4.

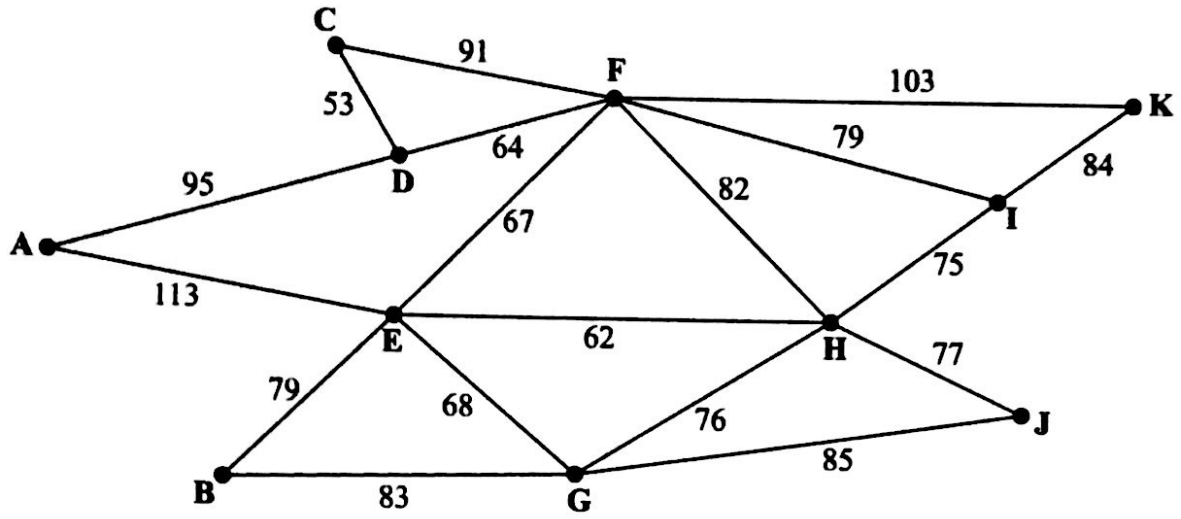

Figure 3

[*The total weight of the network is 1436 m*]

(a) Explain the term **valency**.

(2)

Figure 3 models a system of underground pipes. The number on each arc represents the length, in metres, of that pipe.

Pressure readings indicate that there is a leak in the system and an electronic device is to be used to inspect the system to locate the leak. The device will start and finish at A and travel along each pipe at least once. The length of this inspection route needs to be minimised.

(b) Use the route inspection algorithm to find the pipes that will need to be traversed twice. You should make your method and working clear.

(5)

(c) Find the length of the inspection route.

(1)

Pipe HI is now found to be blocked; it is sealed and will not be replaced. An inspection route is now required that excludes pipe HI. The length of the inspection route must be minimised.

(d) Find the length of the minimum inspection route excluding HI. Justify your answer.

(2)

(e) Given that the device may now start at any vertex and finish at any vertex, find a minimum inspection route, excluding HI.

(2)

(Total 12 marks)

5.

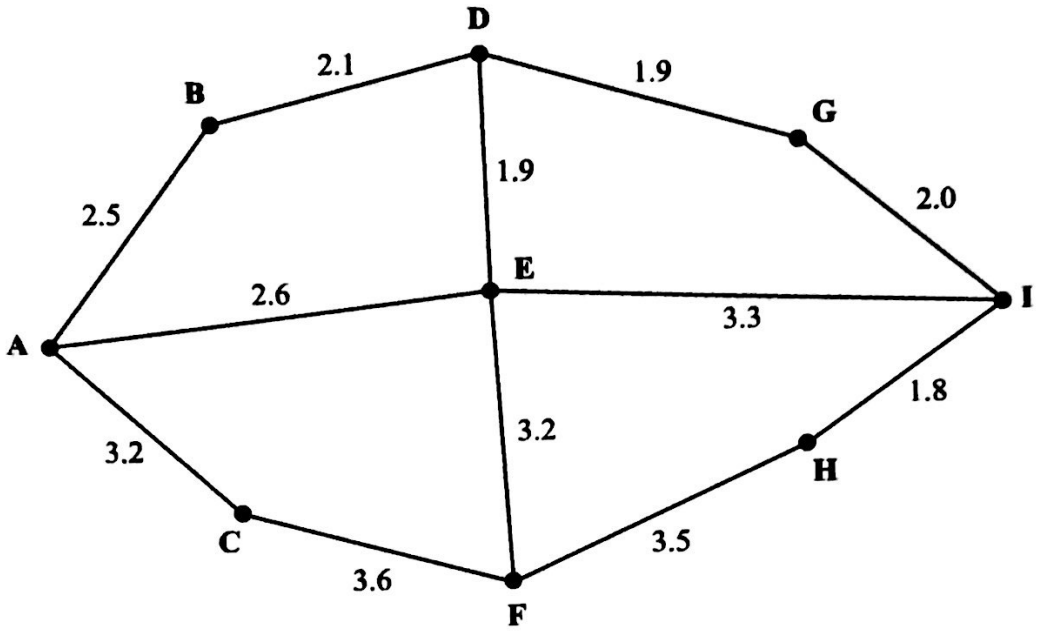

Figure 5

[The total weight of the network is 31.6 km]

Figure 5 models a network of roads. The road markings on these roads are to be renewed. The number on each arc represents the length, in km, of that road. In order to renew the road markings, each road must be traversed at least once.

(a) Use the route inspection algorithm, starting and finishing at A, to find a suitable route, which should be stated. You must make your method and working clear.

(5)

(b) State the roads that must be traversed twice and the length of the route.

(3)

The machine that will be used to renew the road markings can only be delivered to D. It will start at D, but it may finish at any vertex.
Each road must still be traversed at least once.

(c) Given that the route is to be minimised, determine where the machine should finish. Give reasons to justify your answer.

(3)

(Total 11 marks)