Course Code : CAT 206 **SUVT/MS – 22 / 2672**

Fourth Semester B. Tech. (Computer Science and Engineering / Artificial Intelligence and Machine Learning) Examination

ARTIFICIAL INTELLIGENCE : PRINCIPLES AND TECHNIQUES

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.

(2) All questions carry marks as indicated.

(3) Explain your answer with neat sketches, wherever applicable.

1. (a) 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 (CO 1)

(b) For the Taxi driving task, give a PEAS description of the task environment and characterize it in terms of the properties of task environments. 5 (CO 1)

2. (a) Which amongst breadth first search and depth first search algorithms is better ? Why ? 5 (CO 1)

(b) 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 (CO 1)

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

A =

2	8	3
1		4
7	6	5

G =

1	2	3
8		4
7	6	5

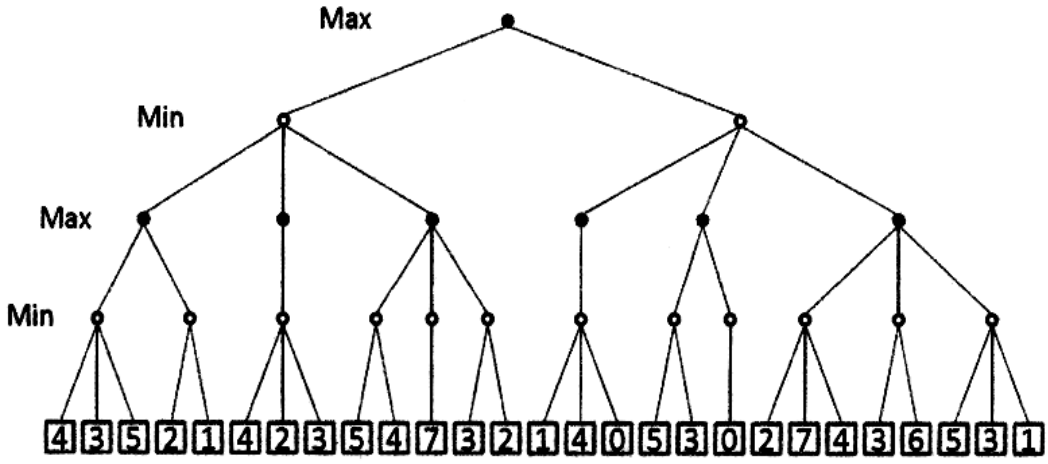
Apply A* Algorithm with Manhattan Heuristic function. Clearly show the open (frontier) and closed (explored) set with appropriate data structure at each step. 5 (CO 1)

(b) Determine two heuristic functions for the problem such that it works on the following example where the numbers are pushed into a 3×3 grid from left to right starting at top :

Start here : 1, 2, 3, 5, 8, 6, 4, 7

Goal state : 1, 2, 3, 4, 5, 6, 7, 8 5 (CO 1)

4. (a) Apply minimax algorithm and Alpha Beta pruning on the following Figure to find out value of root node. How many evaluations are saved while applying Alpha Beta pruning ?



5 (CO 2)

(b) Consider a Latin sequence problem where no two letters will have same value and value for each letter ranges between 0 to 9. If the equation is SEND + MORE = MONEY.

What is a value of M + O + N + E + Y ? 5 (CO 2)

5. (a) From "Horses are animals", it follows that "The head of a horse is the head of an animal." Demonstrate that this inference is valid by carrying out the following steps :

(a) Translate the premise and the conclusion into the language of first - order logic. Use three predicates : HeadOf (h, x) (meaning "h is the head of x"), Horse(x) and Animal(x).

(b) Negate the conclusion, and convert the premise and the negated Conclusion into conjunctive normal form.

(c) Use resolution to show that the conclusion follows from the premise. 5 (CO 3)

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

(1) Some children will eat any food.

(2) No children will eat food that is green.

(3) All children will like food made by Cadbury's.

Prove the following conclusion follows from above premises "No food made by Cadbury's is green." 5 (CO 3)

6. (a) 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. Marry, 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 (CO 4)

(b) Design a Fuzzy controller for the following problem.

Input :

- Temp : {Freezing, Cool, Warm, Hot}
- Cover : {Sunny, Partly, Overcast}

Output :

- Cover : {Sunny, Partly, Overcast}

Rules :

- If it's Sunny and Warm, drive Fast

  Sunny (Cover) $\wedge$ Warm (Temp) $\Rightarrow$ Fast (Speed)

- If it's Cloudy and Cool, drive Slow

  Cloudy (Cover) $\wedge$ Cool (Temp) $\Rightarrow$ Slow (Speed)

How fast will I go if it is

- 65 F^0
- 25 % Cloud Cover ?

Given Data (Input membership levels) :

- 65 F^0 $\Rightarrow$ Cool = 0·4, Warm = 0·7

  25% Cover $\Rightarrow$ Sunny = 0·8, Cloudy = 0·2.

5 (CO 4)