IES/ISS Exam, 2020

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T.B.C. : DFSE-D-STT

Test Booklet Series

D

Serial 1009732

TEST BOOKLET

STATISTICS

Paper II

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

INSTRUCTIONS

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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. Suppose the probability mass function of a random variable X under the parameter $\theta = \theta_0$ and $\theta = \theta_1$, $\theta_1 \neq \theta_0$ is given by

X	0	1	2	3
$p_{\theta_0}(x)$	0·01	0·04	0·50	0·45
$p_{\theta_1}(x)$	0·02	0·08	0·40	0·50

Define a test function φ such that

$$\varphi(x) = \begin{cases} 1, & \text{if } x = 0, 1 \\ 0, & \text{if } x = 2, 3 \end{cases}$$

For testing $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$ the test φ is

(a) a most powerful test at level 0·05

(b) a biased test

(c) test with power 0·90

(d) test of size 0·01

2. Consider the distribution having probability density function of a random variable X as

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

Let $1 \leq X \leq 1{\cdot}5$ be the critical region to test the hypothesis $H_0 : \theta = 1{\cdot}5$ against $H_1 : \theta = 2$. Then

(a) size of the test is 0 and test is unbiased

(b) size of the test is $\frac{1}{2}$ and test is unbiased

(c) size of the test is $\frac{1}{3}$ and test is biased

(d) size of the test is $\frac{1}{3}$ and test is unbiased

3. Let X be a random variable with pmf under H_0 and H_1 given by

X	1	2	3	4	5	6
$p_{\theta_0}(x)$	0·01	0·01	0·01	0·01	0·01	0·95
$p_{\theta_1}(x)$	0·05	0·04	0·03	0·02	0·01	0·85

Consider a test function φ(x) as

$$\varphi(x) = \begin{cases} 1, & \text{if } X = 1, 2 \\ 0{\cdot}25, & \text{if } X = 3 \\ 0, & \text{otherwise} \end{cases}$$

Then which one of the following is correct ?

(a) φ(x) is a most powerful test of level $\alpha = 0{\cdot}03$

(b) φ(x) is a most powerful test of level $\alpha = 0{\cdot}03$ with power 0·0975

(c) φ(x) has size 0·0225 and power 0·0975 but it is not a most powerful test with level $\alpha = 0{\cdot}03$

(d) φ(x) is not a most powerful test of level $\alpha = 0{\cdot}0225$

4. Which one of the following parameters is correct in case of Likelihood Ratio Test (LRT) ?

(a) In LRT, control is not affected over the probabilities of type-I error by suitably choosing the cut-off point λ_0

(b) LRT always gives unbiased test

(c) When null hypothesis is composite, the LR critical region will be always similar

(d) Under certain assumptions, an LRT will be consistent

5. An estimator to be a good estimator,

(a) should be efficient but not necessarily unbiased

(b) should be consistent but not necessarily efficient

(c) should be unbiased but not necessarily sufficient

(d) should be unbiased, consistent, sufficient and efficient

6. For Cauchy distribution, consider the following statements :

1. Sample mean is consistent estimator of the population median.
2. Sample median is consistent estimator of the population median.

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. Let X be distributed Poisson variate with mean $\lambda > 0$. Then unbiased estimator of $e^{-(k+1)\lambda}$, where $k > 0$ is

(a) k^X

(b) X^k

(c) $(-k)^X$

(d) k^{-X}

8. If $X_1, X_2, X_3, ..., X_n$ are random variables having joint pdf $f_\theta(x_1, x_2, ..., x_n)$; $\theta \in \Theta$, then Fisher's information about θ contained in the observation X is given by

(a) $I_\theta = E_\theta\left(\frac{\partial^2 \log_e f_\theta(x)}{\partial\theta^2}\right)$

(b) $I_\theta = E_\theta\left(-\frac{\partial^2 \log_e f_\theta(x)}{\partial\theta^2}\right)^2$

(c) $I_\theta = E_\theta\left(\frac{\partial \log_e f_\theta(x)}{\partial\theta}\right)^2$

(d) None of the above

9. Let $X_1, X_2, X_3, ..., X_n$ be a random sample from a population with pdf

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

The sufficient statistic for θ using factorization theorem will be

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

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

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

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

10. Consider a problem of estimation of parameter θ with respect to an absolute error loss function. Hence $L(\theta, d) = |\theta - d|$. The Bayes rule is given by

(a) Mean of the posterior distribution of θ given X

(b) Mode of the posterior distribution of θ given X

(c) Median of the posterior distribution of θ given X

(d) MLE of θ in the posterior distribution of θ given X

11. Let $X_1, X_2, X_3, ..., X_n$ be a random sample from uniform distribution $U(0, \theta)$ with $f(x, \theta) = \frac{1}{\theta}$; $0 < x < \theta$, then the consistent estimator for $\frac{\theta}{e}$ is

(a) $X_{(1)}$

(b) $\left(\prod_{i=1}^{n} \sqrt[n]{X_i}\right)^n$

(c) $\left(\prod_{i=1}^{n} X_i\right)^{\frac{1}{n}}$

(d) $X_{(n)}$

12. From a sampling from $N(\theta, 1)$ using SPRT for testing $H_0 : \theta = 0$ against $\theta = 2$, the ASN function for $\alpha = 0{\cdot}05$ and $\beta = 0{\cdot}1$ is $E(n) = \frac{L(\theta) \log B + \{1 - L(\theta)\} \log A}{E(Z)}$, where

(a) $A = 18, B = \frac{19}{2}, E(Z) = 4(1 - \theta)$

(b) $A = 18, B = \frac{2}{19}, E(Z) = 4(\theta - 1)$

(c) $A = \frac{2}{19}, B = 18, E(Z) = 4(1 - \theta)$

(d) $A = \frac{2}{19}, B = 18, E(Z) = 4 - \theta$

13. Let X be a random variable with density function $f(x) = \theta e^{-x\theta}$; $0 < x < \infty$. Then the central 95% confidence limits for θ with large sample size n are

(a) $\left(1 + \frac{1{\cdot}96}{\sqrt{n}}\right)\overline{X}, \left(1 - \frac{1{\cdot}96}{\sqrt{n}}\right)\overline{X}$

(b) $\left(1 + \frac{1{\cdot}96}{\sqrt{n}}\right)\frac{1}{\overline{X}}, \left(1 - \frac{1{\cdot}96}{\sqrt{n}}\right)\frac{1}{\overline{X}}$

(c) $\left(1 + \frac{1{\cdot}96}{n}\right)\frac{1}{\overline{X}}, \left(1 - \frac{1{\cdot}96}{n}\right)\frac{1}{\overline{X}}$

(d) $\left(1 + \frac{1{\cdot}96}{n}\right)\overline{X}, \left(1 - \frac{1{\cdot}96}{n}\right)\overline{X}$

14. Let X and Y be independent $N(\theta, \sigma_1^2)$ and $N(\theta, \sigma_2^2)$, where σ_1^2 and σ_2^2 are known. Then the sufficient statistic for θ is

(a) $\overline{x} + \overline{y}$

(b) $\frac{x}{\sigma_1} + \frac{y}{\sigma_2}$

(c) $\frac{x^2}{\sigma_1^2} + \frac{y^2}{\sigma_2^2}$

(d) $\frac{x}{\sigma_1^2} + \frac{y}{\sigma_2^2}$

15. Suppose that $X_1, X_2, X_3, ..., X_n$ be a random sample of size n. An estimator T_n calculated from this sample is said to be a consistent estimator of parameter θ for all $\varepsilon > 0$, $\eta > 0$ and $n \geq m$ if

(a) $E(T_n) = \theta$

(b) $\lim_{n \to \infty} V(T_n) = 0$

(c) $P[\{|T_n - \theta|\} < \varepsilon] > 1 - \eta$

(d) $P[\{|T_n - \theta|\} < \varepsilon] < 1 - \eta$

16. Let $X_1, X_2, X_3, ..., X_n$ be a random sample from $U(0, 5\theta)$.

Define $X_{(1)} = \min (X_1, X_2, X_3, ... X_n)$ and $X_{(n)} = \max (X_1, X_2, X_3, ... X_n)$. Then the maximum likelihood estimator of θ is

(a) $\frac{1}{5} X_{(1)}$

(b) $X_{(1)}$

(c) $X_{(n)}$

(d) $\frac{1}{5} X_{(n)}$

17. Let $X_1, X_2, X_3, ..., X_n$ be an i.i.d. random variables with Poisson (λ). The MLE of λ is

(a) $\overline{X}$

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

(c) $\overline{X} - X_{(1)}$

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

18. Let $X_1, X_2, X_3, ..., X_n$ be a random sample from $N(\mu, 1)$. The uniformly minimum variance unbiased estimator (UMVUE) of μ^2 is given by

(a) $(\overline{X})^2$

(b) $n(\overline{X})^2$

(c) $(\overline{X})^2 - \frac{1}{n}$

(d) $n\{(\overline{X})^2 - 1\}$

19. Let $I(\theta)$ be the Fisher information on θ, supplied by the sample. If T is an unbiased estimator of $\psi(\theta)$, then the variance of T will be

(a) $\geq \dfrac{\left(\frac{\partial \psi}{\partial \theta}\right)^2}{I(\theta)}$

(b) $\leq \dfrac{\left(\frac{\partial \psi}{\partial \theta}\right)^2}{I(\theta)}$

(c) $\geq \dfrac{1}{I(\theta)}$

(d) $\leq \dfrac{1}{I(\theta)}$

20. Bhattacharya bound is the generalisation of the

(a) Cramer–Rao Inequality

(b) Rao–Blackwell theorem

(c) Neyman–Pearson Lemma

(d) Chapman–Robbins–Kiefer bound

21. Let $X_1, X_2, ..., X_n$ be a random sample from normal population with known variance. Consider the two estimators, sample mean and sample median for mean of the normal population. Then efficiency of sample median with respect to sample mean is

(a) π

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

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

(d) 2π

22. For a random sample $X_1, X_2, X_3, ..., X_n$ from $N(\mu, \sigma^2)$ with μ known, the Minimum Variance Unbiased Estimator (MVUE) for the unknown σ^2 is

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

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

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

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

23. Consider a random sample $\{8, 4, \frac{1}{2}, 1\}$ from the distribution having most general form of the probability mass function

$$f(x, \theta) = \left(\frac{x}{\theta}\right)^{\theta A'(\theta)} \exp[A(\theta) + C(x)]$$

where $A'(\theta)$ is the derivative of $A(\theta)$ with respect to θ. The maximum likelihood estimator of θ is

(a) $\frac{27}{8}$

(b) 2

(c) $\frac{32}{27}$

(d) $\frac{5}{2}$

24. Let $\{7{\cdot}05, 6{\cdot}89, 6{\cdot}62, 7{\cdot}32, 7{\cdot}48, 6{\cdot}93, 7{\cdot}17, 6{\cdot}78\}$ be a random sample from uniform $U\left(\theta - \frac{1}{2}, \theta + \frac{1}{2}\right)$ distribution. Then which one of the following would be MLE for θ ?

(a) 6·99 as well as 7·10

(b) 6·87 as well as 7·10

(c) 7·54 as well as 6·92

(d) 6·92 as well as 6·87

25. Let A be most efficient estimator and B is less efficient estimator with efficiency e. Then Cov(A, B – A) equals to

(a) 0

(b) e

(c) e^2

(d) $1 - e$

26. To estimate the parameter λ (variance) of Poisson distribution, a statistic is defined as $s^2 = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n-1}$ from a random sample of size n from the distribution. Then $Var(S^2)$ will be always greater than or equal to

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

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

(c) $\frac{n\lambda}{n-1}$

(d) $\frac{\lambda}{n+1}$

27. Let X_1, X_2 and X_3 be iid normal variates with mean θ and variance 1. Define a statistic $T = X_1 - X_2 - X_3$ for unknown parameter θ. Then the Fisher information contained in statistic T is

(a) 3

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

(c) -3

(d) $-\frac{1}{3}$

28. Let $X_1, X_2, \ldots, X_n$ be a random sample from the distribution having pdf

$f(x, \theta) = e^{-(x-\theta)}, \quad x > \theta.$

Then by factorisation theorem we say that

(a) $\sum_{i=1}^{n} X_i$ is the only sufficient statistic for θ

(b) $\left\{X_{(1)}, \sum_{i=1}^{n} X_i\right\}$ is jointly sufficient for θ

(c) $X_{(n)}$ is sufficient for θ

(d) $\left\{X_{(n)}, \sum_{i=1}^{n} X_i\right\}$ is jointly sufficient for θ

29. Let $X_1, X_2, \ldots, X_n$ be a random sample of size n from $N(\theta, 1)$ population. The complete statistic for θ is

(a) X_1

(b) $X_1 - X_2$

(c) $2X_1 - X_2 - X_3$

(d) $X_1 + X_2 + X_3 + X_4$

30. Suppose (X, Y) follows bivariate normal distribution with means μ_1, μ_2; standard deviations σ_1, σ_2 and correlation coefficient ρ, $-1 < \rho < 1$, where all the parameters are unknown. Then for checking $\sigma_1 = \sigma_2$ is equivalent to verifying the independence of

(a) X and Y

(b) X and X – Y

(c) X + Y and Y

(d) X + Y and X – Y

31. Let $X_1, X_2, X_3, \ldots, X_n$ be iid random variables with $N(\theta, 1)$. The Bhattacharya bound for $g(\theta) = \theta^2$ is

(a) $\frac{4\theta^2}{n} + \frac{2}{n^2}$

(b) $\frac{4\theta^2}{n}$

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

(d) $\frac{2\theta^2}{n} + \frac{1}{n^2}$

32. If $X_1, X_2, X_3, \ldots, X_m$ be independently and identically distributed random variables from B(n, P), then the maximum likelihood estimator of P is

(a) $\frac{\overline{X}}{n}$

(b) $\overline{X}$

(c) $\frac{\overline{X}}{m}$

(d) $\frac{\overline{X}}{mn}$

33. Let $X_1, X_2, X_3, \ldots, X_n$ be independently and identically distributed random variables with

$$f(x, \theta) = \begin{cases} \frac{3x^2}{\theta^3}; & 0 < x < \theta \\ 0; & \text{otherwise} \end{cases}$$

The UMVUE of θ^r is given by

(a) $x_{(n)}^r \left[\frac{r+3}{3}\right]$

(b) $x_{(n)}^r \left[\frac{r+3n}{3n}\right]$

(c) $x_{(1)}^r \left[\frac{r+3n}{3n}\right]$

(d) $x_{(n)}^r \left[\frac{3n}{r+3n}\right]$

34. A random sample of 500 apples was taken from a large consignment and 60 were found to be bad. The 98% confidence limits for the percentage of bad apples in the consignment are

(Significant value of Z at 98% confidence coefficient is 2·33)

(a) (7·62, 13·58)

(b) (8·61, 15·38)

(c) (4·38, 9·13)

(d) (3·08, 6·14)

35. Consider the following statements :

The null hypothesis $H_0 : \theta \in \Theta_0$ is said to be composite if

1. Θ_0 contains more than one point θ.
2. The joint distribution of $(X_1, X_2, X_3, ..., X_n)$ is completely specified.
3. For testing $H_0 : \theta \in \Theta_0$ against alternative $H_1 : \theta \in \Theta_1$ at level α, the critical region w is such that $P_\theta(w) \leq \alpha$ for all $\theta \in \Theta_0$.

Which of the above are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

36. Let $X_1, X_2, X_3, ..., X_n$ be a random sample from $U(\theta, \theta+1)$. Which of the following statements is/are correct ?

1. The estimator $\left(\overline{X} - \frac{1}{2}\right)$ is the best unbiased estimator of θ.
2. The joint probability density function of $X_1, X_2, X_3, ..., X_n$ can be written as

$$f(x, \theta) = \begin{cases} 1; & \max_i x_i - 1 < \theta < \min_i x_i \\ 0; & \text{otherwise} \end{cases}$$

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

37. If $X_1, X_2, X_3, ..., X_n$ is a random sample from uniform distribution $U(0, \theta)$, then the unbiased estimators of θ are

1. $\frac{\overline{X}}{2}$
2. $2\overline{X}$
3. $\frac{n+1}{n} X_{(n)}$
4. $\frac{n}{n+1} X_{(n)}$

Which of the above results are correct ?

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

38. If $X_1, X_2, X_3, ..., X_n$ is a random sample from uniform distribution U(0, θ), then the efficiency of $2\overline{X}$ relative to $\frac{n+1}{n}X_{(n)}$ is

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

(b) $\frac{n}{3}$

(c) $\frac{n+2}{3}$

(d) $\frac{3}{n+2}$

39. If $\hat{\theta}_1 = \frac{X}{n}$ and $\hat{\theta}_2 = \frac{1}{3}$ are the estimators of the parameter θ of a binomial population and $\theta = \frac{1}{2}$, then the values of n for which the mean square error of $\hat{\theta}_2$ is less than the variance of $\hat{\theta}_1$, are

(a) $2 \le n < 7$ only

(b) $1 \le n \le 6$ only

(c) $1 \le n \le 8$ only

(d) $1 \le n \le 4$ only

40. If $X_1, X_2, X_3, ..., X_n$ constitutes a random sample of size n from the population given by

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

, then the estimator of θ by the method of moments is

(a) $\overline{X}$

(b) $3\overline{X}$

(c) $\frac{\overline{X}}{3}$

(d) $\overline{X} + 3$

Consider the following for the next four (4) items :

An experiment was conducted to test for the difference in the mean weights of a single species of fish caught by fishermen in three different lakes. The significance level for the test is 0·05. The incomplete information is provided in the following ANOVA table :

Source of variation	Degrees of freedom	Sum of squares	Mean SS	F statistic
Treatment	–	17·04	–	–
Error	9	–	–	
Total	11	35·04		

41. The null hypothesis for the analysis is

(a) $H_0 : \mu_1 = \mu_2 = ... = \mu_9 (= \mu)$

(b) $H_0 : \mu_1 = \mu_2 = \mu_3 = 0$

(c) $H_0 : \mu_1 = \mu_2 = \mu_3 (= \mu)$

(d) at least one pair of fish populations have same mean

42. If the critical value of F at 5% level of significance is found to be 4·2565, what would be the appropriate interpretation of the test ?

(a) Reject the null hypothesis and conclude that all the populations of fish have different mean weights.

(b) Reject the null hypothesis and conclude that exactly two of the populations of fish have different mean weights.

(c) Reject the null hypothesis and conclude that the mean weight of at least one fish population differs from others.

(d) There is insufficient evidence to claim that the mean weights of fish populations differ.

43. The value of F statistic in the table equals

(a) 2·46

(b) 4·26

(c) 6·24

(d) 8·52

44. If all the observations from three lakes are pooled into a single group, they would have a standard deviation equal to

(a) 2·000

(b) 1·414

(c) 4·128

(d) 5·919

Consider the following for the next three (03) items :

In order to test the effectiveness of three different teaching methods, three instructors were assigned 12 students each. The students were then randomly assigned to the different teaching methods and were taught exactly the same material. The following ANOVA table was obtained for the grades of students who were given identical tests :

Source	Degrees of freedom	Sum of squares (SS)	Mean SS	F-ratio
Methods	–	162	–	–
Instructors	–	90	–	–
Interaction	–	600	–	–
Error	–	900	–	–

Complete the two-way ANOVA table with interaction and answer the following questions.

45. The degrees of freedom associated with the methods, instructors, interaction and errors are respectively

(a) 2, 2, 95 and 107

(b) 3, 3, 101 and 107

(c) 2, 2, 4 and 27

(d) None of the above

46. The mean sum of squares due to methods, instructors, interaction and errors are respectively

(a) 81, 45, 150, 33·33

(b) 81, 45, 6·5, 8·41

(c) 54, 30, 5·94, 8·41

(d) None of the above

47. The F ratios pertaining to methods, instructors and interaction are, respectively

(a) 9·63, 5·35, 0·77

(b) 2·43, 1·35, 4·50

(c) 6·42, 3·57, 0·71

(d) None of the above

48. Independent observations $y_1, y_2, ..., y_n$ have been drawn from $N(\mu, \sigma^2/x_i^2)$; $i = 1, 2, ..., n$; where x_i's are not equal, uncorrelated with the errors in the model and $x_i \neq 0$, for all i. The least squares estimate of μ would be

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

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

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

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

49. Consider a two-way classification with one observation per cell and interaction present

$y_{ij} = \mu + \alpha_i + \beta_j + \gamma_{ij} + e_{ij}$, $i = 1, 2, 3, 4, 5$;

$j = 1, 2, 3, 4$

Then the degrees of freedom for error SS are

(a) 4

(b) 5

(c) 12

(d) 0

50. In a linear model $Y_{n\times1} = X_{n\times p}\beta_{p\times1} + e_{n\times1}$ with usual assumption, if $P = X(X'X)^{-}X'$, then $(I_n - P)X$ is equal to

(a) Null matrix

(b) Some matrix of order $n \times n$

(c) X

(d) I_n

51. Which one of the following organisations compiles Consumer Price Index for Agriculture Labour and Rural Labour (CPI-AL/RL) ?

(a) CSO, Ministry of Statistics and Programme Implementation

(b) Office of Economic Adviser, Ministry of Commerce and Industries

(c) Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

(d) Labour Bureau, Ministry of Labour and Employment

52. Which one of the following organisations compiles and releases vital statistics, regularly, in India ?

(a) Central Statistics Office

(b) Registrar General of India

(c) Directorate General of Health Services

(d) International Institute of Population Studies

53. General Fertility Rate (GFR) is defined as

(a) Number of live births per thousand mid-year female population

(b) Number of live births per hundred mid-year female population

(c) Number of live births per thousand mid-year female population in productive age-group

(d) Number of live births per hundred mid-year female population in productive age-group

54. Which one of the following sampling designs is most commonly used in NSSO household surveys ?

(a) Simple Random Sampling Without Replacement

(b) Systematic Random Sampling

(c) Cluster Sampling

(d) Two-stage Stratified Sampling

55. The subject matter of 78^{th} round of NSSO Survey is

(a) Drinking water, Sanitation, Hygiene and Housing conditions in India

(b) Situation Assessment Survey of Agricultural Household

(c) Domestic Tourism Expenditure

(d) Household Consumption Expenditure

56. The most common survey period of NSSO Household Surveys is

(a) January to December

(b) April to March

(c) July to June

(d) January to June

57. The Gross Value Added (GVA) by an enterprise is defined as

(a) Gross value of output 'minus' Final consumption

(b) Gross value of output 'minus' Export

(c) Gross value of output 'minus' Inventory

(d) Gross value of output 'minus' Intermediate consumption

58. In National Accounts, Domestic Economy is based on the concept of

(a) Resident units

(b) Currency

(c) Nationality

(d) All of the above

59. SASA is associated with

(a) Agricultural Statistics

(b) Wholesale Price Indices

(c) Scheduled Tribe Welfare

(d) Land Ceilings and Reforms

60. The basic unit of data collection in the Agriculture Census is

(a) Operational holding

(b) Ownership holding

(c) Household

(d) None of the above

61. If the population variance is doubled, the width of the confidence interval for the population mean will be

(a) multiplied by 2

(b) divided by 2

(c) multiplied by $\sqrt{2}$

(d) divided by $\sqrt{2}$

62. If 95% confidence interval for μ when σ is known is (18000, 22000), the value of the sample mean will be

(a) 18000

(b) 20000

(c) 22000

(d) 40000

63. Factorization theorem for sufficiency is known as

(a) Rao–Blackwell theorem

(b) Fisher–Neyman theorem

(c) Bernoulli theorem

(d) Cramer–Rao theorem

64. A statistic $T = t(x_1, x_2, x_3, ..., x_n)$ will be sufficient for θ according to factorization theorem iff the joint pdf or pmf can be expressed as

(a) $g(\theta, t) . h(x_1, x_2, x_3, ..., x_n; \theta)$

(b) $g(t, \theta) . h(x_1, x_2, x_3, ..., x_n)$

(c) $g(t, x_i) . h(x_1, x_2, x_3, ..., x_n; \theta)$

(d) $g(x_1, x_2, x_3, ..., x_n; \theta) . h(x_1, x_2, x_3, ..., x_n)$

65. What is the expectation of the loss function ?

(a) The risk function

(b) The power function

(c) The error function

(d) The convex loss function

66. If $x \geq 1$ is the critical region for testing $H_0 : \theta = 2$ against alternative $H_1 : \theta = 1$, on the basis of single observation from the population $f(x, \theta) = \theta e^{-\theta x}$, where $0 \leq x < \infty$. The size of type-II error is

(a) $\frac{e-1}{e}$

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

(c) $\frac{e+1}{e}$

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

67. If $X_1, X_2, X_3, ..., X_n$ are i.i.d. random variables from $N(\mu, \sigma^2)$, σ^2 unknown, then the shortest confidence interval for μ is given as

(a) $\left(\overline{X} - t_{n-1, \frac{\alpha s}{2\sqrt{n}}}, \overline{X} + t_{n-1, \frac{\alpha s}{2\sqrt{n}}}\right)$

(b) $\left(\overline{X} - t_{n-1, \alpha \frac{s}{\sqrt{n}}}, \overline{X} + t_{n-1, \alpha \frac{s}{\sqrt{n}}}\right)$

(c) $\left(\overline{X} - t_{n-1, \frac{\alpha s}{2\sqrt{n-1}}}, \overline{X} + t_{n-1, \frac{\alpha s}{2\sqrt{n-1}}}\right)$

(d) $\left(\overline{X} - t_{n, \frac{\alpha s}{2\sqrt{n}}}, \overline{X} + t_{n, \frac{\alpha s}{2\sqrt{n}}}\right)$

68. If α = P(Type-I error), β = P(Type-II error), then a critical region is said to be unbiased if

(a) $\alpha + \beta < 1$

(b) $\alpha + \beta > 1$

(c) $\alpha > \beta$

(d) $\alpha < \beta$

69. In paired t-test, the observations were recorded in pairs. If the number of pairs is 10, then degrees of freedom are equal to

(a) 18

(b) 10

(c) 9

(d) 5

70. Let X ~ N(μ, σ^2). If both μ and σ^2 are unknown such that $-\infty < \mu < \infty$, $\sigma^2 > 0$, then which one of the following is ***not*** a composite hypothesis ?

(a) $H : \mu \le \mu_0, \sigma^2 > \sigma_0^2$

(b) $H : \mu = \mu_0, \sigma^2 < \sigma_0^2$

(c) $H : \mu = \mu_0, \sigma^2 = \sigma_0^2$

(d) $H : \mu > \mu_0, \sigma^2 > \sigma_0^2$

71. Which one of the following is ***not*** a sustainable development goal ?

(a) Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

(b) End poverty in all its forms everywhere

(c) Promote regulated use of AI

(d) Ensure access to affordable, reliable, sustainable and modern energy for all

72. Which survey of NSSO employs a rotational panel survey design ?

(a) Periodic Labour Force Survey (PLFS)

(b) Employment-Unemployment Survey (EUS)

(c) NSSO Survey on Disability

(d) NSSO Surveys 71^{st} Round-Health and Education

73. If a survey intends to collect data on women and child well-being in India, which one of the following would be the least preferred choice for stratifying variable for selecting villages within a district ?

(a) Female literacy rate

(b) Child mortality rate

(c) Number of individual units with 100 or more workers

(d) Sex ratio

74. Who among the following can be engaged as census enumerators and supervisors in population census operation in India ?

1. School teachers
2. Central government officials
3. Local government officials

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

75. Which of the following can be derived/drawn from population census data ?

1. Sampling frame for conducting All-India Survey with household as ultimate-stage unit
2. Literacy rate
3. Average monthly per capita expenditure (MPCE)
4. Sex ratio

Select the correct answer using the code given below :

(a) 1, 2 and 4

(b) 2, 3 and 4

(c) 1, 2 and 3

(d) 1, 3 and 4

76. Which one of the following organizations is responsible for employing field enumerators for conducting All-India surveys of NSSO ?

(a) SDRD

(b) DPD

(c) CPD

(d) FOD

77. GDP is measured by which of the following equivalent approaches ?

1. Production approach
2. Income approach
3. Expenditure approach

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

78. Which of the following are components of Physical Quality Life Index (PQLI) ?

1. Literacy Rate
2. Infant Mortality Rate
3. Life Expectancy
4. Per Capita Income

Select the correct answer using the code given below :

(a) 1, 2 and 3

(b) 2, 3 and 4

(c) 1, 3 and 4

(d) 1, 2 and 4

79. Point to point inflation of a monthly Index Number is defined as

(a) $\left(\frac{\text{Current Month Index}}{\text{Base Period Index}} - 1\right) \times 100$

(b) $\left(\frac{\text{Current Month Index}}{\text{Last Month Index}} - 1\right) \times 100$

(c) $\left(\frac{\text{Current Month Index}}{\text{First Month Index of the year}} - 1\right) \times 100$

(d) $\left(\frac{\text{Current Month Index}}{\text{Same Month Index of last year}} - 1\right) \times 100$

80. Which one of the following organisations designed 'Ten Fundamental Principles of Official Statistics' ?

(a) World Bank

(b) International Monetary Fund

(c) United Nations

(d) Organisation for Economic Co-operation and Development (OECD)

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