EASTERN UNIVERSITY, SRILANKA

DEPARTMENT OF MATHEMATICS

EXTERNAL DEGREE EXAMINATION IN SCIENCE –2008/2009

THIRD YEAR FIRST SEMESTER (Dec.Jan, 2012/2013)

EXTCS 304 – ARTIFICIAL INTELLIGENCE

(PROPER)

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

Q1

(i) Describe what is meant by Artificial Intelligence and state clearly what is meant by Agent in relation to Artificial Intelligence.

(ii) Describe Medical Diagnosis system as an *agent* in terms of its *percepts, actions, goals, and environment.*

(iii) Describe a *State Space Search* algorithm and explain how it works with the aid of a suitable example.

(iv) Three cannibals and three missionaries must cross a river by a small boat that can only hold at most two people. If the cannibals outnumber the missionaries, on any side of the river, the missionaries are in trouble. Each missionary and each cannibal can row the boat. Find a schedule of crossings that will permit all the missionaries and cannibals to cross the river from the left bank to the right bank safely.[Hint: The state should indicate the number of cannibals, number of missionaries are 'this' side and where the boat is, Initial State (3C, 3M, B), Goal State (0,0,_).

Q2.

(i) Briefly Describe the *Evaluation Search Strategies*.

(ii) Discuss briefly why search is necessary in problem solving?

(iii) Consider the 3-puzzle problem, which is a simpler version of the 8-puzzle where board is 2 × 2 and there are three tiles, numbered 1, 2, and 3. There are four mov move the *blank* up, right, down, and left. These moves are applied, when possible this order for all uninformed searches and in case of sibling ties for other search The start and goal states are

Start

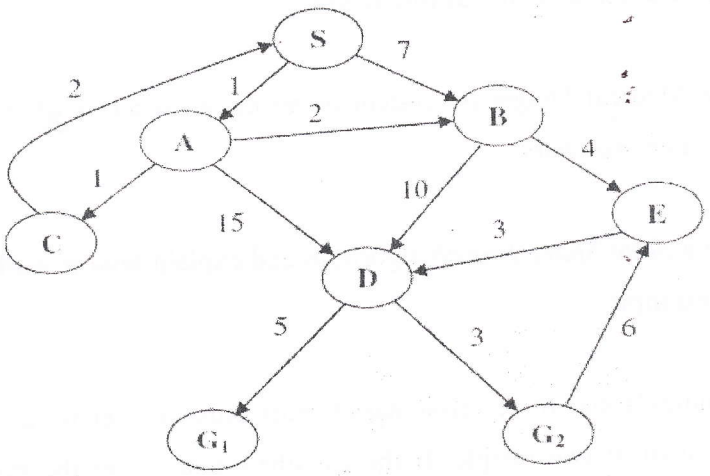
2	
1	3

Goal

1	2
3	

Draw the entire state space for this problem, labeling nodes and arcs clearly.

(iv) Consider the search space below, where *S* is the start node and G_1, and G_2 satisfy goal test. Arcs are labeled with the cost of traversing them.



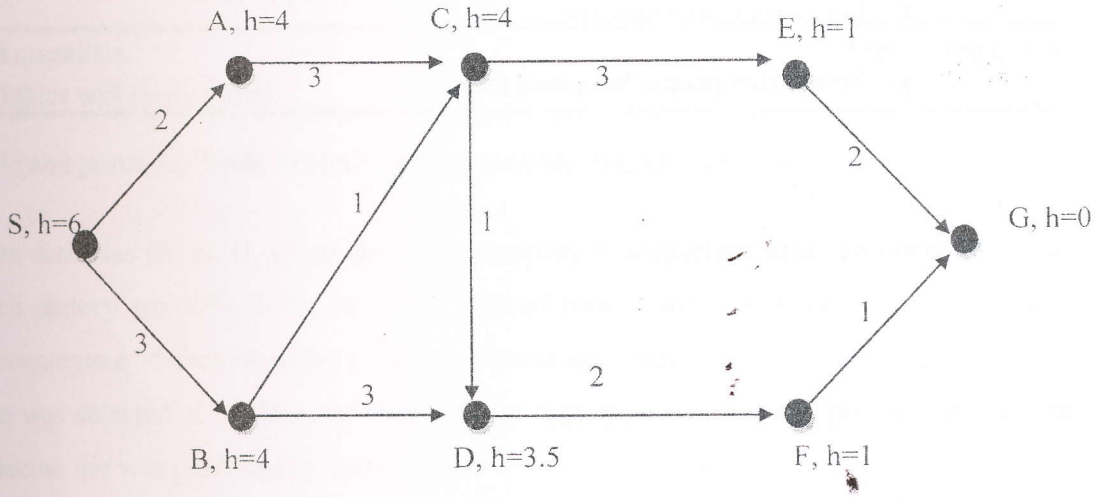
Find the optimal path using the best first search:

Q3

(i) Describe *Uniform Cost Search operation* with the aid of a suitable example.

(ii) Briefly explain A* search algorithm.

(iii) Use the Uniform Cost Search and A* algorithm on the graph below to find the shortest path from node S to node G. Each node is labeled by a capital letter and the value of a heuristic function. Each edge is labeled by the cost to traverse that edge.



(iv) Comment on the above algorithm based on the exercise of part(iii).

Q4.

(i) Describe the *Clause Form* algorithm.

(ii) Represent each of the following sentences in propositional logic:

a. If one has a fever, one should not go to work;

b. It is hot but not sunny.

(iii) By using truth table, prove that whether the following well-formed formulae, **valid, satisfiable, or unsatisfiable:**

a. $(P \rightarrow Q) \wedge (P \rightarrow \neg Q)$

b. $(\neg P \vee \neg Q) \wedge (\neg Q \vee \neg R) \wedge (\neg R \vee \neg P) \wedge P \wedge Q$

c. $((P \rightarrow Q) \wedge (Q \rightarrow R)) \leftrightarrow (P \rightarrow R)$

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

(iv) Translate each of the following axioms into predicate calculus expression and prove that Peter has a nice car using unification and inferences.

a) Peter is a Lecturer;

b) Mary is a Mathematician;

c) Mary is rich;

d) Lecturers are rich;

e) Mathematicians are smart;

f) Lecturers have nice cars;

g) Smart, rich people have nice cars.