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MANIPAL INSTITUTE OF TECHNOLOGY
(Constituent Institute of Manipal University)
MANIPAL-576104

SEVENTH SEMESTER B.E.(CSE) DEGREE END SEMESTER EXAMINATION
DEC. 2013
ARTIFICIAL INTELLIGENCE(ELECTIVE-III) (CSE 423)
DATE: 13-12-2013

TIME: 3 HOURS MAX.MARKS: 50

Instructions to Candidates

- Answer **any five** full questions.

1 A. What do you mean by a partially observable environment? Explain with an example.
1 B. An agent performing an episodic task is considered as performing a simpler task. Why? Explain with an example.
1 C. A goal based agent with an explicit goal can reason about its actions to achieve the goal. How this is made possible in contrast to condition-action rules of a reflex agent. Then, what are the additional details incorporated in goal based agent design. (3 + 3 + 4)

2A. Consider a search tree with depth 4 and branching factor 2. Suppose there are three goal states at level 4 named G_1, G_2 and G_3.

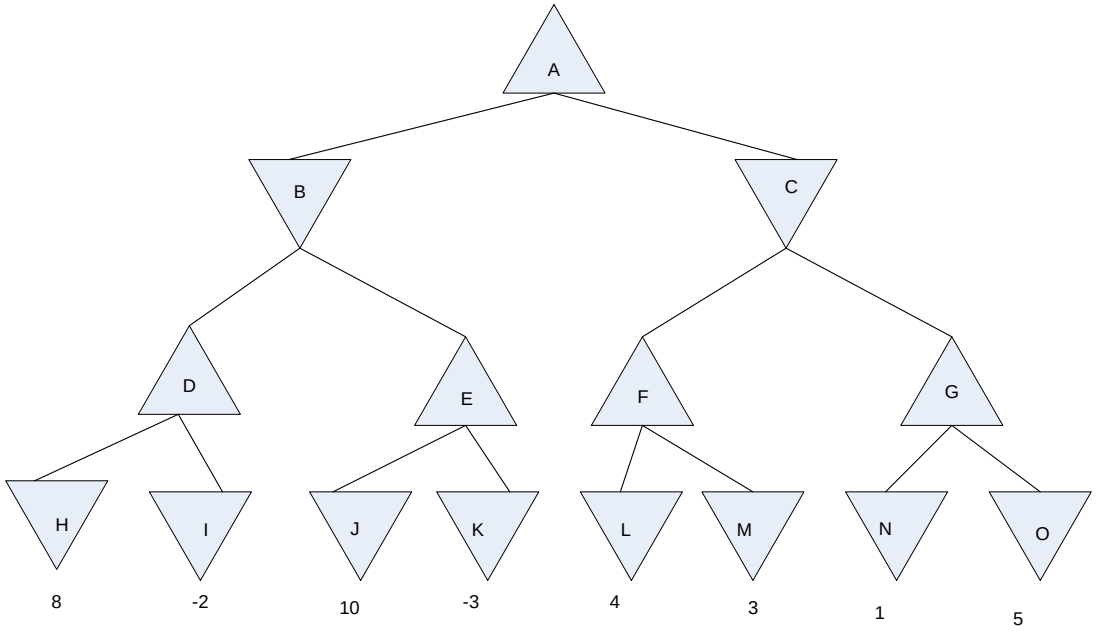
i) Show pictorially how do you make Bi Directional Search (BDS) work when there are three goal states?
ii) What is the limitation of your approach?
iii) Work out the time complexity for BDS and derive the total number of nodes generated with d = 4 and b= 2 considering both searches are breadth first search.

2.B. The environment of Problem Solving Agent is the simplest. What are the characteristics of environment leading to simpler agent design?
2 C. Consider a vacuum cleaner problem with its percepts [location, status] where location is {A, B} and status is {dirty, clean} and actions {L, R, S} denoting left, right and suck. Assume that the agent is initially in square A which is dirty and square B is clean. The goal state describes both squares A and B as clean and the agent is in square B. Draw the state space graph denoting agent by "X" and dirt by "–". Based on the state space graph, answer the following questions

i) How many states are there in this state space graph?
ii) What is the result of action sequence { R, S, L}
iii) How many steps are required to reach the goal state and what is the action sequence?

(3+3+(1*4))

3A. Show that the breadth first search can be treated as a kind of A* algorithm.
3B. The following tree represents all possible outcomes of a hypothetical zero-sum game. MAX nodes are represented by triangles and MIN nodes by inverted triangles Perform minimax on the game tree shown below. Show the assigned utility functions to all states in the search tree. What move should be chosen by A? Comment on time and space complexity of minimax algorithm.



3C. Define planning as a search problem. (2+4+4)

4A. Show that Modus Ponens is sound for propositional calculus. Use truth tables to enumerate all possible interpretations.
4B. Suppose KB = {(P ^ Q) , (P=>R) , (Q ^ R) => S)}. Prove S by i) inference rules and ii) resolution
4C. Consider a vocabulary with the following symbols: *Occupation(p,o)*: Predicate denoting Person *p* has Occupation *o*. *Doctor, Surgeon, Lawyer* are constants denoting occupations. *Joy* is a constant denoting person. Using these symbols write the following assertions in first order logic.

i) Joy is either a surgeon or a lawyer. ii) Joy is a doctor, but he also holds another job
iii) All surgeons are doctors (2+(2+3)+3)

5A. Use first order logic and represent the knowledge by categories that "Vowels and consonants make up the English alphabet". Associate exhaustive decomposition, disjoint and partition for the categories and state a sentence for each of these in first order logic.
5B. Discuss on the working of a decision theoretic agent describing each of the steps involved while selecting rational actions.
5C. State the Bayesian network specification as a model for representing knowledge in an uncertain domain. Illustrate with an example. (3+4+3)

6A. What is meant by knowledge engineering? Illustrate the knowledge engineering process by means of a block diagram.
6B. Distinguish between fuzzy truth values and probability values under the following headings: additvity, uncertainity.
6C. By means of three learning concepts, discuss caching as an example of rote learning.
((1+2)+(2*2)+3)

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