

**B. COMPUTER SC. AND ENGINEERING EXAMINATION, 2013****(4th Year, 1st Semester)****ARTIFICIAL INTELLIGENCE**

Time : Three Hours

Full Marks : 100

**Use a separate Answerscript for each Part.**Answer *any five* questions.

1. (a) What is 'intelligence'? Write down the differences between weak AI and strong AI.  
What is an agent? Discuss on utility based agent and its applicability. 3+5+2+5  
(b) How do you formalize a search strategy? What is a state space graph? 3+2
2. Checker board problem is shown graphically in Figure 1 where each state is reprocuted by the location of blocks A and B chere, initial state is (A4B8).

The operators are as follows :

- i. uA –move Block A up
- ii. uB–move Block B up
- iii. dA–move Block A down
- iv. dB-move Block B down
- v. lA-move Block A left.
- vi. lB- move Block B left.
- vii. rA–move Block A right.
- viii. rB–move Block B right.



0	1	2
3	4 	5
6	7	8 

Figure 1.

- (a) Enumerate the state space for this problem. How many distinct states are there?
- (b) Show the state space graph. Identify closed paths (cycles).
- (c) For the goal state (A8, B4) identify paths from start to goal state that do not contain cycles.

(d) Identify the shortest path (in terms of steps).

20

3. (a) Gomoku is like a tic-tac-toe except that each player is attempting to get five in a row, rather than three. It can be played on any sized board at least as large as  $5 \times 5$ . Assume, it is played on an  $n \times n$  board,  $n > 5$  ( $n$  : integer).

What is the time complexity of depth first search for Gomoku?

Derive a heuristic function for Gomoku that will allow for an informed search to be used.

What cost function would the A\* algorithm minimize in application to Gomoku? 12

- (b) “Greedy algorithm will provide a sub-optimal solution if the heuristic is not admissible”—use a state space graph to provide a counter example of this statement. 4
- (c) If  $h_1(s)$  and  $h_2(s)$  are both admissible heuristic functions, is  $h_3(s) = |h_1(s) - h_2(s)|$  admissible? — Justify. 4
4. (a) Which is more like depth first search – Best first search or hill climbing? Which is more like Breadth first search between these two? — Discuss. 5
- (b) Compare hill climbing and simulated annealing algorithm. 5
- (c) Write down the advantages of crossover and mutation operators in Genetic Algorithms. 5
- (d) In Genetic Algorithm, how do you encode a chromosome? Do you really find out any usefulness of this encoded version? Discuss. 5
5. (a) What is ‘AND-OR’ graph? How do you view a 2-person Game tree as an AND-OR tree? Which nodes are designated as ‘AND’ nodes and which are designated as ‘OR’ nodes? 3+3+3
- (b) What is static evaluation function? Where and how is it computed? 5
- (c) Consider the game tree (Figure 2) in which static scores are all from first player’s point of view which nodes will be pruned if alpha-beta algorithm is used? 6

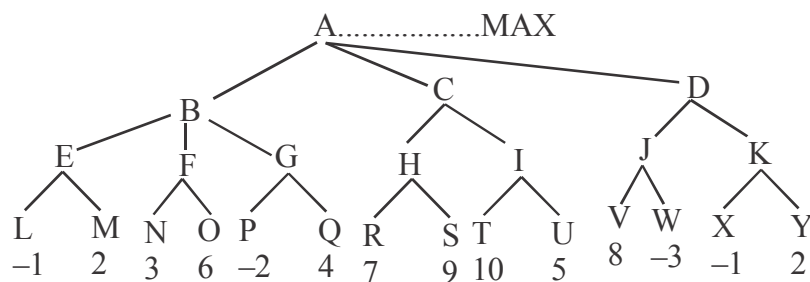


Figure 2

( 3 )

6. (a) Find the mgu of the following set.

$P(x, g(y, A, h(y, B)))$  and  $P(h(A, B), g(A, y, x))$  4

(b) State the differences between propositional logic and first order predicate logic. 2

(c) Represent the following sentences by predicate calculus wffs. 2+2

(i) No two adjacent countries have same colour.

(ii) only one student failed Mathematics.

(d) Consider the following sentences :

Zebras are mammals, striped and medium size.

Mammals are animals and warm-blooded.

Striped things are non-solid and non-spotted. Things of medium size are neither small nor large.

Ifc zeke is a zebra, is zeke non-large?

— Answer this question using resolution refutation. 10

7. (a) Write down the differences between (i) monotonic reasoning system and nonmonotonic reasoning system (ii) SL justification and CP justification (iii) Fuzzy set and crisp set. 3+3+4

(b) Discuss on fuzziness of a fuzzy set. 5

(c) How do you handle uncertainty using Bayes rule? 5

8. Write short notes on :

(a) Control strategies for resolution refutation method and their limitations.

(b) Truth maintenance system. 10+10

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