

Indian Institute of Technology, Madras - BS in Data Science and Applications

Notations :

- 1.Options shown in green color and with ✓ icon are correct.
- 2.Options shown in red color and with ✗ icon are incorrect.

Question Paper Name :

IIT M FOUNDATION AN4 EXAM QPF4 16
JULY 2023

Subject Name :

2023 July: IIT M FOUNDATION AN4 EXAM
QPF4

Creation Date :

2023-07-10 18:54:05

Duration :

240

Total Marks :

705

Display Marks:

Yes

Share Answer Key With Delivery Engine :

Yes

Actual Answer Key :

Yes

Calculator :

Scientific

Magnifying Glass Required? :

No

Ruler Required? :

No

Eraser Required? :

No

Scratch Pad Required? :

No

Rough Sketch/Notepad Required? :

No

Protractor Required? :

No

Show Watermark on Console? :

Yes

Highlighter :

No

Auto Save on Console?

Yes

Change Font Color :

No

Correct Marks : 1

Question Label : Multiple Choice Question

Reena wrote a letter. Here the complement is _____.

Options :

6406531928858. ✖ Wrote a letter

6406531928859. ✔ A letter

6406531928860. ✖ Reena wrote a letter

Sem2 Maths2

Section Id :	64065339057
Section Number :	7
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
Number of Questions to be attempted :	10
Section Marks :	25
Display Number Panel :	Yes
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	64065382496
Question Shuffling Allowed :	No
Is Section Default? :	null

Time : 0

Correct Marks : 0

Question Label : Multiple Choice Question

**THIS IS QUESTION PAPER FOR THE SUBJECT "FOUNDATION LEVEL : SEMESTER 2:
MATHEMATICS FOR DATA SCIENCE II (COMPUTER BASED EXAM)"**

ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?

CROSS CHECK YOUR HALL TICKET TO CONFIRM THE SUBJECTS TO BE WRITTEN.

**(IF IT IS NOT THE CORRECT SUBJECT, PLS CHECK THE SECTION AT THE TOP FOR THE SUBJECTS
REGISTERED BY YOU)**

Options :

6406531928861.  YES

6406531928862.  NO

Sub-Section Number :

2

Sub-Section Id :

64065382497

Question Shuffling Allowed :

Yes

Is Section Default? :

null

Question Number : 149 Question Id : 640653577585 Question Type : MCQ Is Question

Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction

Time : 0

Correct Marks : 2

Question Label : Multiple Choice Question

Match the system of linear equations in Column A with their number of solutions in column B and their geometric representation in Column C.

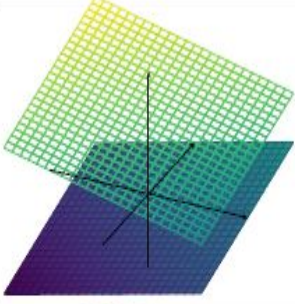
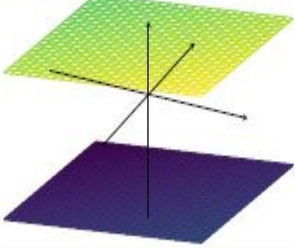
	System of linear equations (Column A)		Number of solutions (Column B)		Geometric representations (Column C)
i)	$x - 2y - z = 8, -x + 2y + z = 4$	a)	No solution	1)	
ii)	$x + y - z = 3, x - y + z = 3$	b)	Infinitely many solutions	2)	

Table: M2Q1:1

Choose the correct option from the following:

Options :

6406531928863. ✖ i) → b → 1, ii) → a → 2.

6406531928864. ✖ i) → a → 1, ii) → b → 2.

6406531928865. ✖ i) → b → 2, ii) → a → 1.

6406531928866. ✔ i) → a → 2, ii) → b → 1.

Sub-Section Number :

3

Sub-Section Id :

64065382498

Question Shuffling Allowed :

Yes

Is Section Default? :

null

Question Number : 150 Question Id : 640653577586 Question Type : MSQ Is Question

Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following matrices satisfy $A^k = 0$ for some natural number k ?

Options :

6406531928867. ✓
$$\begin{bmatrix} 4 & -4 & 0 & 0 \\ 4 & -4 & 0 & 0 \\ 0 & 0 & 4 & -4 \\ 0 & 0 & 4 & -4 \end{bmatrix}$$

6406531928868. ✓
$$\begin{bmatrix} 0 & 3 & 2 & 1 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

6406531928869. ✗
$$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

6406531928870. ✗
$$\begin{bmatrix} -1 & 0 & 0 & 1 \\ 0 & -1 & 0 & 2 \\ 0 & 0 & -1 & 2 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

Question Number : 151 Question Id : 640653577587 Question Type : MSQ Is Question

Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction

Time : 0

Correct Marks : 2 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following subsets of \mathbb{R}^2 is/are vector spaces with respect to usual addition and usual scalar multiplication?

Options :

6406531928871. ✓ $V_1 = \{(x, y) : 2x + 3y = 0\}$

6406531928872. ✓ $V_2 = \{(x, y) : y^2 = 0, x = 2y\}$

6406531928873. ✖ $V_3 = \{(x, y) : x = 1\}$

6406531928874. ✖ $V_4 = \{(x, y) : 2x + 3y - 1 = 0, x - y = 0\}$

Question Number : 152 Question Id : 640653577589 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2 Max. Selectable Options : 0

Question Label : Multiple Select Question

Select the true statement(s).

Options :

6406531928876. ✔ Any subset of a linearly independent set is a linearly independent set.

6406531928877. ✔ Any superset of a spanning set is a spanning set.

6406531928878. ✖ Any subset of a basis is a basis.

6406531928879. ✖ Any superset of a subspace is a subspace.

Question Number : 153 Question Id : 640653577590 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2 Max. Selectable Options : 0

Question Label : Multiple Select Question

Consider the set $W = \{A \in M_n(\mathbb{R}) : \det(A^T) = 0\}$ with the usual addition and usual scalar multiplication of matrices. Which of the following is/are true?

Options :

6406531928880. ✖ W is closed under addition.

6406531928881. ✔ W is closed under scalar multiplication.

6406531928882. ✖ W is a vector space.

6406531928883. ✔ W is not a vector space.

Sub-Section Number : 4
Sub-Section Id : 64065382499
Question Shuffling Allowed : Yes
Is Section Default? : null

Question Number : 154 Question Id : 640653577594 Question Type : SA Calculator : None
Response Time : N.A Think Time : N.A Minimum Instruction Time : 0
Correct Marks : 2

Question Label : Short Answer Question

Let $A = \begin{pmatrix} 2022 & 2023 & 2024 \\ 2022 & 2021 & 2022 \\ 2022 & 2022 & 2022 \end{pmatrix}$. What is the determinant of $\frac{1}{2}A$?

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
505.5

Sub-Section Number : 5
Sub-Section Id : 64065382500
Question Shuffling Allowed : Yes
Is Section Default? : null

Question Number : 155 Question Id : 640653577588 Question Type : SA Calculator : None
Response Time : N.A Think Time : N.A Minimum Instruction Time : 0
Correct Marks : 3
Question Label : Short Answer Question

Consider the system of linear equations represented in the matrix form $Ax = b$, where $A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 2 & 4 \\ 1 & 3 & \alpha \end{pmatrix}$ and $b = \begin{pmatrix} 2 \\ 3 \\ \beta \end{pmatrix}$. What is the value of $\alpha + \beta$ if the above system has infinitely many solutions?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

9

Sub-Section Number :	6
Sub-Section Id :	64065382501
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653577591 **Question Type :** COMPREHENSION **Sub Question Shuffling Allowed :** No **Group Comprehension Questions :** No **Question Pattern Type :** NonMatrix **Calculator :** None **Response Time :** N.A **Think Time :** N.A **Minimum Instruction Time :** 0
Question Numbers : (156 to 157)

Question Label : Comprehension

What is the dimension of vector spaces for the given subquestions.

Sub questions

Question Number : 156 **Question Id :** 640653577592 **Question Type :** SA **Calculator :** None **Response Time :** N.A **Think Time :** N.A **Minimum Instruction Time :** 0
Correct Marks : 1

Question Label : Short Answer Question

$$V_1 = \{(x, y, z) \in \mathbb{R}^3 : 2x + 3y = 0 = 2z + 3x\}$$

with usual addition and scalar multiplication. _____

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
1

Question Number : 157 **Question Id :** 640653577593 **Question Type :** SA **Calculator :** None
Response Time : N.A **Think Time :** N.A **Minimum Instruction Time :** 0
Correct Marks : 2

Question Label : Short Answer Question
 $V_2 = \{A \in M_3(\mathbb{R}) : \text{sum of the diagonal entries of } A \text{ is } 0 \text{ and sum of each row is } 0\}$ with usual addition and scalar multiplication of matrices. _____

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
5

Sub-Section Number :	7
Sub-Section Id :	64065382502
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653577595 **Question Type :** COMPREHENSION **Sub Question Shuffling Allowed :** No **Group Comprehension Questions :** No **Question Pattern Type :** NonMatrix **Calculator :** None **Response Time :** N.A **Think Time :** N.A **Minimum Instruction Time :** 0

Question Numbers : (158 to 162)

Question Label : Comprehension

Shivani, Sruthi and Smriti enjoyed shopping on a Sunday. Shivani bought 2 shirts, a T-shirt and 2 pants, whereas Sruthi bought a T-shirt and a pant and Smriti bought 2 shirts and a pant. They paid Rs. 600, Rs. 400 and Rs. 300 respectively. Suppose x_1 is the price of a shirt, x_2 is the price of a T-shirt and x_3 is the price of a pant. Then the above information forms a system of linear equations. If $Ax = b$ is the matrix representation of the above system, where $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ is the vector that represents the price of a shirt, T-shirt and pant respectively, answer the given subquestions.

Sub questions**Question Number : 158 Question Id : 640653577596 Question Type : MCQ Is Question****Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0****Correct Marks : 1**

Question Label : Multiple Choice Question

Choose the correct option(s):

Options :

$$A = \begin{pmatrix} 2 & 0 & 2 \\ 1 & 1 & 0 \\ 2 & 1 & 1 \end{pmatrix}, b = \begin{pmatrix} 600 \\ 400 \\ 300 \end{pmatrix}$$

6406531928887. ✖

$$A = \begin{pmatrix} 2 & 1 & 2 \\ 0 & 1 & 1 \\ 2 & 0 & 1 \end{pmatrix}, b = \begin{pmatrix} 600 \\ 400 \\ 300 \end{pmatrix}$$

6406531928888. ✔

$$A = \begin{pmatrix} 2 & 1 & 2 \\ 1 & 1 & 0 \\ 2 & 1 & 1 \end{pmatrix}, b = \begin{pmatrix} 600 \\ 400 \\ 300 \end{pmatrix}$$

6406531928889. ✖

$$A = \begin{pmatrix} 2 & 1 & 2 \\ 1 & 1 & 1 \\ 2 & 0 & 1 \end{pmatrix}, b = \begin{pmatrix} 600 \\ 400 \\ 300 \end{pmatrix}$$

6406531928890. ✖

Question Number : 159 Question Id : 640653577597 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

How many solutions does the given system $Ax = b$ have?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

0

Question Number : 160 Question Id : 640653577598 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

Consider the set S of solutions of the system $Ax = 0$, where A is as given. Clearly, S is a vector space with respect to usual addition and scalar multiplication. What is the dimension of S ?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 161 Question Id : 640653577599 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Multiple Choice Question

Which of the following forms a basis for S ?

Options :

6406531928893. ✖ $\{(\frac{1}{2}, 1, -1), (0, 1, -1)\}$

6406531928894. ✔ $\{(\frac{1}{2}, 1, -1)\}$

6406531928895. ✖ $\{(\frac{1}{2}, 1, 1), (0, 1, -1)\}$

6406531928896. ✖ $\{(\frac{1}{2}, 1, 1)\}$

Question Number : 162 Question Id : 640653577600 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Short Answer Question

What is the rank of A ?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

2

Sem2 Statistics2

Section Id :	64065339058
Section Number :	8
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	12
Number of Questions to be attempted :	12
Section Marks :	40
Display Number Panel :	Yes
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	64065382503
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Number : 163 Question Id : 640653577601 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 0

Question Label : Multiple Choice Question

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ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?

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