Assignment 1

Deadline: 23:55pm, October 14 (Monday), 2019

1. We will consider the routing problem shown in Figure 1. We aim at finding the optimal route from S to G with the lowest cost, where S is the starting point and G is the goal point. The number on every edge refers to the cost (e.g., time/distance). An example path is S→A→D→G and the cost of this path is 8 + 9 + 31 = 48.

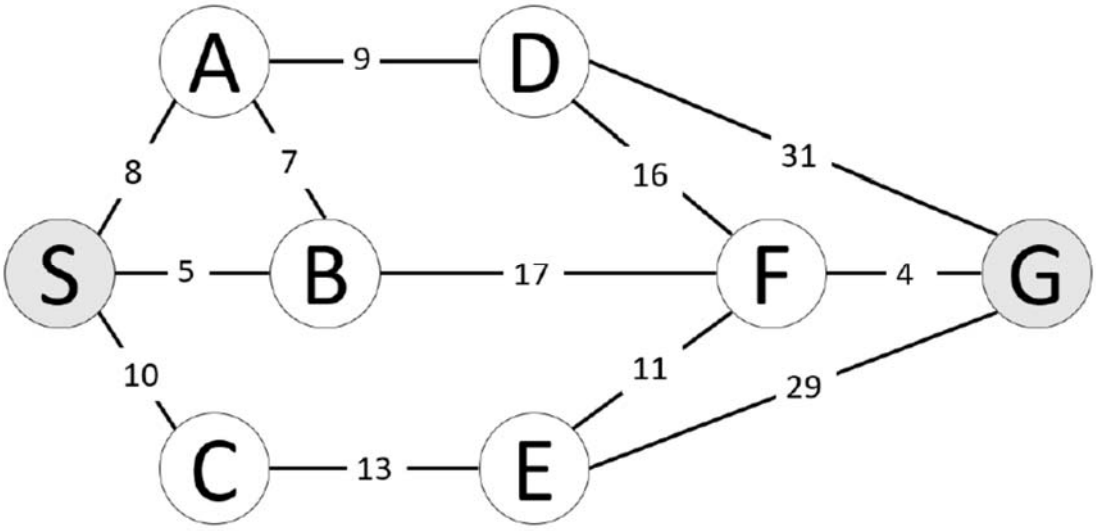

Figure 1

1.1 Please write down the points to be visited in order using Breath-First Search (BFS), then calculate the cost of the solution. (12 marks)
1.2 Please write down the points to be visited in order using Depth-First Search (DFS), then calculate the cost of the solution. (12 marks)
1.3 Please write down the points to be visited in order using Uniform-Cost Search (UCS), then calculate the cost of the solution. (12 marks)

2. Consider the Travelling Salesman Problem (TSP). Given a set of cites and the distances between each pair of cities, we aim at finding the shortest route that visits each city once and only once and returns to the origin city. Figure 2 is an example solution to a TSP problem, the solution is A→B→C→D→A, which leads to the shortest distance 97.

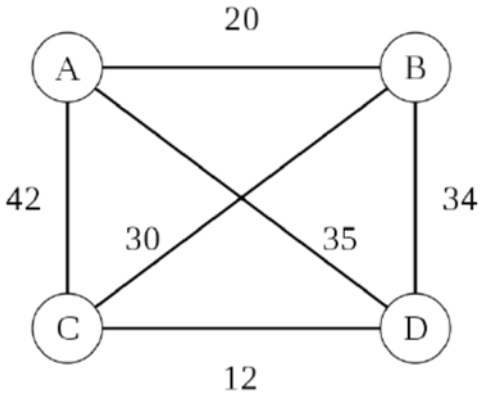

Figure 2

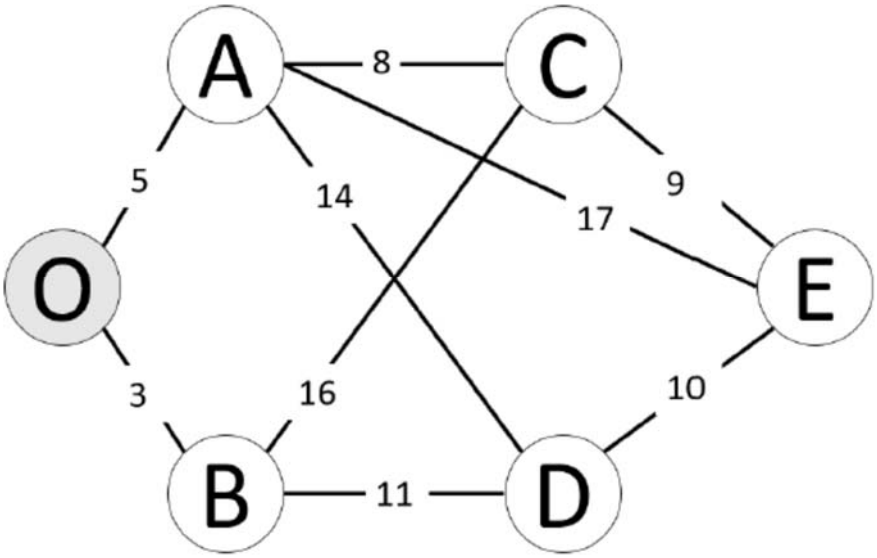

Figure 3

Consider a TSP problem illustrated in Figure 3.

2.1 How will you represent solutions to TSP in an evolutionary algorithm? (12 marks)

2.2 What would be an appropriate fitness function for measuring the quality of solutions? (12 marks)

2.3 Design an appropriate crossover operator. Justify your design. (20 marks)

2.4 Design an appropriate mutation operator. Justify your design. (20 marks)