

- d) Model 'young man' using suitable membership function.  
Then graphically represent 'very young' and 'yet young'.

5

8. Write short notes on : 10+10

- a) Control strategies for resolution refutation systems.  
b) Drawbacks of Hill climbing algorithm.

\_\_\_\_\_x\_\_\_\_\_

# BACHELOR OF COMP. Sc. ENGG. FINAL EXAMINATION, 2009

(4th Year, 1st Semester)

## ARTIFICIAL INTELLIGENCE

Time : Three hours

Full Marks : 100

Answer any *five* questions.

1. a) What is 'AI' ? Discuss on 'weak AI' and 'strong AI'. What is an agent ? How can we visualize an agent as search process ?  
b) Describe the criteria for evaluating search strategies.  
(3+4+3+5)+5
2. a) Derive space and time complexity of iterative deepening search. Why this search process is called an optimal one ?  
6+4

b)

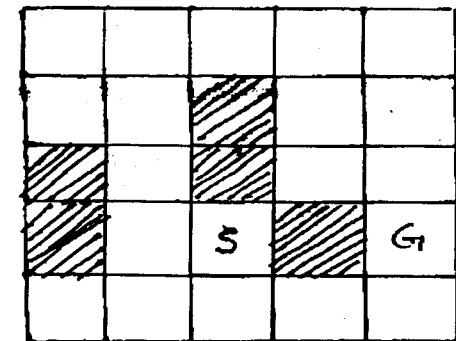


Figure 1

[ TURN OVER ]

( 2 )

Consider the maze shown in Fig. 1. S is the initial state at location (3, 2) and G is the goal state at location (5, 2). Dark squares are blocked cells. Consider that same state will be visited only once. The next state is expanded in the following fixed order : North, West, South, East.

- i) Draw the search tree using breadth first search (BFS). Represent each node using its (x, y) co-ordinates. Number the nodes in the order visited by BFS.
  - ii) For this particular problem, find out the order of nodes searched using iterative deepening (ID).
  - iii) Assume that a move has an associated cost, namely North has cost 2 and other moves have cost 1. What is the order in which nodes are visited using uniform cost search (UCS). 4+3+3
3. a) Compare and contrast blind search and heuristic search.
- b) If the search space contains local minima, what will happen if greedy search with admissible heuristic is used?
- c) Let  $f(n) = (1 - \alpha) g(n) + \alpha h(n)$  where,  $0 \leq \alpha \leq 1$ . Show that if  $h(n)$  is admissible, then the search is still admissible for  $0 \leq \alpha \leq \frac{1}{2}$ .
- d) Discuss the advantages of using  $IDA^*$  over  $A^*$  search. What is the worst case complexity of number of examination of nodes of a N-node tree using  $IDA^*$  search. 4+4+4+8

( 5 )

- iii) A computer system is intelligent if it can perform a task, which if performed by a human, required intelligence. 2+2+3
- b) Find the mgn of the following :  
 $\{ P(y, y, B), P(z, x, z) \}$  3
- c) Consider the following sentences :  
John likes all kinds of foods.  
Apples are food.  
Chicken is food.  
Anything anyone eats and is not killed by is food.  
Bill eats eggs and is still alive.  
Mary eats everything Bill eats.  
— Use resolution to answer the question "what food does Mary eat" ? 10
7. a) What are the components of non-monotonic reasoning system ? Discuss on 'dependency directed backtracking'. Discuss on space requirement of Truth maintenance system. 2+2+2
- b) What type of information (about an information/node) you can obtain by looking at the SL-justification part ? 4
- c) Write notes on cardinality of a fuzzy set and concentration of a fuzzy set. 5

[ TURN OVER ]

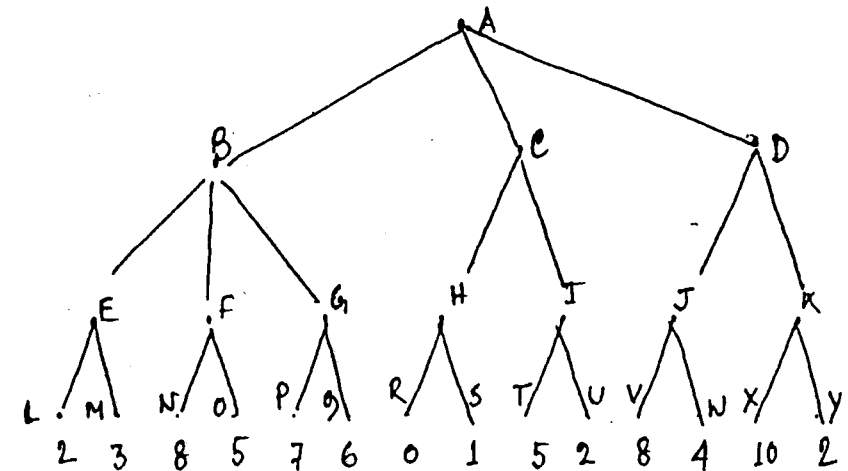
( 3 )

4. a) If you use an admissible heuristic, are the search space visited by hill climbing and best first search the same ? If you, why ? If no, justify or give an illustrative counter example.
- b) What happens when the temperature is cooled too quickly in Simulated Annealing ? What about too slowly ?
- c) How the accuracy of a solution is controlled in genetic algorithm (GA) ? "In GA, crossover and mutation probabilities are chosen in the range 0.6 to 0.9 and 0.005 to 0.01, respectively" — Justify.
- d) Explain how GAs differ from conventional mathematical methods for optimization.  $4+4+(4+4)+4$
5. a) In Tower of Hanoi problem, you are given three pegs and three disks which are initially stacked in increasing size on the left peg. The object of the problem is to recreate the stack on the right peg while observing two restrictions : you can only move one disk at a time and a larger disk can never be placed on top of a smaller disk.
- What are the possible states after 3 moves ?
  - Find out the optimal solution.
  - State one admissible heuristic for this problem.

[ TURN OVER ]

( 4 )

- b) Consider the following game tree, and assume that the first player is the MAX one.



- Which move should the first player choose ?
  - Which nodes will be pruned using  $\alpha - \beta$  pruning algorithm ?  $(4+4+4)+(3+5)$
6. a) Represent the following sentences by predicate calculus WFFS.
- There is a woman who likes all men who are not vegetarians.
  - There is a student who is loved by every other student.