

Name :

Roll No. :

Invigilator's Signature :

CS/MCA/SEM-3/MCA-303/2011-12

2011

INTELLIGENT SYSTEMS

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 any *ten* of the following :
 $10 \times 1 = 10$
 - i) Rational Agents are examples of AI system that
 - a) think rationally
 - b) act rationally
 - c) think like humans
 - d) act like humans.
 - ii) Breadth first search is optimal (admissible)
 - a) always
 - b) if all operators have same cost
 - c) it depends
 - d) none of these.

iii) The space complexities of breadth first, depth first, iterative deepening and bidirectional search (in that order only) are

- a) $b^d, bd, b^{d/2}, bm$ b) $bm, b^d, bd, b^{d/2}$
c) $bm, bd, b^{d/2}, b^d$ d) $b^d, bm, bd, b^{d/2}$

(b – branching factor, d – depth of tree, m–depth of goal)

iv) Which is not heuristic search ?

- a) Constraint satisfaction search
b) Depth-first search
c) Simulated annealing
d) Hill-climbing.

v) Heuristic search algorithms are superior to non-heuristic search algorithms for applications of

- a) Simple nature
b) NP-hard/NP-complete nature
c) Complex nature
d) All of these.

vi) To make a decision about the selection of a move at depth d in Alpha-beta cut-off procedure, the tree should be expanded at least up to a depth

- a) 2 b) $(d - 2)$
c) $(d + 2)$ d) $(d * 2)$.

- vii) Which is not a pure AI game ?
- a) Snakes and Ladders
 - b) Tic-tac-toe
 - c) Ludo
 - d) Chess.
- viii) Epistemology is
- a) study of hypothesis
 - b) knowledge about knowledge
 - c) study of nature of knowledge
 - d) none of these.
- ix) Which of the following is a tautology ?
- a) $p \wedge q \rightarrow p$
 - b) $p \vee q \rightarrow p$
 - c) $p \rightarrow q$
 - d) None of these.
- x) According to Modus-Ponens inference rule, from P and $P \rightarrow Q$ infer
- a) P
 - b) Q
 - c) not P
 - d) not Q .
- xi) The process of adding new knowledge to a knowledge-base and refining or improving knowledge that was previously acquired is called
- a) hypothesis
 - b) knowledge representation
 - c) knowledge acquisition
 - d) none of these.

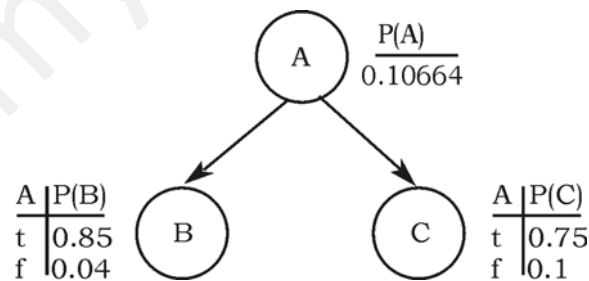
GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$$3 \times 5 = 15$$

2. Define Decision Tree. Describe common decision tree pruning algorithm. 2 + 3
3. Assume a learning problem where each example is represented by four attributes. Each attribute can take two values in the set { a, b }. Run the candidate elimination algorithm on the following examples and indicate the resulting version space. What is the size of the space ?
 $((a, b, b, a), +)$
 $((b, b, b, b), +)$
 $((a, b, b, b), +)$
 $((a, b, a, a), -)$
4. What are the Rules of Inference ? Define resolution refutation. 2 + 3
5. Prove of Admissibility & Completeness of A*. 2 + 3
6. Consider the following Bayesian Network containing 3 Boolean random variables :



Compute the following quantities :

- i) $P(\sim B, C \mid A)$
- ii) $P(A \mid \sim B, C)$ 2 + 3

GROUP – C

(Long Answer Type Questions)

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

7. a) What can AI systems do ? What can AI systems NOT do yet ?
- b) Define Plan-Space Search.
- c) Convert the following English statements to statements in first order logic :
- every body or girl is a child
 - every child gets a doll or a train or a lump of coal
 - no boy gets any doll
 - no child who is good gets any lump of coal
 - Jack is a boy $(2 + 2) + 3 + 8$
8. a) How do you Evaluate Search strategies ?
- b) State the advantages of Breadth First Search and disadvantages of Breadth First Search.
- c) Formulate the WOLF-GOAT-CABBAGE problem. Solve the problem. $2 + (2 + 2) + (4 + 5)$
9. a) Suppose you have the following search space :

State	Next	Cost
S	A	2
S	B	5
A	C	2
A	D	4
B	D	1
B	G	6
D	C	3
D	G	2

- i) Draw the state space of this problem.

ii) Assume that the initial state is A and the goal state is G. Show how each of the following search strategies would create a search tree to find a path from the initial state to the goal state :

- I) Breadth-first search
- II) Uniform cost search
- III) A* search

At each step of the search algorithm, show which node is being expanded, and the content of fringe. Also report the eventual solution found by each algorithm, and the solution cost.

b) Define Constraint Satisfaction Problems.

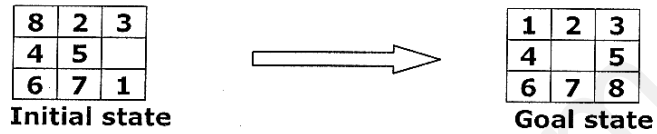
$$\{ 3 + (3 + 3 + 3) \} + 3$$

10. a) Solve 8-Queen problem. How many distinct and unique cases are there ? Give comparison of Propagation Techniques.

b) When does a heuristic consistent ? Critically justify "If a heuristic h is not consistent; the f values along any path will not be non-decreasing".

$$6 + (2 + 2) + 2 + 3$$

11. a) What is Manhattan distance ?
- b) Consider the 8-puzzle problem. Starting from the initial state below, expand the complete game tree and calculate the value of each state till the goal state.



- c) State the heuristic function, you assumed above.

$$3 + (3 + 6) + 3$$
