

**RV COLLEGE OF ENGINEERING®**

(An Autonomous Institution affiliated to VTU, Belagavi)

**I Semester Master of Technology (Common to MIT, MSE, MCN, MCE)  
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (ELECTIVE)****Time: 03 Hours****Maximum Marks: 100****Instructions to candidates:**

- Each unit consists of two questions of 20 marks each.
- Answer FIVE full questions selecting one from each unit (1 to 5).

**UNIT-1**

1	a	Differentiate between Uninformed and Informed search strategies and give two examples for each type.	05
	b	Summarize the PEAS description for the following Task environments: i) Automated taxi ii) Medical diagnosis system	05
	c	Consider the given graph given in Fig 1a representing simplified road map of part of Romania.  The numbers written on edges represent the distance between the nodes. The values of $h_{SLD}$ are given in Fig 1b. $h$ values are the straight-line distances to Bucharest taken from Fig 1a.  Apply Greedy Best-First search using $h_{SLD}$ for finding solution (a route from Arad to Bucharest). Hand-simulate the solution and indicate all the steps/stages showing the progress of Greedy Best-First search for reaching Bucharest.	05

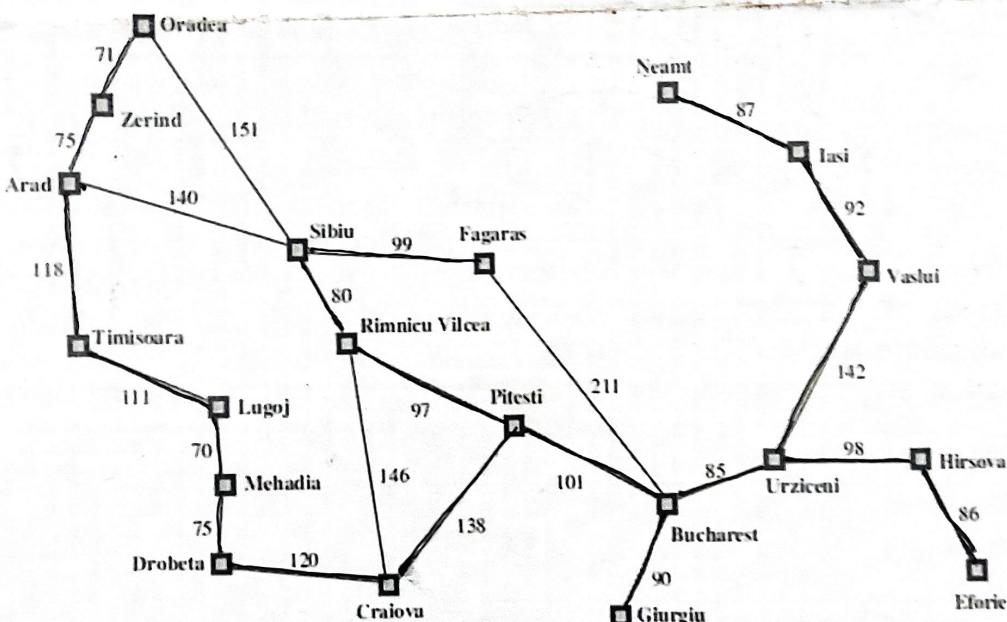


Fig 1a : A simplified road map of part of Romania

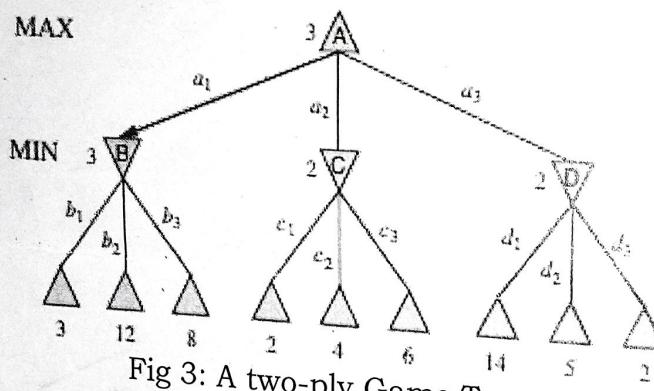
Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Drobeta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Iasi	226	Vaslui	199
Lugoj	244	Zerind	374

Values of  $h_{SLD}$ —straight-line distances to Bucharest.Fig 1b: Values of  $h_{SLD}$ -straight-line distances to Bucharest.**OR**

- 2 a Explain the working principle of Simple Reflex agent with schematic diagram and Write the Agent program for Simple reflex agent.
- b Consider the data given in Question 1c, with Fig 1a and Fig 1b. Apply A\* search strategy for finding solution (a route from Arad to Bucharest). Hand-simulate the solution and indicate all the steps/stages showing the progress of A\* tree search for reaching Bucharest.
- Note:** The values of g are computed from the step costs in Fig 1a and the values of h are the straight-line distances hSLD to Bucharest taken from Fig 1a.

## UNIT-2

3. a Describe Constraint Satisfaction Problem. Illustrate the Map Coloring problem as a Constraint Satisfaction Problem.
- b Apply Alpha-Beta Pruning for the given game tree shown in Fig 3. Illustrate the working principle of the same with neat sketches indicating all the intermediate steps.



OR

- 4 a Describe a game as a search problem formally with all the elements. Illustrate the search tree for the game of Tic-Tac-Toe game. (Indicate partial game tree for Tic-Tac-Toe).
- b Consider a real-world scenario where dealing of uncertainty arises. Illustrate the same for representing knowledge in uncertain domain using Bayesian Network.

## UNIT-3

- 5 a Describe the Find-S algorithm. Illustrate its working considering the Enjoy Sport concept learning task and training examples given in Table 5.

**Table 5: Positive and negative training examples for the target concept EnjoySport**

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

- b What is decision tree learning? Write the ID3 algorithm and illustrate the same, specialized to learning Boolean-valued functions.

OR

6	a	<p>Consider the problem of whether to wait for a table at a restaurant, we have the following attributes:</p> <ul style="list-style-type: none"> <li>• Alternate: whether there is a suitable alternative restaurant nearby.</li> <li>• Bar: whether the restaurant has a comfortable bar area to wait in.</li> <li>• Fri/Sat: true in Fridays and Saturdays.</li> <li>• Hungry: whether we are hungry.</li> <li>• Patrons: how many people are in the restaurant (values are None, Some, and Full).</li> <li>• Price: the restaurant's price range (\$, \$\$, \$\$\$).</li> <li>• Raining: whether it is raining outside.</li> <li>• Reservation: whether we made a reservation.</li> <li>• Type: the kind of restaurant (French, Italian, Thai, or burger).</li> <li>• WaitEstimate: the wait estimated by the host (0 – 10 minutes, 10 – 30, 30 – 60, or &gt; 60).</li> </ul> <p>Construct a decision tree to decide whether to wait for a table at a restaurant. The aim here is to learn a definition for the goal predicate WillWait.</p>	
	b	<p>Write the Candidate-Elimination learning Algorithm. Illustrate the same with suitable example.</p>	10 10

#### UNIT-4

7	a	Write the Naïve Bayes classifier algorithm for learning and classifying text.	10
	b	Explain Mistake bound model for learning and apply it to FIND – S algorithm.	10
		<b>OR</b>	
8	a	In a city, 30% of the population are smokers. It is known that a particular brand of cigarettes causes lung cancer in 2% of the smokers. However, the brand also causes lung cancer in 0.5% of non-smokers. If a randomly selected person is diagnosed with lung cancer, what is the probability that the person is a smoker?	05
	b	What is Bayesian learning? Discuss the features of Bayesian Learning methods.	05
	c	Discuss the following: i) Baye's optimal Classifier ii) Gibbs Algorithm	10

#### UNIT-5

9	a	Write the algorithm for K-Nearest Neighbor learning. Illustrate the same with suitable example.	10
	b	Explain in what respect Reinforcement Learning problem differs from other function approximation tasks.	10
		<b>OR</b>	
10	a	Discuss the Case-Based Reasoning. Illustrate with suitable example system, the generic properties of Case-Based Reasoning systems that distinguish it from K-Nearest neighbor (KNN).	10
	b	Explain the Q function and Q learning algorithm assuming deterministic rewards and actions.	10



## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Date	April 2023	Maximum Marks	10+50
Course Code	21MCE1A1T	Duration	120 Min
Sem	I	CIE - II	

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

SL No	Part A- Quiz	M	B T	CO
1	What are the components of a constraint satisfaction problem ? Use standard notations	2	L2	CO4
2	Give the full specification of a Bayesian Network	2	L2	CO1
3	Define Optimal decision in games	2	L3	CO2
4	Give the equation for chain rule for conditional probability ?	2	L1	CO3
5	Give examples for adversarial search problems?	1	L1	CO2
6	List best methods to represent the knowledge in uncertain domains	1	L2	CO1

SL No	Part B -Test	M	B T	CO
1a	Illustrate with an example, backtracking search for CSPs?	5+5	L3 L2	CO2 CO1
1b	Discuss the Alpha -Beta Pruning techniques with an example			
2	Discuss in detail adversarial search problems? Why are they referred as games? How do you solve such problems.	10	L3	CO2
3a	Define knowledge representation? Illustrate different types of knowledge representation in AI with a help of a sketch.	5	L2	CO3
3b	Explain the relationship between knowledge and intelligence? How do you represent?	5	L2	CO3
4 a	Illustrate with clear steps constraint satisfaction problems, notations, components involved in CSPs with examples	5	L3	CO4
4 b	Interpret inference in Bayesian networks	5	L3	CO2
5a	Discuss in detail Knowledge based agents and their usage?	5	L2	CO2
5b	Illustrate the concept of backtracking with an example	5	L3	CO3

# CBCS SCHEME

USN **A G E I 9 C S 4 1 7**

18CS71

## Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Artificial Intelligence and Machine Learning

Time: 3 hrs.

Max. Marks: 100

**Note:** Answer any FIVE full questions, choosing ONE full question from each module.

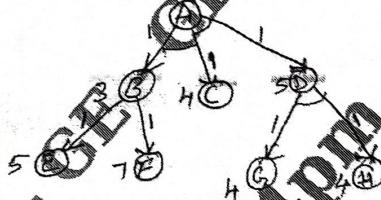
### Module-1

- 1 a. List all task domains of Artificial Intelligence. (06 Marks)  
 b. Explain Minimax procedure of tic-tac-toe. (07 Marks)  
 c. List all production rules for the water jug problem. (07 Marks)

**OR**

- 2 a. Illustrate Slot-and-filler structure method in Question and Answering system. (06 Marks)  
 b. Explain Hill climbing issues which terminates algorithm without finding a goal state or getting to a state from which no better state can be generated. (04 Marks)  
 c. Apply AO\* algorithm for the following graph and find final path. (10 Marks)

Fig. Q2(c)



### Module-2

- 3 a. Convert the following statement into its Equivalent Predicate Logic from  
 i) Marcus was a man ii) Marcus was a Pompeian  
 iii) All Pompeians were Romans iv) Caesar was a Ruler  
 v) All Romans were either loyal to Caesar or hated him.  
 vi) Everyone is loyal to someone  
 vii) People only try to assassinate rulers they are not loyal to.  
 viii) Marcus tried to assassinate Caesar. (08 Marks)  
 b. List the issues on Knowledge representation. (05 Marks)  
 c. Construct maximally specific hypothesis for the following training examples. (07 Marks)

Example	Sky	Air Temp	Humidity	Wind	Water	Forecast	Enjoy Sport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

**OR**

- 4 a. Apply Candidate Elimination algorithm for the dataset given above (Question 3(c)). How do you classify following new instance from the set of hypothesis obtained by Candidate Elimination algorithm? (12 Marks)

Instance	Sky	Air Temp	Humidity	Wind	Water	Forecast	Enjoy Sport
A	Sunny	Warm	Normal	Strong	Cool	Change	?
B	Rainy	Cold	Normal	High	Warm	Same	?

- b. What are Horn Clauses? Write a declarative and a procedural representation. List syntactic difference between Logic and PROLOG. (08 Marks)

Module-3

- 5 a. Construct decision tree using ID3 algorithm for the following data :

(12 Marks)

Day	Outlook	Temp	Humidity	Wind	Decision
1	Sunny	Hot	High	Weak	Yes
2	Sunny	Hot	High	Strong	No
3	Overcast	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	No
5	Rain	Cool	Normal	Weak	Yes

- b. Derive Gradient descent rule.

(08 Marks)

OR

- 6 a. Give decision tree to represent the following Boolean functions :

i)  $A \wedge \neg B$    ii)  $A \vee [B \wedge C]$    iii)  $A \oplus B$    iv)  $[A \wedge B] \vee [C \wedge D]$ .

(08 Marks)

- b. Explain Perceptron with appropriate diagram Represent AND Boolean function using Perception.

(04 Marks)

- c. Write Back propagation algorithm.

(08 Marks)

Module-4

- 7 a. A patient takes a lab test and the result comes back positive. The test returns a correct positive result in only 98% of the cases in which the disease is actually present and a correct negative result in only 99% of the cases in which the disease is not present. Further, 0.008 of the entire population have the Cancer. Does a patient have Cancer or not? (10 Marks)

- b. Derive Brute force MAP learning and also mention assumption made in this process.

(10 Marks)

OR

- 8 a. Explain Minimum Description Length Principle (MDL).

(06 Marks)

- b. Explain Naïve Bayes classifier and Bayesian belief Networks.

(08 Marks)

- c. Write EM algorithm.

(06 Marks)

Module-5

- 9 a. Explain K – NN algorithm.

(06 Marks)

- b. Explain steps of Locally Weighted Linear regression.

(07 Marks)

- c. Describe Radial basis function with appropriate diagram.

(07 Marks)

OR

- 10 a. Illustrate the basic concept of Q – learning using Simple Deterministic World.

(10 Marks)

- b. Explain Q – Learning algorithm.

(10 Marks)

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