

QQQ – Decision 1 – Chapter 5 – The Travelling Salesman Problem (Version 2)

Total Marks: 22

(22 = Platinum, 20 = Gold, 18 = Silver, 15 = Bronze)

1.

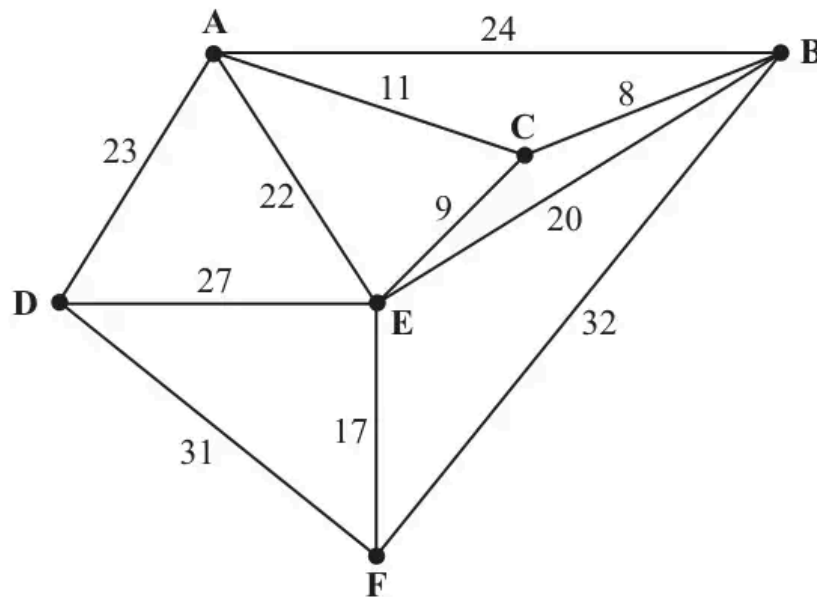


Figure 1

The network in Figure 1 shows the distances, in km, between six towns, A, B, C, D, E and F.

Mabintou needs to visit each town. She will start and finish at A and wishes to minimise the total distance travelled.

- (a) By inspection, complete the two copies of the table of least distances in your answer book. (3)
- (b) Starting at A, use the nearest neighbour algorithm to find an upper bound for the length of Mabintou's route. Write down the route which gives this upper bound. (3)
- (c) Starting by deleting A, and all of its arcs, find a lower bound for the route length. (4)

(Total 10 marks)

2.

	A	B	C	D	E
A	–	15	19	25	20
B	15	–	15	15	25
C	19	15	–	22	11
D	25	15	22	–	18
E	20	25	11	18	–

The table shows the least distances, in km, between five hiding places, A, B, C, D and E.

Agent Goodie has to leave a secret message in each of the hiding places. He will start and finish at A, and wishes to minimise the total distance travelled.

- (a) Use Prim's algorithm to find a minimum spanning tree for this network. Make your order of arc selection clear. (2)
- (b) Use your answer to part (a) to determine an initial upper bound for the length of Agent Goodie's route. (1)
- (c) Show that there are two nearest neighbour routes which start from A. State these routes and their lengths. (3)
- (d) State the better upper bound from your answers to (b) and (c). (1)
- (e) Starting by deleting B, and all of its arcs, find a lower bound for the length of Agent Goodie's route. (4)
- (f) Consider your answers to (d) and (e) and hence state an optimal route. (1)

(Total 12 marks)