

M.Sc. Examination 2018
Semester-I
Computer Science
Course : MCSC-15
(Artificial Intelligence)

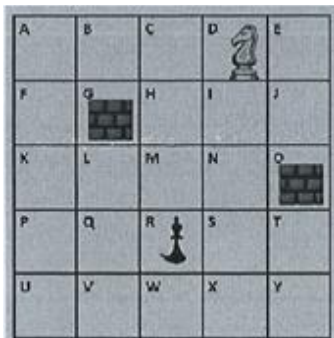
Time : 3 Hours

Full Marks : 40

Questions are of value as indicated in the margin

Answer Question No. 1 and **any four** from the rest.

1. Answer any five questions. 5×2=10
 - a) Express following sentence in FOPL. “*There is a student who is loved by every other student.*”
 - b) How can we evaluate a search strategy?
 - c) Discuss the differences between deterministic and stochastic environment.
 - d) What is a tautology?
 - e) Write down the differences between *inference* and *entailment*.
 - f) What are the advantages of IDA* over A* Search Algorithm?
 - g) Discuss the challenges to develop an intelligent agent for dynamic search environment.
2. In the following figure we have a modified chess board on a 5 x 5 grid. The task is to capture the black king (fixed in square R) by moving the white knight (starting in square D) using only “knight moves” as defined in Chess. Assume the successor function generates legal moves in a clockwise order: (1 right, 2 up); (2 right, 1 up); (2 right, 1 down); (1 right, 2 down); (1 left, 2 down); (2 left, 1 down); (2 left, 1 up); (1 left, 2 up). Note that not all of these moves may be legal from a given square. It is not legal for a knight to move to a square with a wall on it (squares G and O).



- a) Using Depth-First Search, list the squares in the order they are expanded (including the goal node if it is found). Assume that square positions are pushed onto the stack in the clockwise order given above so that when they are removed from Frontier (by popping the stack) the children are visited in counter-clockwise order. State D is expanded first (hint: State M will be examined next). Assume cycle checking is done so that a node is not inserted in the search tree if the grid square position associated with the node occurs somewhere on the path from this node back to the root node.

(2)

Write down the list of states you expanded in the order the solution path found (if any), or explain why no solution is found.

- b) Using Iterative Deepening Search, draw the tree built at each depth until a solution is reached. Use the same ordering for pushing the successors of a node onto the stack as used in (a) and also use the same method for cycle checking as in (a). $5+5=10$

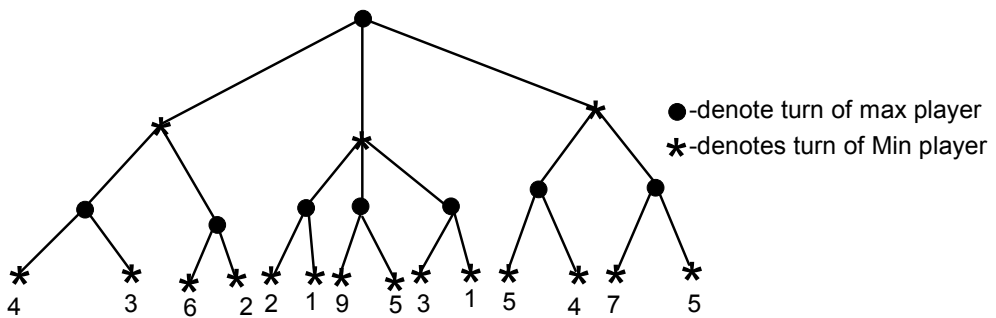
3. Consider the problem of maximizing following function.

$$f(x) = \frac{3x^2}{5} + 9x$$

Develop a Genetic algorithm based solution to solve above stated problem. Following guidelines should be used to develop the solution.

- Binary encoding approach should be used to design the chromosome.
- Population size is 10 and it is fixed.
- Initial population should be constructed randomly.
- Proper parent selection mechanism should be incorporated.
- Single point crossover operator should be used. Probability of the crossover operator is 0.5.
- *Bit flip* operation should be used in the mutation operator. Probability of the crossover operator is 0.3
- Some metric should be used to assess quality of the population.
- Demonstrate the effectiveness of your approach by showing the population up to minimum three generation. 10

4. A partial search tree for a two player game is given below



- a) Find the best move for the MAX player using the minimax procedure.
- b) Using alpha-beta pruning show which parts of the tree do not need to be searched. Indicate where the cutoffs occur. $5+5=10$
5. a) Write down the conditions to unify two predicates $P(t_1, t_2, \dots, t_n)$ and $Q(s_1, s_2, \dots, s_m)$.
- b) Suppose, we have to resolve a query Q from a set of axioms. The set of axioms is $A = \{a_1, a_2, a_3, a_4, a_5, a_6\}$, where

P.T.O.

(3)

- a_1 : If the knife is in the store room, then we saw it when we cleared the store room.
- a_2 : The murder was committed at the basement or inside the apartment
- a_3 : If the murder was committed at the basement, then the knife is in the yellow dust bin.
- a_4 : We did not see a knife when we cleared the store room.
- a_5 : If the murder was committed outside the building, then we are unable to find the knife.
- a_6 : If the murder was committed inside the apartment, then the knife is in the store room.

From the above mentioned axioms resolve following query:

Q: Where is the knife?

2+8=10

6. Imagine that the students of CODECOM (Coding Competition) committee want to hand out fliers about the upcoming programming contest – CODECOM 2019. The student wants to visit the Mathematics(M), Physics(P), Statistics(S), and Integrated Science(I) department to deliver the fliers. The goal is to find a tour as short as possible. The distance matrix between these locations is given as follows:

	M	P	S	I
M	0	0.6	0.9	0.7
P	0.6	0	0.3	0.2
S	0.9	0.3	0	0.4
I	0.7	0.2	0.4	0

Students start applying hill-climbing algorithm from the initial state: $(M - P - S - I)$. Briefly explain your answer for following questions.

- a) What is the next state reached by hill-climbing, or explain why there is no neighboring state.
 - b) When will we know if we should stop or continue the search?
 - c) Will we know if the state is a global optimal solution when we stop? 4+3+3=10
7. Write short notes on following topics (**any two**) : 2×5=10
- a) Simulated Annealing
 - b) SMA*
 - c) Learning Agents
 - d) Bi-Directional Search
 - e) Sematntic Net
