B. COMPUTER SCIENCE AND ENGINEERING EXAMINATION, 2016

(4ᵀᴴ YEAR, 1ˢᵀ SEMESTER)

ARTIFICIAL INTELLIGENCE

Full Marks: 100

Time: Three Hours

Answer any Five Questions

1. (a) Discuss on classifications of AI. Discuss on "Laws of Thought" approach of AI. Write down the advantages of 'Goal Based Agent'. Discuss on 'Problem Solving Agent'.

   4+3+3+5

   (b) Justify –"If the time complexity of a search algorithm is higher, it will not provide an optimal solution".

   5

2. (a) What is 'State space graph'? How do you formalize a search problem?   3+3

   (b) Prove each of the following statements.
   (1) Breadth first search is a special case of uniform cost search.
   (2) Breadth first search and depth first search are special cases of best first search.
   (3) Iterative deepening search is an optimal search algorithm.

   4+4+6

3. (a) In the following maze the successors of a cell include any cell directly to the east, south, west or north of the current cell except that no transition may pass through the central barrier. The search problem is to find a path from **s** to **g**. Assume that you always try to expand East first, then South, then West, then North.
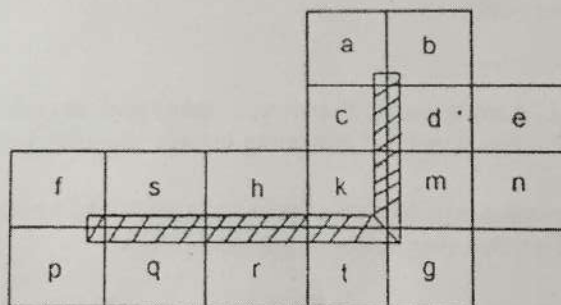

   i) You decide to use a Manhattan-distance heuristic function, where h(state) = shortest number of steps from state to **g** if there were no barriers. Is this heuristic function admissible? – Discuss.   4

   ii) Assume that you use best first greedy search using heuristic h (a version that never re-explores the same state twice). Find out all the states expanded, in the order they are expanded until the algorithm expands the goal state.   4

   iii) Assume you use A* search with the same heuristic h and run until it terminates using the conventional A* termination rule. Find out all the states expanded, in the order they are expanded.   4

(b) If you use an admissible heuristic are the search space visited by hill climbing and best first search the same? If yes, why? If no, justify or give an illustrative counter example.

5

(c) Discuss the advantage(s) of IDA* over A*.

3

4. (a) What is 'look-ahead depth' (in a game tree)? Why the static scores differ (in a game tree) in different look-ahead depth?

4

(b) Consider the following game tree in which static scores are all from first player's point of view. Which should be his best first move? Which branches will be pruned if α-β pruning algorithm is used? (The static scores at the leaf nodes from left to right are as follows: 4, 1, 6 , 3, 2, 8, 9, 4, 3, 3, 5, 8, 1, 13, 5, 7, 7, 4, 5, 3, 27, 19, 3, 2, 1, 50)

8
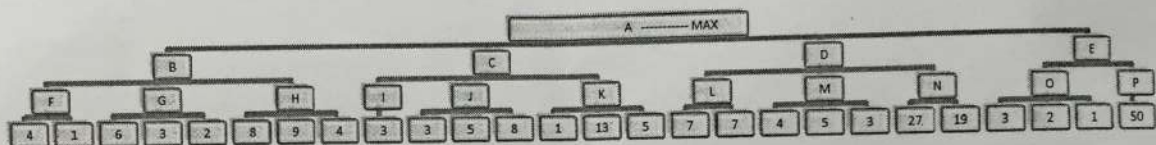
(c) For the said tree, what ordering of leaf nodes (from left to right) results in the most nodes being pruned with α-β (maintain the child-parent relationship). Show your reordering. 5

(d) Define α -cut off and β -cut off. 3

5. (a) How do you draw the correspondence between simulated annealing technique and optimization process? When does simulated annealing behave like hill climbing? 5+3

(b) In Genetic Algorithm, crossover is treated as primary operator and mutation as secondary one – justify. What will happen if mutation is not used in GA? 4+3

(c) How the accuracy of a solution can be controlled in Genetic Algorithm? 3

(d) What is elitist GA? 2

6. (a) Find the *mgu* of the following:
{P(y, y, B), P(z, x ,z)}

4

(b) Convert the following into clause form.

6

If something is a brick, then it is on top of something which is not a pyramid, and nothing is on it that it is also on, and it is not the same thing as anything other than a brick.

(c) Consider the following facts:

1. Every child loves every candy.
2. Anyone who loves some candy is not a nutrition fanatic.
3. Anyone who eats any pumpkin is a nutrition fanatic.
4. Anyone who buys any pumpkin either carves it or eats it.
5. John buys a pumpkin.
6. Alpenliebe is a candy.

Use resolution to prove: If John is a child, then John carves some pumpkin.

10

7. (a) Write down the differences between monotonic reasoning system and non-monotonic reasoning system.

4

(b) What are the components of non-monotonic reasoning system?

2

(c) Comment on space requirement of Truth Maintenance System.

3

(d) Define fuzzy set. Why is membership function needed in fuzzy logic? Discuss on various types of membership functions and give one real life example of each of them.   2+3+6

8. (a) Discuss on AND-OR graph and its applicability to Game Playing Program.   10

(b) Write short note on: Control strategies for resolution refutation method and their limitations.

10