

BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Midterm
 Duration: 1 Hour 30 Minutes

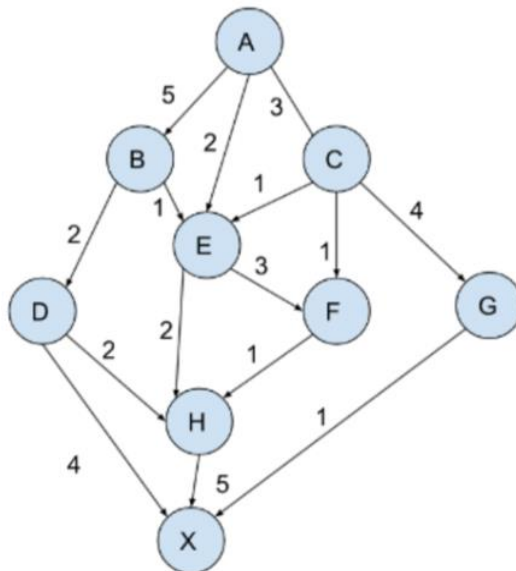
Semester :Summer 2023
 Full Marks: 40

CSE 422: Artificial Intelligence

Answer the following questions.
 Figures in the right margin indicate marks.

Name:	ID:	Section:
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1. CO1
 - a. Using any portion of a random state space graph, illustrate two scenarios showcasing a Local Maxima and a Plateau. You must **explain** with relevant examples. Also, you may assume random values for the objective function of the states. 4
 - b. **Explain** briefly with reasoning which of the following statements are true or false: 3
 - Hill Climbing (steepest ascent) will always work towards the nearest better state whereas Genetic Algorithm may also consider a worse off state.
 - The objective/evaluation function for local search techniques can be both a maximizing or a minimizing function.
 - Hill climbing algorithm allows backtracking.
 - c. Assume 123456 and 789325 represent two chromosomes. **Explain** how you will perform single point crossover and mutation to create 2 new offspring. (Crossover from the middle and you can mutate only 1 gene) 3
2. CO1
 - a. **Find** the maximum possible value of admissible heuristics for each node of the following graph. 5



- b. If a range of heuristic values are given for each node in a graph, which values you should use in A* search to find the most efficient optimal solution? **Justify** your answer 3
 - c. From the definition of consistent heuristic, **show** that $f(n_1) \geq f(n)$ where n_1 is a child of n in A* search tree 2

3. CO2 a.

2	7	6	→15
9	5	1	→15
4	3	8	→15
↙15	↓15	↓15	↘15

The magic square is any 3x3 square where numbers from 1 to 9 are written in such a way that every number occurs exactly once and the sums of all rows and columns and diagonals are exactly 15. In the above picture, you can see one solution for the magic square. But there are many other solutions. Now answer the following questions:

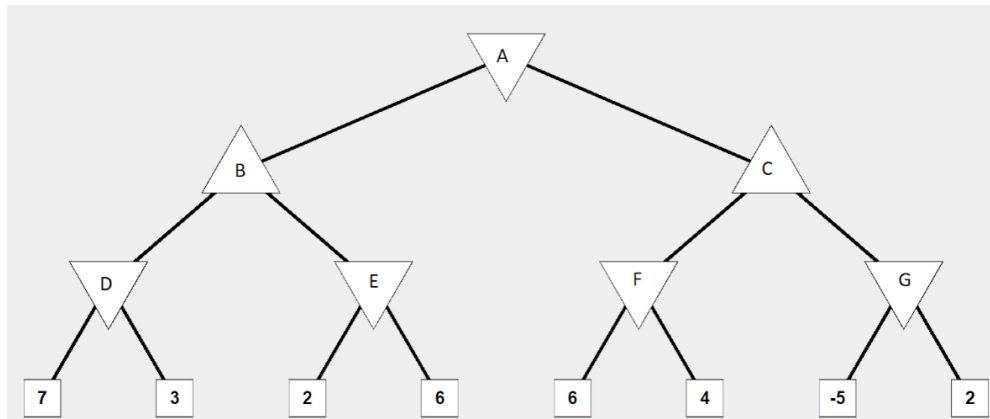
- If the 3x3 square in the above is called A, you can use $A_{i,j}$ to denote the cell in the intersection of the i'th row and the j'th column. **Define** the variables in the square in terms of A.

-**Define** their domains.

-What are the constraints here? **List** them all.

- b. Briefly **discuss** the heuristics used in variable ordering and value ordering while optimizing backtracking to solve Constraint Satisfaction Problems.

4. CO1



- a. For the tree above, **find** the solution using min-max algorithm. Here {A, D, E, F, G} are moves of the minimizing player and {B, C} are the moves of the maximizing player.

- b. **Find** the alpha and beta values for all the nodes if α - β pruning is run on this tree. Which nodes will not be explored after the said pruning? Which branches will be pruned?