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**Question Paper Code: U6203**

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Sixth Semester

Computer Science Engineering

21UCS603 - ARTIFICIAL INTELLLIGENCE AND MACHINE LEARNING

(Common to Information technology)

(Regulation 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

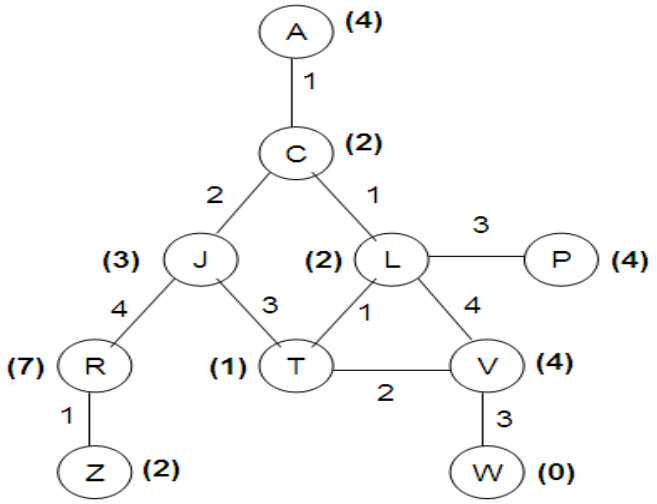
| | | |
|---|---|---|
| 1. | Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers 2n and 2n+1.Draw the portion of the state space for states 1 to 15. | CO2-App |
| 2. | Give a complete problem formulation for the following. Choose 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. | CO2-App |
| 3. | What is Skolemization? | CO1 - U |
| 4. | Define Universal and Existential Quantifiers. | CO1 - U |
| 5. | Define Markov Blanket with example. | CO1 - U |
| 6. | Define Join tree and poly tree. | CO1 - U |
| 7. | Mention the different forms of learning. | CO1 - U |
| 8. | What is over fitting? | CO1 - U |
| 9. | Define Clustering and give the types of clustering with an example. | CO1 - U |
| 10. | State the strengths and weaknesses of k-means clustering algorithm. | 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 W. 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 of the following search algorithms, show the order in which the nodes | CO2-App | (16) |

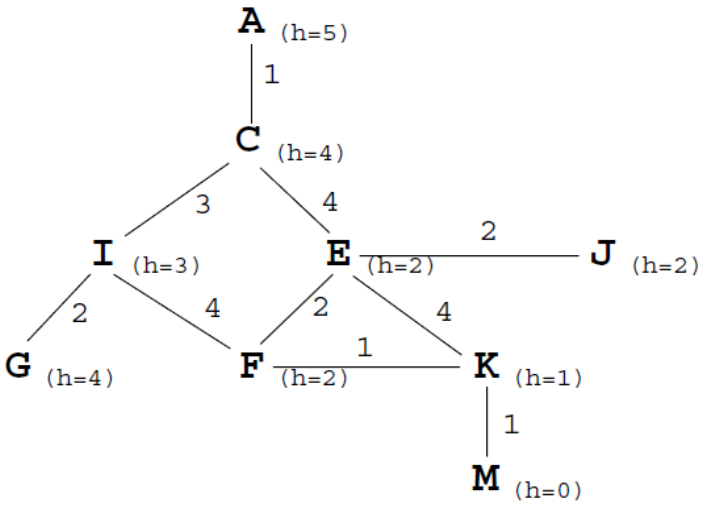
are examined. If there is ambiguity or choice about which node goes next, pick the node that is leftmost in the tree. Terminate the search once the goal node is reached. Show the resultant tree and List of States (Solution):

(i) Greedy Search. (ii) A* Search.

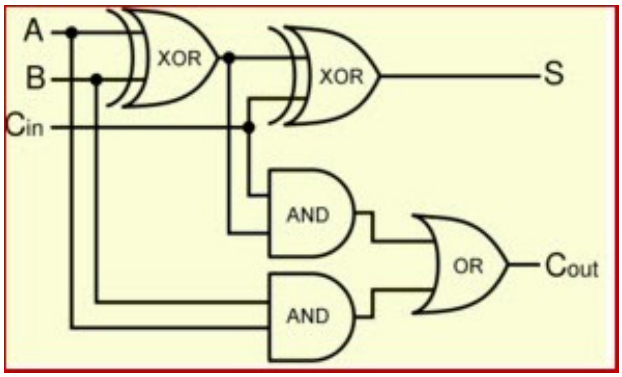



Or

(b) Consider the above search tree. Each node is labelled with a unique letter. The start node for search is A, and the destination is M. 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 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 i)Greedy Search. ii) A* Search. CO2-App (16)



12. (a) Illustrate the various steps associated with the knowledge engineering Process for the following full adder circuit. CO2-App (16)




Or

(b) Consider the following facts. CO2-App (16)

1. John likes all kinds of food
2. Apples are food
3. Chicken is food
4. Anything anyone eats and isn't killed by is food
5. Bill eats peanuts and is still alive
6. 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.

13. (a) Create a Bayesian network for car diagnosis(A Bayesian network describing some features of a car's electrical system and engine. Each variable is Boolean, and the true value indicates that the corresponding aspect of the vehicle is in working order.) CO2-App (16)

a. Extend the network with the Boolean variables Ice Weather and Starter/Victor.

b. Give reasonable conditional probability tables for all the nodes.

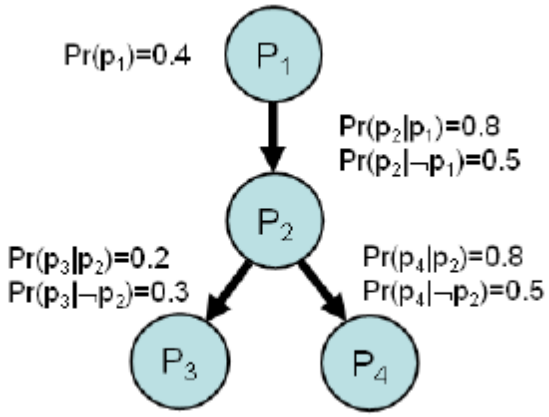
c. How many independent values are contained in the joint probability distribution for eight Boolean nodes, assuming that no conditional independence relations are known to hold among them?

d. How many independent probability values do your network tables contain?

e. The conditional distribution for Starts could be described as a noisy-AND distribution. Define this family in general and relate it to the noisy-OR distribution.

Or

(b) Given the network below, calculate marginal and conditional probabilities: Pr (¬p3), Pr (p2|¬p3), Pr (p1|p2, ¬p3) using inference by enumeration CO2-App (16)




14. (a) NASA wants to discriminate Martians (M) from Humans (H) based on these features (attributes): Green ∈{$N$,$Y$}, Legs ∈{2,3}, Height ∈{$S$,$T$}, Smelly ∈ {$N$,$Y$}. 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) You are an agricultural robot given the following set of plant examples. Each is assigned a class label of + or — depending on whether or not it is a member of the target class: CO2-App (16)

| Example | Vine? | Fruit? | Leaf? | Class |
|---|---|---|---|---|
| Watermelon | Yes | Yes | Curly | + |
| Ivy | Yes | No | Curly | — |
| Bougainvillea | Yes | No | Flat | — |
| Kudzu | Yes | No | Flat | — |
| Maple | No | No | Curly | + |
| Oak | No | No | Flat | + |
| Sycamore | No | No | Flat | + |
| Apple | No | Yes | Curly | — |

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

What class is Grape? (Vine=Yes, Fruit=Yes, Leaf=Curly) ?

What class is Orange? (Vine=No, Fruit=Yes, Leaf=Curly)?

15. (a) Apply any one clustering to the following 8 examples to convert into them into no of 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). CO2-App (16)

Or

(b) Apply Fuzzy C means clustering to the following examples to convert into them into two clusters: A1=(1,3), A2=(1.5,3.2), A3=(1.3,2.5), A4=(3,1). CO2-App (16)