



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 : $10 \times 1 = 10$

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) $P = \text{false}, Q = \text{false}$ b) $P = \text{false}, Q = \text{true}$
- c) $P = \text{true}, Q = \text{false}$ d) $P = \text{true}, Q = \text{true}.$

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

- a) $P(a) \leq 0$
- b) $P(a \wedge b) = P(a)P(a | b)$
- c) $P(a \vee b) = P(a) + P(b)$
- d) $P(\neg a) + P(a) = 1.$



- v) An algorithm that gives optimal solution is
- Hill climbing
 - BFS
 - Blind search
 - A^* .
- vi) Inheritable knowledge is best represented by
- semantic net
 - first order logic
 - database
 - none of these.
- vii) Which of the following is a declarative knowledge ?
- A set of production rules
 - Using LISP code to define a value
 - Describing the objects using a set of attributes and associated values
 - A knowledge about the order in which to pursue the subgoals.
- viii) Resolution can be used for
- question answering
 - theorem proving
 - both (a) & (b)
 - 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
- 6
 - 8
 - 10
 - 2.
- x) Belief of A plus uncertainty of A is called
- plausibility of A
 - doubt of A
 - disbelief of A
 - possibility of A .



GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

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 $L1$. 3
9. a) Draw a partitioned semantic net to represent the knowledge :
- $\forall X \text{ Adult } (X) \rightarrow \text{Loves } (X, \text{Children})$ 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 :

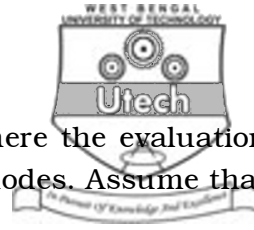
2	8	3
1		4
7	6	5

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 winning 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.