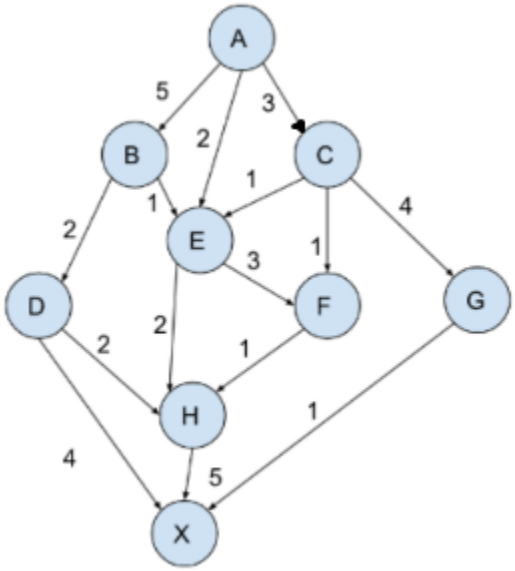
Brac University

CSE422: Artificial Intelligence

Question 1 (CO1)

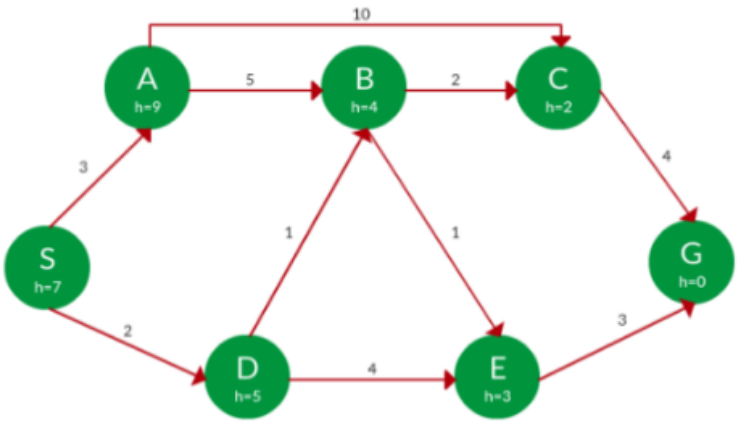


Node	h-Value
A	7
B	5
C	6
D	3
E	4
F	4
G	2
H	2
X	0

- Considering A as the start node, apply Graph version of A* and Greedy Best First Search on the given graph to find the path and the cost of the path.
- Is the heuristic consistent? Show calculations and explain.

Question 2 (CO1)

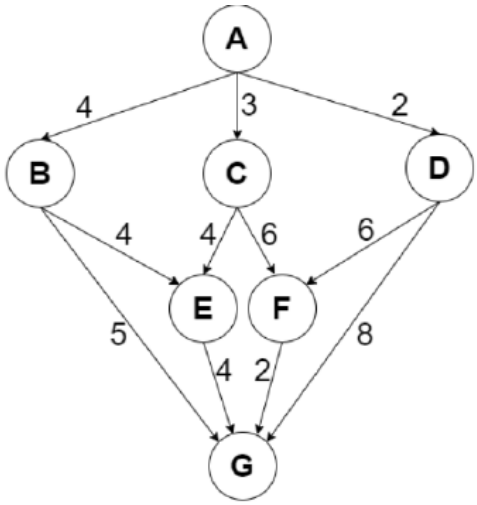
Apply tree A* and Greedy Best First Search on the given graph to find the path and the cost of the path. (Consider S as the start node)



Question 3 (CO1)

Showcase a graph of four nodes where the heuristic is admissible but not consistent.

Question 4 (CO1)



Heuristics

A	9
B	5
C	4
D	6
E	3
F	2
G	0

- Predict whether A* search algorithm will be able to provide an optimal path from the start node A to the goal node G for the above graph. Why or why not?
- Considering A as the start node and G as the goal node, Apply A* search algorithm for the given graph. Make sure to show each step.

Question 5 (CO1)

Object	Reward	Weight
A	20	1
B	5	2
C	10	3
D	40	8
E	15	7
F	25	4
G	4	5
H	7	2

Maximum weight = 12

The above problem is a 0/1 Knapsack problem. You have to carry the different objects in your bag in a way such that the reward is maximized without exceeding the weight limit. You can carry an object exactly once but you always have to carry the object labeled “H”. Assuming you are asked to use Genetic Algorithm for this problem, answer the following questions

1. Encode the problem and create an initial population of 4 different chromosomes
2. Explain what would be an appropriate fitness function for this problem. Use the fitness function and perform natural selection to choose the 2 fittest chromosomes.
3. Using the selected chromosomes perform a single-point crossover to get 2 offspring.
4. Perform mutation and check the fitness of the final offspring. Explain your work.

Question 6 (CO1)

Suppose you have an equation f(x) = x2 - 5x + 6. Assume x can be any number between 0 to 15. Now your job is to find an appropriate value of x such that the value of f(x) = 0 using Genetic Algorithm

1. Consider the fact that every chromosome will have 4 genes, illustrate an appropriate encoding technique to create an initial population of 4 randomly generated chromosomes.
2. Using an appropriate fitness function deduce the 2 fittest chromosomes and perform a single pointer crossover from the middle to create two offspring.

Question 7 (CO1)

Assume [X1, X2, X3, X4, X5, X6, X7, X8] represents a set of 8 numbers where each number can be anything from 1 to 50. Now your task is to find such a set with a combination of numbers where the difference between sum of the even numbers and sum of the odd numbers is 50. And you have to solve this problem using Genetic Algorithm. So, for e.g., if D1 represents sum of the odd numbers and D2 represents sum of the even numbers then (D1 - D2) or (D2 - D1) will be equal to 30 for the solution.

- Encode the problem and deduce two parent chromosomes, PC1 and PC2. But for PC1, the value of X1 should be 50, and for PC2 the value of X1 should be 1.
- Define a suitable fitness function for the problem and calculate the fitness of PC1 and PC2.
- Illustrate single point crossover after X4 between PC1 and PC2, and then perform mutation. You can mutate a number of your choosing. Finally, calculate fitness of the two newly formed child chromosomes and comment on which child is fitter.