EASTERN UNIVERSITY, SRILANKA

DEPARTMENT OF MATHEMATICS

SPECIAL REPEAT EXAMINATION IN SCIENCE –2007/2008

THIRD YEAR, FIRST AND SECOND SEMESTER (Feb, 2010)

CS 304 – ARTIFICIAL INTELLIGENCE

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

Q1

(i) Describe the following terms using suitable examples:

a. Agents;

b. Rational Agent;

c. Intelligence.

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

(iii) What is *State Space Search*? Describe the *State Space Search* algorithm.

(iv) A farmer has a goat, a wolf and a cabbage on the west side of a river. He wants to get all of his animals and his cabbage across the river onto the east side. The farmer has a row boat but he only has enough room for himself and one other thing. The wolf will eat the goat if they are left together alone. The goat will eat the cabbage if they are left together alone. How can the farmer get everything on the east side?

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.

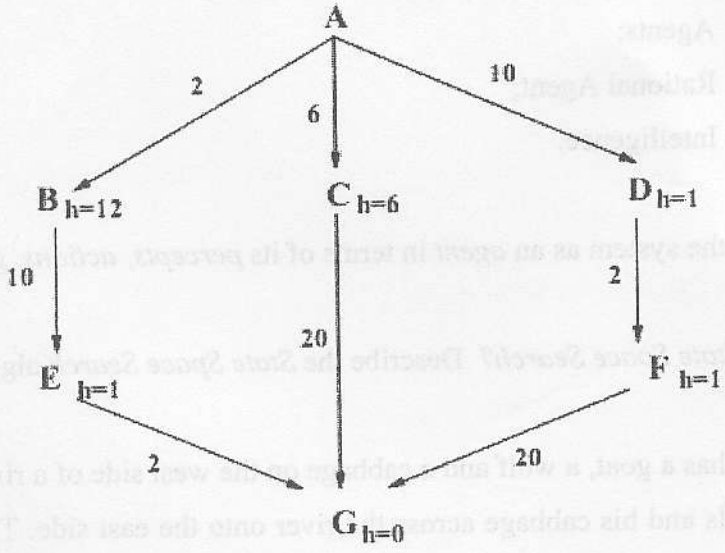
Q2.

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

(ii) Give *Breath First Search* algorithm with suitable control flow diagram and describe the terms *complete* and *optimal* with regard to evaluating search strategies.

(iii) What is the worst – case time and space complexity of the *Breadth First Search* and *Depth First Search* algorithm?

(iv) Consider the search space below, where A is the start node and *G* satisfies the goal test. Where Arcs are labeled with the cost of traversing them and *h* function's values.



Find the optimal path using the following search strategies:

a. Depth First Search;

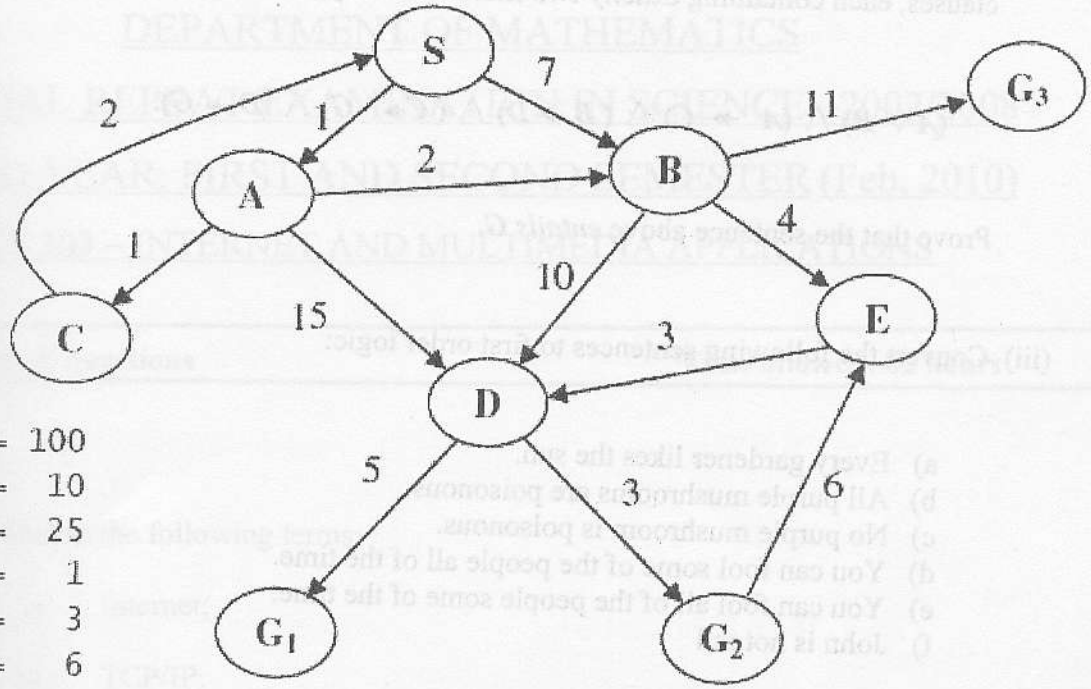
b. Breadth First Search;

c. Hill Climbing (using the *h* function only).

Q3

i. Using an example, describe *Uniform Cost Search operation*?

ii. Consider the search space below, where *S* is the start node and G_1, G_2, and G_3 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. Hill Climbing

(iii) Explain the relationship between the *A** algorithm and the *Uniform Cost Search* algorithm?

Q4.

(i) Describe the ***convert to Clause Form*** algorithm.

(ii) Consider the following propositional expression, which is defined as a conjunction of clauses, each containing *exactly* two literals, namely,

$$(A \vee B) \wedge (A \rightarrow C) \wedge (B \rightarrow D) \wedge (C \rightarrow G) \wedge (D \rightarrow G).$$

Prove that the sentence above *entails* **G.**

(iii) Convert the following sentences to first order logic:

a) Every gardener likes the sun.
b) All purple mushrooms are poisonous.
c) No purple mushroom is poisonous.
d) You can fool some of the people all of the time.
e) You can fool all of the people some of the time.
f) John is not tall

(iv) Demonstrate that the *universal quantifier* and the *existential quantifier* can each be written using the other. A couple of examples are fine.

(v) Consider the following statements.

All cats like fish, cats eat everything they like, and puppy is a cat.

a) Translate the sentences into FOL.
b) Convert the sentences into clausal normal form.
c) Prove that "***puppy eats fish***" using resolution refutation method.