Exam Date & Time: 30-Apr-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

IV SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2024

ARTIFICIAL INTELLIGENCE [CSE 2225]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) List all the approaches of Artificial Intelligence. Propose the approach that is more amenable to scientific development with its benefits. (2)

A)

B) Analyze task environment for the following and justify with reasons.

i. In crossword puzzle, subsequent episodes are dependent on what happened in the previous episodes

ii. In automated taxi driving, one can never predict the behavior of traffic exactly

iii. In chess game, the agent has complete knowledge of the board and everything about the environment is accessible to the agent

iv. In taxi driving, other cars and the taxi keeps moving. (4)

C) Identify and elaborate the process of the agent which operates initially in unknown environments and becomes more competent over the period of time. Utilize a block diagram and describe all its components. (4)

2) How is the task environment of an agent typically defined? Describe the task environment for a Refinery Controller. (2)

A)

B) Formulate the 8-puzzle problem with all its components.

Starting from the initial state for the problem specified as {1,2,3,5,6,0,4,7,8}, draw a portion of the state space tree (ignore all visited nodes) till the final node showing the path from initial node to the final node in 5 steps only. The final state is represented as {1,2,3,4,5,6,7,8,0}. (4)

Give the action sequence to reach from initial to the goal state. '0' indicates the blank space in the puzzle. Moving left (L), right (R) and down (D) can be used as actions.

C) Illustrate and discuss different regions in the state space landscape of hill climbing algorithm. Elaborate the regions at which the hill climbing algorithm fails to progress towards a solution. (4)

3) Consider a graph as shown in the Figure 3A, with A as start node and H as goal node. Apply greedy best first search algorithm on the given graph and show each step using the graph search strategy. The heuristic values at each node is given as follows. (3)

A) A-24, B-19, C-17, D-16, E-14, F-10, G-9, H-0

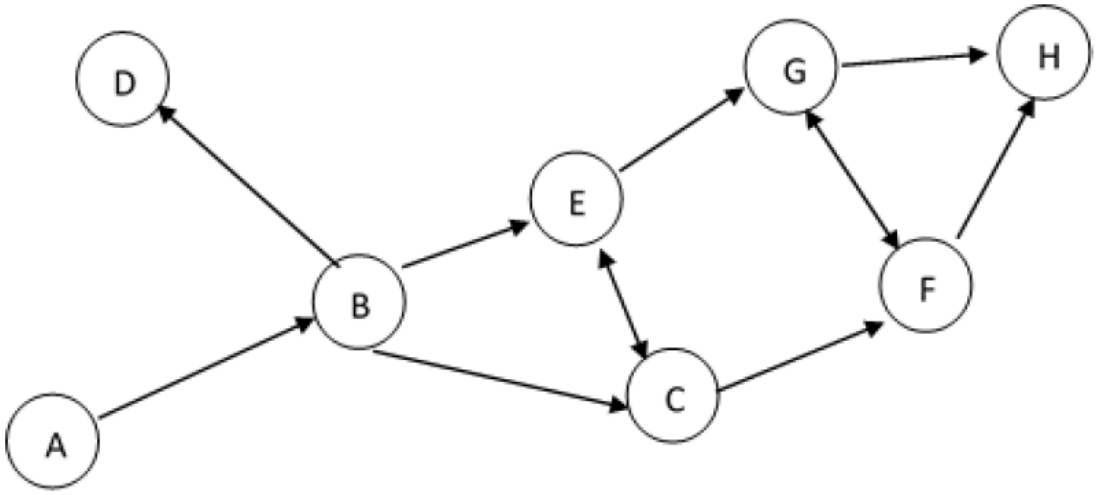
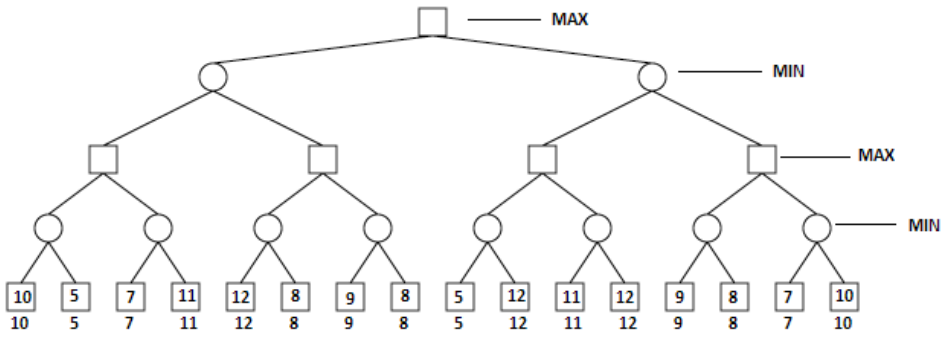


Figure 3A

B) "Search algorithms require a data structure to keep track of the search tree". Justify the statement with discussion on the data structure in use. (2)

C) Elucidate the adversarial search approach and the applications of game theory. Then, solve the given game tree (Figure 3C) using the MINIMAX algorithm and explain the drawbacks of the MINIMAX search. Finally, utilize a suitable pruning technique to limit the search.



(5)

For MAX node = V = MAX (α, β) and $\alpha = -\infty$

For MIN node = V = MIN (α, β) and $\beta = \infty$

Figure 3C

4) How do computable functions and predicates play a fundamental role in the realm of artificial intelligence, particularly within the framework of first-order logic? Show an example for computable functions and predicates. (2)

A)

B) Consider the following Wumpus world problem given in Figure 4B.1. An agent starts from starts from [1,1]. With the help of Propositional logic prove that there is no pit in [2,2] ie., $\neg P_{1,2.}$ (2M) (4)

Initial rules in the knowledge base (KB):

R1: $\neg P_{1,1}$

R2: $B_{1,1}$ Û $(P_{1,2}$ V $P_{2,1})$

R3: $B_{2,1}$ Û $(P_{1,1}$ V $P_{2,2}$ V $P_{3,1})$

Note:

Px,y is true if there is a pit in [x,y]

Wx,y is true if there is a Wumpus in [x,y]

Bx,y is true if the agent perceives a breeze in [x,y]

Sx,y is true if the agent perceives a stench in [x,y]

The figure 4B.2 shows that the agent returns from [2,1] to [1,1] and then goes to [1,2], where it perceives a stench, but no breeze. Add these knowledge as rules to the knowledge base then use resolution theorem to prove that there is a pit in $P_{3,1}$. (2M)

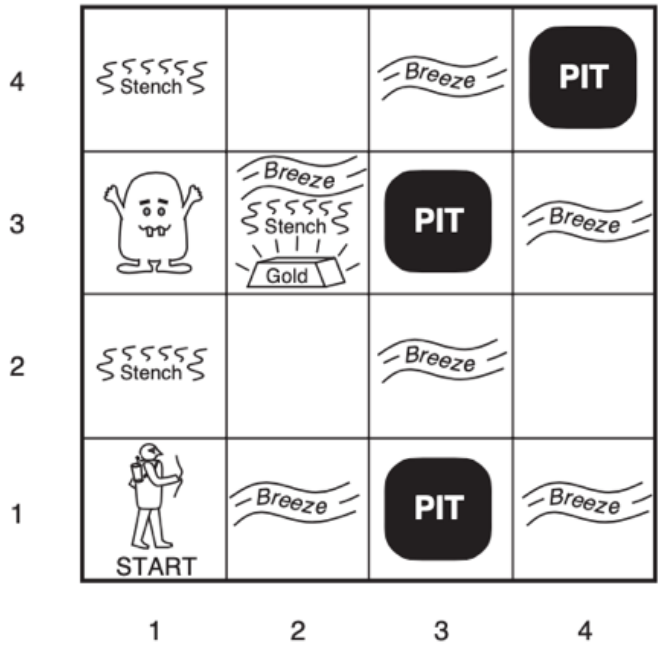


Figure 4B.1

1,4	2,4	3,4	4,4
1,3	2,3	3,3	4,3
1,2 OK	2,2	3,2	4,2
1,1 A OK	2,1 OK	3,1	4,1

Figure 4B.2

C) Imagine you're designing an AI-powered smart home system, tasked with regulating temperature in various rooms. How would you utilize event calculus integrated with first-order logic to ensure efficient monitoring and control of temperature dynamics, considering factors like heating system activation, temperature fluctuations, and user preferences (when to turn on or off)? (4)

5) Consider an AI medical system for diagnosing flu in a patient. By analyzing symptoms like fever, cough and fatigue, it suggest flu as a potential diagnosis. The following are the knowledge base sentences:

A) 1. If a disease causes a symptom, and the patient exhibits that symptom, it suggests the possibility of the disease. (2)

2. If a test result is positive for a disease, it confirms the diagnosis.

Demonstrate how first-order logic through forward reasoning enables AI to infer illnesses based on observed symptoms, aiding in timely medical decisions.

B) Consider two medical tests, A and B, for a virus. Test A is 95% effective at recognizing the virus when it is present, but has a 10% false positive rate (indicating that the virus is present, when it is not). Test B is 90% effective at recognizing the virus, but has a 5% false positive rate. The two tests use independent methods of identifying the virus. The virus is carried by 1% of all people. Say that a person is tested for the virus using only one of the tests, and that test comes back positive for carrying the virus. Which test returning positive is more indicative of someone really carrying the virus? Justify your answer mathematically through probability theory. (4)

C) Discuss expert systems in terms of knowledge representation, knowledge acquisition, and explanation. List a few popular applications of expert systems. (4)

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