Ref. No. : Ex/IT/T/326C/2017

BACHELOR OF ENGINEERING IN INFORMATION TECHNOLOGY

3rd YEAR 2nd SEMESTER EXAMINATION, 2017

Artificial Intelligence

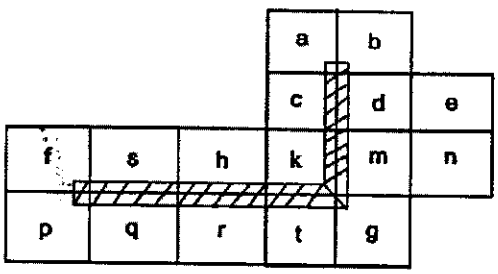
Time: 3 Hours Full Marks: 100

Answer any FIVE (20 x 5 = 100)

1. Justify each of the following statements: 5x4=20
   A) Breadth first search is a special case of uniform cost search.
   B) Breadth first search and depth first search are special cases of best first search.
   C) Uniform cost search is a special case of A* search.
   D) No search method that makes use of heuristic functions can guarantee to find the shortest path from start to goal.

2. 8+4+4+4 = 20
   A) If h1(s) and h2(s) are both admissible heuristic functions, which one of the following is also admissible?
      1) h3(s) = h1(s) + h2(s)
      2) h3(s) = | h1(s) – h2(s) |
      3) h3(s) = max (h1(s), h2(s))
      4) h3(s) = min (h1(s), h2(s))

      For those cases, where h3(s) is not admissible, show a counter example.
   B) In the following maze, the successors of a cell include any cell directly to the east, south, west or north of the current cell except that no transition may pass through the central barrier. The search problem is to find a path from s to g. Assume that you always try to expand East first, then South, then West, then North.
      i) You decide to use a Manhattan distance heuristic function, where h(state) = shortest number of steps from state to g if there were no barriers. Is this heuristic function admissible?
      ii) Assume that you use best first greedy search using heuristic h (a version that never reexplores the same state twice). Find out all the states expanded, in the order they are expanded, until the algorithm expands the goal state.
      iii) Assume you use A* search with heuristic h. and run until it terminates using the conventional A* termination rule. Find all the states expanded, in the order they are expanded.



3. 10+4+6 = 20
   A) Give the initial state, goal state, successor function and cost function for the following problem. (Choose a formulation that is precise enough).

— A 3 foot-tall monkey is in a room where some bananas are suspended from the 8-foot ceiling. He would like to get the bananas. The room contains two stackable, movable, climbable 3-foot high crates.

B) Illustrate how the operation of an AI production system can be characterized as a search procedure.

C) Write a short note on AI production systems.

4. 5x4=20

A) Why the mutation operator is called a secondary operator in GA? How the accuracy of a solution can be increased in GA?

B) "Genetic Algorithm can be viewed as an implicit parallel search technique" - Explain.

C) Explain with example how genetic algorithm helps to overcome the local optima problem.

D) How the accuracy of a solution is controlled in genetic algorithm?

5. 4+10+6 = 20

A) Write down the differences between propositional logic and first order predicate logic.

B) Consider the following set of facts :

i) Marcus was a mean.
ii) Marcus was Pompeian.
iii) Marcus was born in 40 A.D.
iv) All men are mortal.
v) All Pompeians died when the volcano erupted in 79 A.D.
vi) No mortal lives longer than 150 years.
vii) It is now 2008.
viii) Alive means not dead.
ix) If someone dies, then he is dead at all later times.

Use resolution to answer the question "Is Marcus alive now?".

C) Represent the following sentences by predicate calculus well formed formulas.

(i) Apples and bananas are nourishing.
(ii) If two persons fight over a third one's property, then the third one gains.
(iii) No automobile that is over ten years old will be repaired if it is severely damaged.
(iv) If all dogs are carnivorous, then some animals are carnivorous.

6. 4+5+(3+5+3) = 20

A) Explain how GA differs from conventional mathematical method for optimization?

B) Why in GA, crossover and mutation probabilities are chosen in the range near to 1 and near to 0, respectively.

C) 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.

(i) What are the possible states after 3 moves?
(ii) Find out the optimal solution.
(iii) State one admissible heuristic for the problem.