Set A

BRAC UNIVERSITY

Department of Computer Science and Engineering

Examination: Semester Midterm | Semester: Fall 2024

Duration: 1 Hour 20 Minutes | Full Marks: 40

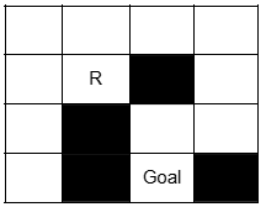
CSE 422: Artificial Intelligence

Answer all the following questions. (**Keep your answers precise and to the point**)

Figures in the right margin indicate marks.

Name:	ID:	Section:

1. CO1 a. In this problem, a (n x m) size room is given and the position of the 'R' robot is given. The robot wants to travel to the goal. It can move to the top, left, bottom, and right adjacent cells (unit cost) which are not black. You are trying to find the shortest path from the R robot's position to the goal cell. The top left of the cell is (1, 1) cell. The goal is (4, 3) cell. [If P1 (x1, y1) and P2 (x2, y2) are two points then the Manhattan distance between those two is |x1 - x2| + |y1 - y2|]



Show the simulation of A* search algorithm (graph search version) with Manhattan distance as a heuristic. Show nodes with costs in the fringe at each step until the goal is removed from the fringe. 7

b. Suppose you have three heuristic functions h1, h2 and h3. Among these h1 and h2 are admissible but h3 is inadmissible. You have decided to create several new heuristic functions defined as follows:

- h4(n) = 0
- h5(n) = 2 × h2(n)
- h6(n) = (h1(n)+h2(n))/2
- h7(n) = max(h1(n), h2(n))
- h8(n) = min(h1(n), h3(n))
- h9(n) = max(h2(n), h3(n))

Now answer the following questions and **justify**. 3

- Which two heuristics are possibly inadmissible?
- Among h6 and h7 which one is dominant?
- In your opinion which heuristic is the best?

2. CO1 You are tasked with designing a seating arrangement for a wedding reception with 8 guests. The guests have specific preferences about whom they would like to sit next to and whom they want to avoid. You need to create a seating arrangement for these guests around a circular table. Depending on the guests' preferred seating arrangements, the aim is to optimize their level of satisfaction. Consider the following constraints:

- Guest 1 (G1) prefers to sit next to Guest 2 and Guest 3 but wants to avoid Guest 4.
- Guest 2 (G2) prefers to sit next to Guest 1 and Guest 4 but wants to avoid Guest 5.
- Guest 3 (G3) prefers to sit next to Guest 1 and Guest 6 but wants to avoid Guest 7.
- Guest 4 (G4) prefers to sit next to Guest 2 and Guest 5 but wants to avoid Guest 8.
- Guest 5 (G5) prefers to sit next to Guest 4 and Guest 6 but wants to avoid Guest 1.
- Guest 6 (G6) prefers to sit next to Guest 3 and Guest 5 but wants to avoid Guest 2.
- Guest 7 (G7) prefers to sit next to Guest 8 but wants to avoid Guest 3.
- Guest 8 (G8) prefers to sit next to Guest 7 but wants to avoid Guest 4.

Answer the following questions based on the scenario above.

a. Encode the problem and **create** four parent chromosomes. 3

b. **Suggest** a possible fitness function and choose the two fittest Chromosomes. You may provide answers either in a mathematical form or a descriptive manner. 4

c. Do you think the regular crossover (as in the n-queen problem) will work in this scenario? If not, briefly **explain** why. 2

d. **Suggest** a possible case of mutation in this context. 1

3. CO1 **Determine** if the statements below are True/False. Justify your answers.

a. In hill climbing search sideways moves on the shoulder (Plateau) increases the probability of finding global optimal. 2.5

b. Simulated Annealing does not require knowledge of the entire search space to work effectively. 2.5

c. Hill climbing algorithm cannot explore the search space exhaustively. 2.5

d. You are programming a robot to find its way out of a simple maze. The robot uses a hill-climbing algorithm, which means it always moves in the direction that seems to bring it closer to the exit, based on its immediate surroundings. Using a hill-climbing algorithm ensures that the shortest path out of the maze will be found by the robot. 2.5

4. CO1 a. In the following tic-tac-toe board position, it is now X's (Max's) move. Find the optimal move for X (Max) out of the three available moves. **Generate** the full game tree from the given board position and use minimax algorithm to find the optimal move. Assign +1 if X (Max) wins, -1 if O (Min) wins and 0 if the game ended draw. 5

	X	O
	X	
X	O	O

b. In the following game tree, **find** the branches which are avoided from search using alpha beta pruning technique 5