Test Paper : **II**

Test Subject : **MATHEMATICAL SCIENCE**

Test Subject Code : **K-2617**

Test Booklet Serial No. : _____

OMR Sheet No. : _____

Roll No. | | | | | | | | |

(Figures as per admission card)

Name & Signature of Invigilator/s

Signature : _____

Name : _____

Paper : II

Subject : MATHEMATICAL SCIENCE

Time : 1 Hour 15 Minutes | Maximum Marks : 100

Number of Pages in this Booklet : **8** | Number of Questions in this Booklet : **50**

ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಸೂಚನೆಗಳು

1. ಈ ಪುಟದ ಮೇಲ್ತುದಿಯಲ್ಲಿ ಒದಗಿಸಿದ ಸ್ಥಳದಲ್ಲಿ ನಿಮ್ಮ ರೋಲ್ ನಂಬರನ್ನು ಬರೆಯಿರಿ.
2. ಈ ಪತ್ರಿಕೆಯು ಬಹು ಆಯ್ಕೆ ವಿಧದ ಐವತ್ತು ಪ್ರಶ್ನೆಗಳನ್ನು ಒಳಗೊಂಡಿದೆ.
3. ಪರೀಕ್ಷೆಯ ಪ್ರಾರಂಭದಲ್ಲಿ, ಪ್ರಶ್ನೆಪುಸ್ತಿಕೆಯನ್ನು ನಿಮಗೆ ನೀಡಲಾಗುವುದು. ಮೊದಲ 5 ನಿಮಿಷಗಳಲ್ಲಿ ನೀವು ಪುಸ್ತಿಕೆಯನ್ನು ತೆರೆಯಲು ಮತ್ತು ಕೆಳಗಿನಂತೆ ಕಡ್ಡಾಯವಾಗಿ ಪರೀಕ್ಷಿಸಲು ಕೋರಲಾಗಿದೆ.
   (i) ಪ್ರಶ್ನೆ ಪುಸ್ತಿಕೆಗೆ ಪ್ರವೇಶಾವಕಾಶ ಪಡೆಯಲು, ಈ ಹೊದಿಕೆ ಪುಟದ ಅಂಚಿನ ಮೇಲಿರುವ ಪೇಪರ್ ಸೀಲನ್ನು ಹರಿಯಿರಿ. ಸ್ಟಿಕ್ಕರ್ ಸೀಲ್ ಇಲ್ಲದ ಅಥವಾ ತೆರೆದ ಪುಸ್ತಿಕೆಯನ್ನು ಸ್ವೀಕರಿಸಬೇಡಿ.
   (ii) **ಪುಸ್ತಿಕೆಯಲ್ಲಿನ ಪ್ರಶ್ನೆಗಳ ಸಂಖ್ಯೆ ಮತ್ತು ಪುಟಗಳ ಸಂಖ್ಯೆಯನ್ನು ಮುಖಪುಟದ ಮೇಲೆ ಮುದ್ರಿಸಿದ ಮಾಹಿತಿಯೊಂದಿಗೆ ತಾಳೆ ನೋಡಿರಿ. ಪುಟಗಳು/ಪ್ರಶ್ನೆಗಳು ಕಾಣೆಯಾದ, ಅಥವಾ ದ್ವಿಪ್ರತಿ ಅಥವಾ ಅನುಕ್ರಮವಾಗಿಲ್ಲದ ಅಥವಾ ಇತರ ಯಾವುದೇ ವ್ಯತ್ಯಾಸದ ದೋಷಪೂರಿತ ಪುಸ್ತಿಕೆಯನ್ನು ಕೂಡಲೆ 5 ನಿಮಿಷದ ಅವಧಿ ಒಳಗೆ, ಸಂವೀಕ್ಷಕರಿಂದ ಸರಿ ಇರುವ ಪುಸ್ತಿಕೆಗೆ ಬದಲಾಯಿಸಿಕೊಳ್ಳಬೇಕು. ಆ ಬಳಿಕ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ಬದಲಾಯಿಸಲಾಗುವುದಿಲ್ಲ, ಯಾವುದೇ ಹೆಚ್ಚು ಸಮಯವನ್ನೂ ಕೊಡಲಾಗುವುದಿಲ್ಲ.**
4. ಪ್ರತಿಯೊಂದು ಪ್ರಶ್ನೆಗೂ (A), (B), (C) ಮತ್ತು (D) ಎಂದು ಗುರುತಿಸಿದ ನಾಲ್ಕು ಪರ್ಯಾಯ ಉತ್ತರಗಳಿವೆ. ನೀವು ಪ್ರಶ್ನೆಯ ಎದುರು ಸರಿಯಾದ ಉತ್ತರದ ಮೇಲೆ, ಕೆಳಗೆ ಕಾಣಿಸಿದಂತೆ ಅಂಡಾಕೃತಿಯನ್ನು ಕಪ್ಪಾಗಿಸಬೇಕು.

   ಉದಾಹರಣೆ: (A) (B) ● (D)

   (C) ಸರಿಯಾದ ಉತ್ತರವಾಗಿದ್ದಾಗ.
5. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ I ರಲ್ಲಿ **ಕೊಟ್ಟಿರುವ OMR ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿ, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ I ಮತ್ತು ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ II ರಲ್ಲಿ ಇರುವ ಪ್ರಶ್ನೆಗಳಿಗೆ ನಿಮ್ಮ ಉತ್ತರಗಳನ್ನು ಸೂಚಿಸತಕ್ಕದ್ದು.** OMR ಹಾಳೆಯಲ್ಲಿ ಅಂಡಾಕೃತಿಯಲ್ಲದೆ ಬೇರೆ ಯಾವುದೇ ಸ್ಥಳದಲ್ಲಿ ಉತ್ತರವನ್ನು ಗುರುತಿಸಿದರೆ, ಅದರ ಮೌಲ್ಯಮಾಪನ ಮಾಡಲಾಗುವುದಿಲ್ಲ.
6. OMR ಉತ್ತರ ಹಾಳೆಯಲ್ಲಿ ಕೊಟ್ಟ ಸೂಚನೆಗಳನ್ನು ಜಾಗರೂಕತೆಯಿಂದ ಓದಿರಿ.
7. ಎಲ್ಲಾ ಕರಡು ಕೆಲಸವನ್ನು ಪುಸ್ತಿಕೆಯ ಕೊನೆಯಲ್ಲಿ ಮಾಡತಕ್ಕದ್ದು.
8. ನಿಮ್ಮ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸಬಹುದಾದ ನಿಮ್ಮ ಹೆಸರು ಅಥವಾ ಯಾವುದೇ ಚಿಹ್ನೆಯನ್ನು, ಸಂಗತವಾದ ಸ್ಥಳ ಹೊರತು ಪಡಿಸಿ, OMR ಉತ್ತರ ಹಾಳೆಯ ಯಾವುದೇ ಭಾಗದಲ್ಲಿ ಬರೆದರೆ, ನೀವು ಅನರ್ಹತೆಗೆ ಬಾಧ್ಯರಾಗಿರುತ್ತೀರಿ.
9. ಪರೀಕ್ಷೆಯು ಮುಗಿದನಂತರ, ಕಡ್ಡಾಯವಾಗಿ OMR ಉತ್ತರ ಹಾಳೆಯನ್ನು ಸಂವೀಕ್ಷಕರಿಗೆ ನೀವು ಹಿಂತಿರುಗಿಸಬೇಕು ಮತ್ತು ಪರೀಕ್ಷಾ ಕೊಠಡಿಯ ಹೊರಗೆ OMR ನ್ನು ನಿಮ್ಮೊಂದಿಗೆ ಕೊಂಡೊಯ್ಯಕೂಡದು.
10. ಪರೀಕ್ಷೆಯ ನಂತರ, ಪರೀಕ್ಷಾ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ಮತ್ತು ನಕಲು OMR ಉತ್ತರ ಹಾಳೆಯನ್ನು ನಿಮ್ಮೊಂದಿಗೆ ತೆಗೆದುಕೊಂಡು ಹೋಗಬಹುದು.
11. **ನೀಲಿ/ಕಪ್ಪು ಬಾಲ್‌ಪಾಯಿಂಟ್ ಪೆನ್ ಮಾತ್ರವೇ ಉಪಯೋಗಿಸಿರಿ.**
12. **ಕ್ಯಾಲ್ಕುಲೇಟರ್, ವಿದ್ಯುನ್ಮಾನ ಉಪಕರಣ ಅಥವಾ ಲಾಗ್ ಟೇಬಲ್ ಇತ್ಯಾದಿಯ ಉಪಯೋಗವನ್ನು ನಿಷೇಧಿಸಲಾಗಿದೆ.**
13. **ಸರಿ ಅಲ್ಲದ ಉತ್ತರಗಳಿಗೆ ಋಣ ಅಂಕ ಇರುವುದಿಲ್ಲ.**
14. **ಕನ್ನಡ ಮತ್ತು ಇಂಗ್ಲೀಷ್ ಆವೃತ್ತಿಗಳ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಗಳಲ್ಲಿ ಯಾವುದೇ ರೀತಿಯ ವ್ಯತ್ಯಾಸಗಳು ಕಂಡುಬಂದಲ್ಲಿ, ಇಂಗ್ಲೀಷ್ ಆವೃತ್ತಿಗಳಲ್ಲಿರುವುದೇ ಅಂತಿಮವೆಂದು ಪರಿಗಣಿಸಬೇಕು.**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of fifty multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of the cover page. Do not accept a booklet without sticker seal or open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.

   Example : (A) (B) ● (D)

   where (C) is the correct response.
5. Your responses to the questions are to be indicated in the **OMR Sheet kept inside the Paper I Booklet only**. If you mark at any place other than in the circles in the OMR Sheet, it will not be evaluated.
6. Read the instructions given in OMR carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the test OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must NOT carry it with you outside the Examination Hall.
10. You can take away question booklet and carbon copy of OMR Answer Sheet after the examination.
11. **Use only Blue/Black Ball point pen.**
12. **Use of any calculator, Electronic gadgets or log table etc., is prohibited.**
13. **There is no negative marks for incorrect answers.**
14. **In case of any discrepancy found in the Kannada translation of a question booklet the question in English version shall be taken as final.**

MATHEMATICAL SCIENCE
Paper – II

Note : This paper contains **fifty (50)** objective type questions. **Each** question carries **two (2)** marks. **All** questions are **compulsory**.

1. If $a = \lim_{n\to\infty}\left(1+\frac{1}{2}+\ldots+\frac{1}{n}\right)$ and

$b = \lim_{n\to\infty}\frac{1}{n}\left(1+\frac{1}{2}+\ldots+\frac{1}{n}\right)$, then

(A) $a = \infty$, $b = 0$

(B) $a = \infty = b$

(C) $a = \infty$, $b = 1$

(D) $a = 0 = b$

2. If $x_1 = \sqrt{2}$, $x_{n+1} = \sqrt{2x_n}$, $n \geq 1$, then

$\lim_{n\to\infty} \log_e x_n =$

(A) $\log_e\left(2+\sqrt{2}\right)$

(B) $\log_e 2$

(C) $\log_e 4$

(D) 2

3. Let E be a noncompact but bounded subset of $\mathbb{R}$, x_0 be a limit point of E which is not in E and $g : E \to \mathbb{R}$ be defined by $g(x) = \frac{1}{1+(x-x_0)^2}$.

Then which one of the following statements is not true ?

(A) g is continuous on E

(B) g is bounded on E

(C) g attains its maximum on E

(D) g is monotonically decreasing for $x > x_0$

4. The Cauchy product of the series $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{n}$ with itself is

(A) $\sum_{n=1}^{\infty}\frac{1}{n^2}$ (B) Convergent

(C) Divergent (D) $\sum_{n=1}^{\infty}\frac{1}{n(n+1)}$

5. Which one of the following is a metric on $\mathbb{R}$?

(A) $d(x, y) = |x^2 - y^2|$

(B) $d(x, y) = |x - 2y|$

(C) $d(x, y) = \frac{|x-y|}{1+|x-y|}$

(D) $d(x, y) = (x-y)^2$

6. $\lim_{n\to\infty}\frac{n^{\sqrt{2}}}{\left(1+\sqrt{2}\right)^n} =$

(A) 1 (B) ∞

(C) 0 (D) $\sqrt{2}$

7. Which one of the following sets is countable ?

(A) The set of all sequences whose elements are the digits 0 and 1

(B) The set of all n-tuples of elements of a countable set

(C) The non-empty perfect set in $\mathbb{R}^k$

(D) The set of all transcendental numbers

8. Which one of the following statements is not true ?
(A) There always exists a basis for every finite dimensional vector space
(B) If V is a finite dimensional vector space, then V is canonically isomorphic to V**
(C) For every subspace W_1 of a finite dimensional vector space V, there exists a subspace W_2 of V such that $V = W_1 \oplus W_2$
(D) If V is a finite dimensional vector space, W is a subspace of V and A is the annihilator then
dim A(W) = dim V + dim W

9. Let the characteristic equation of a matrix A be $\lambda^2 - \lambda - 1 = 0$. Then
(A) A^{-1} does not exist
(B) $A^{-1} = A$
(C) $A^{-1} = A + I$
(D) $A^{-1} = A - I$

10. If $\alpha = (3, 1, -4)$, $\beta = (2, 2, -3)$ and $\gamma = (0, -4, 1)$ are vectors in $\mathbb{R}^3$, then
(A) α, β, γ are linearly dependent
(B) α, β, γ are linearly independent
(C) α, β are linearly dependent
(D) α, γ are linearly dependent

11. If W_1 and W_2 are two subspaces of a finite dimensional vector space V, then dim $(W_1 + W_2)$ =
(A) dim W_1 + dim W_2
(B) dim W_1 + dim W_2 – dim $(W_1 \cup W_2)$
(C) dim W_1 + dim W_2 – dim $(W_1 \cap W_2)$
(D) dim W_1 – dim W_2 + dim $(W_1 \cup W_2)$

12. If V is a vector space of all 2×2 matrices over the field of reals, then dim V =
(A) 1 (B) 2
(C) 3 (D) 4

13. Which one of the following is not a linear transformation from $\mathbb{R}^3$ to $\mathbb{R}^3$?
(A) T(x, y, z) = (x, 2y, 3x – y)
(B) T(x, y, z) = (x – y, 0, y – z)
(C) T(x, y, z) = (0, 0, 0)
(D) T(x, y, z) = (1, x, z)

14. If $\left(\frac{1-i}{1+i}\right)^{100} = a + ib$, then $\frac{b}{a} =$
(A) 0 (B) 1
(C) – 1 (D) i

15. Under the transformation $w = \frac{z-i}{1+iz}$, the circle |w| = 1 corresponds to
(A) The real axis in the z-plane
(B) The imaginary axis in the z-plane
(C) A circle
(D) An ellipse

16. The radius of convergence of the power series $\sum_{n=0}^{\infty} (n + 2i)^n z^n$ is
(A) 0 (B) 1
(C) ∞ (D) 2

17. If C is the circle |z| = 1, then the value of the integral $\int_C \frac{z+4}{z^2+2z+5} dz$ is
(A) 1 + i (B) 0
(C) 1 – 2i (D) 1

18. In the symmetric group S_3, the number of elements that satisfy the equation $x^2 = e$, is
(A) 4
(B) 3
(C) 6
(D) 0

19. If f = (1 3 5 6) and g = (2 4 7 8) then which one of the following statements is true ?
(A) f and g are not conjugates
(B) $fg \neq gf$
(C) $o(f) \neq o(g)$
(D) f and g are conjugates

20. If F is a field, then F has
(A) an infinite number of ideals
(B) exactly two ideals
(C) exactly one ideal
(D) no ideal

21. If p is a prime number, then which one of the following statements is not true ?
(A) Any group of order p is cyclic
(B) Any group of order p^2 is abelian
(C) Any group of order 2p is abelian
(D) Any p-group has non-trivial centre

22. Which one of the following statements is not true ?
(A) Every closed subspace of a compact space is compact
(B) Every compact subspace of any topological space is closed
(C) The image of a compact space under a continuous map is compact
(D) The product of compact spaces is compact

23. Let A be a subset of a topological space X. Then $Int(A) \cup Bd(A) \cup Int(X - A) =$
(A) A
(B) $\overline{A}$
(C) ϕ
(D) X

24. Let A and B be subsets of a topological space X. Then which one of the following need not be true in general
(A) $Int(A \cap B) = Int(A) \cap Int(B)$
(B) $\overline{X - A} = X - IntA$
(C) $\overline{A \cap B} = \overline{A} \cap \overline{B}$
(D) $Bd(A) = \overline{A} - Int(A)$

25. Let $(y - c)^2 = cx$ be the primitive of the differential equation

$$4x\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0.$$

The number of integral curves which pass through (1, 2) is
(A) 1 (B) 2
(C) 3 (D) 4

26. For the partial differential equation $\frac{\partial z}{\partial x} + 2xy^3 \frac{\partial z}{\partial y} = z^3$, the general solution can be expressed in the form F(u, v) = 0, where
(A) $u = x^2 + y^{-2}, v = x - \frac{z^{-2}}{2}$
(B) $u = x^2 - y^2, v = x - z^{-2}$
(C) $u = x^2 - \frac{y^2}{2}, v = x - \frac{z^{-2}}{2}$
(D) $u = x^2 + \frac{y^{-2}}{2}, v = x^2 + \frac{z^{-2}}{2}$

27. Which one of the following matrices admits a Choleskey decomposition ?

(A) $\begin{pmatrix} 1 & i \\ i & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 2i \\ -2i & 1 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & -2 \\ -2 & 5 \end{pmatrix}$ (D) $\begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix}$

28. A particle is moving with a force perpendicular to and proportional to its distance from the line of zero velocity. Then the path of the quickest descent is a

(A) Parabola
(B) Straight line
(C) Circle
(D) Hyperbola

29. A solution of the integral equation

$g(s) = s + \int_0^1 su^2 g(u)du$ is

(A) $g(t) = \frac{3t}{4}$

(B) $g(t) = \frac{4t}{3}$

(C) $g(t) = \frac{2t}{3}$

(D) $g(t) = \frac{3t}{2}$

30. A body continues to be in its state of rest or of uniform motion unless no external force is applied to it. This law is known as the

(A) Law of inertia
(B) Law of force
(C) Law of action and reaction
(D) Fourier law

31. For a sequence $\{A_n, n \geq 1\}$ of events, lim inf A_n is equal to which one of the following ?

(A) $\bigcap_{n=1}^{\infty} \bigcup_{k=n}^{\infty} A_k^c$

(B) $\bigcup_{n=1}^{\infty} \bigcap_{k=n}^{\infty} A_k^c$

(C) $\left(\bigcap_{n=1}^{\infty} \bigcup_{k=n}^{\infty} A_k^c \right)^c$

(D) $\left(\bigcup_{n=1}^{\infty} \bigcap_{k=n}^{\infty} A_k^c \right)^c$

32. If a linear programming problem has two optimal solutions, which one of the following is true ?

(A) It has only two extreme points
(B) It has an infinite number of optimal solutions
(C) It has only a finite number of optimal solutions
(D) It has only four extreme points

33. From which one of the following graphical representations of a data set, data can be retrieved ?

(A) Box plot
(B) Histogram
(C) Stem-and-leaf diagram
(D) Pi diagram

34. Whenever expectations exist, which one of the following is true ?

(A) $E(\exp(X)) \geq \exp(E(X))$
(B) $E(\exp(X)) \leq \exp(E(X))$
(C) $E(\exp(X)) = \exp(E(X))$
(D) $E(\exp(X)) \neq \exp(E(X))$

35. If random variable X has uniform distribution over (0, 2), which one of the following is true ?

(A) $P\left(X > \frac{3}{2}\right) \leq \frac{1}{9}$

(B) $P\left(X > \frac{3}{2}\right) \leq \frac{2}{9}$

(C) $P\left(X > \frac{3}{2}\right) \leq \frac{1}{3}$

(D) $P\left(X > \frac{3}{2}\right) \leq \frac{4}{9}$

36. If X_n has Cauchy distribution with parameter $\frac{1}{n}, n \geq 1$, and X_n's are independent random variables, which one of the following is true ?

(A) SLLN holds but WLLN does not
(B) WLLN holds but SLLN does not
(C) WLLN does not hold
(D) WLLN and SLLN hold

37. Which one of the following is true in general ?

(A) $X_n \xrightarrow{d} X \Rightarrow X_n \xrightarrow{p} X$

(B) $X_n \xrightarrow{p} X \Rightarrow X_n \xrightarrow{d} X$

(C) $X_n \xrightarrow{p} X \Rightarrow X_n \xrightarrow{a.s.} X$

(D) $X_n \xrightarrow{d} X \Rightarrow X_n \xrightarrow{a.s.} X$

38. Which one of the following is the distribution of the second order statistic from a random sample from uniform distribution over (0, 1) ?

(A) Uniform (0, 1)
(B) Standard Exponential
(C) Gamma
(D) Beta

39. Which one of the following is true if the moment generating function of random variable X is $\exp\left(\frac{t^2}{2}\right)$?

(A) $E(X^2) = V(X)$ (B) $E(X) = V(X)$
(C) X ~ Cauchy (D) $V(X) = 0$

40. If X has F(m, n) distribution, what is the distribution of $Y = \frac{1}{1 + \left(\frac{m}{n}\right)X}$?

(A) Beta (B) Gamma
(C) Student's T (D) F(n, m)

41. What is the distribution of sum of two independent standard exponential random variables ?

(A) Standard Exponential
(B) Standard Pareto
(C) Gamma
(D) Normal

42. What is an assignment problem ?

(A) It is a non-linear programming problem
(B) It is an integer non-linear programming problem
(C) It is a dynamic programming problem
(D) It is an integer linear programming problem

43. In a game, if the minimax value and the maximin value agree, then the corresponding pure strategies are called 'optimal' strategies and the game is said to have what ?

(A) Fixed point (B) Saddle point
(C) Extreme point (D) Critical point

44. In a one-way ANOVA with 3 classes and 3 observations per class, given that the F-value is 15 and the total sum of squares is 12, what is the mean squares between the classes ?

(A) 3
(B) 4
(C) 5
(D) 6

45. In a design of experiment, 3 levels of one fixed set of treatments and 4 levels of another fixed set are run in all possible 12 combinations on 12 experimental units completely at random. What is the design called ?

(A) Completely randomized design
(B) Completely randomized block design
(C) Complete block design
(D) Complete design

46. What is the sampling distribution of the test statistic $\frac{\beta_1 - \hat{\beta}_1}{SE(\hat{\beta}_1)}$ in a simple linear regression model $y = \beta_0 + \beta_1 x + \in$?

(A) F
(B) Standard Normal
(C) t_{n-2}
(D) t_{n-1}

47. Among the following, which one is not a contrast ?

(A) $\mu_1 - 3\mu_2 + 2\mu_3$
(B) $\mu_1 - 3\mu_2 - 2\mu_3 + 3\mu_4$
(C) $\mu_1 - \mu_2 - \mu_3 + \mu_4$
(D) $\mu_1 + 2\mu_2 - \mu_3 - 2\mu_4$

48. Given two samples of sizes 4 and 10, what is the mean of the two-sample Mann-Whitney-Wilcoxon statistic ?

(A) 5 (B) $\frac{5}{2}$
(C) 10 (D) 20

49. What is the Cramer-Rao lower bound to the variance of any unbiased estimator of λ^2 given that $\{X_1, X_2, \ldots, X_{10}\}$ is a random sample from Poisson (λ) distribution ?

(A) $\frac{\lambda}{10}$
(B) $\frac{\sqrt{\lambda}}{10}$
(C) $\frac{\lambda^2}{5}$
(D) $\frac{\lambda}{5}$

50. Given that $\{X_1, \ldots, X_n\}$ is a random sample from Normal $(0, \sigma^2)$, which of the following is true ?

(A) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is unbiased for σ^2
(B) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is consistent for σ^2
(C) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is MVUE for σ^2
(D) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is UMVUE for σ^2

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Space for Rough Work