Hall Ticket Number:

Code No. : 16635 AS

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (I.T.) VI-Semester Advanced Supplementary Examinations, August-2022

Artificial Intelligence and Machine Learning

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.	What is Artificial Intelligence? What are the sub-areas of AI?	2	1	1	1
2.	List any four problem characteristics.	2	1	1	1
3.	Differentiate between propositional logic and predicate logic.	2	2	2	2
4.	What are the different methods for measuring the performance of a classifier?	2	1	2	1
5.	Why does decision tree lead to overfitting? How do you avoid overfitting in decision trees?	2	1	3	1
6.	Why kernel trick is used in SVM? List out different kernel functions.	2	1	3	1
7.	What is a perceptron? Draw the structure of a single perceptron.	2	2	4	2
8.	What are Bayesian Belief Networks? What is the purpose of BBN?	2	1	4	1
9.	What is meant by ensemble learning? List out the types of ensemble learning.	2	1	5	1
10.	What is Q-learning?	2	1	5	1
	Part-B (5 × 8 = 40 Marks)				
11. a)	You are given two jugs, a 4-gallon one and a 3-gallon one, and a water faucet to fill the jugs with water. Neither jug has any measuring markings on it. How can you get exactly 2 gallons of water in the 4-gallon jug? Write the production rules to solve this problem.	4	2	1	2
b)	Write and explain Branch & Bound search algorithm.	4	2	1	2
12. a)	Show that (~U Λ S) is a logical consequence of the set {A V C, C→B, ~B, A→S, ~U} using resolution refutation method.	3	4	2	3
b)	Consider the following five training examples X = [2, 4, 6, 8, 10] Y = [10, 30, 50, 70, 90] The above dataset is regressed with least squares regression to $Y = \beta_0+\beta_1 X$. What is the best linear fit on this dataset?	5	3	2	3

Contd... 2

13. Consider the following dataset and construct the decision tree using ID3 algorithm. Show the computation of information gain at each of the nodes. [Here the target attribute is *Hired*]. — 8 4 3 3

Major	Experience	Tie	Hired?
CS	Programming	Pretty	No
CS	Programming	Pretty	No
CS	Management	Pretty	Yes
CS	Management	Ugly	Yes
Business	Programming	Pretty	Yes
Business	Programming	Ugly	Yes
Business	Management	Pretty	No
Business	Management	Pretty	No

14. a) Explain backpropagation learning to update the weights of a hidden layer in a multilayer neural network. — 4 2 4 2

b) Derive an equation for MAP hypothesis using Bayes theorem. Suppose that a patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result in only 97% of the cases. Furthermore, only 0.008 of the entire population has this disease. — 4 2 4 2

1. What is the probability that this patient has cancer?
2. What is the probability that he does not have cancer?
3. What is the diagnosis?

15. a) Write and explain AdaBoost learning algorithm. — 4 2 5 2

b) For the given data points, construct the dendrogram using complete linkage clustering algorithm. — 4 3 5 3

	A	B
P1	1	1
P2	3	2
P3	5	5
P4	3	4
P5	4	8
P6	3	6

16. a) Explain the effect of overestimation and underestimation of heuristic function in A* algorithm with suitable examples. — 4 4 1 4

Contd... 3

b)	Why can't we use Mean Square Error (MSE) as a cost function for Logistic Regression? Explain Gradient Descent for Logistic Regression.	4	2	2	2
17.	Answer any ***two*** of the following:				
a)	Consider the training data given below where Y is the class variable. **X** -2 -1 1 2 **Y** 1 -1 -1 1 Assume that you are using a linear SVM. Let α_1, α_2, α_3, α_4 be the Lagrangian multipliers for the four data points. Write the precise expression for the Lagrangian dual optimization problem (objective function and constraints) that needs to be solved in order to compute the values of α_1, α_2, α_3, α_4 for the dataset given above. (Note: Simplify the expressions by substituting for X and Y).	4	3	3	3
b)	Consider the following dataset about stolen vehicles. Using Naïve Bayes classifier, predict the target for the new data: {Color= *Red*, Type= *SUV*, Origin= *Domestic*}.	4	3	4	3
c)	Explain DBSCAN algorithm for density based clustering. List out its advantages compared to K-means.	4	2	5	2

Color	**Type**	**Origin**	**Stolen**
Red	Sports	Domestic	Yes
Red	Sports	Domestic	No
Red	Sports	Domestic	Yes
Yellow	Sports	Domestic	No
Yellow	Sports	Imported	Yes
Yellow	SUV	Imported	No
Yellow	SUV	Imported	Yes
Yellow	SUV	Domestic	No
Red	SUV	Imported	No
Red	Sports	Imported	Yes

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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