

C. ✖ BCNF

D. ✔ None of these

MLF

Number of Questions : 18

Section Marks : 50

Question Number : 56 Question Type : MCQ

Correct Marks : 0

Question Label : Multiple Choice Question

THIS IS QUESTION PAPER FOR THE SUBJECT "DIPLOMA LEVEL: MACHINE LEARNING FOUNDATIONS"

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 :

A. ✔ Yes

B. ✖ No

Question Number : 57 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

Consider a matrix A of size $n \times n$. Let a_{jk} denotes an element at j^{th} row and k^{th} column. The elements a_{jj} of the matrix are all of complex number i . The elements at $a_{jk} = \overline{a_{kj}}$, for $j \neq k$. Then, the matrix iA is

Options :

- A. ✖ Hermitian
- B. ✖ Symmetric
- C. ✖ Hermitian and Symmetric
- D. ✖ Hermitian but not Symmetric
- E. ✔ Neither Hermitian nor Symmetric

Question Number : 58 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

It is known that the operation $z \cdot z$, where $z \in \mathbb{C}^n$, always outputs a real number. Then the resultant scalar for the operation $z \cdot Az$, where A is a Hermitian matrix of size $n \times n$, is

Options :

- A. ✖ Always a complex number
- B. ✔ Always a real number
- C. ✖ Always an imaginary number
- D. ✖ Real or complex based on the elements of the matrix A

Question Number : 59 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

The Schur's decomposition for the matrix $A = \begin{bmatrix} 1 & i & 2i \\ -i & 2 & -i \\ -2i & i & 1 \end{bmatrix}$ is QTQ^* . Let $B = kA$ for some $k \in \mathbb{R}$. Then Schur's decomposition of B is

Options :

- A. ✖ QTQ^*
- B. ✔ The matrix T will be multiplied by k

- C. ✖ The matrix Q will be multiplied by k
- D. ✖ The matrix Q^* will be multiplied by k

Question Number : 60 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

The function $f(x, y) = 2x^2 + 2xy + 2y^2 - 18x$ has a stationary point at

Options :

- A. ✖ (6, 3)
- B. ✖ (-3, 6)
- C. ✖ (-6, -3)
- D. ✔ (6, -3)

Question Number : 61 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

The matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ is

Options :

- A. ✔ positive definite
- B. ✖ positive semi-definite
- C. ✖ negative definite
- D. ✖ negative semi-definite

Question Number : 62 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

The correct representation of $x^2 + y^2 - z^2 - xy - zy + zx$ in the matrix form is

Options :

A. ✖
$$\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} 1 & -1 & 0 \\ 0 & -1 & 0 \\ 1 & 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

B. ✖
$$\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

C. ✔
$$\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \\ 1 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

D. ✖
$$\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 \\ -1 & 0 & 1 \\ 1 & 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Question Number : 63 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

What is the value of k , if the function $f : \mathbb{R} \rightarrow \mathbb{R}, f(x, y) = kx^2 + 8y^2$ is a convex function?

Options :

A. ✖ $k \geq \frac{1}{2}$

B. ✖ $k < 1$

C. ✓ $k > 0$

D. ✗ None of these

Question Number : 64 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

Compute the Hessian matrix at the point $(0,1,\pi)$ of the following 3 variable function: $f(x,y,z) = e^{-x} \cdot \sin(yz)$

Options :

A. ✗ $\begin{bmatrix} 0 & \pi & 1 \\ \pi & 0 & -1 \\ 1 & 0 & 1 \end{bmatrix}$

B. ✗ $\begin{bmatrix} 1 & \pi & 1 \\ \pi & 0 & -1 \\ 1 & -1 & 0 \end{bmatrix}$

C. ✓ $\begin{bmatrix} 0 & \pi & 1 \\ \pi & 0 & -1 \\ 1 & -1 & 0 \end{bmatrix}$

D. ✗ None of these

Question Number : 65 Question Type : MSQ

Correct Marks : 2

Question Label : Multiple Select Question

Which of the following is/are a convex function?

Options :

A. ✖ $f(x) = \frac{1}{x^5}$ over \mathbb{R}

B. ✔ $f(x) = -\log(x)$ over \mathbb{R}

C. ✔ $f(x) = 4x^4 + 5x$ over \mathbb{R}

D. ✖ $-e^x$ given $x \in \mathbb{R}$

Question Number : 66 Question Type : MSQ

Correct Marks : 3

Question Label : Multiple Select Question

Given S is a convex set and the points $x_1, x_2, x_3, x_4 \in S$. Which of the following points must be the part of the convex hull formed by these points:

Options :

A. ✔ $0.1x_1 + 0.2x_2 + 0.3x_3 + 0.4x_4$

B. ✖ $-0.1x_1 + 0.2x_2 + 0.6x_3 + 0.7x_4$

C. ✖ $0.1x_1 + 0.1^2x_2 + 0.1^3x_3 + 0.1^3x_4$

D. ✔ $0.25x_1 + 0.25x_2 + 0.25x_3 + 0.25x_4$

Question Number : 67 Question Type : SA

Correct Marks : 2

Question Label : Short Answer Question

Consider the vector $w = \begin{bmatrix} 2 \\ 0 \\ 1+i \\ 1-i \end{bmatrix}$ and $z = \begin{bmatrix} 2+2i \\ 2+2i \\ -2-2i \\ 2+2i \end{bmatrix}$. $z = u + v$ for some u, v from \mathbb{C}^4 . If $v \cdot w$ is $-4 - 8i$, $u \cdot w = a + ib$, then what is the value of $a + b$?

NOTE: Enter your answer to the nearest integer.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

4

Question Number : 68 Question Type : SA

Correct Marks : 2

Question Label : Short Answer Question

A matrix S is decomposed using SVD as given below

$$S = \begin{bmatrix} -0.9739 & -0.1146 & 0.1961 \\ -0.1539 & -0.3023 & -0.9407 \\ 0.1671 & -0.9463 & 0.2768 \end{bmatrix} \begin{bmatrix} 7.6574 & 0 & 0 \\ 0 & 3.3214 & 0 \\ 0 & 0 & 2.5164 \end{bmatrix} \begin{bmatrix} -0.2578 & 0.6829 & 0.6835 \\ -0.4651 & -0.7078 & 0.5317 \\ -0.8469 & 0.1808 & -0.5001 \end{bmatrix}$$

Then the absolute value of the determinant of the matrix SS^T is?

NOTE: Enter your answer to the nearest integer.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

248 to 264

Question Number : 69 Question Type : SA

Correct Marks : 3

Question Label : Short Answer Question

Suppose a vector u of size $n \times 1$ is formed by the expression $u(k) = \text{Re}\left(\exp\left(\frac{ik\theta}{2}\right)\right)$, for $k = 0, 1, \dots, n-1$, where k denotes the k^{th} element in the vector u . Suppose $A = uu^T$. The number of non-zero singular values σ_i on the diagonal matrix Σ obtained by applying SVD on the matrix A is?

NOTE: Enter your answer to the nearest integer.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 70 Question Type : SA

Correct Marks : 3

Question Label : Short Answer Question

The distance of the point on the sphere $x^2 + y^2 + z^2 = 3$ farthest from the point $(2,2,2)$ is ____.

NOTE: Enter your answer in two decimal places.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

5.00 to 6.00

Question Number : 71 Question Type : SA

Correct Marks : 4

Question Label : Short Answer Question

If $f(10) = 2500$, $f'(10) = 1000$ and $f''(10) = 50$, then what could be the approximate value of $f(10.2)$?

NOTE: Enter your answer to the nearest integer.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

2700 to 2702

Question Type : COMPREHENSION

Question Numbers : (72 to 74)

Question Label : Comprehension

Consider the data points x_1, x_2, x_3 to answer the given subquestions.

$$x_1 = \begin{bmatrix} 1 \\ 2 \end{bmatrix}, x_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, x_3 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

Sub questions

Question Number : 72 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

The mean vector of the data points x_1, x_2, x_3 is

Options :

A. ✖ $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$

B. ✔ $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$

C. ✖ $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$

D. ✖ $\begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix}$

Question Number : 73 Question Type : MCQ

Correct Marks : 3

Question Label : Multiple Choice Question

The covariance matrix

$$C = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(x_i - \bar{x})^T$$

for the data points x_1, x_2, x_3 is

Options :

A. ✖ $\begin{bmatrix} 0.67 & 0.33 \\ -0.33 & 0.67 \end{bmatrix}$

B. ✖ $\begin{bmatrix} 0.67 & -0.33 \\ -0.33 & 0 \end{bmatrix}$

C. ✔ $\begin{bmatrix} 0.67 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}$

D. ✖ $\begin{bmatrix} -0.67 & -0.33 \\ 0.33 & 0.67 \end{bmatrix}$

Question Number : 74 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

The eigenvalues of the covariance matrix $C = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(x_i - \bar{x})^T$ are

Options :

A. ✖ 0.5, 0.5

B. ✖ 0.33, 0.33

C. ✔ 1, 0.34

D. ✖ 0.67, 0.67

Question Type : COMPREHENSION

Question Numbers : (75 to 76)

Question Label : Comprehension

Consider the function $f(x) = 25x^2 + 625 - 250x$.

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 75 Question Type : SA

Correct Marks : 4

Question Label : Short Answer Question

Starting with $x_0 = 3$, in how many iterations, will Newton's method be able to achieve the function's minimum value considering an error of 0.1?

NOTE: Enter your answer to the nearest integer.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Question Number : 76 Question Type : SA

Correct Marks : 4

Question Label : Short Answer Question

Starting with $x_0 = 3$ and $\eta = 0.01$, in how many iterations will gradient descent be able to reach the function's minimum value considering an error of 0.1?

NOTE: Enter your answer to the nearest integer.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

5

MLP

Number of Questions : 22

Section Marks : 50

Question Number : 77 Question Type : MCQ

Correct Marks : 0

Question Label : Multiple Choice Question

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REGISTERED BY YOU)

Options :

A. ✓ YES

B. ✗ NO

Question Number : 78 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question