

BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Midterm
Duration: 1 Hour 15 Minutes

Semester: Fall 2023
Full Marks: 40

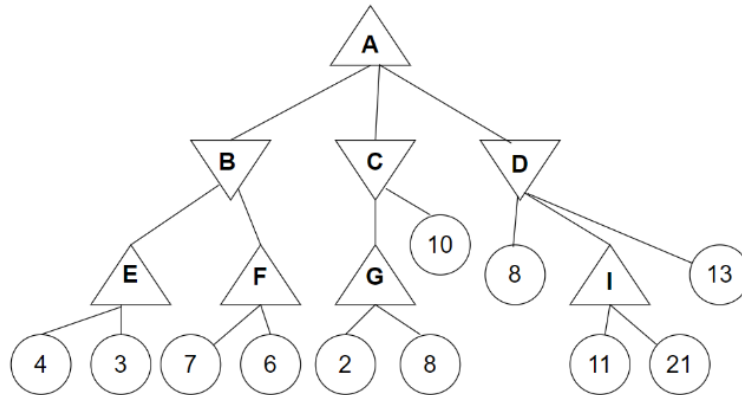
CSE 422: Artificial Intelligence

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

- 1. CO1** Suppose you are asked to generate a set of 4 numbers $[x_1, x_2, x_3, x_4]$ in the range of -10 to 10 where $x_1 * x_2 * x_3 * x_4 = 100$. Now, you have to solve this problem using Genetic Algorithm.
- a. **Encode** the problem and deduce two parent chromosomes, PC1 and PC2. 3
 - b. **Define** a suitable fitness function for the problem and calculate the fitness of PC1 and PC2. 2
 - c. **Illustrate** a single-point crossover at any point you prefer between PC1 and PC2, then perform mutation. You can mutate only two numbers of your choosing. 2
 - d. **Explain** briefly the role of crossover in finding the optimal solution in such types of problems. 3
- 2. CO1**
- a. **Determine** which of the following statements are true or false. Give short reasons behind your answers. 7.5
 - A Goal-based agent is perfectly suited to handle a task with conflicting goals.
 - For simulated annealing, the maximum value for $e^{\Delta E/T}$ is positive infinity.
 - Local Search Algorithms may have a maximizing or a minimizing objective function
 - For simulated annealing to reach the global optima, a thumb rule is to initialize the temperature variable with a very low value and, in every iteration it should be lowered down rapidly.
 - Chess is an example of a deterministic environment.
 - b. **Define** what a plateau is concerning hill climbing. Then using a state space graph present a scenario that depicts a plateau for the 8 puzzle problem. [Do not need to formulate the entire state space. Just show a subset of the state space graph] 2.5
- 3. CO1**
- a. The alpha-beta search algorithm computes the same optimal moves as the minimax algorithm. **Define** if the statement is true or false. and why? 2
 - b. **State** whether in a specific context it is possible that Minimax and alpha-beta pruning search would have the same worst case time complexity? [True/False] 1

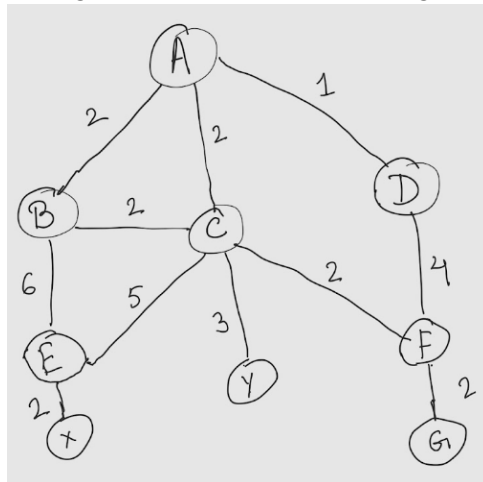
- c. Given the following snippet of state space tree of a two player game, **perform** alpha-beta pruning showing alpha, beta and node values for all the nodes.

7



4.CO1

In the graph below let, A, B, C, D, E, F, G, X, Y denote different states of a problem space, where the edge between the states describes the action, and the number along the edge is the cost of the action to go from one state to another.



Let G be your goal. In the table below we give you the heuristic value to reach G from any given node, n in the graph.

n	A	B	C	D	E	F	X	Y	G
h(n)	5	3	4	5	2	2	1	8	0

- From looking at the graph, **find** the optimal path from A to G (DO NOT USE ANY SIMULATION) and show that the given heuristic for A does not overestimate the actual cost. 1
- For A* algorithm to be optimal, **state** the condition that has to be imposed on the heuristics of the states in this problem. 1
- Check the heuristics for C, Y and D. **Change** the values of the heuristics for these states, so that the optimality condition on heuristic value for A* algorithm on graph search is also satisfied. 4
- Using the given graph and the given values, by simulation, **explain** why the Greedy best search is incomplete. 4

