

Sixth Semester B. E. (Computer Science and Engineering) Examination

ARTIFICIAL INTELLIGENCE

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry marks as indicated against them.
- (2) Assume suitable data wherever necessary.
- (3) Illustrate your answers wherever necessary with the help of neat sketches.

1. Solve any Two :—

- (a) Consider the missionaries and cannibals problem which is stated as follows:
3 missionaries and 3 cannibals are on one side of the river along with a boat which can hold one or two people. Find a way to get everyone to the other side, without leaving a group of missionaries in one place outnumbered by the cannibals in that place.

How will you represent state of the above problem ?

What are different actions (operators) of the above problem ? 5(CO1)

- (b) Write seven characteristics of AI problems with appropriate examples.
5(CO1)
- (c) Solve three jealous couple problem, using proper state representation. Three couples want to cross a river. The boat they have available is small and can hold only 2 people. A complication is that the three men are extremely jealous, and don't want any man or men to be with their wife on one of the two shores if he is not there himself. How many minimum trips does it take them to all get across the river ? 5(CO1)

2. Solve any Two :—

- (a) Apply BFS (graph version) to missionaries and cannibals problem up to three levels from the initial node. Clearly show the frontier (open) and explored (closed) set with appropriate data structure at each step.
5(CO2)

- (b) What is the maximum number of nodes generated in the following searching algorithm with branching factor of b and depth d ?

(a) Depth limited DFS with depth d .

(b) Iterative Deepening Search (IDS).

What are the total numbers of nodes generated for $b = 6$ and $d = 8$? 5(CO2)

- (c) Initial state A and Goal state G of 8-puzzle problem are as follows :

$$A = \begin{array}{|c|c|c|} \hline 2 & 8 & 3 \\ \hline 1 & & 4 \\ \hline 7 & 6 & 5 \\ \hline \end{array}$$

$$G = \begin{array}{|c|c|c|} \hline 1 & 2 & 3 \\ \hline 8 & & 4 \\ \hline 7 & 6 & 5 \\ \hline \end{array}$$

Apply A^* Algorithm with Manhattan Heuristic function. Clearly show the open (frontier) and closed (explored) set with appropriate data structure at each step. 5(CO2)

3. Solve any **Two** :—

- (a) Write implication and double implication in terms of basic connectives (conjunction, disjunction, and negation). Verify with the help of truth table. 5(CO3)

- (b) Write the following sentences in to first order predicate logic :

(1) Deepak is either a surgeon or a lawyer.

(2) All surgeons are doctors.

(3) Deepak has a boss who is a lawyer.

(4) There exists a lawyer, all of whose customers are doctors.

(5) Harish does not have a lawyer (i.e. not a customer of any lawyer). 5(CO3)

- (c) Write the following sentences in to first order predicate logic and then convert into skolem normal form :

(1) Every object has some color.

(2) Somene likes everyone. 5(CO3)

4. Solve any **Two** :—

- (a) After your yearly cheekup, the doctor has bad news and good news. The bad news is that you tested positive for a serious disease. Let the probability of testing positive when you do have the disease is 0.99 and the probability of testing negative when you don't have the disease is 0.98. The good news is that this is a rare disease, striking only 1 in 5000 peoples of your age. Why is it good news that the disease is rare ? What are the chances that you actually have the disease ? 5(CO4)
- (b) You have a new burglar alarm installed at home. It is fairly reliable at detecting a burglary, but also responds on occasion to minor earthquakes. You also have two neighbors, John and Mary, who have promised to call you at work when they hear the alarm. John always calls when he hears the alarm, but sometimes confuses the telephone ringing with the alarm and calls then too. Mary, on the other hand, likes rather loud music and sometimes misses the alarm altogether.
- (i) Draw the Bayesian network for this event.
- (ii) Determine $P(J \wedge m \wedge a \wedge \sim b \wedge \sim e)$. Consider any suitable values in conditional probability tables. 5(CO4)
- (c) How basic operations union, intersection and $\sim A \vee B$ are defined in terms of membership functions on fuzzy sets ? Explain with proper example. 5(CO4)

5. Solve any **Two** :—

- (a) Consider the learning task represented by the training examples of Table 1.

Day	Outlook	Temperature	Humidity	Wind	Play Tennis
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

Contd..

Day	Outlook	Temperature	Humidity	Wind	Play Tennis
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 1

Apply ID3 algorithm and decide which attribute should be selected as decision attribute for the root node ? 5(CO5)

- (b) Design a three input perceptron that implements Boolean function $A \rightarrow B$, take 1 as biased input. 5(CO5)
- (c) Apply perceptron learning algorithm up to four iterations, to solve NAND classification problem. Take initial weight vector $w = [0.1 \ 0.2 \ 0.3]^T$. 5(CO5)

6. Solve any **Two** :—

- (a) What do you mean by an expert system shell ? How is it designed? 5(CO6)
- (b) What are the features of a typical expert system ? 5(CO6)
- (c) Consider the knowledge base given as :

$Y \ \& \ D \rightarrow Z$

$X \ \& \ B \ \& \ E \rightarrow Y$

$A \rightarrow X$

$C \rightarrow L$

$L \ \& \ M \rightarrow N$

And the contents in the database are A, B, C, D, E

Prove that 'Z' is true by using forward and backward chaining.

5(CO6)