Let $f : \mathbb{R} \to \mathbb{R}$ be the function, $f(x) = 1 + e^{-x}$. What is the value of the derivative of f at x where $f(x) = 1.4$? 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 :
0.4

MLT

Section Id :	64065369431
Section Number :	2
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	12
Number of Questions to be attempted :	12
Section Marks :	50
Display Number Panel :	Yes
Section Negative Marks :	0
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	No
Section Maximum Duration :	0
Section Minimum Duration :	0
Section Time In :	Minutes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	640653146952
Question Shuffling Allowed :	No

Question Number : 14 Question Id : 640653996000 Question Type : MCQ
Correct Marks : 0
Question Label : Multiple Choice Question
THIS IS QUESTION PAPER FOR THE SUBJECT "DIPLOMA LEVEL : MACHINE LEARNING TECHNIQUES (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 :

6406533362183. ✔ YES

6406533362184. ✖ NO

Sub-Section Number : 2

Sub-Section Id : 640653146953

Question Shuffling Allowed : Yes

Question Number : 15 Question Id : 640653996006 Question Type : MCQ

Correct Marks : 4

Question Label : Multiple Choice Question

Let $\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$ be vectors in $\mathbb{R}^2$. Define the functions k_1 and k_2 as:

$$k_1(\mathbf{x}, \mathbf{y}) = x_1y_1 + x_2y_2 + (x_1 + x_2)(y_1 + y_2)$$
$$k_2(\mathbf{x}, \mathbf{y}) = x_1y_1 + x_2y_2 + (x_1^2 + y_2^2) + 3$$

Which of the following statements is true?

Options :

6406533362192. ✖ Both k_1 and k_2 are valid kernels.

6406533362193. ✔ k_1 is a valid kernel, but k_2 is not a valid kernel.

6406533362194. ✖ k_2 is a valid kernel, but k_1 is not a valid kernel.

6406533362195. ✖ Neither k_1 nor k_2 is a valid kernel.

Question Number : 16 Question Id : 640653996008 Question Type : MCQ

Correct Marks : 4

Question Label : Multiple Choice Question

Consider the following kernel:

$$k : R^2 \times R^2 \rightarrow R$$
$$k(x, y) = (x^T y)^2 + 1$$

Which of the following transformation mapping ϕ may correspond to the kernel k?

Options :

6406533362198. ✔ $\phi([x_1, x_2]^T) = [x_1^2, \sqrt{2}x_1x_2, x_2^2, 1]^T$

6406533362199. ✖ $\phi([x_1, x_2]^T) = [x_1^2, x_1 + x_2, x_2^2, 1]^T$

6406533362200. ✖ $\phi([x_1, x_2]^T) = [x_1, \sqrt{2}x_1^2 x_2^2, x_2, 1]^T$

6406533362201. ✖ $\phi([x_1, x_2]^T) = [x_1, x_1 x_2, x_2, 1]^T$

Sub-Section Number : 3
Sub-Section Id : 640653146954
Question Shuffling Allowed : Yes

Question Number : 17 Question Id : 640653996007 Question Type : MCQ
Correct Marks : 3
Question Label : Multiple Choice Question

Given n data points in a d-dimensional space with a non-linear relationship, we apply kernel PCA to reduce the dimensionality and select the first k principal components. Is it possible for k to be greater than d?

Options :

6406533362196. ✔ yes

6406533362197. ✖ No

Sub-Section Number : 4
Sub-Section Id : 640653146955
Question Shuffling Allowed : Yes

Question Number : 18 Question Id : 640653996004 Question Type : MSQ
Correct Marks : 4 Max. Selectable Options : 0
Question Label : Multiple Select Question

Which of the following expressions is the reconstruction error for a dataset of n points, with respect to a line passing through the origin represented by the vector $\mathbf{w}$. Note that $||\mathbf{w}|| = 1$.

Options :

6406533362187. ✔ $\frac{1}{n}\sum_{i=1}^{n} ||\mathbf{x}_i - (\mathbf{x}_i^T\mathbf{w})\mathbf{w}||^2$

6406533362188. ✔ $\frac{1}{n}\sum_{i=1}^{n} \left[\mathbf{x}_i - (\mathbf{x}_i^T\mathbf{w})\mathbf{w}\right]^T \left[\mathbf{x}_i - (\mathbf{x}_i^T\mathbf{w})\mathbf{w}\right]$

6406533362189. ✖ $\frac{1}{n}\sum_{i=1}^{n}\left[\mathbf{x}_i^T\mathbf{x}_i \mid (\mathbf{x}_i^T\mathbf{w})^2\right]$

6406533362190. ✖ $-\frac{1}{n}\sum_{i=1}^{n}(\mathbf{x}_i^T\mathbf{w})^2$

Sub-Section Number : 5
Sub-Section Id : 640653146956
Question Shuffling Allowed : Yes

Question Number : 19 Question Id : 640653996013 Question Type : MSQ
Correct Marks : 5 Max. Selectable Options : 0
Question Label : Multiple Select Question

Let $X_1, X_2, \ldots, X_n$ be n i.i.d. samples with parameter θ, which follows one of the following PDFs:

For $\theta = -1$, we have

$$f(x \mid \theta) = \begin{cases} 5x^4, & \text{if } 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}.$$

For $\theta = 1$, we have

$$f(x \mid \theta) = \begin{cases} 1, & \text{if } 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}.$$

Suppose we wish to find the maximum likelihood estimate of θ, then which among the following are true?

Options :

6406533362211. ✔ If $\prod_{i=1}^{n} 5x_i^4 < 1$, then $\hat{\theta}_{MLE} = 1$

6406533362212. ✖ If $\prod_{i=1}^{n} 5x_i^4 > 1$, then $\hat{\theta}_{MLE} = 1$

6406533362213. ✖ If $\prod_{i=1}^{n} 5x_i^4 < 1$, then $\hat{\theta}_{MLE} = -1$

6406533362214. ✔ If $\prod_{i=1}^{n} 5x_i^4 > 1$, then $\hat{\theta}_{MLE} = -1$

Sub-Section Number : 6

Sub-Section Id : 640653146957
Question Shuffling Allowed : Yes

Question Number : 20 Question Id : 640653996005 Question Type : SA
Correct Marks : 3
Question Label : Short Answer Question

The eigenvalues of the covariance matrix of a centered dataset in $\mathbb{R}^5$ are $30, 10, 10, 0, 0$. Standard PCA is performed on this dataset. What is the variance captured by the top two principal components expressed as a percentage of total variance?

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
80

Sub-Section Number : 7
Sub-Section Id : 640653146958
Question Shuffling Allowed : Yes

Question Number : 21 Question Id : 640653996012 Question Type : SA
Correct Marks : 5
Question Label : Short Answer Question

Consider the following data points for k-means clustering.

$$(-1,0),(-1,1),(-1,-1),(2,0),(3,1),(3,-1),(4,0)$$

In the initialization step of k-means with k = 2, suppose $\mu_1^0 = (-1,0)$ and $\mu_2^0 = (2,0)$. Distances of datapoints from initial cluster means is tabulated below:

x_i	$\|x_i - \mu_1^0\|_2^2$	$\|x_i - \mu_2^0\|_2^2$
$(-1,0)$	0	3
$(-1,1)$	1	10
$(-1,-1)$	1	10
$(2,0)$	3	0
$(3,1)$	17	2
$(3,-1)$	17	2
$(4,0)$	5	2

As per these cluster centers, the data points are then assigned to either cluster 1 or cluster 2. After this assignment, what will be the value of the objective function?
Note: Objective function is given by

$$F(z_1, z_2, \ldots, z_n) = \sum_{i=1}^{n} \|x_i - \mu_{z_i}\|_2^2$$

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
6

Sub-Section Number : 8
Sub-Section Id : 640653146959
Question Shuffling Allowed : Yes

Question Number : 22 Question Id : 640653996014 Question Type : SA
Correct Marks : 4
Question Label : Short Answer Question

Consider a GMM for 5 points:

$$x_1 = 1, x_2 = 1.2, x_3 = 2, x_4 = 1.5, x_5 = 0.5$$

At some time-step in the EM algorithm, following are the values of λ_k^i for the k-th mixture after the E-step:

$$\lambda_k^1 = 0.3, \lambda_k^2 = 0.1, \lambda_k^3 = 2.5, \lambda_k^4 = 0.6, \lambda_k^5 = 0.8$$

What is the estimate of μ_k after the M-step? Enter your 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 :
1.50 to 1.60

Question Number : 23 Question Id : 640653996015 Question Type : SA
Correct Marks : 4
Question Label : Short Answer Question
Consider a dataset with 100 total data points. Each data point is classified as either type A or type B. We model this using a Bernoulli distribution, where p is the probability of a data point being type A. If the maximum likelihood estimate (MLE) of *p* based on the dataset is 0.4, how many data points of type B are there in this dataset?
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
60

Sub-Section Number :	9
Sub-Section Id :	640653146960
Question Shuffling Allowed :	No

Question Id : 640653996001 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix
Question Numbers : (24 to 25)
Question Label : Comprehension
Given the vector $\mathbf{x} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$ and the line passing through the origin represented by the vector $\mathbf{w} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$.
Answer the given subquestions.

Sub questions

Question Number : 24 Question Id : 640653996002 Question Type : SA
Correct Marks : 3
Question Label : Short Answer Question

Find the length of the projection of $\mathbf{x}$ onto the line defined by $\mathbf{w}$.
Enter your 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 :
4.8 to 5.1

Question Number : 25 Question Id : 640653996003 Question Type : SA
Correct Marks : 4
Question Label : Short Answer Question

Calculate the magnitude(norm) of reconstruction error after projecting $\mathbf{x}$ onto the line defined by $\mathbf{w}$.
Enter your 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 :
0.5 to 0.9

Question Id : 640653996009 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix
Question Numbers : (26 to 27)
Question Label : Comprehension

A k-means++ algorithm with $k = 3$ is applied on the following 2D points:

$$(0,1),(1,0),(1,2),(2,1),(2,3),(2,4),(3,2)$$

First cluster mean μ_1^0 is chosen as (2, 1).
Suppose the point with the highest score is chosen as the 2nd cluster mean μ_2^0.

Based on the above data, answer the given subquestions.
Sub questions

Question Number : 26 Question Id : 640653996010 Question Type : MCQ

Correct Marks : 3

Question Label : Multiple Choice Question

What is μ_2^0? Use squared distance to calculate the scores.

Options :

6406533362202. ✖ (0,1)

6406533362203. ✖ (2,3)

6406533362204. ✖ (3,2)

6406533362205. ✔ (2,4)

Question Number : 27 Question Id : 640653996011 Question Type : MCQ

Correct Marks : 4

Question Label : Multiple Choice Question

Which point has the lowest probability of being chosen as the 3rd cluster mean? Use squared distance to calculate the scores.

Options :

6406533362206. ✖ (1,0)

6406533362207. ✔ (2,3)

6406533362208. ✖ (3,2)

6406533362209. ✖ (1,2)

MLP

Section Id :	64065369432
Section Number :	3
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	18
Number of Questions to be attempted :	18
Section Marks :	50
Display Number Panel :	Yes
Section Negative Marks :	0
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	No
Section Maximum Duration :	0
Section Minimum Duration :	0
Section Time In :	Minutes
Maximum Instruction Time :	0