Code No. : 16147 (G) N/O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. VI-Semester Main & Backlog Examinations, May/June-2023
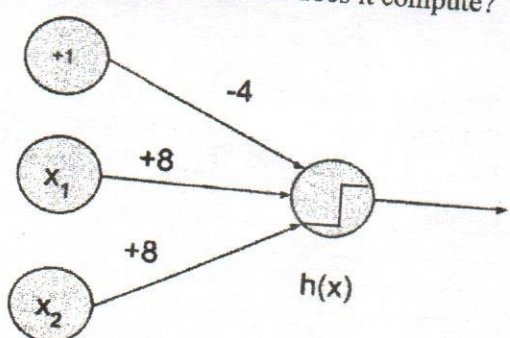
Fundamentals of Machine Learning (OE-IV)

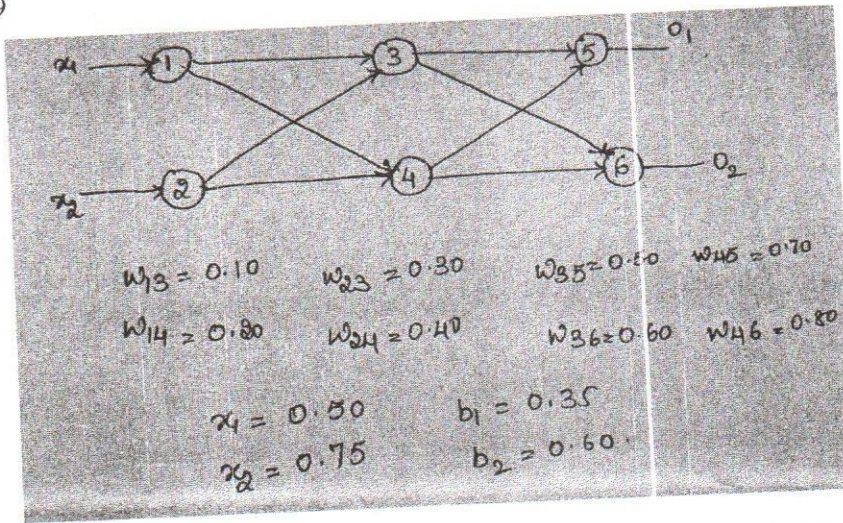(Common to Civil & Mech.)

Time: **3 hours**

Max. Marks: 60

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	List any four problem statements in AI.	2	1	1	1
2.	Justify the importance of Test error (or Generalization error) metric in evaluating ML models?	2	2	1	1
3.	Illustrate the significance of ML Performance metric.	2	2	2	1
4.	List different Python data types along with an example.	2	1	2	1
5.	Define a neuron. List few functions that can be used as an activation function in neural networks.	2	1	3	1
6.	The following neural network takes two binary valued inputs X_1 and X_2, and the activation function is the threshold function ($h(x) = 1$ if $x>0$; 0 otherwise). Which of the following logical functions does it compute?	2	2	3	1

OR b) AND c) NAND d) none

Q. No.	Stem of the question	M	L	CO	PO
7.	What are Support Vectors in SVM?	2	1	4	1
8.	X and Y are Boolean random variables. Given: $P(X=1) = 0.3$; $P(X=0) = 0.7$; $P(Y=1 \mid X=1) = 0.4$; $P(Y=0 \mid X=1) = 0.6$; $P(Y=1 \mid X=0) = 0.6$; $P(Y=0 \mid X=0) = 0.4$; Calculate $P(X=1 \mid Y=0)$ using Bayes rule.	2	2	4	1
9.	Discuss briefly about Density based clustering?	2	1	5	1
10.	What does k mean in k-means clustering?	2	1	5	1

Part-B (5 × 8 = 40 Marks)

		M	L	CO	PO
11. a)	Compare and contrast Supervised and Unsupervised Learning.	4	2	1	1

b) What are the advantages of using Numpy over Python lists? What are the different ways to create a Numpy array from a python list? **4 1 1 1**

12. a) Discuss how Linear Regression works. Write a python code to implement Linear Regression. **4 3 2 2**

b) Compare and contrast Linear Regression with Logistic Regression. **4 3 2 2**

13. a) Explain the details of Perceptron algorithm for Boolean AND function. **4 3 3 1**

b) Assume the neurons use a sigmoid activation function. Perform a forward pass on the network and calculate the error. The given outputs are $O_1 = 0.01$, $O_2 = 0.99$ **4 3 3 2**

$w_{13} = 0.10$ $w_{23} = 0.30$ $w_{35} = 0.50$ $w_{45} = 0.70$

$w_{14} = 0.80$ $w_{24} = 0.40$ $w_{36} = 0.60$ $w_{46} = 0.80$

$x_1 = 0.50$ $b_1 = 0.35$

$x_2 = 0.75$ $b_2 = 0.60$

14. a) Consider the following dataset for the features considered for playing tennis. Using Naïve Bayes algorithm predict if tennis can be played on a particular day which is { outlook : sunny, Temperature : mild , Humidity : high, wind : weak} **4 3 4 2**

Outlook	Temperature	Humidity	Wind	Play tennis
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Weak	Yes
Rain	Cool	Normal	Strong	No
overcast	Cool	Normal	Strong	Yes
Sunny	Mild	High	Weak	No
Sunny	Cool	Normal	Weak	Yes
Rain	Mild	Normal	Weak	Yes
Sunny	Mild	Normal	Strong	Yes
Overcast	Mild	High	Strong	Yes
Overcast	Hot	Normal	Weak	Yes
Rain	Mild	High	strong	No

b) How does Support Vector Machine Algorithm work? How is SVM different from Linear Regression? Explain. **4 2 4 1**

15. a) Explain DBSCAN algorithm for density-based clustering. List out its advantages compared to K-means. **4 2 5 1**

			M	L	CO	PO
b)	Given the following data set consisting of the scores of two variables A & B on each of 12 individuals: Predict 3 clusters using k-means algorithm?		4	3	5	2

Subject	A	B
1	1.0	1.0
2	1.5	2.0
3	3.0	4.0
4	5.0	7.0
5	3.5	5.0
6	4.5	5.0
7	4.8	6.0
8	5.2	7.0
9	5.5	6.0
10	6.0	7.0
11	6.4	8.0
12	6.8	7.0

			M	L	CO	PO
16. a)	Discuss the steps in solving a Machine Learning Problem.		4	2	1	1
b)	Explain the following performance metrics used for Classification in Machine Learning: i) Precision ii) Recall iii) Specificity iv) F1 Score		4	2	2	1
17.	Answer any *two* of the following:					
a)	Illustrate how Back Propagation algorithm works in a Neural Network with appropriate example.		4	3	3	2
b)	Compare and Contrast Classification and Clustering.		4	3	5	2
c)	Discuss the use of kernel in Support Vector Machines.		4	2	4	1

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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