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# B.M.S. College of Engineering, Bengaluru-560019

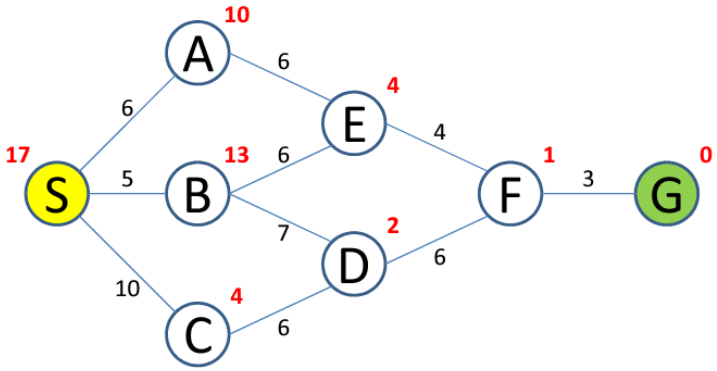
**Autonomous Institute Affiliated to VTU**

## September / October 2023 Semester End Main Examinations

**Programme: B.E.** **Semester: IV**
**Branch: AI & ML** **Duration: 3 hrs.**
**Course Code: 22AM4PCIAI** **Max Marks: 100**
**Course: Introduction to Artificial Intelligence**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | UNIT - I | *CO* | *PO* | Marks |
|---|---|---|---|---|---|
| 1 | a) | How do the agent's components function? | *1* | *1* | **5** |
| | b) | Mention the types of environments suitable for the following tasks and justify your selection.<br>i. Agent monitoring the temperature of the boiler in a manufacturing plant.<br>ii. Agent-detecting network attacks<br>iii. Robot navigation<br>iv. Radiology images analysis<br>v. Cab aggregation agent | *1* | *1* | **5** |
| | c) | Compare Breadth First Search and Depth First Search strategy with its working, completeness, optimality, time complexity and space complexity. | *1* | *1* | **10** |
| | | **UNIT - II** | | | |
| 2 | a) | Find the value of T + E + N if ONE + ONE + ONE + ONE = TEN using Cryptarithmetic Problem. | *1* | *1* | **10** |
| | b) | Analyze the following graph and perform A* operations considering S as source and G as destination nodes.<br>  | *1* | *2* | **10** |
| | | **OR** | | | |

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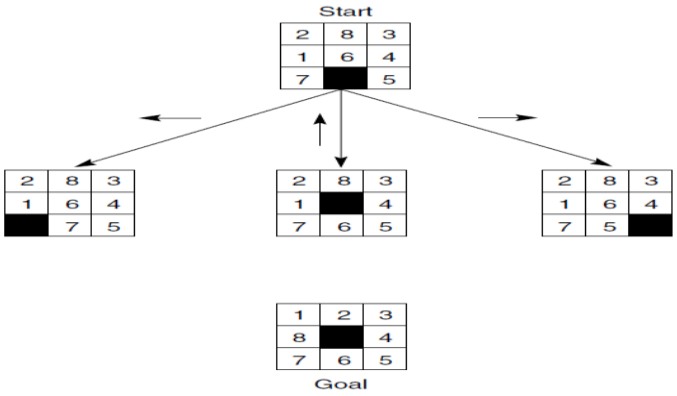
| | 3 | a) | Provide two Heuristics for addressing the 8-Puzzle Problem and create a table to display the outcomes when these heuristics are applied to the provided child states.<br>  <br> | *1* | *3* | **12** |
| | | b) | Define Admissible Heuristics and list the benefits. "All A* algorithms are admissible"– Discuss its meaning. How A* be used for path navigation in robots? | *1* | *2* | **8** |
| | | | **UNIT - III** | | | |
| | 4 | a) | a. Convert the following sentences into First Order Logic.<br>i. Everyone who sees Mary loves Mary.<br>ii. Someone walks and someone talks.<br>b. Convert the following statements in First Order Logic to equivalent English sentences.<br>i. $River(Indus) \wedge \neg \exists x[River(x) \wedge longest(x,Indus) \wedge In(x,India)]$<br>ii. $\forall x \forall y[(Reg(x) \wedge Reg(y)) \rightarrow (Overlap(x,y) \leftrightarrow \exists z[Part(z,x) \wedge Part(z,y)])]$ | *2* | *2* | **8** |
| | | b) | The production system views the forward and backward as symmetric processes.<br>Consider a game of playing 8 puzzles. The rules defined are;<br>Square 1 is empty and square 2 contains tile n. →<br>Also, Square 2 is empty and Square 1 contains the tile n.<br>Square 1 empty Square 4 contains tile n. →<br>Also, Square 4 is empty and Square 1 contains tile n.<br>Solve the problem using Forward and Backward Reasoning. | *2* | *2* | **8** |
| | | c) | Discuss the need for Ontology-based Knowledge Representation. | *2* | *1* | **4** |
| | | | **OR** | | | |
| | 5 | a) | Define Modus Ponens and give an example. Write the following sentences using predicate calculus (Hint: Use quantifiers, implications, and, or, etc.)<br>i. Tom's sister knows Mary's brother.<br>ii. Everest is the highest mountain on Earth. | *2* | *2* | **6** |
| | | b) | You are on the side of the river. You are given a m liter jug and a n liter jug where 0 < m < n. Both the jugs are initially empty. The jugs don't have markings to allow measuring smaller quantities. | *2* | *2* | **8** |

| | | | | | | |
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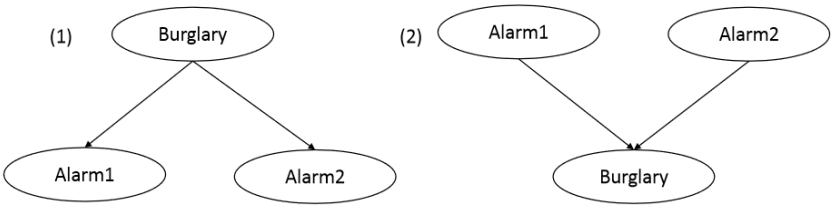
| | | | You have to use the jugs to measure d liters of water where d < n. Determine the minimum no of operations to be performed to obtain d liters of water in one of jug.<br>The operations you can perform are:<br>i. Empty a Jug.<br>ii. Fill a Jug.<br>iii. Pour water from one jug to the other until one of the jugs is either empty or full.<br>Write the State space representation for the above problem (assume m=3, n=4 and d=2), and show the application of rules. | | | |
| | | c) | Illustrate Procedural and Declarative Knowledge by considering an agriculture sector, where AI is deployed for various purposes. | *2* | *2* | **6** |
| | | | **UNIT - IV** | | | |
| | 6 | a) | Write the difference between the following, and give suitable examples;<br>i. Exact Inference and Approximate Inference<br>ii. Conditional probability query and Maximum posterior probability query. | *3* | *2* | **4** |
| | | b) | To safeguard your house, you recently installed two different alarm systems by two different reputable manufacturers that use entirely different sensors for their alarm systems.<br>i. Which one of the two Bayesian networks given below makes independence assumptions that are not true? Explain all of your reasoning. Alarm1 means that the first alarm system rings, Alarm2 implies that the second alarm system rings, and Burglary means that a burglary is in progress<br>  <br>(1) Burglary → Alarm1, Alarm2<br>(2) Alarm1, Alarm2 → Burglary<br>ii. Consider the First Bayesian network. How many probabilities need to be specified for its conditional probability tables? How many probabilities would need to be given if the same joint probability distribution were specified in a joint probability table?<br>iii. Consider the second Bayesian network. Assume that:<br>P(Alarm1) = 0.1<br>P(Alarm2) = 0.2<br>P(Burglary \| Alarm1, Alarm2) = 0.8<br>P(Burglary \| Alarm1, Not(Alarm2)) = 0.7<br>P(Burglary \| Not(Alarm1), Alarm2) = 0.6<br>P(Burglary \| Not(Alarm1), Not(Alarm2) = 0.5<br>Calculate P(Alarm2 \| Burglary, Alarm1). Show all of your reasoning. | *3* | *3* | **10** |

<table>
<tr><td></td><td></td><td>c)</td><td>Discuss the role of Probability Theory in representing knowledge in an uncertain domain.</td><td>3</td><td>1</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Illustrate MYCIN expert system architecture in detail.</td><td>3</td><td>1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Differentiate between Forward Chaining and Backward Chaining strategies used for inferencing in an expert system.</td><td>3</td><td>1</td><td>5</td></tr>
<tr><td></td><td></td><td>c)</td><td>Identify the nomenclature for the following knowledge representation as per the expert system.
<table>
<tr><td>i.</td><td>IF<condition 1><br>AND<condition 2><br>OR<condition 3><br>THEN <action></td></tr>
<tr><td>ii.</td><td>IF ‘oiltank’ is empty<br>THEN bus cannot start</td></tr>
<tr><td>iii.</td><td>IF car cannot start<br>AND ‘tank’ is empty<br>THEN put petrol in the tank<br>Step 1 is done<br>IF Step 1 is done<br>AND tank is full<br>THEN check the car battery<br>Step 2 is done</td></tr>
<tr><td>iv</td><td>IF fluid spills<br>AND pH of the spill < 6<br>AND smells acidic or sour<br>THEN the spills is an acetic acid</td></tr>
<tr><td>v</td><td>IF monsoon season<br>AND cloudy sky<br>AND weather station predicted rain<br>THEN you are advised to bring an umbrella</td></tr>
</table></td><td>3</td><td>2</td><td>5</td></tr>
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