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FOR KSET PREPARATION

KSET 2023 Mathematical Sciences Question Paper

EXAM	YEAR	TYPE
KSET	2023	Question Paper

K - SET

ಕ್ರಮ ಸಂಖ್ಯೆ 399265

ವರ್ಷನ್ ಸಂಕೇತ **A1**

ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆ - 2023

ಪತ್ರಿಕೆ – II

ವಿಷಯ: ಗಣಿತ ವಿಜ್ಞಾನಗಳು

ವಿಷಯ ಸಂಕೇತ:26

ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ ಸಂಕೇತ	ಅವಧಿ	ಒಟ್ಟು ಪ್ರಶ್ನೆಗಳ ಸಂಖ್ಯೆ	ಗರಿಷ್ಠ ಅಂಕಗಳು	ನಿಮ್ಮ ನೋಂದಣಿ ಸಂಖ್ಯೆಯನ್ನು ನಮೂದಿಸಿ						
MAT202326	ಎರಡು ಘಂಟೆಗಳು	100	200							

ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಸೂಚನೆಗಳು

ಮಾಡಿ:

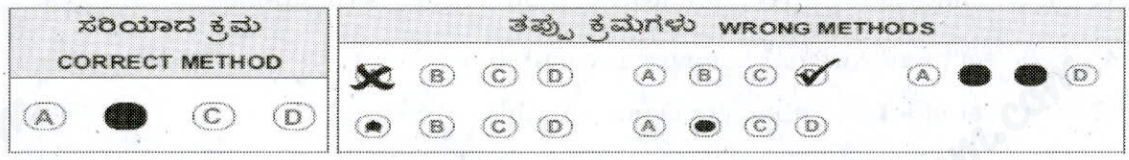
1. ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರು ಈ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ನಿಮಗೆ ಎರಡನೇ ಬೆಲ್ ಆದ ನಂತರ ಕೊಡುತ್ತಾರೆ.
2. ನೊಂದಣಿ ಸಂಖ್ಯೆಯನ್ನು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಬರೆದು ಅದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವೃತ್ತಗಳನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತುಂಬಿದ್ದೀರೆಂದು ಖಾತ್ರಿಪಡಿಸಿಕೊಳ್ಳತಕ್ಕದ್ದು.
3. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ವರ್ಷನ್ ಕೋಡ್ ಅನ್ನು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಬರೆದು ಅದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವೃತ್ತಗಳನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತುಂಬಬೇಕು.
4. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ವರ್ಷನ್ ಕೋಡ್ ಮತ್ತು ಕ್ರಮ ಸಂಖ್ಯೆಯನ್ನು ನಾಮಿನಲ್ ರೋಲ್‌ನಲ್ಲಿ ತಪ್ಪಿಲ್ಲದೆ ಬರೆಯಬೇಕು.
5. ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯ ಕೆಳಭಾಗದ ನಿಗದಿತ ಜಾಗದಲ್ಲಿ ಕಡ್ಡಾಯವಾಗಿ ಸಹಿ ಮಾಡಬೇಕು.

ಮಾಡಬೇಡಿ:

1. **ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಮುದ್ರಿತವಾಗಿರುವ ಟೈಮಿಂಗ್ & ಮಾರ್ಕನ್ನು ತಿದ್ದಬಾರದು / ಹಾಳುಮಾಡಬಾರದು / ಅಳಿಸಬಾರದು.**
2. ಮೂರನೇ ಬೆಲ್ ಆಗುವವರೆಗೂ,
   - ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಬಲಭಾಗದಲ್ಲಿರುವ ಸೀಲ್ ಅನ್ನು ತೆಗೆಯಬಾರದು.
   - ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಒಳಗಡೆ ಇರುವ ಪ್ರಶ್ನೆಗಳನ್ನು ನೋಡಲು ಪ್ರಯತ್ನಿಸಬಾರದು ಮತ್ತು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಉತ್ತರಿಸಲು ಪ್ರಾರಂಭಿಸಬಾರದು.

ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಮುಖ್ಯ ಸೂಚನೆಗಳು

1. ಪ್ರಶ್ನೆಗಳಲ್ಲಿ ಬಳಸಿರುವ signs and symbols ಗಳನ್ನು, ಬೇರೆ ರೀತಿಯಲ್ಲಿ ಹೇಳದ ಹೊರತು, ನಿಗದಿತ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಅರ್ಥವನ್ನು ಪರಿಗಣಿಸಬೇಕು.
2. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಒಟ್ಟು **100** ಪ್ರಶ್ನೆಗಳಿದ್ದು, ಪ್ರತಿ ಪ್ರಶ್ನೆಗೂ 4 ಬಹು ಆಯ್ಕೆ ಉತ್ತರಗಳು ಇರುತ್ತವೆ. ಪ್ರತಿ ಪ್ರಶ್ನೆಯ ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ನಾಲ್ಕು ಬಹು ಆಯ್ಕೆಯ ಉತ್ತರಗಳಲ್ಲಿ ಸರಿಯಾದ ಒಂದು ಉತ್ತರವನ್ನು ಆಯ್ಕೆ ಮಾಡಿ.
3. ಮೂರನೇ ಬೆಲ್ ಆದ ನಂತರ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಬಲಭಾಗದಲ್ಲಿರುವ ಸೀಲ್ ತೆಗೆದು ಈ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಯಾವುದೇ ಪುಟಗಳು ಮುದ್ರಿತವಾಗಿಲ್ಲದೇ ಇರುವುದು ಕಂಡು ಬಂದಲ್ಲಿ ಅಥವಾ ಹರಿದು ಹೋಗಿದ್ದಲ್ಲಿ ಅಥವಾ ಯಾವುದೇ ಆಕ್ಷರಗಳು ಬಿಟ್ಟುಹೋಗಿದ್ದಲ್ಲಿ ಎಂಬುದನ್ನು ಖಚಿತಪಡಿಸಿಕೊಂಡು, ಈ ರೀತಿ ಆಗಿದ್ದರೆ ಪ್ರಶ್ನೆಪತ್ರಿಕೆಯನ್ನು ಬದಲಾಯಿಸಿ ಕೊಳ್ಳುವುದು. ನಂತರ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಉತ್ತರಿಸಲು ಪ್ರಾರಂಭಿಸುವುದು.
4. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿನ ಪ್ರಶ್ನೆಗೆ ಅನುಗುಣವಾಗಿರುವ ಸರಿ ಉತ್ತರವನ್ನು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಅದೇ ಕ್ರಮ ಸಂಖ್ಯೆಯ ಮುಂದೆ ನೀಡಿರುವ ಸಂಬಂಧಿಸಿದ ವೃತ್ತವನ್ನು ನೀಲಿ ಅಥವಾ ಕಪ್ಪು ಬಾಲ್ ಪಾಯಿಂಟ್ ಪೆನ್‌ನಿಂದ ಸಂಪೂರ್ಣ ತುಂಬುವುದು.



5. ಈ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯನ್ನು ಸ್ಕ್ಯಾನ್ ಮಾಡುವ ಸ್ಕ್ಯಾನರ್ ಬಹಳ ಸೂಕ್ಷ್ಮವಾಗಿದ್ದು ಸಣ್ಣ ಗುರುತನ್ನು ಸಹ ದಾಖಲಿಸುತ್ತದೆ. ಆದ್ದರಿಂದ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಉತ್ತರಿಸುವಾಗ ಎಚ್ಚರಿಕೆ ವಹಿಸಿ.
6. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಕೊಟ್ಟಿರುವ ಖಾಲಿ ಜಾಗವನ್ನು ರಫ್ ಕೆಲಸಕ್ಕೆ ಉಪಯೋಗಿಸಿ. ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯನ್ನು ಇದಕ್ಕೆ ಉಪಯೋಗಿಸಬೇಡಿ.
7. **ಕೊನೆಯ ಬೆಲ್ ಆದ ನಂತರ ಉತ್ತರಿಸುವುದನ್ನು ನಿಲ್ಲಿಸಿ, ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯನ್ನು ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರಿಗೆ ಯಥಾಸ್ಥಿತಿಯಲ್ಲಿ ನೀಡಿರಿ.**
8. ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರು ಮೇಲ್ಭಾಗದ ಹಾಳೆಯನ್ನು ಪ್ರತ್ಯೇಕಿಸಿ (ಕಚೇರಿ ಪ್ರತಿ) ತಮ್ಮ ವಶದಲ್ಲಿ ಇಟ್ಟುಕೊಂಡು ತಳಬದಿಯ ಯಥಾಪ್ರತಿಯನ್ನು (ಅಭ್ಯರ್ಥಿಯ ಪ್ರತಿ) ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಕೊಡುತ್ತಾರೆ.
9. ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳಿಗೆ ಸಮಾನ ಅಂಕಗಳಿರುತ್ತದೆ. ಋಣಾತ್ಮಕ ಮೌಲ್ಯಮಾಪನವಿರುವುದಿಲ್ಲ.
10. ಯಾವುದೇ ರೀತಿಯ ಮೊಬೈಲ್ ಫೋನ್, ಕ್ಯಾಲ್ಕ್ಯುಲೇಟರ್ ಮತ್ತು ಇತರೆ ರೀತಿಯ ಎಲೆಕ್ಟ್ರಾನಿಕ್/ಕಮ್ಯುನಿಕೇಷನ್ ಸಾಧನಗಳು ಇತ್ಯಾದಿಗಳನ್ನು ಪರೀಕ್ಷಾ ಕೇಂದ್ರದ ಅವರಣದೊಳಗೆ ತರುವುದನ್ನು ನಿಷೇಧಿಸಿದೆ.

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1. Given that there are real constants a, b, c, d such that the identity $kx^2 + 2xy + y^2 = (ax + by)^2 + (cx + dy)^2$ holds for all $x, y \in R$. This implies :

(A) $0 < k < 1$ (B) $k = -5$

(C) There is no such $k \in R$ (D) $k \geq 1$

2. Which of the following series is convergent ?

(A) $\sum_{n=1}^{\infty} \frac{n!}{n^n}$ (B) $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n+1} - n}$

(C) $\sum_{n=1}^{\infty} \frac{1}{2n-1}$ (D) $\sum_{n=1}^{\infty} n^{-2}\, 2^n$

3. Which statement among the following is ***not*** true ?

(A) If a set of real numbers has a minimum, then it has an infimum

(B) Every subset of real numbers which is bounded below has a minimum

(C) There exists a subset of real numbers with a supremum but no maximum

(D) There exists a subset of real numbers with an infimum but no minimum

4. $\lim_{n \to \infty} \frac{1}{\sqrt{n}} \left(\frac{1}{\sqrt{1} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{5}} + \ldots\ldots + \frac{1}{\sqrt{2n-1} + \sqrt{2n+1}} \right)$ equals :

(A) $\sqrt{2} + 1$ (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{1}{\sqrt{2}+1}$ (D) $\sqrt{2}$

5. Which statement among the following is ***not*** true ?

(A) If S_1 and S_2 are two countable sets, then $S_1 \cup S_2$ is countable

(B) The set of all rational numbers is countable

(C) The set of all real numbers is uncountable

(D) The set of all irrational numbers is countable

6. The sequence $\{(-1)^n\}$ is :

(A) convergent (B) divergent (C) unbounded (D) bounded

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7. Let $f(x) = \begin{cases} \frac{\sin x^2}{x} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$

Then which of the following statement is correct ?

f(x) is :

(A) continuous and differentiable at x = 0

(B) neither continuous nor differentiable at x = 0

(C) continuous but not differentiable at x = 0

(D) limit does not exist

8. Let $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to \mathbb{R}$ be two uniformly continuous functions. Then which of the following statement is ***not*** true ?

(A) f + g is uniformly continuous

(B) f – g is uniformly continuous

(C) fg is uniformly continuous

(D) 2f + 3g is uniformly continuous

9. Let f be a continuous function from a compact metric space X into a metric space Y. Then which of the following statement is ***not*** correct ?

(A) f(X) is compact

(B) f is bounded

(C) f is not uniformly continuous on X

(D) f is a constant function

10. Let $f : (0, 1) \to \mathbb{R}$ be a function defined by

$$f(x) = \begin{cases} 0 & \text{for x irrational} \\ \frac{1}{q} & \text{for } x = \frac{p}{q}, p, q \in \mathbb{N}, (p, q) = 1 \end{cases}$$

Then f is continuous at :

(A) all irrational points on (0, 1)

(B) all rational points on (0, 1)

(C) all points on (0, 1)

(D) all points of the form $\frac{1}{q}$ for some $q \in \mathbb{N}$

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11. If a metric space is both totally bounded and complete, then it is :

(A) discrete

(B) connected

(C) compact

(D) not compact

12. Which one of the following statement is ***not*** correct ?

(A) A countable union of the countable sets is countable

(B) The set of all sequences whose elements are the digits 0 and 1, is countable

(C) Every infinite subset of a compact set has a limit point in the set

(D) Intersection of a closed set and a compact set is a compact set

13. Let $F : \mathbb{R}^4 \to \mathbb{R}^2$ be defined by $F(x_1, x_2, x_3, x_4) = (x_1, x_2 - 2, x_3\ x_4^2 + 4)$

Near $(1, 2, -1, 2)$

(A) x_1 cannot be expressed as a function of x_2 and x_3

(B) x_4 cannot be expressed as a function of x_2 and x_3

(C) x_3 cannot be expressed as a function of x_1 and x_2

(D) x_2 cannot be expressed as a function of x_1 and x_4

14. Which of the following is ***not*** a subspace of vector space R^3 over R ?

(A) $W = \{(x, y, z) \in R^3 \mid x + y + z = 0\}$

(B) $W = \{(x, y, z) \in R^3 \mid x \geq 0\}$

(C) $W = \{(x, y, z) \in R^3 \mid x = y = z\}$

(D) $W = \{(x, y, z) \in R^3 \mid x - 3y + 4z = 0\}$

15. Find the value of 'm' such that the vector $(m, 7, -4)$ is a linear combination of vectors $(-2, 2, 1)$ and $(2, 1, -2)$.

(A) 2 (B) -2 (C) 0 (D) -1

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16. Let V be the vector space of all 3×3 symmetric matrices with real entries over R. Then the dimension of V is :

(A) 3 (B) 9 (C) 6 (D) 1

17. If the matrix $\begin{bmatrix} -4 & 10 \\ -2 & k \end{bmatrix}$ is singular, then the value of k is :

(A) 0 (B) -5

(C) $-\frac{1}{5}$ (D) 5

18. For what value of λ, do the simultaneous equations $2x + 3y = 1$, $6x + 9y = \lambda$ have infinite solutions ?

(A) $\lambda = 1$ (B) $\lambda = 3$

(C) $\lambda \neq 3$ (D) $\lambda = 0$

19. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and I be the 3×3 identity matrix. If $3A^{-1} = kA^2 - mA + nI$ for $k, m, n \in R$, then (k, m, n) equals :

(A) $(1, 5, -7)$

(B) $(1, -5, 7)$

(C) $(1, 7, 5)$

(D) $(1, 3, 1)$

20. Let A be a 3×3 matrix with eigenvalues $-1, 1, 0$. Then the determinant of $I + A^{200}$ is :

(A) 9

(B) 4

(C) 200

(D) 0

Space for Rough Work

21. Let $A = \begin{bmatrix} 2 & 1 \\ 3 & k \end{bmatrix}$. What is the value of k for which the eigenvalues of the matrix A are positive ?

(A) $k < \frac{3}{2}$ (B) $k = 2$ (C) $k > \frac{3}{2}$ (D) $k < -\frac{3}{2}$

22. If the product of two eigenvalues of the matrix $\begin{bmatrix} 4 & 1 & -1 \\ 2 & 5 & -2 \\ 1 & 1 & 2 \end{bmatrix}$ is 9, then third eigenvalue is :

(A) 3 (B) 5 (C) 4 (D) 2

23. The distance between any two orthonormal vectors in an inner product space is :

(A) 1 (B) 0 (C) $\sqrt{2}$ (D) 2

24. Let T be a linear operator on R^2 defined by

$T(x, y) = (3x + 4y, 2x - 5y)$.

Then the matrix representation of T relative to the basis $B = \{(1, 2), (2, 3)\}$ is :

(A) $\begin{bmatrix} -49 & -76 \\ 30 & 47 \end{bmatrix}$ (B) $\begin{bmatrix} 49 & -76 \\ 30 & -47 \end{bmatrix}$

(C) $\begin{bmatrix} 3 & 4 \\ 2 & -5 \end{bmatrix}$ (D) $\begin{bmatrix} -3 & 4 \\ 2 & -5 \end{bmatrix}$

25. Which of the following matrix is diagonalizable over R ?

(A) $\begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 4 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ (D) $\begin{bmatrix} 3 & -1 & 1 \\ 7 & -5 & 1 \\ 6 & -6 & 2 \end{bmatrix}$

Space for Rough Work

26. Which of the following series is absolutely convergent ?

(A) $\sum_{n=1}^{\infty} \frac{i^n \log n}{n^2+1}$

(B) $\sum_{n=1}^{\infty} \frac{(2i)^n}{1-(2i)^n}$

(C) $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{\log n}{n}$

(D) $\sum_{n=1}^{\infty} \frac{e^{in\pi}}{n}$

27. The set $\{J \in \mathbb{C} : \sum_{n=1}^{\infty} \frac{1}{2^n}\left(\frac{1}{z+1}\right)^n$ is absolutely convergent$\}$

(A) $B\left[-1, \frac{1}{2}\right]$

(B) $\mathbb{C} \setminus B\left[-1, \frac{1}{2}\right]$

(C) $\mathbb{C} \setminus B\,[0, 1]$

(D) $\mathbb{C}$

28. Let P be a polynomial $P(x) = \sum_{i=0}^{k} a_i x^i$ with $a_k \neq 0$. Then the radius of convergence of the series $\sum_{n=0}^{\infty} P(n)\, z^n$ is :

(A) $|a_k|$

(B) $\frac{1}{|a_k|}$

(C) 1

(D) ∞

29. The principal value of $(-1)^i$ is :

(A) $e^{-(2n+1)\pi}, n \in \mathbb{Z}$

(B) $e^{(2n+1)\pi}, n \in \mathbb{Z}$

(C) $e^{(2n+\frac{1}{2})\pi}, n \in \mathbb{Z}$

(D) $e^{(2n-1)\pi}, n \in \mathbb{Z}$

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30. For which of the pair/s of paths δ and the function $f : [\delta] \to \mathbb{C}$ given below in (i) – (iv), $\int_{\delta} f = 0$?

(i) $\delta(t) = e^{it}$, $0 \le t \le 2\pi$ and $f(z) = \dfrac{z^3}{z^2+4}$

(ii) $\delta(t) = e^{it}$, $0 \le t \le 2\pi$ and $f(z) = \dfrac{e^z - 1}{z}$

(iii) $\delta(t) = e^{it}$, $0 \le t \le 2\pi$ and $f(z) = \dfrac{1}{z^2} - \dfrac{3}{z^4} + \dfrac{1}{z^{2023}}$

(iv) δ is any closed path lying in the half plane $\{z \in \mathbb{C} : \text{Re } z > 0\}$ and $f(z) = \dfrac{1}{z}$

(A) All of (i), (ii), (iii) and (iv)
(B) Only (i), (ii) and (iii)
(C) Only (i) and (ii)
(D) Only (i)

31. Let $f : U \to \mathbb{C}$ be analytic where U is a region in $\mathbb{C}$.

Which of the following conditions given below will make the function f a constant ?

(A) $U = \mathbb{C}$
(B) $f^1(z) = 0$ on U
(C) f is bounded on U
(D) $U = \mathbb{C}$ and f is bounded on U

32. Consider the function $f(z) = (z - a)^m g(z)$, where $g(a) \neq 0$ for a fixed $a \in \mathbb{C}$. Which one of the following is ***false*** ?

(A) a is a zero of order m for f

(B) a is a pole of order m for $\dfrac{1}{f}$

(C) $\dfrac{1}{f}$ has an isolated singularity at a

(D) $\dfrac{1}{f}$ has an essential singularity at a

33. Given $v(x, y) = x^4 - 6x^2y^2 + y^4$, the analytic function $f(z) = u(x, y) + iv(x, y)$ for some constant c is :

(A) $iz^3 + c$
(B) $iz^4 + c$
(C) $-iz^4 + c$
(D) $-iz^3 + c$

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34. Let $\phi : \mathbb{C}_\infty \to \mathbb{C}_\infty$ be a (fractional) or bilinear transformation which has 0, 1 and ∞ as fixed points, then :

(A) ϕ takes circles to lines

(B) ϕ maps the right half plane to the upper half plane

(C) ϕ is the identity map

(D) Such a ϕ does not exist

35. The value $\int_\delta \frac{e^z}{z^3}\, dz$ where $\delta(t) = e^{it}$, $0 \le t \le 2\pi$ is :

(A) $\frac{\pi}{2}i$ (B) πi (C) $2\pi i$ (D) 0

36. Let m be a positive integer. Two integers a and b are congruent modulo m if :

(A) $m \mid a$ (B) $m \mid b$ (C) $m \mid a$ and $m \mid b$ (D) $m \mid a - b$

37. Which of the following is true ?

(A) $\mathbb{Z}_n$ is a group with respect to multiplication modulo n

(B) Q is a group with respect to multiplication

(C) $\mathbb{Z}$ is a group with respect to multiplication

(D) $\mathbb{Z}_n$ is a group with respect to addition modulo n

38. The group $\mathbb{Z} \times \mathbb{Z}$ with respect to componentwise addition is generated by :

(A) (1, 0) (B) (0, 1) (C) (1, 1) (D) (1, 0) and (0, 1)

39. Which of the following is conjugate to (1, 2, 3) (4, 5, 6, 7) in S_{10}, the symmetric group of degree 10 ?

(A) (1, 2) (3, 4, 5, 6, 7)

(B) (1, 2, 3, 4) (5, 6, 7)

(C) (1, 2, 3, 4, 5) (6, 7)

(D) (1, 2, 3) (4, 5, 6)

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40. The number of elements in S_n, the symmetric group of degree n, which are conjugate to $(1, 2, 3, \ldots, r)$ is :

(A) r (B) r! (C) ${}^nP_r$ (D) $\frac{1}{r}{}^nP_r$

41. The number of zero-divisor of a finite commutative ring with identity of order n is :

(A) n

(B) $\phi(n)$, the Euler ϕ-function

(C) $n - \phi(n)$

(D) $n - \phi(n) - 1$

42. Let C[0, 1] be the ring of all continuous real-valued functions on [0, 1] with respect to pointwise addition and pointwise multiplication. Then which of the following statement is true ?

(A) C[0, 1] is an integral domain

(B) For every $a \in (0, 1)$, $I = \{f \in C[0, 1] \mid f(a) = 0\}$ is a maximal ideal

(C) For every $a \in (0, 1)$, $I = \{f \in C[0, 1] \mid f(a) = 0\}$ is not a maximal ideal

(D) For every ideal I of C[0, 1], there exists $a \in (0, 1)$ such that $I = \{f \in C[0, 1] \mid f(a) = 0\}$

43. Let $\mathbb{Z}_p$ be the set of all integers modulo p. Then which of the following ring is a field ?

(A) $\frac{\mathbb{Z}_2[x]}{\langle x^2 - x + 1 \rangle}$ (B) $\frac{\mathbb{Z}_3[x]}{\langle x^2 - x + 1 \rangle}$

(C) $\frac{\mathbb{Z}_5[x]}{\langle x^2 - x + 3 \rangle}$ (D) $\frac{\mathbb{Z}_7[x]}{\langle x^2 - x + 1 \rangle}$

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44. Which of the following statement is true ?

(A) There exists a subfield of order 4 of a field with 8 elements

(B) The extension field $\mathbb{R}$ of $\mathbb{Q}$ is finite

(C) The extension field $\mathbb{C}$ of $\mathbb{R}$ is finite

(D) The extension field $\mathbb{C}$ of $\mathbb{Q}$ is finite

45. Let α be a square root of 2 and let β be a 4^{th} root of 2. Which of the following statement is ***not*** true ?

(A) If the characteristic $\mathbb{F}$ is 2, and $[\mathbb{E} : \mathbb{F}] = 2$, then $\mathbb{E}$ over $\mathbb{F}$ is a Galois extension

(B) $\mathbb{Q}(\beta)$ over $\mathbb{Q}(\alpha)$ is a Galois extension

(C) $\mathbb{Q}(\alpha)$ over $\mathbb{Q}$ is a Galois extension

(D) $\mathbb{Q}(\beta)$ over $\mathbb{Q}$ is a Galois extension

46. Let τ_c, τ_f, τ_l, τ_u denote the co-countable, co-finite, lower limit and usual topology on $\mathbb{R}$. Let i denote the identity map on $\mathbb{R}$. Then :

(A) $i : (\mathbb{R}, \tau_c) \to (\mathbb{R}, \tau_u)$ is continuous

(B) $i : (\mathbb{R}, \tau_l) \to (\mathbb{R}, \tau_u)$ is continuous

(C) $i : (\mathbb{R}, \tau_f) \to (\mathbb{R}, \tau_c)$ is continuous

(D) $i : (\mathbb{R}, \tau_c) \to (\mathbb{R}, \tau_l)$ is continuous

47. Let τ_1 and τ_2 be topologies on X such that $\tau_1 \subsetneq \tau_2$

Pick out the correct statement.

(A) If (X, τ_1) is Hausdorff then (X, τ_2) is compact

(B) If (X, τ_2) is compact then (X, τ_1) is Hausdorff

(C) If (X, τ_2) is not compact then (X, τ_1) is Hausdorff

(D) If (X, τ_2) is compact then (X, τ_1) is not Hausdorff

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48. Consider $\mathbb{R}$ with topology generated by the basis $\mathcal{B} = \{[n, n+1) : n \in \mathbb{Z}\}$

Pick out the correct statement.

(A) $(\mathbb{R}, \tau)$ is compact.

(B) $(\mathbb{R}, \tau)$ is sequentially compact.

(C) $(\mathbb{R}, \tau)$ has following property : Every infinite subset has an accumulation point in $\mathbb{R}$.

(D) Every sequence in $\mathbb{R}$ converges.

49. In the Hilbert cube $\mathbb{R}^{\mathbb{N}}$ with product topology, pick out the set which is open.

(A) $G = \prod_{n \in \mathbb{N}} G_n$ where $G_n = (-n, n)$ for all $n \in \mathbb{N}$

(B) $G = \prod_{n \in \mathbb{N}} G_n$ where $G_n = (-25, 25)$ for all $n \in \mathbb{N}$

(C) $G = \prod_{n \in \mathbb{N}} G_n$ where $G_n = \mathbb{R} \setminus \{0\}$ for all $n \in \mathbb{N}$

(D) $G = \prod_{n \in \mathbb{N}} G_n$ where $G_n = \begin{cases} \mathbb{R} \setminus \{0\} \text{ if } n \leq 25 \\ \mathbb{R} \text{ if } n > 25 \end{cases}$

50. Consider the sets $L = [0, 1] \times \{0\}$, $A_n = \left\{\frac{1}{n}\right\} \times [0, 1]$ for $n \in \mathbb{N}$ with usual subspace topology of $\mathbb{R}^2$ with Euclidean metric.

Which of the following sets is ***not*** connected ?

(A) $L \cup A_n$ for some $n \in \mathbb{N}$

(B) $L \cup \left(\bigcup_{n \in \mathbb{N}} A_n\right)$

(C) $A_n \cup P$ for some $n \in \mathbb{N}$

(D) $L \cup \left(\bigcup_{n \in \mathbb{N}} A_n\right) \cup \{P\}$

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51. The particular solution of $y'' + y = \sec x$:

(A) is $\cos x \cdot \log(\cos x) + x \cos x$ (B) is $\cos x \cdot \log(\cos x) + x \sin x$

(C) is not unique (D) does not exist

52. Suppose a ball is thrown upwards from the ground with initial velocity 49 m/s. Neglecting air resistance, calculate the time taken by it before it reaches the ground.

(A) 7 seconds (B) 5 seconds (C) 10 seconds (D) 3 seconds

53. The function $f(x, y) = y^{2/3}$ on $R : |x| \leq 1, |y| \leq 1$

(A) is continuous and satisfies Lipschitz condition

(B) is not continuous, but satisfies Lipschitz condition

(C) is continuous, but does not satisfy Lipschitz condition

(D) is neither continuous nor does it satisfy Lipschitz condition

54. The Green's function $G(x, t)$ which allows the unique solution of $y'' + y = f(x)$, $y(0) = y(\pi/2) = 0$, $x \in [0, \pi/2]$, where f is continuous, to be expressed in the form $y(x) = \int_0^{\pi/2} G(x, t) f(t)$ is given by :

(A) $G(x, t) = \begin{cases} -\sin x \cos t, & 0 \leq x \leq t \leq \pi/2 \\ -\sin t \cos x, & 0 \leq t \leq x \leq \pi/2 \end{cases}$

(B) $G(x, t) = \begin{cases} e^{ix} \cos t, & 0 \leq x \leq t \leq \pi/2 \\ e^{it} \cos x, & 0 \leq t \leq x \leq \pi/2 \end{cases}$

(C) $G(x, t) = \begin{cases} e^{ix} \sin t, & 0 \leq x \leq t \leq \pi/2 \\ e^{ix} \cos t, & 0 \leq t \leq x \leq \pi/2 \end{cases}$

(D) $G(x, t) = \begin{cases} ie^{ix} \sin t, & 0 \leq x \leq t \leq \pi/2 \\ ie^{-ix} \cos t, & 0 \leq t \leq x \leq \pi/2 \end{cases}$

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55. The general integral of $y^2p - xyq = x(z - 2y)$ is given by :

(A) $f(x^2 - y^2, y(y - z)) = 0$ (B) $f(x^2 + y^2, y(y - z)) = 0$

(C) $f(x^2 - y^2) = g(y(y + z))$ (D) $f(x^3 - y^3) = g(y(y - z))$

56. Which of the following statement is/are correct ?

(i) Characteristics of a pde determines domain of dependence alone

(ii) Characteristics of a pde determines range of influence alone

(iii) Characteristics of a pde determine both domain of dependence and range of influence

(iv) Characteristics of a pde make the integral surface continuous

(A) Both (iii) and (iv) (B) Only (iii)

(C) (i), (ii) and (iii) (D) Only (iv)

57. The integral of $(1 + yz)dx + x(z - x)dy - (1 + xy)dz = 0$ is :

(A) $(1 + x^2y)\ (1 + cy) = (1 + y^2z)$ (B) $(1 - xy)\ (1 + cy) = (1 - yz)$

(C) $(1 + yz)\ (1 + cy) = (1 + xz)$ (D) $(1 + xy)\ (1 + cy) = (1 + yz)$

58. The solution of the IVP $z_x - zz_y + z = 0$ for all y and $x > 0$, for the initial data curve $C : x_0 = 0, y_0 = s, z_0 = -2s, -\infty < s < \infty$ is :

(A) $z = -\dfrac{2y}{3e^{-x} - 2}, 0 \le x < \log\left(\dfrac{2}{3}\right)$ (B) $z = -\dfrac{2y}{3e^{x} - 2}, 0 \le x < \log\left(\dfrac{2}{3}\right)$

(C) $z = -\dfrac{2y}{3e^{x} - 2}, x \in [0, \infty) \setminus \log\left(\dfrac{2}{3}\right)$ (D) $z = -\dfrac{2y}{3e^{x} - 1}, x \in (-\infty, \infty) \setminus \log\left(\dfrac{2}{3}\right)$

59. If r is a root of $f(x) = 0$ and its $(n + 1)^{th}$ approximate is $x_{n+1} = g(x_n)$, then the error associated with Newton's method corresponding to x_{n+1} is given by (with ξ lying in the interval from x_n to r) :

(A) $e_{n+1} = \dfrac{g'(\xi)}{3} e_n^3$ (B) $e_{n+1} = \dfrac{g''(\xi)}{2} e_n^2$

(C) $e_{n+1} = \dfrac{g''(\xi)}{3} e_n^2$ (D) $e_{n+1} = \dfrac{g'(\xi)}{6} e_n^2$

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60. The sufficient conditions for the convergence of the fixed point iteration method to find a root r of $x = g(x)$ are :

(A) continuity of $g(x)$ and $g'(x)$

(B) continuity of $g'(x)$ and $|g'(x)| < 1$

(C) continuity of $g(x)$ and $g'(x)$ and $|g'(x)| < 1$

(D) differentiability of $g(x)$ and $|g'(x)| < 1$

61. The following data for $f(x) = x^4$ is given.

x	0·4	0·6	0·8
f(x)	0·0256	0·1296	0·4096

Then $f'(0{\cdot}8)$ and $f''(0{\cdot}8)$, using quadratic interpolation, are respectively :

(A) 2·012 and 7·12

(B) 1·916 and 5·62

(C) 2·048 and 7·68

(D) 1·840 and 4·40

62. Given that $f(0) = 1$, $f(1) = 3$, $f(3) = 55$. Then the unique polynomial of degree 2 or less which fits the given data and the bound on the error are respectively

(A) $x^2 + x + 1$ and $(0{\cdot}2510)\left(\underset{0\le x\le 3}{\text{Max}} \left| x^2 + x + 1 \right|\right)$

(B) $4x^2 - 2x + 1$ and $(0{\cdot}3612)\left(\underset{0\le x\le 3}{\text{Max}} \left| 8x - 2 \right|\right)$

(C) $8x^2 - 6x + 1$ and $(0{\cdot}3521)\left(\underset{0\le x\le 3}{\text{Max}} \left| x(x-1)(x-3) \right|\right)$

(D) $8x^2 - 6x + 1$ and $(0{\cdot}3521)\left(\underset{0\le x\le 3}{\text{Max}} \left| f'''(x) \right|\right)$

63. An approximate value of $(17)^{1/3}$, performing three iterations of the Newton-Raphson method is (take $x_0 = 2$) :

(A) $x_3 = 2{\cdot}5826$

(B) $x_3 = 2{\cdot}5713$

(C) $x_3 = 2{\cdot}7502$

(D) $x_3 = 2{\cdot}5703$

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64. Suppose f(x) possesses Fourier transform, where $-\infty < x < \infty$. Then the convolution u(x, y) of f(x) and $\sqrt{\frac{2}{\pi}}\frac{y}{y^2+x^2}$, $y > 0$, is given by :

(A) $\frac{y}{\pi}\int_{-\infty}^{\infty}\frac{f(\xi)}{y^2+(x-\xi)^2}d\xi$

(B) $\frac{y}{\pi}\int_{0}^{\infty}\frac{f(\xi)}{y^2+(x+\xi)^2}d\xi$

(C) $\frac{y}{\pi}\int_{-\infty}^{\infty}\frac{f(\xi)}{(y-\xi)^2+(x+\xi)^2}d\xi$

(D) $\frac{y}{\sqrt{2\pi}}\int_{-\infty}^{\infty}\frac{f(\xi)}{y^2+x^2}d\xi$

65. The solution of $y'' + 2y' + 2y = f(x)$ with f continuous and $y(0) = y'(0) = 1$ can be written in the form :

(A) $e^{-x}(\cos x + 2\sin x) + \int_0^1 e^{-(x-t)} f(t)\,dt$

(B) $e^{-x}(\cos x + 2\sin x) + \int_0^x e^{-(x-t)} \sin(x-t) f(t)\,dt$

(C) $e^{x}(2\cos x + \sin x) + \int_0^x e^{-t} \cos(x-t) f(t)\,dt$

(D) $e^{-x}(\cos x + 2\sin x) + \int_0^x \sin(x-t) f(t)\,dt$

66. The solution of $y(x) = \cos x + \lambda\int_0^{\pi} \sin xy(t)\,dt$ is given by :

(A) $y(x) = \sin x$, provided $\lambda \neq -1$

(B) $y(x) = \sin x + \cos x$

(C) $y(x) = \cos x$, provided $\lambda \neq \frac{1}{2}$

(D) $y(x) = \sin x$, provided $\lambda \neq \frac{1}{2}$

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67. For $y(x) = f(x) + \lambda \int_0^1 (-y(t))\, dt$, $D(\lambda)$ and $D(x, t; \lambda)$ are respectively :

(A) $1 - \lambda, x - 1$ (B) $\lambda - 1, x + 1$ (C) $2\lambda, -1$ (D) $1 + \lambda, -1$

68. The geodesic on a cylinder, using the principles of calculus of variations, is given by a :

(A) circle (B) ellipse (C) circular helix (D) elliptical helix

69. The extremal of $\int_{x_0}^{x_1} (x^2y'^2 + 2y^2 + 2xy)\, dx$ is :

(A) $y = c_1x + c_2x^2 + \frac{1}{3}x \log x$ (B) $y = c_1x + c_2x^{-2} + \frac{1}{3}\log x$

(C) $y = c_1x + c_2x^{-2} + \frac{1}{3}x \log |x|$ (D) $y = c_1x + c_2x^{-2} + 3x \log x$

70. Which of the following is the most appropriate extremal of $\int_{x_1}^{x_2} \frac{\sqrt{1+y'^2}}{y}\, dx$?

(A) a family of ellipses

(B) a family of circles

(C) a family of circles having centre on the x-axis

(D) a family of circles of constant radius having centres on a line

71. The kinetic and potential energies of a planetary motion in two dimensions are $\frac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2)$ and $V(r)$. Then the two first integrals of motion are :

(A) $mr^2\theta = A$, $\frac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2) - V(r) = B$

(B) $mr\dot{\theta}^2 = A$, $\frac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2) + V(r) = B$

(C) $mr^2\dot{\theta} = A$, $\dot{r}^2 + r^2\dot{\theta}^2 - V(r) = B$

(D) $mr^2\dot{\theta} = A$, $\frac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2) + V(r) = B$

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72. The equation of motion of a ring sliding on a uniformly rotating wire in a force-free space (with ω being angular velocity and r being the distance along the wire from rotation axis) is given by :

(A) $\ddot{r} + \frac{1}{2} r\omega^2 = 0$ (B) $\ddot{r} = r\omega^2$ (C) $\ddot{r} - \frac{1}{2} r\omega^2 = 0$ (D) $\ddot{r} + r\omega^2 = 0$

73. Consider a hoop rolling, without slipping, down an inclined plane. Then taking l to be the length of the inclined plane and θ to be the acute angle it makes with the horizontal, the Lagrangian is given by :

(A) $L = \frac{M\dot{x}^2}{2} + \frac{Mr\dot{\theta}^2}{2} + Mg(l - x)\sin\phi$

(B) $L = \frac{M\dot{x}^2}{2} + \frac{Mr\dot{\theta}^2}{2} + Mgl\cos\phi$

(C) $L = \frac{M\dot{x}^2}{2} + \frac{Mr^2\dot{\theta}^2}{2} - Mg(l - x)\sin\phi$

(D) $L = \frac{M\dot{x}^2}{2} + \frac{Mr^2\dot{\theta}^2}{2} + Mgl\sin(\theta - \phi)$

74. Consider a particle of mass m that is constrained to move on the surface of a cylinder given by $x^2 + y^2 = a^2$. The particle is subjected to a force directed towards the origin and proportional to the distance of the particle from the origin and is given by $E = -kr$. Then the angular momentum about the z-axis p_ϕ is :

(A) p_z/m (B) k/ma^2 (C) $ma^2\dot{\phi}$ (D) constant

75. The Routhian function for Kepler's problem, in the normal notations, is given by :

(A) $R = \frac{m}{2}(\dot{r}^2 + r\dot{\theta}^2) + \frac{m\mu}{r} - c\ddot{\theta}$

(B) $R = \frac{m}{2}(\dot{r}^2 + r^2\dot{\theta}^2) + \frac{m\mu}{r} - c\dot{\theta}$

(C) $R = \frac{m}{2}(r^2 + r^2\dot{\theta}^2) - \frac{m\mu}{r} + c\dot{\theta}^2$

(D) $R = \frac{m}{2}(\dot{r}^2 + r^2\dot{\theta}^2) - \frac{m\mu}{r} + c\dot{\theta}$

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76. The role of Exploratory graphs in data analysis is :

(A) They are made for formal presentations

(B) Axes, legends and other details are clearly and exactly detailed

(C) They are used in place of formal modelling

(D) They are typically made very quickly

77. Sum of squares of deviationing taken from which quantity is minimum ?

(A) Arithmetic Mean (B) Median

(C) Mode (D) Harmonic Mean

78. In a population consisting of equal number of men and women, 20% of men and 60% of women are unemployed. What is the probability that a person selected at random is employed ?

(A) $\frac{12}{20}$ (B) $\frac{20}{80}$ (C) $\frac{60}{80}$ (D) $\frac{6}{20}$

79. If the variates X_i are bounded then the necessary and sufficient condition for the weak law of large numbers to hold is :

(A) $\lim_{n\to\infty} \frac{\text{var}(X_1 + X_2 + \ldots X_n)}{n} = 0$ (B) $\text{var}(X_1 + X_2 + \ldots + X_n) < \infty$

(C) $\lim_{n\to\infty} \frac{E(X_1 + X_2 \ldots + X_n)}{n} = \mu$ (D) $\lim_{n\to\infty} \frac{\text{var}(X_1 + X_2 + \ldots + X_n)}{n^2} = 0$

80. Which of the following is ***not*** true ?

(A) Yule process is covariance stationary process.

(B) Pure random process is strong sense stationary process.

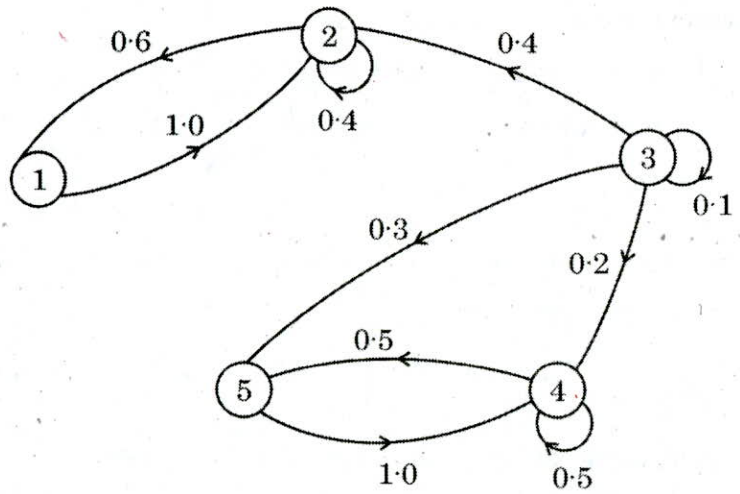
(C) First Order Markov process can be considered as a Moving Average process of infinite order.

(D) Auto regressive process can be represented by an Moving Average process of infinite order.

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81. Find the recurrent class(es) of the following transition graph :



(A) (1, 2, 3) and (3, 4, 5)

(B) (1, 2, 3, 4, 5)

(C) (1, 2) and (4, 5)

(D) (2, 3) and (3, 4)

82. Which distribution is having lack of memory property ?

(A) Binomial Distribution

(B) Poisson Distribution

(C) Normal Distribution

(D) Exponential Distribution

83. Let $X \sim U(0, 1)$ and $Y = X^2$. Then which among the following is true ?

(A) X and Y are independent and uncorrelated

(B) X and Y are independent but correlated

(C) X and Y are not dependent but correlated

(D) X and Y are neither independent nor correlated

84. Which of the following statement is ***not*** true ?

(A) A consistent estimator is unique.

(B) A consistent estimator is not necessarily unbiased.

(C) Unbiased estimators do not always exist.

(D) Unbiased estimators may not be unique.

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85. Let $X_1, X_2, ..., X_n$ be independent random observations from the exponential distribution with mean $\frac{1}{\theta}$, then the Fisher information measure is given by

(A) $\frac{n}{\theta^2}$ (B) $\frac{n}{\theta}$ (C) $\frac{1}{\theta^2}$ (D) $-\frac{n}{\theta}$

86. A size α, test $\phi(x)$ for testing $H_0 : \theta \in \Omega_0$ against $H_1 : \theta \in \Omega$, is unbiased if and only if its power function $\beta_\phi(\theta)$ satisfies

(A) $\beta_\phi(\theta) \geq \alpha$, for $\theta \in \Omega_0$ and $\beta_\phi(\theta) \geq \alpha$, for $\theta \in \Omega_1$

(B) $\beta_\phi(\theta) \leq \alpha$, for $\theta \in \Omega_0$ and $\beta_\phi(\theta) \geq \alpha$, for $\theta \in \Omega_1$

(C) $\beta_\phi(\theta) \geq \alpha$, for $\theta \in \Omega_0$ and $\beta_\phi(\theta) \leq \alpha$, for $\theta \in \Omega_1$

(D) $\beta_\phi(\theta) \leq \alpha$, for $\theta \in \Omega_0$ and $\beta_\phi(\theta) \leq \alpha$, for $\theta \in \Omega_1$

87. The invariance in hypothesis testing problem was first suggested by

(A) Neyman-Pearson (B) Wald

(C) Hotelling (D) Pitman

88. If the sample size is large, the variate R in Wald-Wolfowitz run test is distributed with variance,

(A) $\frac{2\,mn(2\,mn-m-n)}{(m+n)(m+n-1)}$ (B) $\frac{2\,mn(2\,mn-m-n)}{(m+n)^2(m+n-1)}$

(C) $\frac{mn(2\,mn-m-n)}{(m+n)^2(m+n-1)}$ (D) $\frac{2\,mn(2\,m-m-n)}{n^2(n-1)}$

89. Find the Wilcoxon rank-sum test statistic for the following data :

X :	11·2	9·4	12·0	12·6	11·4	13·2
Y :	15·4	14·0	11·3	16·4	14·1	13·4

(A) 78 (B) 53 (C) 21 (D) 25

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90. Which theorem is the basis for splitting the total sum of squares in ANOVA ?

(A) Gauss-Markov Theorem

(B) Cochran's Theorem

(C) Neyman-Pearson Lemma

(D) Lehmann-Scheffé Theorem

91. The necessary and sufficient condition for the estimability of a linear parametric function $\lambda'\beta$ in a general linear model $Y = X\beta + e$ is :

(A) Rank (X) = Rank (Y)

(B) Rank (X) = Rank (e)

(C) Rank (X) = Rank (X′, Y)

(D) $\text{Rank}(X) = \text{Rank}\begin{pmatrix} X \\ \lambda' \end{pmatrix}$

92. Which of the following is a form of Minkowski metric ?

(A) $\alpha_{ij} = \left[\sum_{k=1}^{p} \left| X_{ik} - X_{jk} \right|^{r}\right]^{\frac{1}{r}}$

(B) $\alpha_{ij} = \left[\sum (X_{ik} - X_{jk})^2\right]^{\frac{1}{2}}$

(C) $\alpha_{ij} = \sum_{k=1}^{p} \left| X_{ik} - X_{jk} \right|$

(D) $\alpha_{ij} = \sum (X_{ik} - X_{jk})^2$

93. The sampling distribution of the sample covariance matrix of a multivariate normal population is :

(A) Chi-square distribution

(B) F-distribution

(C) Wishart distribution

(D) Multivariate normal distribution

94. The procedure for selecting a probability proportional to size sample with replacement is given by

(A) Lahiri Method

(B) Cochran Method

(C) Murthy Method

(D) Desraj Method

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95. With usual notation, the relative precision of systematic sampling with simple random sampling is given by

(A) $\frac{1-f}{n}[1+\rho(n-1)]$ (B) $\frac{N-1}{N-n}[1-\rho(n-1)]$

(C) $\frac{N-1}{N-n}[1+\rho(n-1)]$ (D) $\frac{1-f}{n}[1-\rho(n-1)]$

96. When we have 4 treatments with 4 blocks each of size 3 and the number of replications is 3, then which of the following design is suitable ?

(A) CRD (B) RBD

(C) BIBD (D) PBIBD

97. Which of the following principle is ***not*** used in Completely Randomized Design ?

(A) Randomization (B) Replication

(C) Local Control (D) Uniformity trial

98. If the hazard function $h(t) = t^3$, $t \geq 0$, then the cumulative hazard function is :

(A) $\frac{t^3}{3}$ (B) $\frac{t^2}{2}$ (C) $3t$ (D) $\frac{t^4}{4}$

99. In solving a linear programming problem by graphical method of two-dimension, one constraint line comes parallel to the objective function line, then the problem will have

(A) unbounded solution (B) degenerate solution

(C) infeasible solution (D) infinite number of solutions

100. Vehicles pass through a toll gate @ 90/hr. The average time to pass through the gate is 36 seconds. What will be the percentage of idle time if it install one more gate to reduce the average time to pass through the toll gate to 30 seconds ?

(A) 90% (B) 75%

(C) 25% (D) 10%

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COMPETITIVE EXAMINATION-2023

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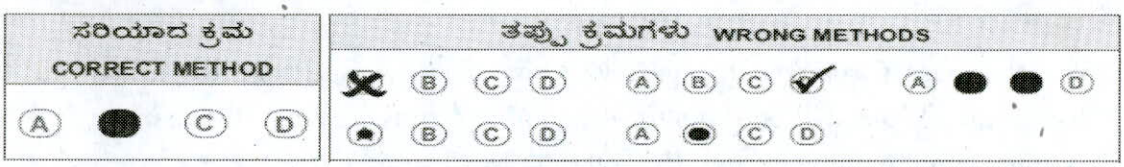
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