



EASTERN UNIVERSITY, SRILANKA

THIRD EXAMINATION IN SCIENCE –2007/2008

FIRST SEMESTER (Dec. /Jan. 2008)

CS 304 – ARTIFICIAL INTELLIGENCE

(PROPER & REPEAT)

Answer all questions

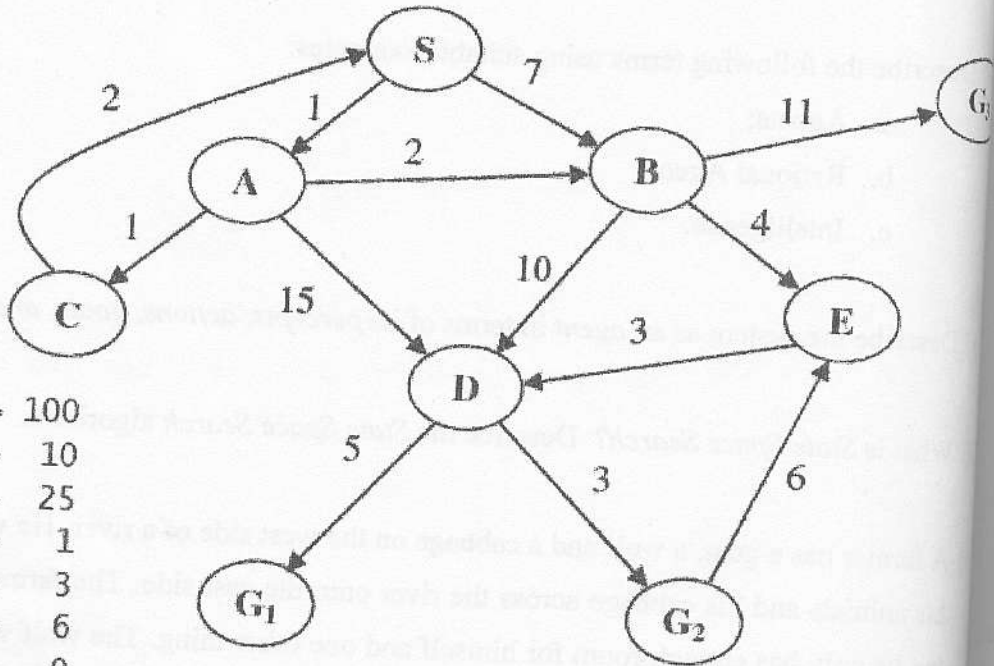
Time allowed: 02 hours

Q1

- (i) Describe the following terms using suitable examples:
- Agents;
 - Rational Agent;
 - 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?
- 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.
 - 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 *Depth First Search* algorithm with suitable control flow diagram and describe 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 *First Search* algorithm.
- (iv) Consider the search space below, where S is the start node and G_1, G_2 , and G_3 satisfy goal test. Arcs are labeled with the cost of traversing them and h function's value reported besides the graph:



- $h(S) = 100$
- $h(A) = 10$
- $h(B) = 25$
- $h(C) = 1$
- $h(D) = 3$
- $h(E) = 6$
- $h(G_1) = 0$
- $h(G_2) = 0$
- $h(G_3) = 0$

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).

Strai

A

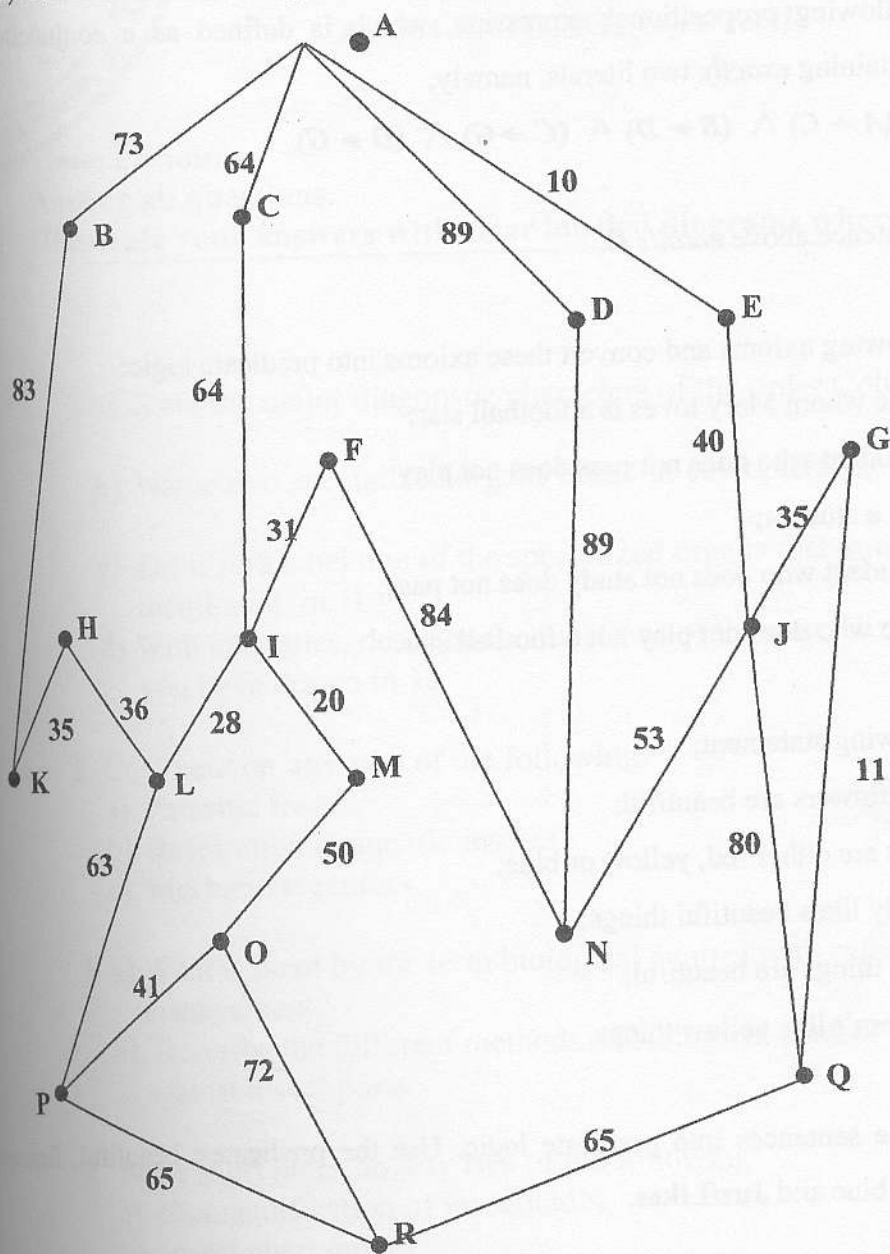
B

C

D

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

(ii) Consider the following map (not drawn to scale):



Using the A^* algorithm, work out a route from A to R, using the following cost functions

$g(n)$ = the distance between each town (shown on map);

$h(n)$ = the straight line distance between any town and town R. These distances are given in the table below.

Straight Line Distance (SLD) to R

A	240
B	186
C	182
D	163
E	170

F	150
G	165
H	139
I	120
J	130

K	122
L	104
M	100
N	77
O	72

P	65
Q	65
R	0

(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) Consider the following axioms and convert these axioms into predicate logic:

- Anyone whom Mary loves is a football star;
- Any student who does not pass does not play;
- John is a student;
- Any student who does not study does not pass;
- Anyone who does not play is not a football star.

- (iv) Consider the following statement:

- All red flowers are beautiful;
- Flowers are either red, yellow or blue;
- **Juzi** only likes beautiful things;
- No blue things are beautiful;
- **Juzi** doesn't like yellow things.

a) Translate the sentences into predicate logic. Use the predicates: beautiful, flower, red, yellow, blue and **JuziLikes**.

b) Convert your sentences into *Clausal Normal Form* (CNF).

c) Show with *resolution* that if **Juzi** likes a flower, then it is red.