Brac University

CSE422: Artificial Intelligence

### Question 1 (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 2 (CO1)
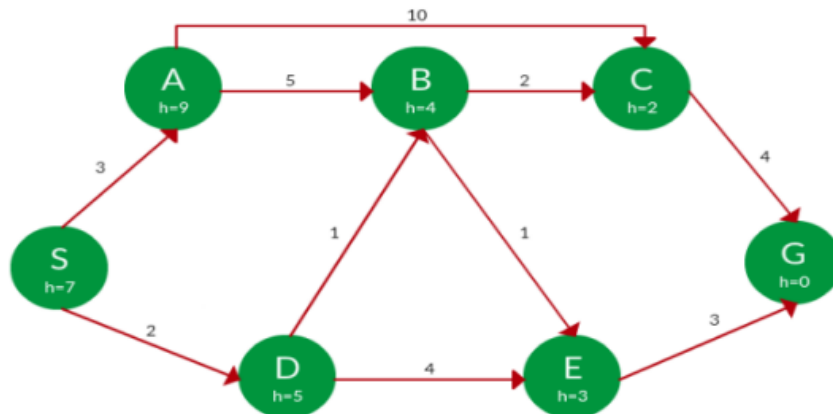
Apply Graph version of A* and Greedy Best First Search on the given graph to find the path and the cost of the path.

Question 3 (CO1)
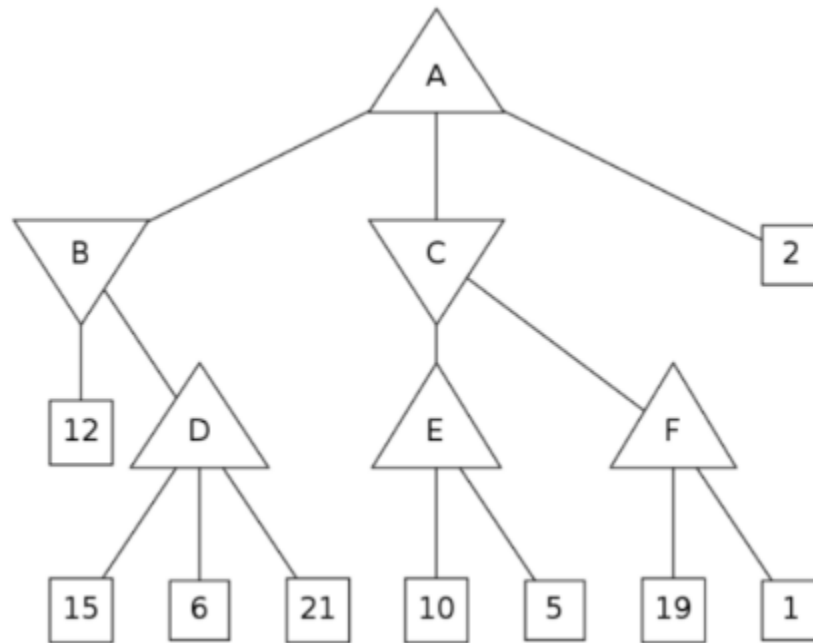
What will be the alpha- and beta- values of each node in this tree if alpha-beta pruning is run on this tree? Also, illustrate the crossed-out branches that would be pruned by alpha-beta pruning.

Question 4 (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 indexed numbers and sum of the odd indexed numbers is 50. And you have to solve this problem using Genetic Algorithm. So, for e.g., if D1 represents sum of the odd indexed numbers and D2 represents sum of the even indexed numbers then (D1 - D2) or (D2 - D1) will be equal to 50 for the solution.

a. 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.

b. Define a suitable fitness function for the problem and calculate the fitness of PC1 and PC2.

c. 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.

Question 5 (CO1)

a. Define the PEAS of a search engine such as Google. What type of agent should a search engine be? Provide proper explanation

b. What are the drawbacks of the hill climbing algorithm? Mention and briefly describe 2 solutions of the drawbacks of hill climbing algorithm