IITJ, III Year (CSE), II Semester
End Semester Examination, 2014
32002:Artificial Intelligence

Duration: 3 Hours Max. Marks 50

Instructions:

a. Attempt all questions.

b. Every answer should be detailed, and supported with sufficient logic for justification.

Questions:

1. Solve the *Towers of Hanoi* problem using DFS (depth first search), and find out the space and time complexity for $n = 4$ disks. (5)

2. Show that: (3,2,2)

   (a) During the execution of the A^* algorithm, there is always a node in the open list, that lies on the path to the goal.

   (b) If there exits a path to the goal, A^* algorithm will terminate after finding the path of to goal.

   (c) If there is no solution, A^* will explore the whole graph.

3. (a) Prove that if a heuristic is consistent (monotonic), it can never overestimate the cost to reach the goal (i.e., admissible). Construct an admissible heuristic that is not consistent. (3)

   (b) Is there a danger of Local maximum in GA? How does GA tries to avoid it? (3)

   (c) What are the data structures used to implement the *open* list in BFS, DFS, Best first search? Justify your answer. (3)

4. (a) Apply alpha-beta search (from left to right) to the game tree in figure 1. Show the backed-up value of each node. Mark with an X any branches that are not searched. Identify these as alpha / beta cut-offs. Mark the best move with an arrow from root node. (5)

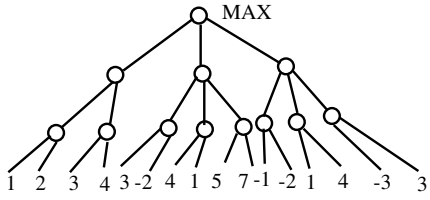

Figure 1: game-tree.

   (b) Consider the min-max tree shown in the figure 2, whose leaves are labeled with natural numbers; n and m are variables. (3,3)

      i. Assign values to n and m such that, to compute the value at the root node, no alpha-beta cut is possible. Compute the value of the root node.

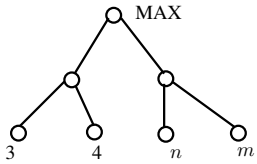

Figure 2: Min-max tree.

ii. Assign values to n and m such that, to compute the value at the root node, an alpha-beta cut is possible. Indicate the cut and compute the value of the root node.

5. Consider a wall-to-wall dirty carpet in a drawing room, free of obstacles. It is required to vacuum clean by an intelligent robot-driven vacuum cleaner. Draw the path taken by the vacuum cleaner as accurately as you can. Explain it with reference to any of the form of planning you have studied. (5)

6. Give a precise formulation for each of the following as constraint satisfaction problems:

   (a) Rectilinear-floor planning: find non-overlapping places in a large rectangle for a number of smaller rectangles. (4)

   (b) Class-Scheduling: There is a fixed number of professors and classrooms, a list of classes to be offered, and a list of possible time slots for classes. Each professor has a set of classes that he or she can teach. (4)

7. In high-level languages, the parse-tree of each statement is used to construct intermediate code, thus implementing the compilation process. Suggest, how such an approach can be used for natural language translation. What will be the difficulties, if any, and how they can be resolved? (5)