

QQQ – Decision 1 – Chapter 4 – Route Inspection (Version 1)

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1.

- (a) Explain why a network cannot have an odd number of vertices of odd degree. (2)

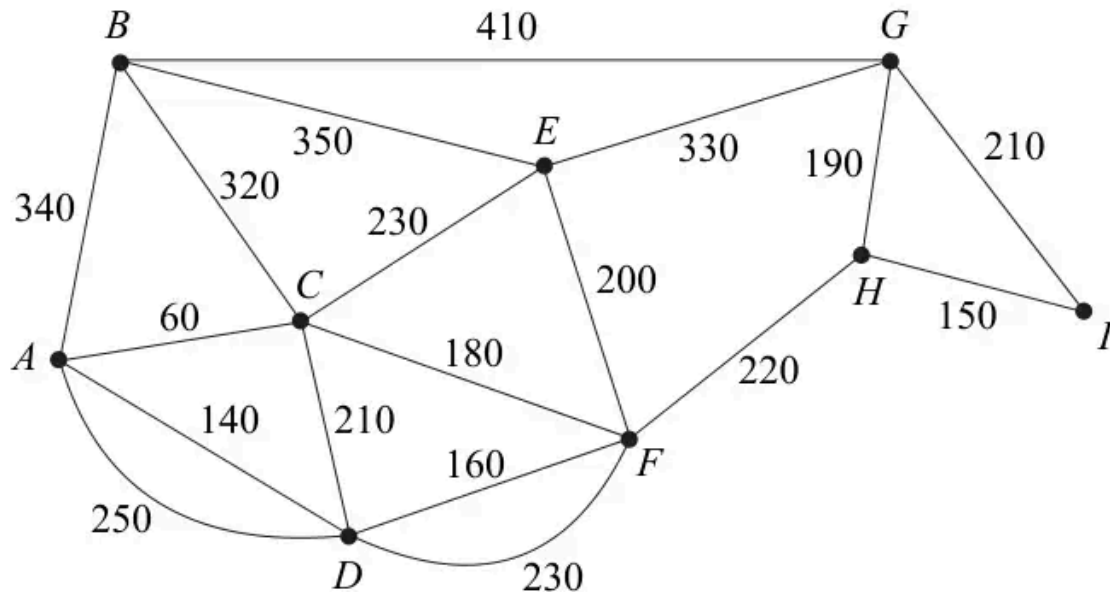


Figure 4

Figure 4 shows a network of paths in a public park. The number on each arc represents the length of that path in metres. Hamish needs to walk along each path at least once to check the paths for frost damage starting and finishing at *A*. He wishes to minimise the total distance he walks.

- (b) Use the route inspection algorithm to find which paths, if any, need to be traversed twice. (4)

- (c) Find the length of Hamish's route.

[The total weight of the network in Figure 4 is 4180 m.] (1)

(Total 7 marks)

2.

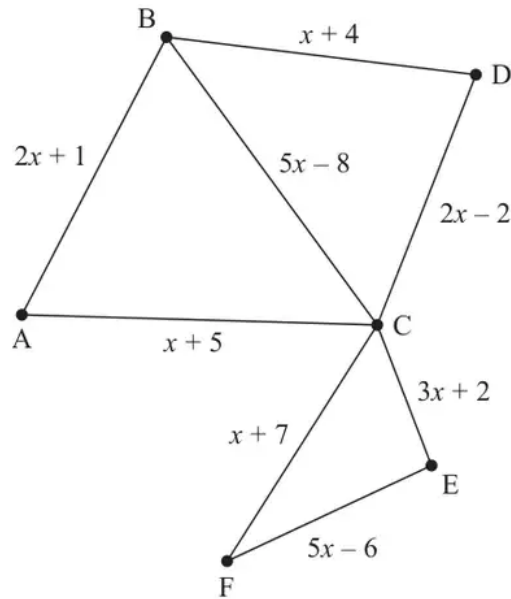


Figure 4

[The weight of the network is $20x + 3$]

Figure 4 shows a graph G that contains 8 arcs and 6 vertices.

- (a) State the minimum number of arcs that would need to be added to make G into an Eulerian graph. (1)
- (b) Explain whether or not the route $A - C - F - E - C - D - B$ is an example of a path on G . (1)

Figure 4 represents a network of 8 roads in a city. The expression on each arc gives the time, in minutes, to travel along the corresponding road.

You are given that $x > 1.6$

A route is required that

- starts and finishes at the same vertex
- traverses each road at least once
- minimises the total time taken

The route inspection algorithm is applied to the network in Figure 4 and the time taken for the route is found to be at most 189 minutes.

Given that the inspection route contains two roads that need to be traversed twice,

- (c) determine the range of possible values of x , making your reasoning clear. (6)

(Total 8 marks)

3.

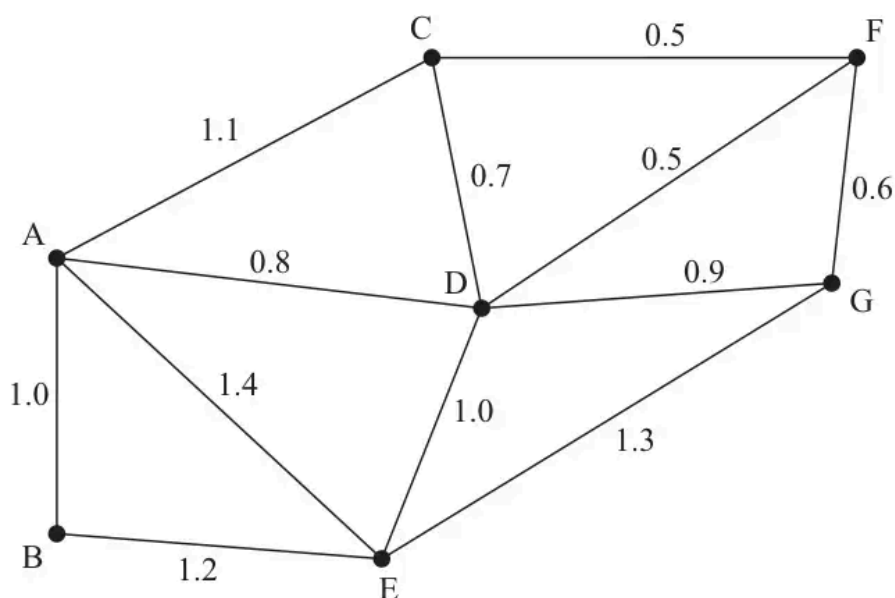


Figure 4

Figure 4 models a network of roads in a housing estate. The number on each arc represents the length, in km, of the road.

The total weight of the network is 11 km.

A council worker needs to travel along each road once to inspect the road surface. He will start and finish at A and wishes to minimise the length of his route.

- (a) Use an appropriate algorithm to find a route for the council worker. You should make your method and working clear. State your route and its length. (6)

A postal worker needs to walk along each road twice, once on each side of the road. She must start and finish at A. The length of her route is to be minimised. You should ignore the width of the road.

- (b) (i) Explain how this differs from the standard route inspection problem. (1)
 (ii) Find the length of the shortest route for the postal worker. (2)

(Total 9 marks)