Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CSE)/SEM-7/CS-702/2009-10

2009
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 × 1 = 10

   i) When a state is discovered by heuristic search, it is guaranteed that same state won't be found later in the search at a cheaper cost. This property is called

   a) optimality

   b) monotonicity

   c) diversity

   d) none of these.

ii) Which of the following statements is *not* true of Bayesian learning ?

a) Prior knowledge can be combined with observed data to determine hypotheses

b) They can accommodate hypotheses that make probabilistic predictions

c) It is computationally feasible to estimate the required probabilistic predictions

d) New instances can be classified by combining the predictions of multiple hypotheses, weighted by their probabilities.

iii) Let P and Q be proposition symbols. Which of the following are models of $\neg P \vee Q \Rightarrow \neg P \wedge Q$?

a) P = false, Q = false b) P = false, Q = true

c) P = true, Q = false d) P = true, Q = true.

iv) Let a and b be any two events. Which of the following *must* be true ?

a) $P(a) \leq 0$

b) $P(a \wedge b) = P(a)\,P(a \mid b)$

c) $P(a \vee b) = P(a) + P(b)$

d) $P(\neg a) + P(a) = 1$.

v) An algorithm that gives optimal solution is

a) Hill climbing b) BFS

c) Blind search d) A^*.

vi) Inheritable knowledge is best represented by

a) semantic net b) first order logic

c) database d) none of these.

vii) 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.

viii) Resolution can be used for

a) question answering b) theorem proving

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

ix) On the optimal path, generated by A^* algorithm h-cost (heuristic cost) of the root node = 8. At a node N on this path g-cost (generation cost) = 2; its h-cost is

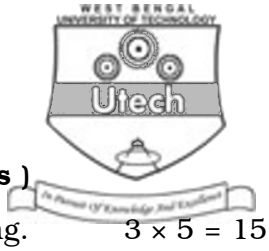
a) 6 b) 8

c) 10 d) 2.

x) Belief of A plus uncertainty of A is called

a) plausibility of A b) doubt of A

c) disbelief of A d) possibility of A.



GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What is an expert system ? Why is it required ? 2 + 3

3. Write a program in PROLOG or LISP to find out GCD of *n* numbers.

4. A problem-solving search can proceed in either the forward or the backward direction. What factors determine the choice of direction for a particular problem ? Justify your answer.

5. A box contains 10 screws out of which 3 are defective. Two screws are drawn at random. Let A = first drawn screw is non-defective, B = second drawn screw is non-defective.

   Using the concept of sampling without replacement evaluate $P(B/A)$ and $P(A \cap B)$. 2 + 3

6. Write a context-free grammar to parse the sentence :

   John gave a book to Mary.

   Also give the semantic representation of the above sentence.

   $2\frac{1}{2} + 2\frac{1}{2}$

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following. 3 × 15 = 45

7. a) Given two jugs with no measuring marker, a 4 gallon jug and a 3 gallon jug. There is a pump to fill the jug with water. How do you get exactly 2 gallons of water in the 4 gallon jug ? Give the state space for the problem. Describe the production rules and provide a possible solution with the help of a state space graph. 8

   b) What is Hill Climbing technique ? Describe it with an example. 2 + 2

   c) What are the loopholes of the Hill Climbing search technique ? 3

8. a) Represent the following using predicate logic and draw the conclusions as required. 10

      i) *X* is an Indian

      ii) *Y* is an Indian

      iii) *X* is a leader

      iv) Every Indian is a man

v) Everyone is loyal to someone

vi) Every man is either loyal to a leader or hate a leader

vii) Man tries to assassinate a leader if he is not loyal to him

viii) *Y* assassinated *X*.

Conclude that *Y* hated *X*.

b) What are the advantages of predicate logic over propositional logic ? 2

c) Write a program in LISP or PROLOG to delete the first three elements from a list *L* producing list *L*1. 3

9. a) Draw a partitioned semantic net to represent the knowledge :

$\forall X$ Adult (X) $\rightarrow$ Loves (X, Children) 4

b) Represent each of the following pieces of knowledge by a semantic net :

i) Loves (mary, john)

ii) Loves (mary, john) $\wedge$ Hates (john, mita)

iii) Loves (mary, john) $\rightarrow$ Hates (mita, john). 6

c) Compare and contrast hill climbing and best-first search procedures. 5

10. Consider the following 8-puzzle problem :

Given the critical state :

2	8	3
1		4
7	6	5

and Goal the state :

1	2	3
8		4
7	6	5

i) List the operators.

ii) Select a heuristic function for the 8-puzzle problem

iii) Solve the problem by A^* algorithm with your selected heuristic function. 2 + 3 + 10

11. Given a game tree for a two-ply game, where the evaluation function for winding are given at the leaf nodes. Assume that the game is opened by the maximizer.

a) Using Minimax algorithm, determine which nodes the maximizer and the minimizer should select in their first turn.

b) Identify the nodes that will be pruned by invoking Alpha-Beta algorithms. $7\frac{1}{2} + 7\frac{1}{2}$

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

a) Bayesian network

b) Genetic algorithm

c) Constraint satisfaction problems

d) Semantic and Syntactic analysis with reference to NLP

e) Neural network.