

CS-703C

ARTIFICIAL INTELLIGENCE

Time Allotted: 3 Hours

Full Marks: 70

*The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.*

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions.

10×1 = 10

- (i) If in a problem the number of initial states is much more than the number of final states we should use
☒ (A) backward reasoning (B) forward reasoning
(C) both (A) and (B) (D) none of these
- (ii) Let a and b be any two events. Which of the following must be true?
☒ (A) $P(a \cup b) = P(a) + P(b)$ (B) $P(a) \leq 0$
(C) $P(a) + P(\neg a) = 1$ (D) none of these
- (iii) "Mary is slightly ill". This statement can be completely expressed in
(A) FOPL (B) propositional logic ☒ (C) fuzzy logic (D) none of these
- (iv) A Bayesian network is a
(A) tree (B) directed graph ☒ (C) undirected graph (D) none of these
- (v) Uninformed search is also known as
(A) brute force search (B) hill climbing search
(C) ☒ blind search (D) none of these
- (vi) For a given proposition p , $p \vee \neg p = \text{true}$ is a
(A) tautology (B) contradiction ☒ (C) satisfiable formula (D) none of these
- (vii) Skolem function is used in
(A) unification algorithm (B) natural deduction
(C) ☒ conversion to clause form (D) none of these
- (viii) Inheritable knowledge is best represented by
☒ (A) semantic net (B) database (C) first order logic (D) none of these

- (ix) The first order logic is
✓(A) both sound and complete (B) sound but not complete
(C) complete but not sound (D) neither sound nor complete
- (x) Which of the following is NOT a conflict resolution strategy in production systems?
(A) production rules (B) recency
(C) refraction (D) specificity ✓
- (xi) Meta-rules are one type of
(A) conflict resolution strategies (B) part of a big rule
(C) facts (D) production system ✓
- (xii) Inheritable knowledge is best represented by
(A) semantic net (B) database
(C) first order logic (D) none of these ✓

GROUP B
(Short Answer Type Questions)

Answer any *three* questions.

3×5 = 15

2. (a) What do you mean by completeness of a search method? When do you think BFS and DFS can be incomplete? 1+2
(b) Did Depth limited search always show the completeness property? Explain. 2
3. Write a program in PROLOG to find the length of a list using accumulator. 5
4. Define α - cutoff and β -cutoff of a game tree. 5
5. Consider the following : 5
(a) The start state is given by :
ON (C, A) ^ ONTABLE (A) ^ ONTABLE (B)
(b) The goal state is given by :
ON (A, B) ^ ON (B, C) ^ ONTABLE (C)
Solve this problem corresponding to Goal Stack.
6. Briefly explain the problems with Hill Climbing search. How it is different from Gradient Descent Search? 3+2

GROUP C
(Long Answer Type Questions)

Answer any *three* questions.

3×15 = 45

8

7. (a) Consider the following problem :

The 8-puzzle consists of a 3×3 board with 8 numbered tiles and a blank space. Each tile has a number on it. A tile adjacent to the blank space can only slide into that space. The game consists of a starting position and a specified goal position. The goal is to transform the starting position into the goal position by sliding the tiles around. Convert this problem to a state space search problem. Show that it works on the following example :

Start

2	8	3
1	6	4
7		5

Goal

1	2	3
8		4
7	6	5

- (b) Justify each of the following statements :

2+2.5+2.5

- (i) BFS is a special case of Uniform-Cost search.
(ii) Uniform-Cost search is a special case of A* search.
(iii) DFS can be viewed as a special case of Depth-limited search.

8. (a) A farmer has a wolf, goat and cabbage. He wants to cross a river with all its possessions. He has a single boat that can carry at most one of his possessions on any trip. Moreover, an unattended wolf eats goat and unattended goat eats cabbage. How does he do the transportation?

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Describe a production system stating clearly the production rules and control strategies. Now, show that your proposed production system solution can solve this problem.

- (b) What are the pitfalls of the Hill Climbing search technique?

3

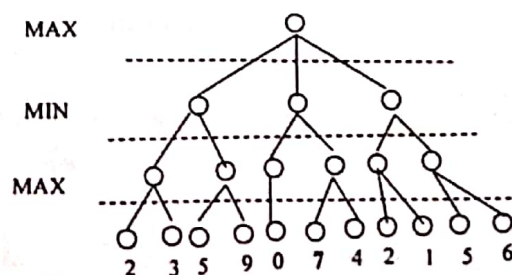
- (c) When one has cold, one usually has a high temperature (80% of the time). At any time around 1 in every 10000 people has a cold and 1 in every 1000 people has a high temperature.

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Now, suppose that you have a high temperature. What is the probability that you have cold?

9. (a) Consider the following game tree.

4+6



- (i) Using MINIMAX procedure, determine what moves should be chosen by the maximizer in his first turn.
(ii) Execute Alpha-Beta pruning on the above game tree. How many terminal nodes are examined? For each cutoff specify whether it is an ALPHA-cutoff or Beta-cutoff.

- (b) Given the following initial and the goal state for the Block's world problem. Construct a set of operators (rules) and hence generate a plan to reach the goal state from initial state.

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Initial State : On(C, A), Clear(C), ON(B, table), Clear (B)

Goal state : ON(B, A), On (C, B).

- 10.(a) Convert the following sentences into first order predicate logic :

1×4=2

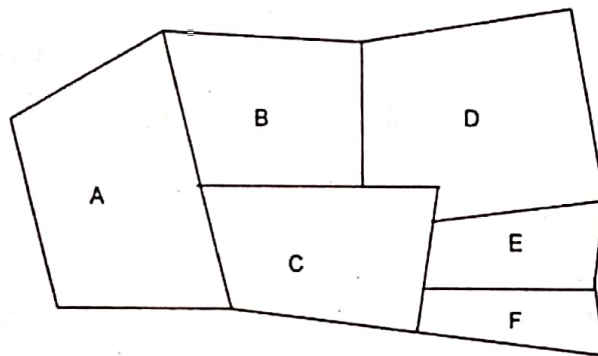
- (i) Everyone loves Ram.
- (ii) Not everyone likes Ravana.
- (iii) No frogs are birds.
- (iv) Some vehicles are not motorcycles.
- (v) No person buys an expensive policy.

- (b) Art is the father of John. Bob is father of Kim. Fathers are parents. Prove that Art is the parent of John.

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- (c) Consider the "map colouring problem" where a given map is to be coloured in a manner so that no neighbouring states of a country contain the same colour. Give a solution to following map colouring problem viewing it as a Constraint Satisfaction Problem.

5



- 11.(a) Translate the following into clausal form :

6

$(\forall x)(Px) \rightarrow ((\forall y)(P(y) \rightarrow P(f(x, y))) \wedge \sim (\forall y)(Q(x, y) \rightarrow P(y)))$

- (b) Draw Conceptual graph for the following sentence –

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"The dog scratches its ear with its paw".

- (c) Write a program in PROLOG or LISP clause for having DOUBLE (L, LL). Each element in the list L appears twice in the list LL. For example, DOUBLE ([1, 2], [1, 1, 2, 2]) is true.

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Question paper of
6th day 1st half
dated → 09/12/14.
Lib