6406532329908. ✔ 10

6406532329909. ✖ 5

MLF

Section Id :	64065349263
Section Number :	4
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	16
Number of Questions to be attempted :	16
Section Marks :	40
Display Number Panel :	Yes
Section Negative Marks :	0
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 :	640653103266
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Number : 81 Question Id : 640653697657 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

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

FOUNDATIONS (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 :

6406532330022. ✔ YES

6406532330023. ✖ NO

Question Number : 82 Question Id : 640653697658 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

Discrete random variables:

Distribution	PMF ($f_X(k)$)	CDF ($F_X(x)$)	$E[X]$	$\text{Var}(X)$
Uniform(A) $A = \{a, a+1, \ldots, b\}$	$\frac{1}{n}$, $x = k$ $n = b - a + 1$ $k = a, a+1, \ldots, b$	$\begin{cases} 0 & x < 0 \\ \frac{k-a+1}{n} & k \leq x < k+1 \\ & k = a, a+1, \ldots, b-1, b \\ 1 & x \geq n \end{cases}$	$\frac{a+b}{2}$	$\frac{n^2-1}{12}$
Bernoulli(p)	$\begin{cases} p & x = 1 \\ 1-p & x = 0 \end{cases}$	$\begin{cases} 0 & x < 0 \\ 1-p & 0 \leq x < 1 \\ 1 & x \geq 1 \end{cases}$	p	$p(1-p)$
Binomial(n, p)	${}^nC_k p^k (1-p)^{n-k}$, $k = 0, 1, \ldots, n$	$\begin{cases} 0 & x < 0 \\ \sum_{i=0}^{k} {}^nC_i p^i (1-p)^{n-i} & k \leq x < k+1 \\ & k = 0, 1, \ldots, n \\ 1 & x \geq n \end{cases}$	np	$np(1-p)$
Geometric(p)	$(1-p)^{k-1}p$, $k = 1, \ldots, \infty$	$\begin{cases} 0 & x < 0 \\ 1-(1-p)^k & k \leq x < k+1 \\ & k = 1, \ldots, \infty \end{cases}$	$\frac{1}{p}$	$\frac{1-p}{p^2}$
Poisson(λ)	$\frac{e^{-\lambda}\lambda^k}{k!}$, $k = 0, 1, \ldots, \infty$	$\begin{cases} 0 & x < 0 \\ e^{-\lambda} \sum_{i=0}^{k} \frac{\lambda^i}{i!} & k \leq x < k+1 \\ & k = 0, 1, \ldots, \infty \end{cases}$	λ	λ

Continuous random variables:

Distribution	PDF ($f_X(k)$)	CDF ($F_X(x)$)	$E[X]$	$\text{Var}(X)$
$\text{Uniform}[a,b]$	$\frac{1}{b-a}$, $a \leq x \leq b$	$\begin{cases} 0 & x \leq a \\ \frac{x-a}{b-a} & a < x < b \\ 1 & x \geq b \end{cases}$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
$\text{Exp}(\lambda)$	$\lambda e^{-\lambda x}$, $x > 0$	$\begin{cases} 0 & x \leq 0 \\ 1 - e^{-\lambda x} & x > 0 \end{cases}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$
$\text{Normal}(\mu, \sigma^2)$	$\frac{1}{\sigma\sqrt{2\pi}} \exp\left(\frac{-(x-\mu)^2}{2\sigma^2}\right)$, $-\infty < x < \infty$	No closed form	μ	σ^2
$\text{Gamma}(\alpha, \beta)$	$\frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\beta x}$, $x > 0$		$\frac{\alpha}{\beta}$	$\frac{\alpha}{\beta^2}$
$\text{Beta}(\alpha, \beta)$	$\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1}(1-x)^{\beta-1}$ $0 < x < 1$		$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$

1. **Markov's inequality:** Let X be a discrete random variable taking non-negative values with a finite mean μ. Then,

$$P(X \geq c) \leq \frac{\mu}{c}$$

2. **Chebyshev's inequality:** Let X be a discrete random variable with a finite mean μ and a finite variance σ^2. Then,

$$P(\mid X - \mu \mid \geq k\sigma) \leq \frac{1}{k^2}$$

3. **Weak Law of Large numbers:** Let $X_1, X_2, \ldots, X_n \sim$ iid X with $E[X] = \mu, \text{Var}(X) = \sigma^2$.
Define sample mean $\overline{X} = \frac{X_1 + X_2 + \ldots + X_n}{n}$. Then,

$$P(|\overline{X} - \mu| > \delta) \leq \frac{\sigma^2}{n\delta^2}$$

4. **Using CLT to approximate probability:** Let $X_1, X_2, \ldots, X_n \sim$ iid X with $E[X] = \mu, \text{Var}(X) = \sigma^2$.
Define $Y = X_1 + X_2 + \ldots + X_n$. Then,

$$\frac{Y - n\mu}{\sqrt{n}\sigma} \approx \text{Normal}(0, 1).$$

5. **Likelihood of i.i.d. samples**: Likelihood of a sampling $x_1, x_2, \ldots, x_n$, denoted

$$L(x_1, \ldots, x_n) = \prod_{i=1}^{n} f_X(x_i; \theta_1, \theta_2, \ldots)$$

6. **Maximum likelihood (ML) estimation**:

$$\theta_1^*, \theta_2^*, \ldots = \arg \max_{\theta_1^*, \theta_2^*, \ldots} \prod_{i=1}^{n} f_X(x_i; \theta_1, \theta_2, \ldots)$$

Options :

6406532330024. ✔ Useful Data has been mentioned above.

6406532330025. ✖ This data attachment is just for a reference & not for an evaluation.

Sub-Section Number : 2

Sub-Section Id : 640653103267

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 83 Question Id : 640653697659 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 an encoder-decoder pair used for dimensionality reduction, where the encoder function is denoted as $f(x_1, x_2, x_3) = (x_1 + x_2 + x_3)/3$ and the decoder function is denoted as $g(u) = \begin{bmatrix} u & u^2 & u \end{bmatrix}$.

Compute the reconstruction error $\left(R(f, g) = \frac{1}{n} \sum_{i=1}^{n} \|X_i - g(f(X_i))\|^2 \right)$ for the following dataset:

$$X_1 = [1, 2, 0], \quad X_2 = [-1, 1, 0], \quad X_3 = [1, 2, 3]$$

Enter the answer correct to two decimal places.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

3.31 to 3.35

Question Number : 84 Question Id : 640653697662 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

Let X and Y be two independent random variables, where $X \sim \text{Bernoulli}\left(\frac{1}{2}\right)$ and $Y \sim \text{Bernoulli}\left(\frac{1}{4}\right)$. Determine $P(X + Y = 1)$ and enter the answer correct to one decimal place.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

0.5

Question Number : 85 Question Id : 640653697664 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

Suppose you want to check whether a coin is fair or not. The coin shows heads with probability p each time it is flipped. Suppose you flip the coin 1000 times and observe a total of 485 heads, then find the ML estimate of p. Enter the answer correct to three decimal places.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Range

Text Areas : PlainText

Possible Answers :

0.480 to 0.490

Sub-Section Number :	3
Sub-Section Id :	640653103268
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 86 Question Id : 640653697660 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

What is the linear approximation of $f(x, y) = e^{xy}$ around $(1, 1)$?

Options :

6406532330027. ✔ $e(x+y-1)$

6406532330028. ✖ $x+y-1$

6406532330029. ✖ e

6406532330030. ✖ $ex+ey$

Question Number : 87 Question Id : 640653697663 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Let $X = \begin{pmatrix} X_1 \\ X_2 \\ X_3 \end{pmatrix} \sim \text{Normal}\,(\mu, \sum)$, where $\mu = \begin{pmatrix} 2 \\ 5 \\ 1 \end{pmatrix}$ and $\sum = \begin{pmatrix} 5 & 2 & -2 \\ 2 & 6 & 3 \\ -2 & 3 & 8 \end{pmatrix}$

If $Y = BX$, where $B = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 3 & 1 \end{pmatrix}$, then find the distribution of Y.

Options :

6406532330033. ✖ $Y \sim \text{Normal}\left(\begin{bmatrix} 5 \\ 16 \end{bmatrix}, \begin{bmatrix} 80 & 25 \\ 25 & 20 \end{bmatrix}\right)$

6406532330034. ✔ $Y \sim \text{Normal}\left(\begin{bmatrix} 5 \\ 16 \end{bmatrix}, \begin{bmatrix} 20 & 25 \\ 25 & 80 \end{bmatrix}\right)$

6406532330035. ✖ $Y \sim \text{Normal}\left(\begin{bmatrix} 2 \\ 5 \end{bmatrix}, \begin{bmatrix} 20 & 25 \\ 25 & 80 \end{bmatrix}\right)$

6406532330036. ✖ $Y \sim \text{Normal}\left(\begin{bmatrix}0\\0\end{bmatrix}, \begin{bmatrix}80 & 25\\25 & 20\end{bmatrix}\right)$

Question Number : 88 Question Id : 640653697673 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

There once lived a queen named Queen Dido who was exiled from her kingdom, and so she fled to another nearby kingdom. She begged the king of the nearby kingdom to give her some land. The king agreed to give her a rectangular piece of land, which she could enclose with a rope of length 96 units. How should Queen Dido choose the sides of the rectangle so that she gets as much land as possible?
Hint: Perimeter of the rectangle with sides x and y is $2(x+y)$.

Options :

6406532330063. ✔ $x = 24, y = 24$

6406532330064. ✖ $x = 30, y = 18$

6406532330065. ✖ $x = 48, y = 0$

6406532330066. ✖ $x = 48, y = 48$

Sub-Section Number :	4
Sub-Section Id :	640653103269
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 89 Question Id : 640653697661 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 4

Question Label : Short Answer Question

Let X and Y have the following joint density function

$$f(x,y) = \begin{cases} x(y-x)e^{-y}, & 0 < x \leq y < \infty \\ 0, & \text{otherwise} \end{cases}$$

Find the conditional expectation $E(X \mid Y = 2)$.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Sub-Section Number :	5
Sub-Section Id :	640653103270
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 90 Question Id : 640653697665 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

Let $A = \begin{pmatrix} 1 & 2 & 0 \\ 3 & 3 & 1 \\ 4 & 5 & 2 \end{pmatrix}$. Find the nullspace of A.

Options :

6406532330038. ✖ $\text{span}\left\{ \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \right\}$

6406532330039. ✔ $\left\{\begin{pmatrix}0\\0\\0\end{pmatrix}\right\}$

6406532330040. ✖ $\text{span}\left\{\begin{pmatrix}-1\\-1\\-1\end{pmatrix}\right\}$

6406532330041. ✖ $\text{span}\left\{\begin{pmatrix}1\\-1\\1\end{pmatrix}\right\}$

Question Number : 91 Question Id : 640653697666 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 among the following statements are correct?

Options :

6406532330042. ✖ The eigenvalues of a matrix are on its main diagonal.

6406532330043. ✔ Each eigenvector of an $n \times n$ matrix A is also an eigenvector of A^2.

6406532330044. ✖ Two eigenvectors corresponding to the same eigenvalues are always linearly dependent.

6406532330045. ✖ If v_1 and v_2 are linearly independent eigenvectors, then they correspond to distinct eigenvalues.

Question Number : 92 Question Id : 640653697672 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

A firm produces two products, A and B, with respective manufacturing costs of Rs. 20 and Rs. 30 per unit. The objective is to minimize the total manufacturing cost while meeting certain production constraints. A minimum of 250 units must be produced daily, and at least 1000 machine hours should be utilized each day. Machine hours consumption per unit is 6 hours for A and 5 hours for B. Let the number of units of A produced per day be x_1 and the number of units of B produced per day be x_2. Then, choose the correct optimization problem from the following:

Options :

6406532330059. ✖
$$\begin{array}{ll}\textbf{Minimize:} & x_1 + x_2 \\ \textbf{Subject to:} & x_1 + x_2 \geq 250, 6x_1 + 5x_2 \geq 1000, x_1, x_2 \geq 0\end{array}$$

6406532330060. ✖
$$\begin{array}{ll}\textbf{Minimize:} & 20x_1 + 30x_2 \\ \textbf{Subject to:} & x_1 + x_2 \leq 250, 6x_1 + 5x_2 \leq 1000, x_1, x_2 \geq 0\end{array}$$

6406532330061. ✖
$$\begin{array}{ll}\textbf{Minimize:} & x_1 + x_2 \\ \textbf{Subject to:} & x_1 + x_2 \geq 250, 6x_1 + 5x_2 \geq 1000, x_1, x_2 \geq 0\end{array}$$

6406532330062. ✔
$$\begin{array}{ll}\textbf{Minimize:} & 20x_1 + 30x_2 \\ \textbf{Subject to:} & x_1 + x_2 \geq 250, 6x_1 + 5x_2 \geq 1000, x_1, x_2 \geq 0\end{array}$$

Sub-Section Number :	6
Sub-Section Id :	640653103271
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 93 Question Id : 640653697667 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Let A be a $n \times n$ positive definite matrix. Then, which among the following are correct?

Options :

6406532330046. ✔ A^k is positive definite, for all $k \geq 1$.

6406532330047. ✔ Each of the diagonal entry of A will be positive.

6406532330048. ✖ rA is positive definite, $r \in \mathbb{R}$.

6406532330049. ✔ A^{-1} is positive definite.

Question Number : 94 Question Id : 640653697671 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Consider functions $f(x) = \sqrt{x},\ x \geq 0$ and $g(x) = \mid x \mid,\ x \in \mathbb{R}$. Then, which among the following options are correct?

Options :

6406532330055. ✖ fog is convex.

6406532330056. ✔ fog is not convex.

6406532330057. ✔ $-f$ is convex.

6406532330058. ✖ $h : (0, \infty) \to \mathbb{R}$ defined by $h(x) = f(x) + g(x)$ is convex.

Sub-Section Number : 7

Sub-Section Id : 640653103272

Question Shuffling Allowed : No

Is Section Default? : null

Question Id : 640653697668 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 : (95 to 96)

Question Label : Comprehension

Consider the following data points:

$$X_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}, \quad X_3 = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

For the given data points, the goal is to find transformed data points for one dimensional PCA. Based on the information, answer the given subquestions.

Sub questions

Question Number : 95 Question Id : 640653697669 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 represents the covariance matrix, *C* for the given data points?

Options :

6406532330050. ✖ $\frac{1}{3}\begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$

6406532330051. ✖ $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

6406532330052. ✔ $\frac{1}{3}\begin{bmatrix}2 & 1\\1 & 2\end{bmatrix}$

6406532330053. ✖ $\begin{bmatrix}2 & 1\\1 & 2\end{bmatrix}$

Question Number : 96 Question Id : 640653697670 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

What is the value of the projected variance?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

1

Sub-Section Number :	8
Sub-Section Id :	640653103273
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 97 Question Id : 640653697674 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

Let $S = \{x_1, x_2, x_3, x_4\} \subseteq \mathbb{R}^d$. Which of the following points must be the part of convex hull(S)?

Options :

6406532330067. ✔ $0.4x_1 + 0.6x_2$

6406532330068. ✔ $0.4x_1 + 0.2x_2 + 0.2x_3 + 0.2x_4$

6406532330069. ✖ $0.4x_1 - 0.2x_2 + 0.5x_3 + 0.3x_4$

6406532330070. ✖ $0.4x_1 + 0.2x_2 + 0.3x_3 + 0.3x_4$

Java

Section Id :	64065349264
Section Number :	5
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	24
Number of Questions to be attempted :	24
Section Marks :	100
Display Number Panel :	Yes
Section Negative Marks :	0
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 :	640653103274
Question Shuffling Allowed :	No
Is Section Default? :	null