

Time: Three hours

Full Marks: 100

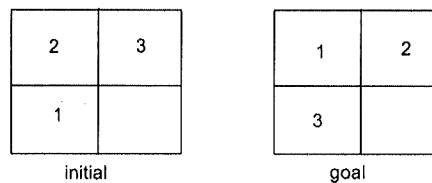
A separate answer script shall be used to answer PART A and PART B

All questions under the same CO should be answered together.

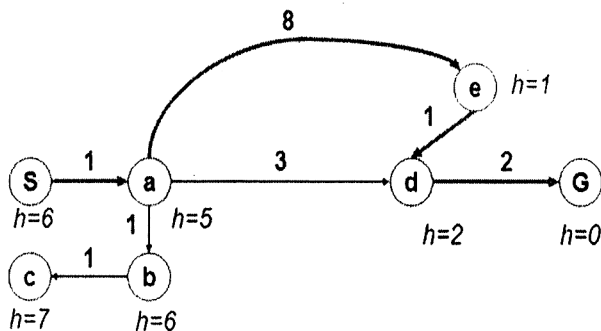
PART - A

CO1 [1] Answer any seven from CO1 of this block as mentioned [3 x 7 = 21]
 [21]

- Draw the structure of an agent in an environment.
- Breadth first search is a special case of uniform cost search. – Justify it.
- Uniform cost search is a special case of A* search. – Justify it.
- Why heuristics are used in search methods? Define Path Cost.
- What is Local Maxima? What do you mean by Constraint Satisfaction?
- Write comparative assessment of artificial intelligence approaches.
- Draw the search tree using BFS of the 3-puzzle problem given below. Assume that repeated states are not detected.



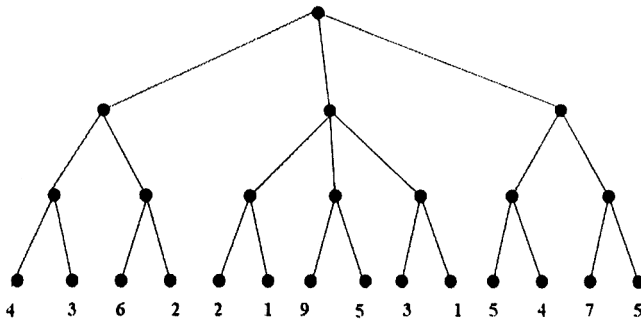
- Can DFS find the goal of the 3-puzzle problem presented above? If yes, show it. If no, why? Assume that repeated states are not detected.
- What is admissibility of heuristics?
- Execute A* on the below graph with different heuristic values.



[Turn over

CO2
[29]

[2] Answer (a) and any TEN from the rest of this block as mentioned. [9 + (2 x 10) = 29]
 (a) Execute both the minimax algorithm and alpha-beta pruning algorithm on the below search tree and write down your observation. (9)



- (b) What is the meaning of alpha and beta in alpha-beta pruning?
 (c) What is multi-agent environment?
 (d) Differentiate between Hill Climbing and Simulated Annealing algorithm.
 (e) What are the problems encountered during hill climbing search?
 (f) What are the ways available to deal with problems faced during Hill-Climbing search?
 (g) What is the complexity of Minimax algorithm and justify your answer.
 (h) Explain game search.
 (I) What do you mean by configuration search problem, explain with example.
 (j) Constraint satisfaction problem is a configuration search problem - justify it.
 (k) Differentiate between exploration and exploitation in state space search.
 (l) Explain some of the limitations of simulated annealing algorithm.

Part B

CO3: Answer Q3A and any 1 question from rest

Full marks: 20

3A. Consider the following sentences:

- Aurelius was a man.
- Aurelius was a Pompian.
- All Pompians were Romans.
- Caesar was a ruler.
- All Romans were either loyal to Caesar or hated him.
- Everyone is loyal to someone.
- People only try to assassinate rulers they are not loyal to.
- Aurelius tried to assassinate Caesar.

With the above sentences, write a PROLOG program to answer that "Was Aurelius loyal to Caesar?"

(15)

B. Represent the following sentences in first-order logic:

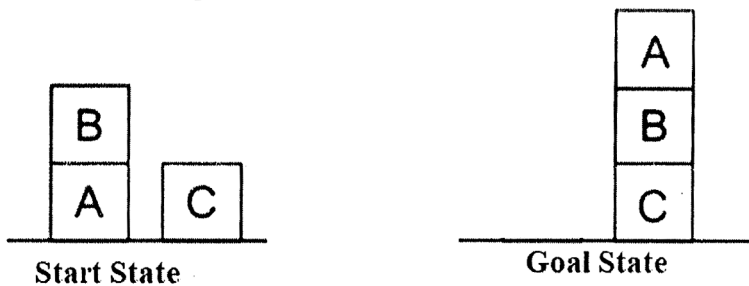
- a) "No region in South America borders any region in Europe."

b) "Joan has exactly one daughter" (2+3)

C. Difference between predicate and propositional logic. What are the limitations of Predicate logic as a tool for Knowledge representation? (2+3)

CO4: Answer any 2 questions **Full marks: 20**

4A. What is Goal Stack Planning? Write a Goal Stack Solution Plan of Blocks World Problem for the following start and goal state.



(2+8)

B. What are the basic components of situation calculus? Write a solution plan in situation calculus to solve the Blocks World Problem for the above start and goal state. (3+7)

C. Consider the action of taking a train from Delhi to Kolkata with preconditions $At(\text{Agent}, \text{Delhi}) \wedge At(\text{Train}, \text{Delhi})$ and add list $At(\text{Agent}, \text{Kolkata}) \wedge At(\text{Train}, \text{Kolkata})$.

(i) Write the components of STRIPS for the given scenario.

(ii) What additional preconditions might be required to guarantee that the action can be applied?

(7+3)

CO5: Answer any 1 question **Full marks: 10**

5A. Define uncertain knowledge, prior probability and conditional probability. Explain the process of knowledge acquisition technique. (5+5)

B. Mention role of inference engine in expert system. Discuss the types of Expert System. Compare their characteristics in terms of knowledge representation, uncertainty tolerance, and inference engine. (3+3+4)

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CO1: Explain the basics of artificial intelligence and explain and illustrate different searching techniques. (K3)

CO2: Explain and illustrate different constraint satisfaction problem. (K3)

CO3: Explain and illustrate representation of knowledge and proving theorems (K3)

CO4: Understand and explain planning and decision making (K2)

CO5: Solve problem related to uncertain knowledge. (K4)