CSE422: Artificial Intelligence

Assignment 2

Genetic Algorithm

Question 1:

Object	Profit	Weight
A	7	3
B	3	2
C	12	6
D	5	8
E	4	5
F	16	1
G	20	4

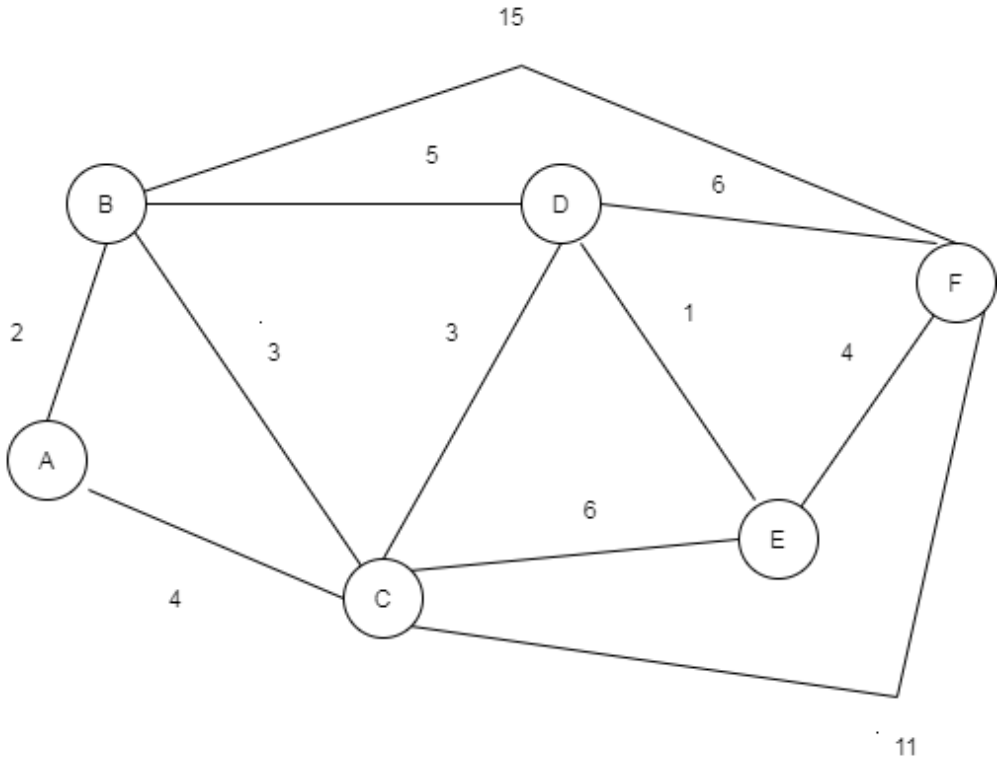
Maximum weight = 20

The above problem is a 0/1 Knapsack problem. Here there are 7 different objects labelled from A to G. The objective of this problem is to carry the different objects in your bag in such a way such that the profit is maximized. But you have to make sure that your bag does not exceed the maximum weight i.e. the maximum weight that this bag can carry is less than or equal to 15. Remember you can carry an object exactly once. Now it is your job to use Genetic Algorithm to solve this problem.

1. **Encode the problem and create an initial population of 4 different chromosomes (2 marks)**
2. **Think of an appropriate fitness function to this problem and give proper justification. (2 marks)**
3. **Use the fitness function to calculate the fitness level of all the chromosomes in your population (4 marks)**
4. **Perform natural selection and select the two fittest chromosomes (1 mark)**
5. **Use the parents from (4) and perform crossover to get 2 offspring (2 marks)**
6. **Perform mutation and check the fitness of the final offspring. Comment whether you have found the optimal solution or not. (3 marks)**

Question 2:

Suppose you have been given a map of 6 cities connected with each other via different paths. Your job is to visit every city just once covering the minimum distance possible. Solve this problem using Genetic Algorithm. You can start at any point and end at any point. Just make sure that all the cities have been covered.



1. **Encode the problem and create an initial population of 3 different chromosomes (1.5 marks)**

2. **Choose any one parent from your above solution and identify the following:**

    i. **Gene (0.5 mark)**
    ii. **Chromosome (0.5 mark)**

3. **Think of an appropriate fitness function to this problem and give proper justification. (2 marks)**

4. **Use the fitness function to calculate the fitness level of all the chromosomes in your population. Select the fittest 2 chromosomes based on the fitness function. (3.5 marks)**

5. **Perform crossover that you have been taught in the class on the selected parents. Now based on the offspring, for this problem do you think that is the best way to perform crossover? If not, explain why. (3.5 marks)**

6. **Perform mutation that you have been taught in the class on the produced offspring. Now based on the mutated offspring, for this problem do you think that is the best way to perform mutation? If not, explain why. (3.5 marks)**