$ being sample mean, which of the following classes describes all MVB estimators of θ?

(a) All estimators of the type $A\overline{X} + B$, where A and B are given constants

(b) $\overline{X}$ only

(c) All the estimators of $f(\overline{X})$, where f is a real-valued function

(d) No estimator attains MVB in this case

32. Let 5, 2, 3, 4, 3, 2, 4, 5, 3, 2 be a sample taken from a normal population with mean 0 and variance σ^2. The minimum variance bound estimator for σ^2 is

(a) 33

(b) 3·3

(c) 1·21

(d) 12·1

33. If $(X_1, X_2, X_3, ..., X_n)$ is a random sample from $N(1, \sigma^2)$, then which one of the following is unbiased for σ^2 and has variance equal to Cramer-Rao bound?

(a) $\frac{1}{n}\sum_{i=1}^{n}(X_i - 1)^2$

(b) $\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2$

(c) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2$

(d) $\frac{1}{n-1}\sum_{i=1}^{n}(X_i - 1)^2$

34. If $(X_1, X_2, X_3, ..., X_n)$ be i.i.d. $N(\mu, \sigma^2)$ with μ known, then C-R bound for estimation of $\sigma^2 = \theta$ will be

(a) $\frac{2\theta}{n}$

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

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

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

35. Suppose the p.d.f. is

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

The sufficient statistic for θ based on a random sample of size n is

(a) $\sum_{i=1}^{n} X_i$

(b) $\overline{X}$

(c) $X_{(1)}$

(d) $X_{(n)}$

36. Let $(X_1, X_2, X_3, ..., X_n)$ be a random sample from a population with the p.d.f.

$$f(x, \theta) = \theta x^{\theta - 1}; \; 0 < x < 1, \; \theta > 0$$

Which one of the following is correct?

(a) $t_1 = \sum_{i=1}^{n} X_i$ is sufficient for θ.

(b) $t_1 = \prod_{i=1}^{n} X_i$ is sufficient for θ.

(c) No sufficient statistic exists for θ.

(d) None of the above

37. Let 5, 3, 3, 6, 2, 3, 5, 4, 3, 6 be a sample of size 10 from a population following Poisson (λ) distribution. The UMVUE of λ is

(a) 40

(b) 8

(c) 4

(d) 3

38. A random sample of 60 schoolchildren gives 40 spectacle users. The 95% confidence limits of the spectacle users of the population of schoolchildren are

(a) 66%, 89%

(b) 66%, 79%

(c) 55%, 66%

(d) 55%, 79%

39. A sample of size one is drawn from Poisson distribution with parameter θ. To test $H_0 : \lambda = 1$ against $H_1 : \lambda = 2$, consider the new randomized test with critical region $\omega = \{x : x > 3\}$. The probability of Type–I error is

(a) $(3e^2 - 19)/(3e^2)$

(b) $(3e - 5)/3$

(c) $(3e - 8)/(3e)$

(d) $(3e^2 - 16)/(3e^2)$

40. Let $(X_1, X_2, X_3, ..., X_n)$ be a random sample from $N(\mu, \sigma^2)$ distribution, where both μ and σ^2 are unknown. The shortest expected length confidence interval for μ is obtained using

(a) standard normal distribution

(b) t-distribution

(c) F-distribution

(d) Chi-square distribution

41. Let X be a random variable having exponential distribution with mean $\frac{1}{\theta}$. Consider the critical region $\omega = \{x : x > 2\}$ to test $H_0 : \theta = 1$ against $H_1 : \theta = 2$. The power of the test at $\theta = 2$ is

(a) $(e^2 - 1) / e^2$

(b) $1 / e^4$

(c) $(e^4 - 1) / e^4$

(d) $1 / e^2$

42. The Neyman-Pearson fundamental lemma gives the method of construction of

(a) uniformly most powerful test

(b) most powerful test

(c) unbiased test

(d) randomized test

43. For the problem of testing $\mu = \mu_0$ against $\mu \neq \mu_0$ in sampling from $N(\mu, \sigma^2)$ distribution, where both μ and σ^2 are unknown, the likelihood ratio test is equivalent to

(a) uniformly most powerful test

(b) uniformly most powerful similar test

(c) uniformly most powerful invariant test

(d) uniformly most powerful unbiased test

44. Let X_i $(i = 1, 2, 3, \ldots, n)$ be distributed as $N(\mu_i, 1)$ distribution. The likelihood ratio test for testing $H_0 : \mu_1 = \mu_2 = \ldots = \mu_n = 0$ against $H_1 : \mu_i \neq 0$, for some i, is based on the statistic

(a) $\sum_{i=1}^{n} \left(\frac{X_i^2}{\mu_i} \right)$

(b) $\sum_{i=1}^{n} X_i^2$

(c) $\sum_{i=1}^{n} (X_i - \overline{X})^2$

(d) $\sum_{i=1}^{n} X_i$

45. Under the regularity conditions, if λ_n is the likelihood ratio, then the asymptotic distribution of $-2\log\lambda_n$, as $n \to \infty$, is

(a) normal distribution

(b) Chi-square distribution

(c) *F*-distribution

(d) *t*-distribution

46. In a Sequential Probability Ratio Test (SPRT), λ_m denotes the likelihood ratio at *m*th stage of the experiment; α and β are the probabilities of Type–I and Type–II errors respectively. Which of the following pairs is/are correctly matched?

1. $\lambda_m \geq \frac{1-\beta}{\alpha}$: Terminate the process with the rejection of null hypothesis H_0

2. $\frac{\beta}{1-\alpha} < \lambda_m < \frac{1-\beta}{\alpha}$: Terminate the process with the acceptance of H_0

3. $\lambda_m \leq \frac{\beta}{1-\alpha}$: Continue sampling by taking an additional observation

Select the correct answer using the code given below.

(a) 1 only

(b) 1 and 2

(c) 1 and 3

(d) 2 and 3

47. If *N* is stopping time for an SPRT, then which one of the following is correct?

(a) $P[N < \infty] = \frac{1}{4}$

(b) $P[N < \infty] = \frac{1}{2}$

(c) $P[N < \infty] = 1$

(d) $P[N < \infty] = \frac{3}{4}$

48. Let $\delta(x)$ be an estimator of θ and $L[\theta, \delta(x)]$ be the loss function associated with $\delta(x)$ at θ. Then the risk $R(\theta, \delta) = E[L(\theta, \delta(x))]$ is mean squared error if the associated loss function is

(a) $L[\theta, \delta(x)] = (\theta - a)^3$

(b) $L[\theta, \delta(x)] = (\theta - a)^2$

(c) $L[\theta, \delta(x)] = |\theta - a|$

(d) $L[\theta, \delta(x)] = \theta(\theta - a)^2$

49. Let $(X_1, X_2, X_3, \ldots, X_n) \sim N(\mu, 1)$ and let prior distribution of μ be $N(0, 1)$. Let $L(\mu, \delta) = [\mu - \delta(x)]^2$. Then the Bayes' risk associated with δ is

(a) $\dfrac{\sum_{i=1}^{n} x_i}{n+1}$

(b) $\dfrac{2}{n+2}$

(c) $\dfrac{1}{n+1}$

(d) $\dfrac{\sum_{i=1}^{n} x_i^2}{n}$

50. The Bayes' estimator of a parameter under squared error loss function is

(a) posterior mean

(b) posterior median

(c) posterior mode

(d) posterior variance

51. Which one of the following statements is ***not*** correct?

(a) If any Bayes' solution is unique, it must be admissible.

(b) A uniformly best decision rule always exists.

(c) Posterior median is the Bayes' estimator under the absolute error loss function.

(d) A Bayes' decision rule, whose risk is constant, is also a minimax decision rule.

52. Let $(X_1, X_2, X_3, \ldots, X_n)$ denote a random sample from a population with the density $f(x, \theta) = \sqrt{\theta} x^{\sqrt{\theta}-1}$, $0 \le x \le 1$, $\theta > 0$. The MLE of θ is given by

(a) $\dfrac{\sum_{i=1}^{n} \log x_i}{n}$

(b) $\left(\dfrac{\sum_{i=1}^{n} \log x_i}{n}\right)^2$

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

(d) $\dfrac{n^2}{\left(\sum_{i=1}^{n} \log x_i\right)^2}$

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53. Let $(X_1, X_2, X_3, ..., X_n)$ be an i.i.d. sequence of random variables $(n > 2)$ from the distribution whose density function is $f(x, \theta) = \theta x^{\theta-1}$, $0 < x < 1$, $\theta > 0$. If $Z = -\left(\sum_{i=1}^{n} \log X_i\right)$, then an unbiased estimator of θ is

(a) $\frac{n}{Z}$

(b) $\frac{n-1}{Z}$

(c) nZ

(d) $(n-1)Z$

54. A statistic $t = t(x_1, x_2, x_3, ..., x_n)$ is sufficient for θ. Consider the following statements :

1. It contains all the information about θ.
2. The likelihood function can be expressed as

$$L(x, \theta) = g(t, \theta)h(x_1, x_2, x_3, ..., x_n)$$

3. The conditional distribution of $x_1, x_2, x_3, ..., x_n$ given t is independent of θ.

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

55. Let $(X_1, X_2, X_3, ..., X_n)$ be a random sample from Rayleigh distribution with the p.d.f. $f(x, \theta) = \frac{x}{\theta}\exp\left\{-\frac{x^2}{2\theta}\right\}$; $x > 0$, $\theta > 0$. The complete sufficient statistic for θ is

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

(b) $\bar{x}$

(c) $\sum_{i=1}^{n} x_i^2$

(d) $\max(x_1, x_2, x_3, ..., x_n)$

56. A single observation X is drawn from $B(10, p)$ distribution. Reject $H_0 : p = \frac{1}{2}$ in favour of $H_1 : p = \frac{1}{4}$ if $X \leq 3$. Then the power of the test is

(a) $369\left(\frac{3^7}{4^{10}}\right)$

(b) $366\left(\frac{3^7}{4^{10}}\right)$

(c) $372\left(\frac{3^7}{4^{10}}\right)$

(d) $375\left(\frac{3^7}{4^{10}}\right)$

57. For testing H_0 against H_1, if $\phi(x)$ is a UMP, then

(a) $\phi(x)$ is always unbiased

(b) $\phi(x)$ is never unbiased

(c) $\phi(x)$ has power less than its size

(d) None of the above

58. Let X_1 and X_2 be i.i.d. random variables with Poisson. Then $(X_1 + 2X_2)$ is not sufficient because

(a) $P(X_1 = 1, X_2 = 1 \mid T = 3)$ depends on λ

(b) $(X_1 + 2X_2)$ is Poisson

(c) $(X_1 + 2X_2)$ is not Poisson

(d) $P(X_1 = 1, X_2 = 1 \mid T = 3)$ is Poisson with parameter one

where $T = (X_1 + 2X_2)$.

59. Let X be the random variable from the p.m.f.

$$f(x, \theta) = \begin{cases} \left(\frac{\theta}{2}\right)^{|x|} (1-\theta)^{1-|x|}; & x = -1, 0, 1 \text{ and } 0 < \theta < 1 \\ 0 & ; \text{ otherwise} \end{cases}$$

The complete sufficient statistic for θ

(a) is X

(b) is $X - 1$

(c) is $|X|$

(d) does not exist

60. Let $(X_1, X_2, X_3, \ldots, X_n)$ be i.i.d. random variables with $N(\theta, 1)$. Then C-R lower bound for the variance of an unbiased estimator of θ^r is

(a) $\frac{\theta^r}{n}$

(b) $\frac{r\theta^{r-1}}{n}$

(c) $\frac{r^2\theta^{2r-2}}{n}$

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

61. Which of the following are true for Sustainable Development Goals (SDGs)?

1. It has 8 goals.
2. It has 17 goals.
3. It is recommended by UNICEF.
4. It is recommended by UNDP.
5. Life below water, Life on land, No Poverty and Climate Action are included in SDGs.

Select the correct answer using the code given below.

(a) 1, 3 and 5

(b) 2 and 4 only

(c) 2, 4 and 5

(d) None of the options is correct

62. Which one of the following is ***not*** a desirable property of official statistics?

(a) It should be relevant.

(b) It should be brought out in a timely manner.

(c) It should be reliable and credible.

(d) It should be able to disclose an individual unit's data.

63. The reliability of data collected through sample surveys may be measured by

(a) average

(b) standard deviation

(c) coefficient of variation

(d) standard error

64. The Ultimate Stage Unit for data collection in socio-economic survey of NSSO (National Sample Survey Office) is

(a) individual

(b) family

(c) household

(d) village/UFS (Urban Frame Survey) block

65. The most common sampling design used by NSSO in its socio-economic surveys is

(a) simple random sampling

(b) circular systematic sampling

(c) probability proportional to size (PPS) sampling

(d) two-stage stratified sampling

66. Metadata is

(a) unit level data

(b) data in tabular format

(c) raw data (i.e., no data validation has been done)

(d) data about data/information about data

67. The subject of Statistics comes under which of the following Lists of the Constitution of India?

(a) Union List

(b) State List

(c) Concurrent List

(d) All of the above

68. Which of the following are the main activities of CSO (Central Statistics Office)?

1. Coordination of statistical activities in the country
2. Evolving statistical standards
3. Collecting data through sample surveys
4. Providing guidance and training in the field of official statistics

Select the correct answer using the code given below.

(a) 1, 2 and 3

(b) 2, 3 and 4

(c) 1, 2 and 4

(d) 1, 3 and 4

69. The Collection of Statistics Act, 2008 is applicable on

1. industrial and business concerns
2. individual and household
3. government and private agencies/enterprises

Which of the above are correct?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

70. The Dearness Allowance (DA) of Central and State Government employees is linked with

(a) WPI (Wholesale Price Index)

(b) CPI (Consumer Price Index)—U&R (Urban and Rural)

(c) CPI (Consumer Price Index)—IW (Industrial Workers)

(d) CPI (Consumer Price Index)—AL (Agricultural Labour)/RL (Rural Labour)

71. The retail inflation in India is being measured on which one of the following indices?

(a) CPI (Consumer Price Index)—IW (Industrial Workers)

(b) WPI (Wholesale Price Index)

(c) CPI (Consumer Price Index)—U&R (Urban and Rural)

(d) CPI (Consumer Price Index)—AL (Agricultural Labour)/RL (Rural Labour)

72. Annual inflation rate can be calculated as

(a) $\frac{\text{CPI (current year)} - \text{CPI (last year)}}{\text{CPI (last year)}} \times 100$

(b) CPI (current year) – CPI (last year)

(c) $\frac{\text{CPI (current year)} - \text{CPI (base year)}}{\text{CPI (base year)}} \times 100$

(d) CPI (current year) – CPI (base year)

73. Price deflators are used to obtain

(a) GDP at constant prices

(b) GDP at current prices

(c) GDP at basic prices

(d) GVA at producer prices

74. Which of the following are the sources of industrial data in India?

1. Annual Survey of Industries (ASI)
2. Economic Census (EC)
3. Employment, Unemployment Survey of NSSO
4. Micro, Small and Medium Enterprise (MSME) Survey

Select the correct answer using the code given below.

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

75. Which one of the following is ***not*** correct for Minimum Support Price (MSP)?

(a) MSP is the price at which government purchases food grains from the farmers.

(b) MSP ensures adequate food grains production in the country.

(c) MSP is a direct benefit transfer.

(d) MSP is recommended by CACP (Commission for Agricultural Costs and Prices).

76. Which among the following is a data source from where Infant Mortality Rate can be calculated for India?

(a) NSSO Health Survey

(b) Economic Census

(c) NSSO Disability Survey

(d) Population Census

77. Which one of the following organizations releases Wholesale Price Index (WPI)?

(a) Labour Bureau

(b) NSSO

(c) CSO

(d) Office of Economic Adviser, the Ministry of Commerce and Industry

78. The periodicity of Agriculture Census in India is

(a) 5 years

(b) 7 years

(c) 10 years

(d) 15 years

79. Effective literacy rate is the literacy rate

(a) taking the population from age 7 years and above into account

(b) taking the entire population into account

(c) taking the population from age 7 years to 60 years into account

(d) None of the above

80. The Human Development Index (HDI) developed by UNDP does ***not*** include

(a) life expectancy at birth

(b) gender equality

(c) expected and mean years of schooling

(d) GNI per capita

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