

**CSL 412 - Artificial Intelligence (Slot D)**  
**Mid Semester Examination (October 2020)**

**Time:** 1 hour

**Max. Marks:** 25

Q1 (a) Prove that the A\* search algorithm is optimal for tree search if the heuristic function used is admissible. (2)

(b) What happens if the heuristic function is not consistent and we use A\* for graph search (i.e. we remember the repeated states)? What modifications are required in A\* search if the heuristic function is not consistent and that there are repeated states? (2)

Q2 Give the basic principles that govern the design of the memory bounded A\* (MA\*) algorithm. In which situation, will the MA\* algorithm not be able to find the optimal solution? What is the advantage of MA\* over Recursive Best First Search? (2)

Q3. Trace the operation of the Iterative Deepening Search and A\* search technique using a suitable heuristic applied to 8-tile puzzle. The initial and the goal states are shown below. Find out the total number of nodes generated. At the maximum, how many nodes need to be stored in the fringe list? (5)

2	1	5
3	B	6
4	7	8

Initial State

1	2	3
4	5	6
7	8	B

Goal State

Q4. What are the heuristics used for solving the Constraint Satisfaction Problem? Give algorithms for their computation. What is constraint propagation and how is it helpful? Explain it using an example. Give an algorithm for performing constraint propagation. (6)

Q5. Explain how simulated annealing technique can be used to solve the eight queens problem. Using an example current state, how will you find the neighboring states of a the state? How are probabilities of the neighboring states found out? What is the role of temperature in assigning the probabilities? How is the next state selected? (5)

Q6. Explain how a local search technique be used to solve the CSP. What should we do if the technique is not able to find an assignment to all the variables of the CSP? (3)