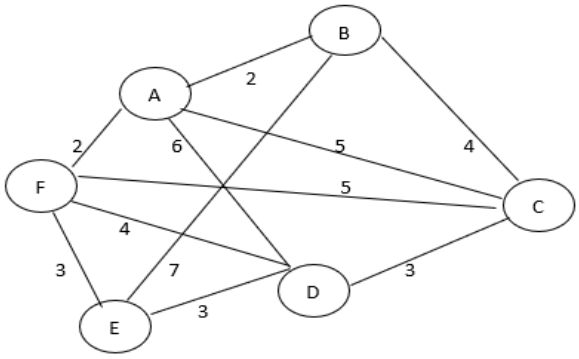
Assignment 2

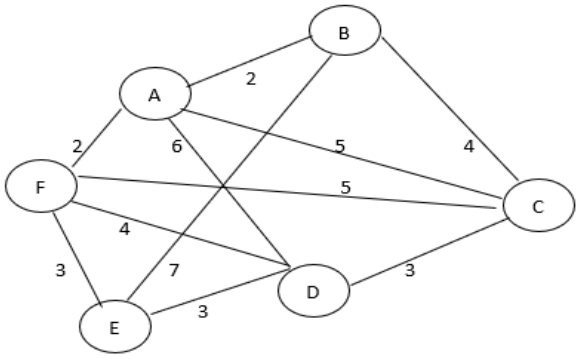
1. Solve the given Travelling and Salesman Problem (TSP) using Genetic Algorithms. (Illustrate problem solving with next two generations, say generate offspring 1 and offspring 2).



   i) Create an initial population size (N = 4) for the candidate TSP solutions. Define the fitness function to minimize the travelling cost.
      a. Apply tournament selection technique to select the parent for crossover.
      b. Apply edge recombination crossover technique to generate offsprings.
      c. Apply reversing/inversion mutation technique to mutate two genes of chromosome.

   ii) Create an initial population size (N = 4) for the candidate TSP solutions. Define the fitness function to minimize the travelling cost.
      a. Apply elitism selection technique to select the parent for crossover.
      b. Apply order crossover technique to generate offsprings.
      c. Apply scramble mutation technique to mutate two genes of chromosome.

2. Solve the given Travelling and Salesman Problem (TSP) using Ant Colony Optimization. (Illustrate problem solving with next two generations)



   Assume initially the pheromone value **(τ) = 0.5** of all the connected edges,
   α = 1, β = 1, and evaporation rate ρ = 0.6.

a) Consider three ants K_1, K_2, and K_3 randomly placed on the A, C, and F respectively. Compute the traveling path that has been chosen by ant K_1, K_2, and K_3
b) Compute the pheromone deposited by each ant K_1, K_2 and K_3 over their chosen edges.
c) Compute the updated pheromone value over all the edges of the given graph at the end of the first iteration (evaporation rate $\rho = 0.6$).
d) Draw the graphical representation with updated pheromone values over all the edges after the completion of each iteration.

3. Consider the Job Shop Scheduling Problem where you have been given n number of jobs and m number of machines. There are few constraints to the problem given below:
   - Multiple jobs on different machines can be executed simultaneously.
   - All the jobs should be executed in their given sequence only.
   - Single machine should not execute multiples job at the same time.

Jobs (J)	**Machines (times)**		
Sequence	**S_1**	**S_2**	**S_3**
J_1	M_2 : 3	M_1 : 3	M_3 : 4
J_2	M_3 : 2	M_2 : 1	M_1 : 4
J_3	M_3 : 3	M_1 : 2	M_2 : 3

Solve the Job Shop Scheduling Problem using Ant Colony Optimization (ACO) (Illustrate the problem solving with only one iteration) **Assume $\alpha = 1$, $\beta = 1$, and evaporation rate $\rho = 0.6$**.

a) Draw the graphical representations of these jobs and machines (say operations connected edges) to solve the problem using ACO. Assume initially the pheromone value **$(\tau) = 0.5$** of all the connected edges)
b) Consider three ants K_1, K_2 and K_3 randomly placed on the J_1, J_2 and J_3 respectively. Compute the order of executions of the jobs (say operations) that has been chosen by ant K_1, K_2 and K_3
c) Compute the pheromone deposited by each ant K_1, K_2 and K_3 over their chosen jobs (say operations edges).
d) Compute the updated pheromone value over all the edges of the given graph at the end of first iteration (evaporation rate $\rho = 0.6$).
e) Draw the graphical representation of these jobs and machines (say operations) with updated pheromone values over all the edges after the completion of iteration 1.