EASTERN UNIVERSITY, SRILANKA

DEPARTMENT OF MATHEMATICS

THIRD EXAMINATION IN SCIENCE –2008/2009

FIRST SEMESTER (Jun. /Aug. 2011)

CS 304 – ARTIFICIAL INTELLIGENCE

(PROPER & REPEAT)

Answer all questions **Time allowed: 02 hours**

01.

i. Explain various characteristics of AI (Artificial Intelligence).

ii. What is an intelligent agent? Give any four characteristics of agent.

iii. Briefly explain the structure of intelligent agent.

iv. What do you mean by Turing Test in AI?

v. Briefly explain the goals of AI.

02.

i. Define in your own words the following terms:

   a) State

   b) State Space

   c) Search tree

   d) Goal

   e) Successor function

ii. Write whether each statement in true (T) or false (F), and provide a short explanation.

   a) Uniform cost search is a special case of Breadth first search.

   b) Breadth first search, Depth first search and Uniform cost search are special cases of Best first search.

   c) A* search is a special case of Uniform cost search.

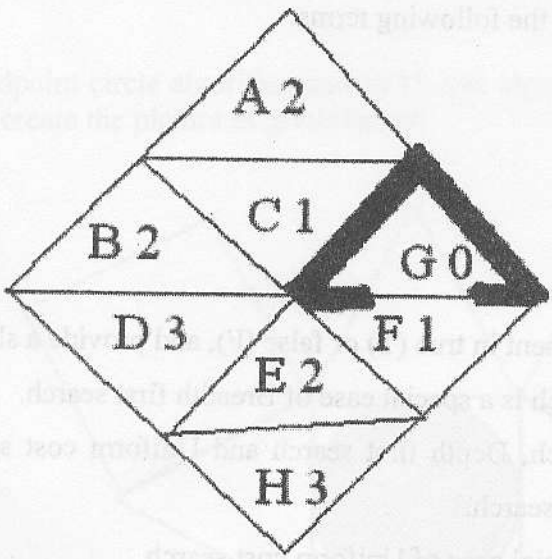
iii. Three jealous husbands and their wives need to cross a river. They find a small boat that can contain no more than two persons. Find the simplest schedule of crossings that will permit all six people to cross the river so that none of the women shall be left in company with any of the men, unless her husband is present. It is assumed that all passengers on the boat unboard before the next trip and at least one person has to be in the boat for each crossing.

a) Formulate this puzzle as search; that is, give a state space representation, start state, goal state, and operators. Show how you would use it to encode the start state and goal state.

b) Solve the above problem using search (any method of your choice). Draw the search tree and show the final solution.

iv. Consider the following path-finding problem. One can move from one small triangle to another if they share a vertex (e.g., *A* can go to *B* and *C*). However, the goal *G* can only be accessed from *F*. The actual cost of each move is as follows:

- A move down one level (e.g. A → C or B → E) costs 1.
- A move sideways on the same level (e.g. C → B or E → F) costs 2.
- A move up one level (e.g. B → A or C → A) costs 3.



Show your search tree, and ***circle*** states that are expanded. What is the *cost* of your solution path?

03.

i. Briefly describe the evaluation search strategies.

ii. Why search is necessary in problem solving.

iii. Write short notes on the following topics;

a) Best First Search

b) A* Search

iv. Write down the time complexity and the space complexity for each of the following algorithm, assuming a constant branching factor of size b and that a goal exists at depth d in the tree. Express your answer in big O notation.

a) Breadth First Search

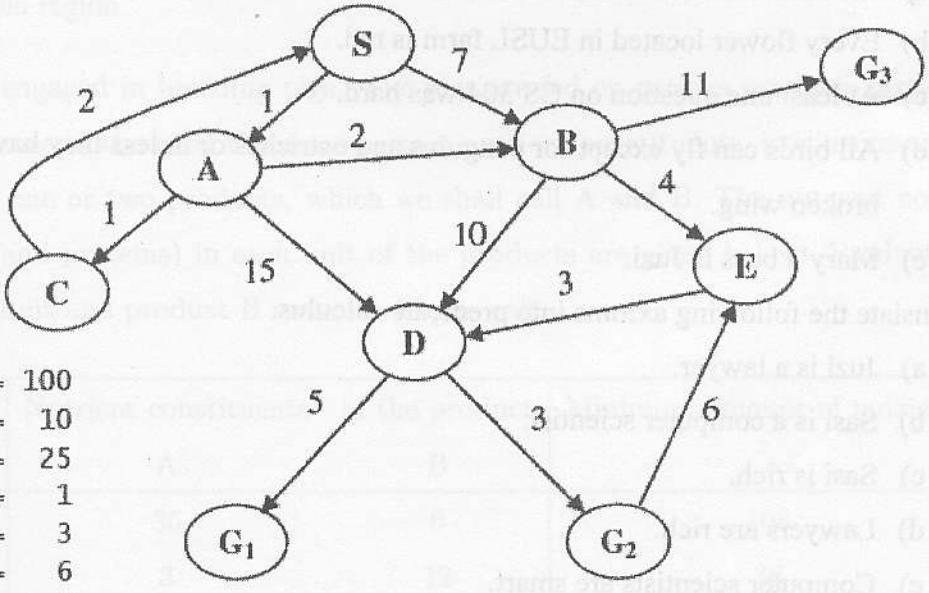
b) Depth First Search

c) Iterative Deepening Search

d) Uniform Cost Search

e) A* Search

v. Consider the search space below, where *S* is the start node and *G1*, *G2*, and *G3* satisfy the goal test. Arcs are labeled with the cost of traversing them and the *h* function's values are reported beside the graph.



h(S) = 100
h(A) = 10
h(B) = 25
h(C) = 1
h(D) = 3
h(E) = 6
h(G1) = 0
h(G2) = 0
h(G3) = 0

Find the Optimal path using the following search strategies:

a) Best First Search,

b) A* Search,

c) Iterative Deepening Search.

04.

i. Represent each of these sentences in propositional logic.

a) If I take CS, I cannot take Mathematics.

b) I must take either CS or Mathematics but not both.

c) I must take at least two of CS304, CS303 and CS353.

ii. For each of the following well-formed formulae, use truth tables to show whether it is valid, satisfiable. Or unsatisfiable

a) $P \rightarrow Q) \wedge (P \rightarrow \sim Q)$

b) $(P \rightarrow Q) \wedge P \rightarrow R) \wedge (\sim Q \rightarrow \sim R) \wedge P$

c) $(P \rightarrow Q) \vee (Q \rightarrow P)$

d) $(P \rightarrow Q) \rightarrow (Q \rightarrow R) \leftrightarrow (P \rightarrow R)$

iii. Represent each of these sentences in first- order predicate logic (FOP)

a) All basketballs are made of rubbers.

b) Every flower located in EUSL farm is red.

c) At least one question on CS 304 was hard.

d) All birds can fly except for penguins and ostriches or unless they have a broken wing.

e) Mary's boss is Juzi.

iv. Translate the following axioms into predicate calculus.

a) Juzi is a lawyer.

b) Sasi is a computer scientist.

c) Sasi is rich.

d) Lawyers are rich.

e) Computer scientists are smart.

f) Lawyers have nice cars.

g) Smart, rich people have nice cars.

v. Perform the unification and inferences necessary to prove **Juzi has a nice car.**