2013

ARTIFICIAL INTELLIGENCE

Time Allotted : 3 Hours | *Full Marks* : 70

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. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) Algorithm that gives optimal solution is

      a) Hill climbing b) BFS

      c) Blind search d) A^*.

   ii) Skolem function is used in

      a) unification algorithm

      b) natural deduction

      c) conversion of clausal form

      d) none of these.

iii) The most appropriate representation for "Alive means not dead" is

a) $\forall_x : \exists_y : [\text{alive}(x,y) \rightarrow \neg \text{dead}(x,y)]$

b) $\forall_x : \forall_y : [\text{alive}(x,y) \rightarrow \neg \text{dead}(x,y)]$

c) $\forall_x : \forall_y : [\text{alive}(x,y) \rightarrow \neg \text{dead}(x,y)] \wedge [\neg \text{dead}(x,y) \rightarrow \text{alive}(x,y)]$

d) $\exists_x : \forall_y : [\text{alive}(x,y) \rightarrow \neg \text{dead}(x,y)] \wedge [\neg \text{dead}(x,y) \rightarrow \text{alive}(x,y)]$.

iv) What will be the output of the following Prolog program segment ?

fib (0, 0)

fib (F, G) : – Y is F – 1, fib (Y, U), G is F + U

for ? fib (3, X).

a) X = 0 1 1 b) X = 1 1 2

c) X = 2 d) None of these.

v) Inheritable knowledge is best represented by

a) semantic net b) first order logic

c) database d) none of these.

vi) Which of the following is a Declarative knowledge ?

a) A set of production rules

b) Using LISP code to define a value

c) Describing the objects using a set of attributes and associated values

d) A knowledge about the order in which to pursue the subgoals.

vii) Resolution can be used for

a) question answering b) theorem proving

c) both (a) and (b) d) none of these.

viii) Which of the following is there in Prolog ?

a) Existential quantifier b) Universal quantifier

c) Conjunction d) Disjunction.

ix) Heuristic search has

a) minimization of function value

b) maximization of function value

c) both (a) and (b)

d) none of these.

x) Which is not heuristic search ?

a) Constraint satisfaction search

b) Depth first search

c) Simulated annealing

d) Steepest ascent Hill climbing.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. a) What do you mean by completeness of a search method ? When do you think BFS & DFS can be incomplete ?

   b) Did Depth limited search always show the completeness property ? Explain. (1 + 2) + 2

3. Write a program in Prolog to find the length of a list using accumulator.

4. Define α-cutoff & β-cutoff of a game tree.

5. Consider the following :

   a) The start state is given by :

   $ON(C,A) \wedge ONTABLE(A) \wedge ONTABLE(B)$

   b) The goal state is given by :

   $ON(A,B) \wedge ON(B,C) \wedge ONTABLE(C)$

   Solve this problem corresponding to Goal Stack.

6. With an example show a simplified Frame system.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Consider the following problem :

   A farmer is on the left bank of a river with a boat, a cabbage, a goat, and a wolf. The task is to get everything to the right bank of the river. The restrictions are as follows :

   Only the farmer can handle the boat, when he is in the boat, there is only space for one more item and the farmer can't leave the goat alone either with the wolf, or with the cabbage.

   Represent this problem as a state space search problem & show at least one solution path.

   b) Define admissible & consistent heuristic. For a heuristic h, prove the following :

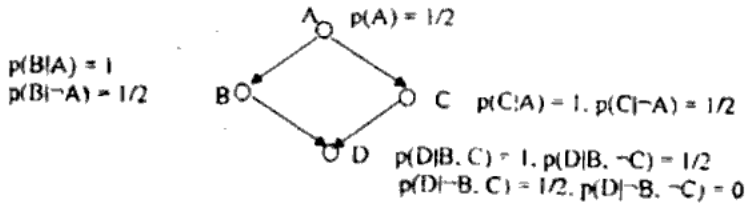
   i) if h is consistent, then prove that $h(n) \leq c(n,n') + h(n')$ is applicable for any descendent n' of n

   ii) if h is consistent, then prove that h is admissible also. $8 + (2 + 2\frac{1}{2} + 2\frac{1}{2})$

8. a) What are the different approaches to knowledge representation ?

   b) State the difference between Inheritable knowledge and Inferential knowledge.

c) An admission committee for a college is trying to determine the probability that an admitted candidate is really qualified. The relevant probabilities are given in the following Bayes network. Find $p(A|D)$.



d) Explain the phenomenon 'Stuck at local optimum' from the perspective of Hill climbing. How can it be resolved using Simulated Annealing ? 3 + 3 + 2 + (3 + 4)

9. a) State the basic principle of Resolution method for both Proposition & Predicates.

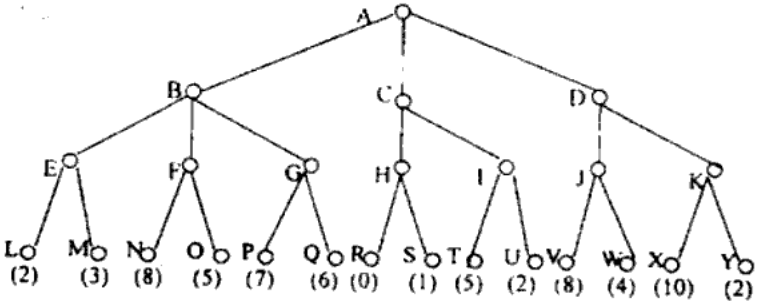
b) Consider the following FOPL sentences from the domain of Monkey-Banana problem :

(i) in_room (bananas), (ii) in_room (chair), (iii) in_room (monkey), (iv) tall (chair), (v) ¬ close (bananas, floor), (vi) can_move (monkey, chair, bananas), (vii) can_climb (monkey, chair), (viii) close (X, Y) → can_reach(X, Y), (ix) (get_on (X, Y) ∧ under (Y, bananas) ∧ tall (Y)) → close (X, bananas), (x) (in_room) X ∧ in_room (Y) ∧ in_room (Z) ∧ can_move (X,Y,Z)) → close(Z, floor) ∨ under (Y, Z), (xi) can_climb (X, Y) → get_on (X,Y)

Now from those given sentences prove that 'monkey can reach to the bananas' using Resolution method. 5 + 10

10. a) Define Constraint Satisfaction Problem. 4-queens problem seeks to place 4-queens in a 4 × 4 chess board such that no two queens will attack each other in either horizontal or vertical or diagonal way. Formulate this problem as CSP.

b) Consider the following game tree in which the static scores (in parentheses at the leaf nodes) are all from the first player's point of view. Assume that the first player is the maximizing player.



i) What move should the first player choose ?

ii) What nodes would not need to be examined using alpha-beta cutoff algorithm, assuming that nodes are examined in left-to-right order ?

(2 + 3) + (3 + 7)

11. Write short notes on any *three* of the following : 3 × 5

a) Dempster-Shafer evidence theory

b) Simulated Annealing

c) Heuristic Search

d) Intelligent Agent

e) Expert System.

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