

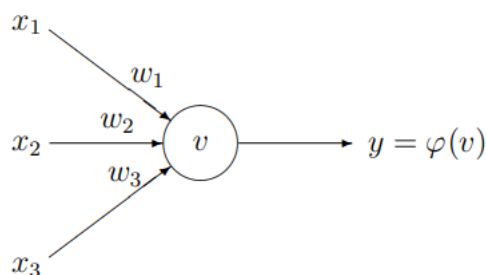
Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022**COMPUTER SCIENCE AND SYSTEMS ENGINEERING****(2021 Scheme)****Course Code: 21SE105-D****Course Name: Foundations of Machine Learning Techniques****Max. Marks: 60****Duration: 3 Hours****PART A****(Answer all questions. Each question carries 3 marks)**

1. Three identical boxes contain black and white balls. The first box contains 3 black and 2 white balls, the second box has 4 black and 5 white balls, and the third box has 2 black and 4 white balls. A box is chosen randomly and a ball is drawn from it. If the ball that is drawn out is black, what will be the probability that the second box is chosen?
2. Give short note on linear regression
3. With an example explain about unsupervised learning.
4. Write short note on dimensionality reduction methods.
5. Differentiate between Gradient Descent and Stochastic Gradient Descent
6. Why convexity is important in optimization?
7. Explain the Solution to XOR problem using neural network.
8. Below is a diagram of a single artificial neuron (unit):



The node has three inputs $x = (x_1, x_2, x_3)$ that receive only binary signals (either 0 or 1). How many different input patterns this node can receive? Can you give a formula that computes the number of binary input patterns for a given number of inputs?

PART B**(Answer one full question from each module, each question carries 6 marks)****MODULE I**

9. Explain about the discriminant methods used in two class and multi class classification with neat diagrams (6)

OR

10. Steve, a police officer was conducting his routine checks at highways and found a “red domestic SUV” without a driver. He waited for some time but couldn’t find the owner. So, he decided to predict whether the car is stolen or not using the previous car theft records available in the station. What will be his prediction if he uses naïve bayes for classification. Dataset is given below (6)

Sl.No	Color	Type	Origin	Stolen?
1	Red	Sports	Domestic	Yes
2	Red	Sports	Domestic	No
3	Red	Sports	Domestic	Yes
4	Yellow	Sports	Domestic	No
5	Yellow	Sports	Imported	Yes
6	Yellow	SUV	Imported	No
7	Yellow	SUV	Imported	Yes
8	Yellow	SUV	Domestic	No
9	Red	SUV	Imported	No
10	Red	Sports	Imported	Yes

MODULE II

11. What are Support vectors? How classification is performed by SVM? (6)
Explain the effect of hyper parameter ‘C’ in SVM, with a neat diagram.

OR

12. NASA wants to be able to discriminate between Martians (M) and Humans (H) based on the following characteristics: Green $\in\{N, Y\}$, Legs $\in\{2,3\}$, Height $\in\{S, T\}$, Smelly $\in\{N, Y\}$. (6)

Our available training data is as follows:

	Species	Green	Legs	Height	Smelly
1	M	N	3	S	Y
2	M	Y	2	T	N
3	M	Y	3	T	N
4	M	N	2	S	Y
5	M	Y	3	T	N
6	H	N	2	T	Y
7	H	N	2	S	N
8	H	N	2	T	N
9	H	Y	2	S	N
10	H	N	2	T	Y

Design a decision tree using ID3 algorithm and draw the tree.

MODULE III

13. Use k-means algorithm to cluster the following 8 points into 3 clusters: (6)
A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2),
A8=(4,9). Suppose that initial centroid of each cluster is A1, A4, A7.

OR

14. Describe the concept of Expectation Maximization algorithm (6)

MODULE IV

15. How linear models can be made nonlinear? Give 3 examples of kernel functions. (6)

OR

16. Illustrate on (6)
(i) Kernel PCA
(ii) Kernel ICA

MODULE V

17. Explain the principle of the gradient descent algorithm. Accompany (6)
your explanation with a diagram. What happens if the learning rate is too high or too low during gradient descent?

OR

18. What do you mean by constrained optimization? Explain in detail about (6)
Lagrangian approach.

MODULE VI

19. Draw and explain the architecture of convolutional neural network. (6)

OR

20. Demonstrate the structure of Long Short Term Memory with neat (6)
diagram.
