

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

ARTIFICIAL INTELLIGENCE

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions are compulsory.
- (2) Solve any **Two** sub questions from each question.
- (3) All the sub questions in Question no. **One** are compulsory.
- (4) All questions carry marks as indicated.
- (5) Explain your answer with neat sketches, wherever applicable.

1. (a) For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties of task environments
 - (i) Practicing tennis against a wall.
 - (ii) Bidding on an item at an auction 5(CO 1)
- (b) Formulate each of the following problem in terms of State, Initial State, Actions, Goal Test and path cost
 - (i) 8 – puzzle problem
 - (ii) Traveling salesperson problem 5(CO 1)
2. (a) Discuss the working of A* algorithm with an example. Provide the TWO cases in which A* algorithm is optimal. 5(CO 2)
- (b) Which of the following are true and which are false ? Explain your answers.
 - (i) Depth – first search always expands at least as many nodes as A* search with an admissible heuristic.
 - (ii) $h(n) = 0$ is an admissible heuristic for the 8 – puzzle.
 - (iii) A* is of no use in robotics because percepts, states, and actions are continuous.

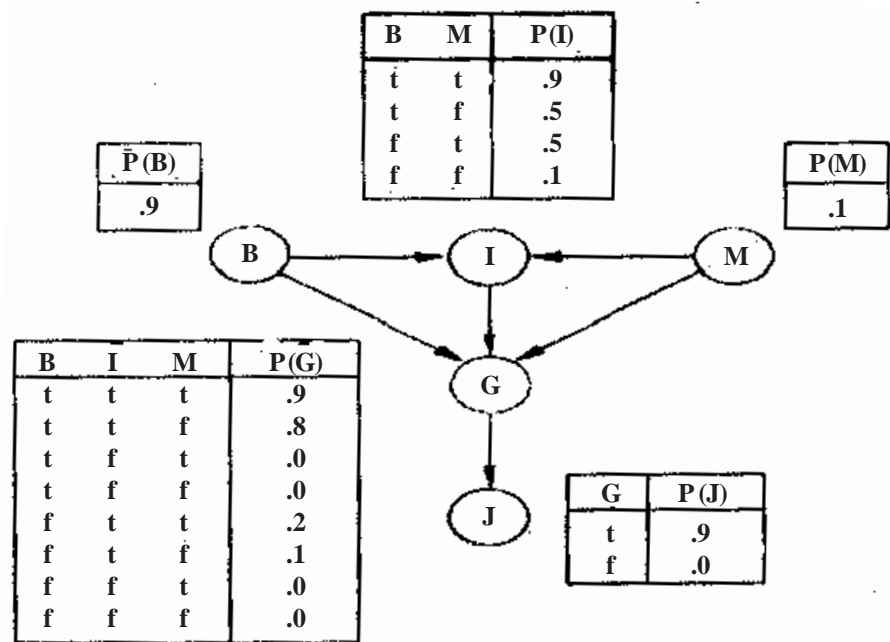
- (iv) Breadth – first search is complete even if zero step costs are allowed.
 - (v) Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves. 5(CO 2)
 - (c) Explain the drawbacks of the Hill Climbing algorithms. Also propose the possible remedies over them. 5(CO 2)
3. (a) According to some political pundits, a person who is radical (R) is electable (E) if he/she is conservative (C), but otherwise is not electable.
- (i) Which of the following are correct representations of this assertion ?
 - (a) $(R \wedge E) \iff C$
 - (b) $R \implies (E \iff C)$
 - (c) $R \implies ((C \implies E) \vee \neg E)$
 - (ii) Which of the sentences in (a) can be expressed in Horn form ?. 5(CO 3)
- (b) Write the steps to convert the predicates in to clause form. 5(CO 3)
- (c) 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 by using resolution,
 "No food made by Cadbury's is green". 5(CO 3)
4. (a) In your local nuclear power station, there is an alarm that senses when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core. Consider the Boolean variables A (alarm sounds), FA (alarm is faulty), and FG (gauge is faulty) and the multivalued nodes

G (gauge reading) and T (actual core temperature).

- (i) Draw a Bayesian network for this domain, given that the gauge is more likely to fail when the core temperature gets too high.
- (ii) Suppose there are just two possible actual and measured temperatures, normal and high ; the probability that the gauge gives the correct temperature is x when it is working, but y when it is faulty. Give the conditional probability table associated with G.
- (iii) Suppose the alarm works correctly unless it is faulty, in which case it never sounds. Give the conditional probability table associated with A.

5(CO 4)

- (b) Consider the Bayes net shown in Figure with Boolean variables
 B=BrokeElectionLaw, I=Indicated
 M=PoliticallyMotivated Prosecutor, G=FoundGuilty, J=Jailed.



- (i) Calculate the value of $P(b, i, \neg m, g, j)$
- (ii) Calculate the probability that someone goes to jail given that they broke the law, have been indicted, and face a politically motivated prosecutor.

5(CO 4)

- (c) How the basic operations like Union, Intersection and set difference are defined in terms of membership function on the fuzzy sets ? Explain with an example. 5(CO 4)

5. (a) Apply Inductive learning to solve Curve fitting. 5(CO 5)
- (b) Consider the following data set comprised of three binary input attributes (A₁, A₂ and A₃) and one binary output :—

Example	A ₁	A ₂	A ₃	Output y
x ₁	1	0	0	0
x ₂	1	0	1	0
x ₃	0	1	0	0
x ₄	1	1	1	1
x ₅	1	1	0	1

Use the decision tree algorithm to learn a decision tree for these data. Show the computations made to determine the attribute to split at each node. 5(CO 5)

- (c) Explain working of a single neuron. Solve NAND classification problem by using single neuron. 5(CO 5)

6. (a) Consider the knowledge base given as :

Y & D → Z
 X & B & E → Y
 A → X
 C → L
 L & M → N

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

Prove that 'Z' is true by using forward and backward chaining. Also List down the difference between forward and backward chaining. 5(CO 6)

- (b) Provide the details about following expert systems
 (1) PROSPECTOR (2) DENDRAL 5(CO 6)
- (c) List the main players involved in expert system development and explain. 5(CO 6)