

D1 Jan 2010 Solutions

①a)

A ————— 1

B . . . . . 2

C ————— 3

D ————— 4

E ————— 5

F . . . . . 6

b)  $B - 3 = C - 1 = A - 2$

c.s  $B = 3 - C = 1 - A = 2$

improved match

A ————— 1

B ————— 2

C ————— 3

D ————— 4

E ————— 5

F . . . . . 6

$$F - 4 = D - 5 = E - 1 = C - 6$$

c.s  $F = 4 - D = 5 - E = 1 - C = 6$



Complete match:

$$A=2, B=3, C=6, D=5, E=1, F=4$$

- ② a) I) A connected graph is a finite number of vertices connected by edges so that it is possible to find a path between any pair of vertices.

Eg)



connected



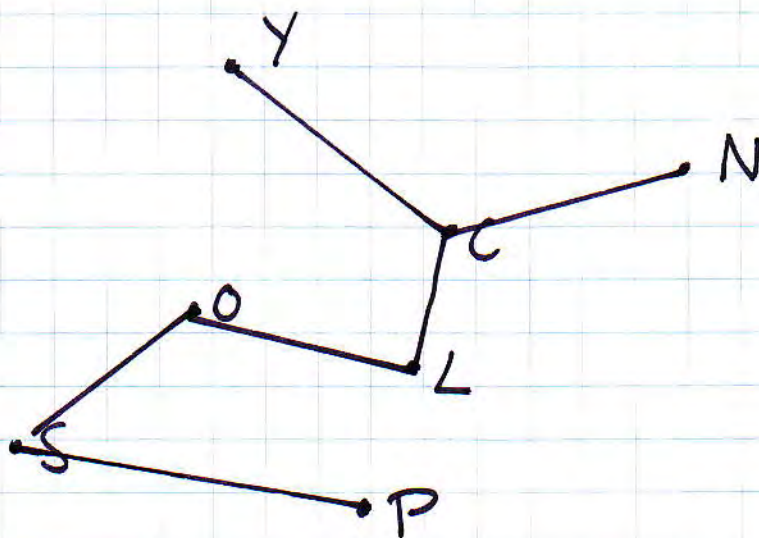
unconnected

- II) A tree is a graph with no cycles  
 III) A spanning tree is a tree that connects all vertices.

b) Kruskal's algorithm.

c) I) Next page.

II)





|                | ③         | ①      | ④       | ②      | ⑥          | ⑤         | ⑦    |
|----------------|-----------|--------|---------|--------|------------|-----------|------|
|                | Cambridge | London | Norwich | Oxford | Portsmouth | Salisbury | York |
| Cambridge (C)  |           | 60     | 62      | 81     | 132        | 139       | 156  |
| London (L)     | 60        |        | 116     | 56     | 74         | 88        | 211  |
| Norwich (N)    | 62        | 116    |         | 144    | 204        | 201       | 181  |
| Oxford (O)     | 81        | 56     | 144     |        | 84         | 63        | 184  |
| Portsmouth (P) | 132       | 74     | 204     | 84     |            | 43        | 269  |
| Salisbury (S)  | 139       | 88     | 201     | 63     | 43         |           | 248  |
| York (Y)       | 156       | 211    | 181     | 184    | 269        | 248       |      |

Order Figure 2  
 LO LC CN OS SP CY

$$\text{weight of tree} = 60 + 62 + 56 + 156 + 63 + 43$$

$$= \underline{\underline{440 \text{ miles}}}$$

③ a) see page 4.

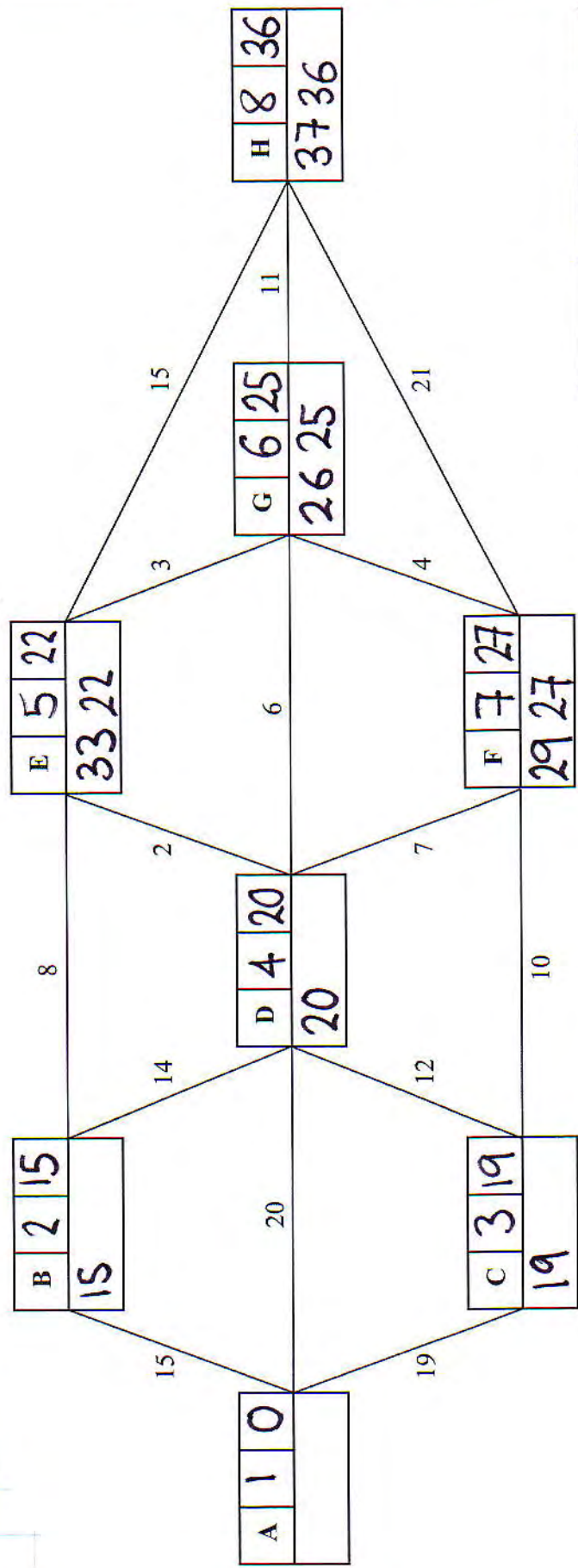
b) odd vertices A, C, B, H

$$\begin{array}{lll} AC = 19 & AB = 15 & AH = 36 \\ BH = 22 & CH = 25 & CB = 22 \\ \hline 41 & 40 & 58 \end{array}$$

↑  
min pairing

$$\therefore \text{Shortest time} = 167 + 40 = \underline{\underline{207 \text{ mins}}}$$





Key:

| Vertex         | Order of labelling | Final value |
|----------------|--------------------|-------------|
| Working values |                    |             |

Quickest route: ADEGH  
 Time taken: 36 mins.