CHENNAI MATHEMATICAL INSTITUTE

M.Sc. Data Science Entrance Examination 2024

19th May 2024

Enter your *Admit Card Number*: D – ☐☐☐ – ☐☐☐☐

IMPORTANT INSTRUCTIONS

- This booklet consists of 24 pages, including this cover page. Pages 3 to 12 contain space to answer the questions in Part B. Pages 13 to 24 are meant for rough work.
- Part (A) consists of multiple-choice questions. For questions in part (A), you have to provide the answers on the computer. There may be multiple correct choices. You have to select all the correct options and no incorrect option to get full marks. For instance, if you believe the correct options are (a) and (c), choose only (a) and (c). **There is no partial credit.**
- For questions in part (B), you have to write your answer in this answer booklet in the space provided for the question, along with a short explanation.
- **Part(A) will be used for screening.** Part (B) will be graded only if you score a certain minimum in part (A). However your scores in both parts will be used while making the final decision.
- **Time allowed is 3 hours, 30 minutes. Total points: 100** = 40 for part A + 60 for part B.
- For numerical answers, the following forms are acceptable: fractions, decimals, symbolic e.g.: $\binom{n}{r}$, ${}^nP_r$, $n!$ etc.

For office use only

	Points	Remarks
Part A		
Part B		
Total		

B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	Total
B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	Total

Notation and terminology

- A function f from a set A to a set B is said to be **injective (or one-to-one)** if $f(x) = f(y)$ implies $x = y$ for all $x, y \in A$;
- f is said to be **surjective (or onto)** for every $y \in B$ there exists $x \in A$ such that $f(x) = y$;
- f is said to be **bijective** if it is both injective and surjective;
- f is said to be **invertible** if there exists a function g from B to A such that $f(g(y)) = y$ for all $y \in B$ and $g(f(x)) = x$ for all $x \in A$.
- For a matrix A, A^T denotes the transpose of A. For a square matrix A, $|A|$ denotes the determinant of A and trace(A) denotes the *trace* of A — namely the sum of the diagonal elements of A.
- A *diagonal matrix* is a square matrix D with all off-diagonal entries equal to zero i.e. $d_{ij} = 0$ for all $i \neq j$.
- An *upper triangular matrix* is a square matrix A for which all entries below the diagonal are zero, i.e. $a_{ij} = 0$ for $i > j$.
- A *symmetric matrix* is a square matrix S for which $s_{ij} = s_{ji}$ for all $i \neq j$.

Part B

For questions in part (B), you have to write your answer with a short explanation in the space provided below. For numerical answers, the following forms are acceptable: fractions, decimals, symbolic e.g.: $\binom{n}{r}$, ${}^nP_r$, $n!$ *etc.*

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(1)

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(2)

(3)

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(4)

(5)

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(6)

(7)

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(8)

(9)

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(10)

(11)

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(12)

(13)

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(14)

(15)

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(16)

(17)

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(18)

(19)

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(20)

Rough work

Rough work

Rough work

Rough work

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