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RV COLLEGE OF ENGINEERING®
(An Autonomous Institution Affiliated to VTU)
IV Semester B. E. Regular Examinations Sept/Oct – 2024
Artificial Intelligence and Machine Learning

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Time: 03 Hours
Maximum Marks: 100

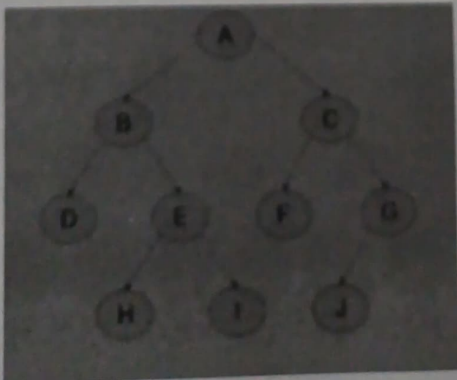**Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

			M	BT	CO
1	1.1	List any two approaches followed during development of AI systems.	02	1	1
	1.2	State any two properties of Search Algorithms.	02	1	1
	1.3	Define Hill Climbing problem.	02	3	2
	1.4	Define two parameters in Alpha Beta Pruning.	02	3	2
	1.5	(see tables below)	02	3	2

Index	1	2	3	4	5
Actual	Dog	Dog	Dog	Not Dog	Dog
Predicted	Dog	Not Dog	Dog	Not Dog	Dog
Result	TP	FN	TP	TN	TP

Index	6	7	8	9	10
Actual	Not Dog	Dog	Dog	Not Dog	Not Dog
Predicted	Dog	Dog	Dog	Not Dog	Not Dog
Result	FP	TP	TP	TN	TN

For the following data, Calculate:
- a) Accuracy
- b) Precision

			M	BT	CO
	1.6	Define repeated holdout method.	02	4	1
	1.7	Give two real world examples of lazy learners.	02	1	1
	1.8	Define probabilistic classification models.	02	1	1
	1.9	Define Cohesion.	02	1	1
	1.10	List two limitations of K-means algorithm.	02	3	2

PART-B

			M	BT	CO
2	a	Differentiate between model based reflex agents and Goal based reflex agents with an example.	06	2	1
	b	Discuss Depth First Algorithm and apply the same for the given Fig 2b to move from node *A* to node *J*? Give its advantages and disadvantages.	10	4	1

Fig 2b

3	a	Find the most cost-effective path to reach from start state S to final state G using A* Algorithm in the fig 3a.			
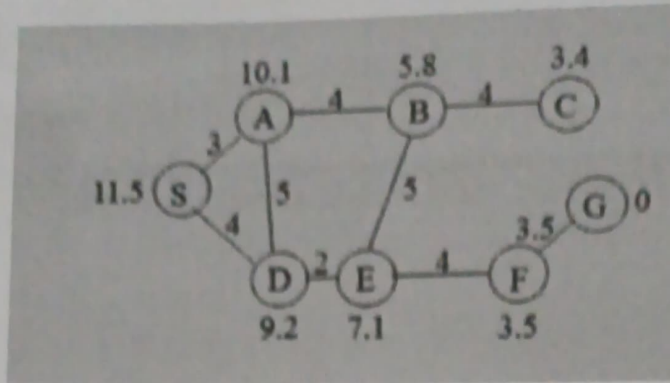
Fig 3a

			06	3	2
2	b	For the following two-play game tree shown in Fig 3b, the terminal nodes show the values computed by the function. Use the alpha beta pruning algorithm to compute the values for other nodes in the given game tree and discuss the advantages and disadvantages of the algorithm.			

Fig 3b

			10	4	2
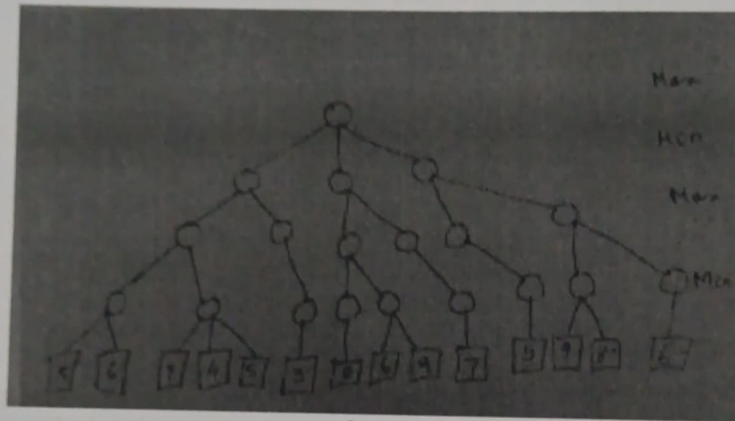
OR

	a	For the following two-play game tree shown in Fig 4a, the terminal nodes show the utility values computed by the utility function. Use the Min-Max algorithm to compute the utility values for other nodes in the given game tree and discuss the advantages and disadvantages of the algorithm.			

Fig 4a

			10	3	2
	b	Discuss Game as a search Problem and also discuss the effect of Max and Min in two persons Game.	06	2	2

				10	2	2

5 **a** Apply the Decision tree algorithm to the following data considering Gini Index Construct the final tree
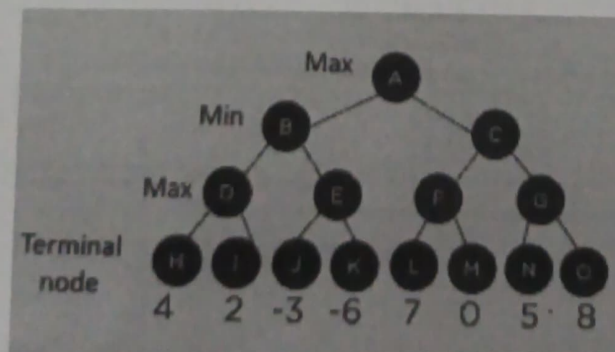
Weekend	Weather	Parents	Money	Decision
W1	Sunny	Yes	Rich	Cinema
W2	Sunny	No	Rich	Tennis
W3	Windy	Yes	Rich	Cinema
W4	Rainy	Yes	Poor	Cinema
W5	Rainy	No	Rich	Stay In
W6	Rainy	Yes	Poor	Cinema
W7	Windy	No	Poor	Cinema
W8	Windy	No	Rich	Shopping
W9	Windy	Yes	Rich	Cinema
W10	Sunny	No	Rich	Tennis

b Summarize how impurity is used to evaluate attribute test condition. | 06 | 3 | 2 |

OR

6 **a** Discuss the two reasons for Model Over fitting with an example. | 10 | 3 | 2 |

b Assume the scientists predict that 350 test samples contain the genetic variant and 150 samples don't. If they determine the actual number of samples containing the variant is 305, the actual number of samples without the variant is 195. The confusion matrix of the model is

	Predicted without the variant	Predicted with the variant
Actual number without the variant = 195	True negative = 45	False positive = 150
Actual number with the variant = 305	False negative = 105	True positive = 200

Calculate :
  i)   Model Accuracy
  ii) Misclassification Error
  iii) Sensitivity | 06 | 3 | 2 |

7 **a** Given a dataset, train a K-nearest neighbors (KNN) model using the KNN algorithm with $K = 5$ and Euclidean distance. Additionally, provide a pseudo code for the training process. After training the model, predict its response for a specific test example.
Sepal Length= 5.2, Sepal Width= 3.1, Species=?

Sepal Length	Sepal Width	Species
5.3	3.7	Setosa
5.1	3.8	Setosa
7.2	3.0	Virginica
5.4	3.4	Setosa
5.1	3.3	Setosa
5.4	3.9	Setosa
7.4	2.8	Virginica
6.1	2.8	Verscicolor
7.3	2.9	Virginica
6.0	2.7	Verscicolor
5.8	2.8	Virginica
6.3	2.3	Verscicolor
5.1	2.5	Verscicolor
6.3	2.5	Verscicolor
5.5	2.4	Verscicolor

	10	4	1

b Discuss Characteristics of Nearest neighbor Classifier. | 06 | 3 | 1 |

OR

8 a Explain how Naïve Bayes theorem is used in classification. Demonstrate how it can be used to predict the class for a given validation sample using a provided training dataset and give the class prediction for the given test example.
Test Example Age:<=30,Income:Medium,Student :Yes, Credit rating :Fair

Id	Age	Income	Student	Credit Rating	Buy Computer
1	<= 30	High	No	Fair	No
2	<= 30	High	No	Excellent	No
3	31 – 40	High	No	Fair	Yes
4	> 40	Medium	No	Fair	Yes
5	> 40	Low	Yes	Fair	Yes
6	> 40	Low	Yes	Excellent	No
7	31 – 40	Low	Yes	Excellent	Yes
8	<= 30	Medium	No	Fair	No
9	<= 30	Low	Yes	Fair	Yes
10	> 40	Medium	Yes	Fair	Yes
11	<= 30	Medium	Yes	Excellent	Yes
12	31 – 40	Medium	No	Excellent	Yes
13	31 – 40	High	Yes	Fair	Yes
14	> 40	Medium	No	Excellent	No

10		

b Discuss the characteristics of Logistic Regression

06	3	1
	2	1

9 a Discuss the following types of clusters:
   i)   Well Separated clusters
   ii) Graph Based Clusters
   iii) Prototyped Based Clusters

b Write and Explain K means algorithm.
Use the K-means algorithm and Euclidean distance to cluster the following 8 examples into 3 clusters:
$A1 = (2,10), A2 = (2,5), A3 = (8,4), A4 = (5,8), A5 = (7,5), A6 = (6,4), A7 = (1,2), A8 = (4,9)$.
Suppose that the initial seeds(centers of each cluster) are $A1, A4$ and $A7$.
Apply the K-means algorithm for 2 epochs. At the end of each epoch Show:
   i)   The new clusters(i.e. the examples belonging to each cluster)
   ii) The centers of the new clusters

06	2	2
10	2	2

OR

10 a Discuss hoe K-means handles Outliers and Empty clusters.
b Discuss two unsupervised approaches for assessing cluster validity that are based on the proximity matrix.

06	3	2
10	2	2