Route Inspection – Q1 [Practice/E](16/6/21)

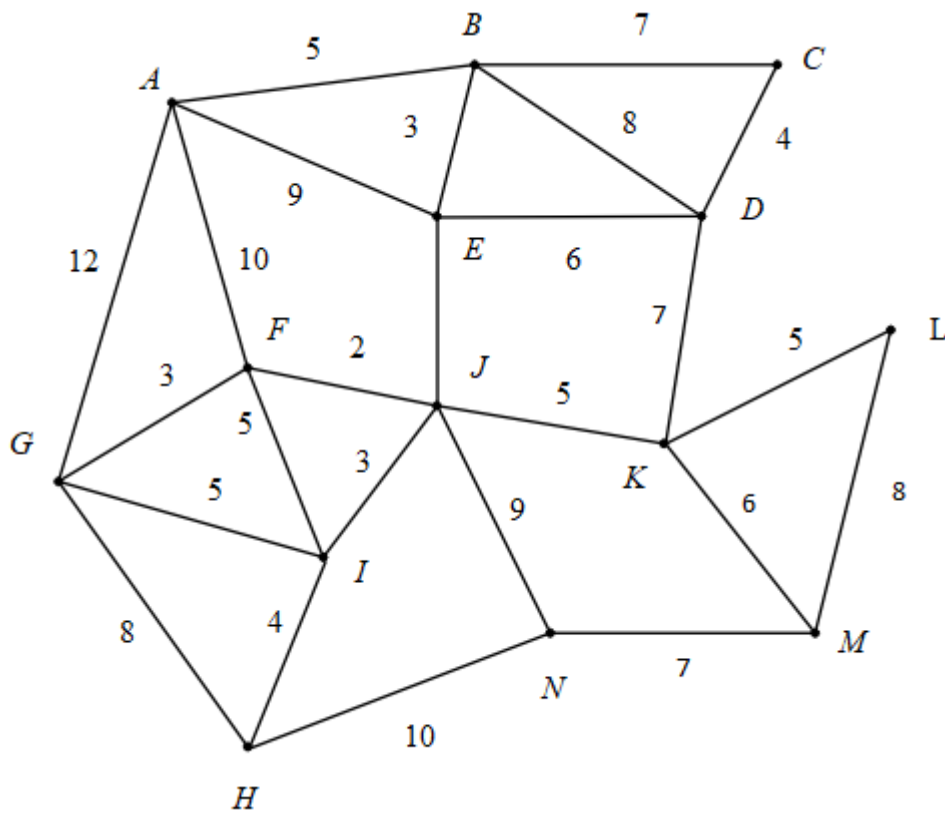Find the length of the shortest route that covers all the arcs in the network below at least once:

(i) Starting at H and finishing at N.

(ii) Starting at A and finishing at A.

(iii) Starting and finishing at any node.

In each case, give an example of a possible route.

(The network has a total weight of 151.)

Solution

(i) The odd nodes are H, J, M and N. We need to duplicate the shortest route from J to M (in order to convert J and M to even nodes). This means duplicating the arcs JK and KM, with a total weight of 11, so that the length of the shortest route is $151 + 11 = 162$

A possible route is HGIHNJKMKJIFGAFJEABCDBEDKLMN

[Tip: Repeat the arcs that have to be duplicated straightaway; ie so that KJ follows JKM.]

(ii) We need to consider each possible pairing amongst the odd nodes:

HJ[HIJ] 7 MN 7   Total $= 14$

HM[HNM] 17 JN 9   Total $= 26$

HN 10 JM [JKM] 11 Total $= 21$

So the shortest route will involve duplicating HIJ and MN, and will have length $151 + 14 = 165$

A possible route is ABCDBEAGFIGHIJIHNMNJKMLKDEJFA

(iii) We can choose to start at H and finish at J, or vice-versa, as this leaves the shortest distance to be duplicated; ie MN. [Or start at M and finish N, or vice-versa.] So the shortest route will have length $151 + 7 = 158$.

A possible route is HNMNJKMLKDCBDEBAEJFAGFIGHIJ