Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U6203

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Sixth Semester

Computer Science and Engineering

21UCS603– ARTIFICIAL INTELLLIGENCE AND MACHINE LEARNING

(Regulations 2021)

(Common to Information technology)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

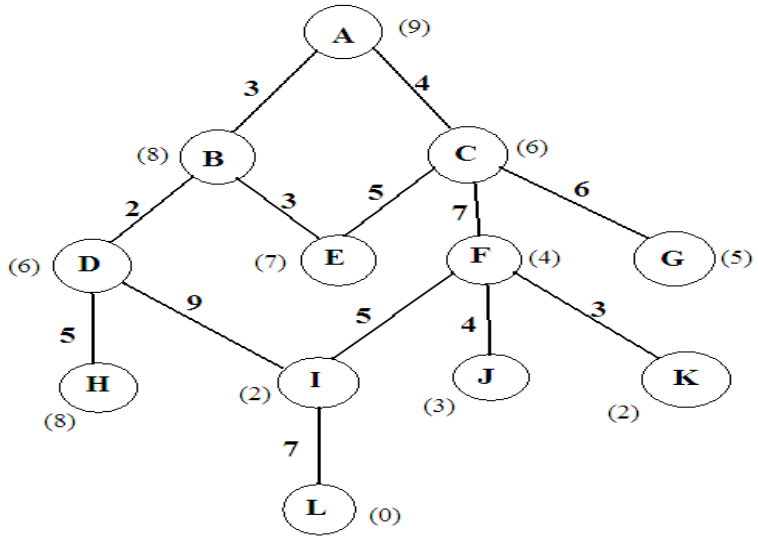
PART A - (10 x 2 = 20 Marks)

1.	List the criteria to measure the performance of search strategies.	CO1- U
2.	Give a complete problem formulation for the following. Choose a formulation that is precise enough to be implemented. You have three jugs, measuring 12 gallons, 8 gallons, and 3 gallons, and a water faucet. You can fill the jugs up or empty them out from one to another or onto the ground. You need to measure out exactly one gallon.	CO1-App
3.	Define Universal and Existential Quantifiers.	CO1- U
4.	Convert into CNF $B_{2,1} <=> (P_{1,1} V P_{2,2} V P_{3,1})$	CO2-App
5.	Define Bayes theorem	CO1- U
6.	Let P(h)=0.01(one in 100 women tested have it) P(e/h)=0.8 and P(e/-h)=0.1(true and false positive rates). What is P(h/e)?	CO2-App
7.	Mention the different forms of learning	CO1- U
8.	What are the characteristics of SVM?	CO1- U
9.	Given two objects represented by the tuples (22, 1, 42, 10) and (20, 0, 36, 8): Compute the Manhatten distance between the two objects.	CO2-App
10.	Define Clustering and give the types of clustering with an example.	CO1- U

PART – B (5 x 16= 80 Marks)

11.	(a)	Consider the following search tree. Each node is labeled with a unique letter. The start node for search is A, and the destination is L. The cost of each edge is shown on the edge. The heuristic value h for the node is shown next to that node in parenthesis. For each	CO2- App	(16)

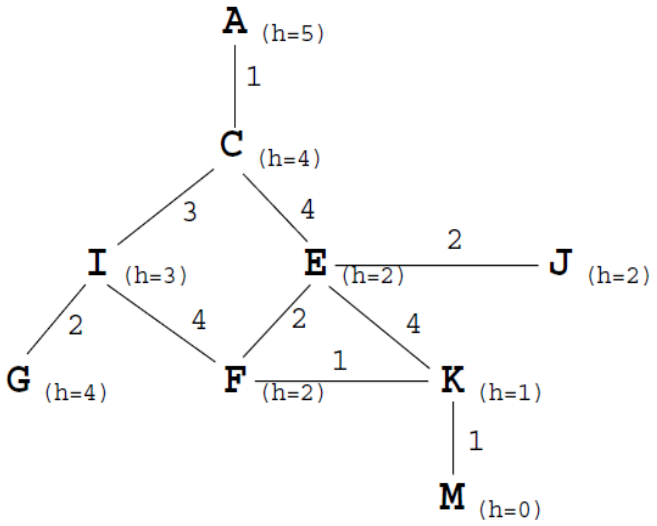
of the following search algorithms, show the order in which the nodes are examined. If there is ambiguity or choice about which node goes next, pick the node that is leftmost in the tree. Terminate the search once the goal node is reached. Show the Resultant tree and List of States for Using A*Search and Greedy Search



Or

(b) Consider the tree shown below. The numbers on the arcs are the arc lengths. Assume that the nodes are expanded in alphabetical order when no other order is specified by the search, and that the start state is A and goal is state M. No visited or expanded lists are used. What order would the states be expanded by each type of search? Stop when you expand G. Write only the sequence of states expanded by each search. Write only the sequence of states expanded by the following search i) Breadth-first search ii) Depth-first search
iii) Iterative deepening search

CO2- App (16)



12. (a) Consider the following facts. CO2- App (16)

- John likes all kinds of food
- Apples are food
- Chicken is food
- Anything anyone eats and isn't killed by is food
- Bill eats peanuts and is still alive
- Sue eats everything bill eats.

(i) Transform these sentences into FOL

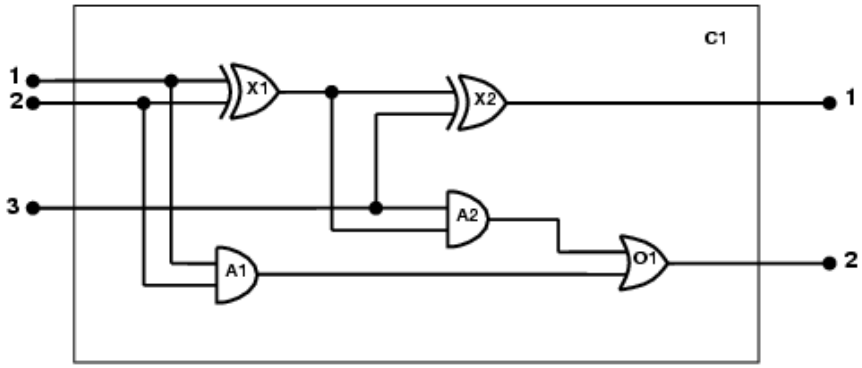
(ii) Arrange those into clause form.

(iii) Justify John likes peanuts by resolution.

(iv) Justify John likes peanuts by Backward Chaining.

Or

(b) Illustrate the various steps associated with the knowledge engineering process for the following one bit full adder. CO2- App (16)

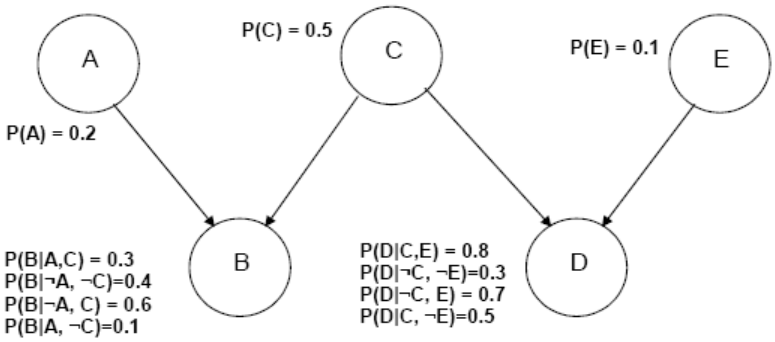


13. (a) (i) Consider the following joint probability table: CO2- App (8)

	SeeingCheetah		¬ SeeingCheetah	
	Rain	¬ Rain	Rain	¬ Rain
HaveBinoculars	0.01	0.2	0.5	0.1
¬ HaveBinoculars	0.01	0.1	0.04	0.04

1. What is the probability P(¬ SeeingCheetah)?
2. What is the probability P(¬Rain, SeeingCheetah)?
3. What is the probability P(¬ HaveBinoculars | ¬ Rain)?

(ii) Consider the following Bayesian Network. What is the probability P(¬A, B, C, D, ¬E) ? CO2- App (8)



Or

(b) Apply Naive Bayes classifier for making a decision to Play Tennis using the following attribute: CO2- App (16)

< Outlook: sunny, Temperature: cool, Humidity: high, Wind: strong >

Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

Table: Training examples for the target concept *PlayTennis*

14. (a) NASA wants to discriminate Martians (M) from Humans (H) based on these features (attributes): Green $\in\{N,Y\}$, Legs $\in\{2,3\}$, Height $\in\{S,T\}$, Smelly $\in \{N,Y\}$. Your available training data is as follows (N = No, Y = Yes, S = Small, T = Tall): CO2- App (16)

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

Please note:
A human might be green or have three legs for many possible reasons, e.g., if they were an actor playing a Martian as a role in a film or play. Anyway, it's a made-up problem for the test.

Which attribute would information gain choose as the root of the tree? and Draw the decision tree that would be constructed by recursively applying information gain to select roots of sub-trees, as in the Decision-Tree-Learning algorithm

Or

(b) The sales of a company (in million dollars) for each year are shown in the table below. CO2- App (16)

x (year)	2005	2006	2007	2008	2009
y (sales)	12	19	29	37	45

a) Find the least square regression line y = a x + b.
b) Use the least squares regression line as a model to estimate the sales of the company in 2012.

15. (a) Apply K-means clustering to the following 8 examples to convert into them in to 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). Assume the initial seeds are A1, A4, and A7. CO2- App (16)

Or

(b) Apply Agglomerative Hierarchical clustering to the following CO2- App examples to convert into different cluster: (16)

	X1	X2
A	1	1
B	1.5	1.5
C	5	5
D	3	4
E	4	4
F	3	3.5