Brac University

CSE422: Artificial Intelligence

Question 1

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.

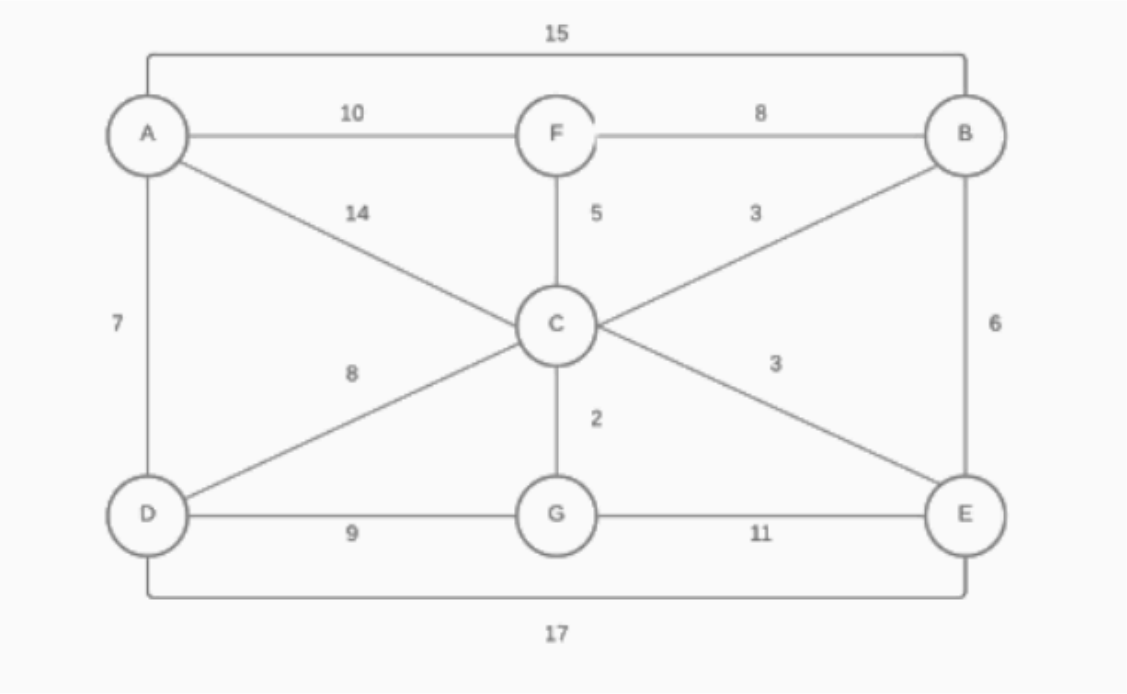
Question 2

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.

3. Explain how you can mutate the offspring derived from (B) and comment on the fitness of the final produced offspring.

Question3



This is a map of 7 cities (A, B, C, D, E, F, and G) that are connected with each other via different paths. Your job is to visit every city just once covering the minimum distance possible. You have to find the optimal combination of cities using the Genetic Algorithm. You can start at any point and end at any point but keep in mind that every city must be visited.

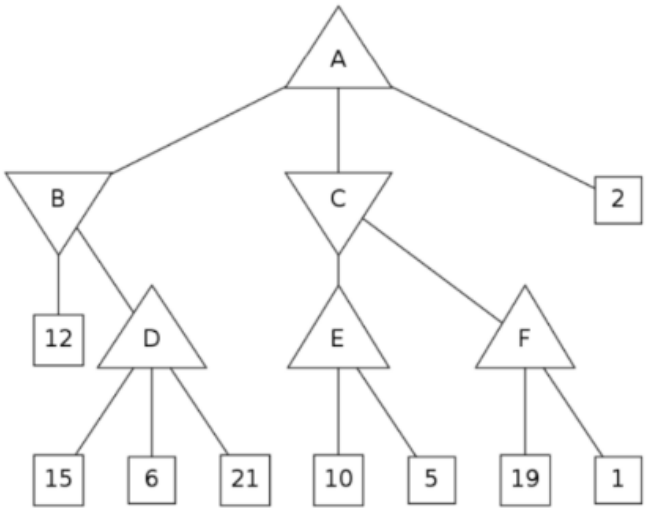
1. Encode the problem and create an initial population of 4 different chromosomes.

2. Using an appropriate fitness function, perform natural selection to choose the 2 fittest chromosomes.

3. Perform single point crossover from the 3rd index of your selected chromosomes to get 2 offspring. Are they eligible as a solution? If not, explain with reason.

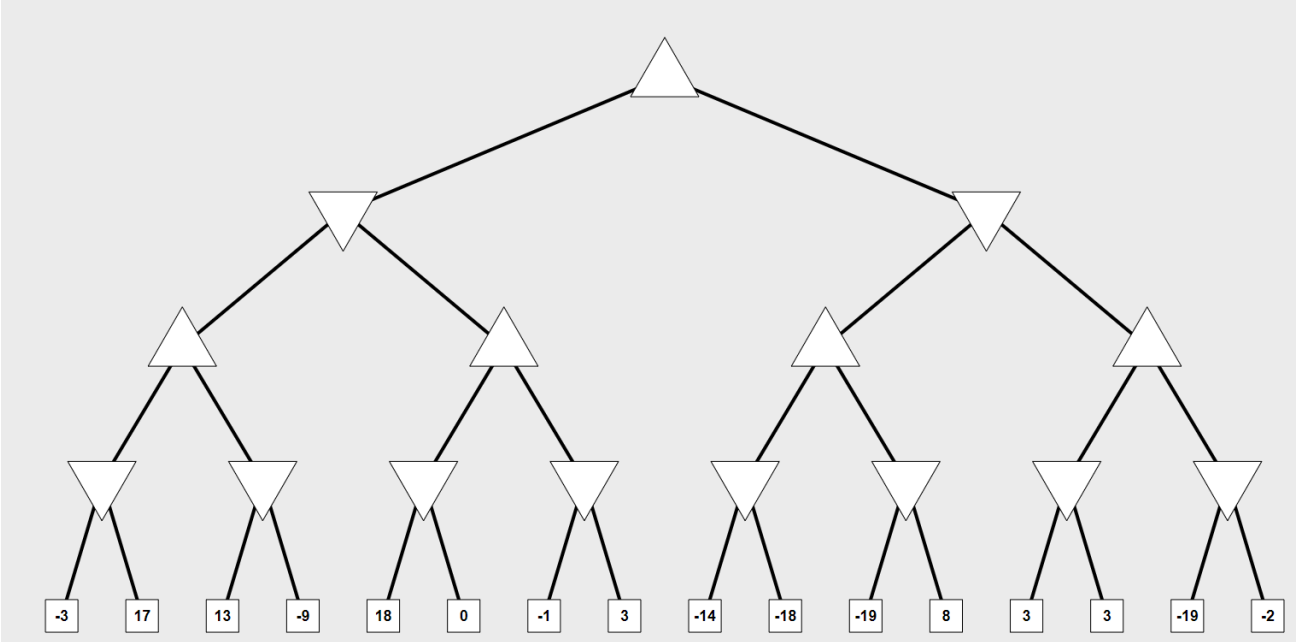
4. Would the usual method of mutation work here? Explain your opinion.

Question 4



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 5



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.