

a) It is not in alphabetical order

b) Bubble Sort

J M C B T H K R Q F

J C B M H K R Q F T

C B J H K M Q F R T

B C H J J K Q F M R T

B C H J J Q F K M R T

B C H Q F J K M R T

B C Q F H J K M R T

B C F Q H J K M R T

B C F Q H J K M R T

NO swaps so stop.

OR Quick Sort.

J M C B T H K R Q F

C B Q F H J M T K R

C B F Q H J M K R T

B C F Q H J K M R T

B C F Q H J K M R T

Question 1 continued

Remaining sublists all size 1 so stop.

c) 1. Ben  $\frac{10+1}{2} = 5.5$  6 = Jenny

2. Charles  $\frac{2}{2}$  discard 1-6

3. Freya  $\frac{7+10}{2} = 8.5$  9 = Richard

4. Greg  $\frac{2}{2}$  discard 9-10

5. Hy  $\frac{7+8}{2} = 7.5$  8 = Merry

6. Jenny  $\frac{2}{2}$  discard 8

7. Kim Found #

8. Merry

9. Richard

10. Toby

a) I) A connected graph with no cycles

II) A tree that contains all the vertices of a network and does so with the minimum length.

b) Order: AB DE BC BD <sup>AC rejected</sup> BE <sup>rejected</sup> CE <sup>rejected</sup> EF <sup>CF</sup>

$$\text{Length} = 10 + 12 + 13 + 14 + 18$$

$$= \underline{\underline{67}}$$

## Question 2 continued

(c)

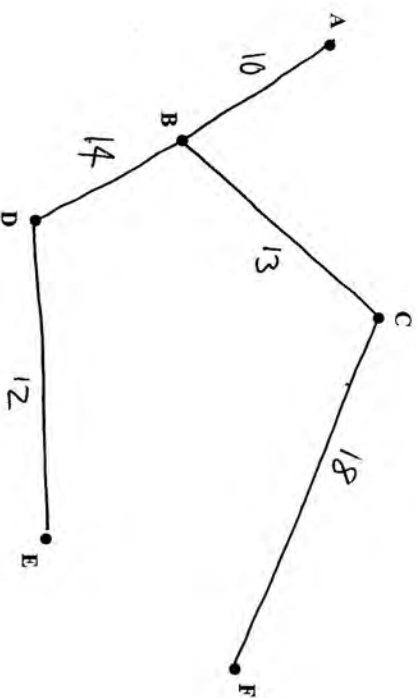


Diagram 1

(d)

NO AS you can have CF or ~~FE~~ in your min spanning tree.

3. (a)

$$\begin{aligned} 6x + 5y &\leq 60 \\ 2x + 3y &\geq 12 \\ x &\leq 20 \\ 3x &\geq 2y \end{aligned}$$

b)  $P = 3x + y$

Optimal point when  $x = 2y$  meets  $6x + 5y = 60$

$$\Rightarrow 6(2y) + 5y = 60$$

$$17y = 60$$

Leave blank

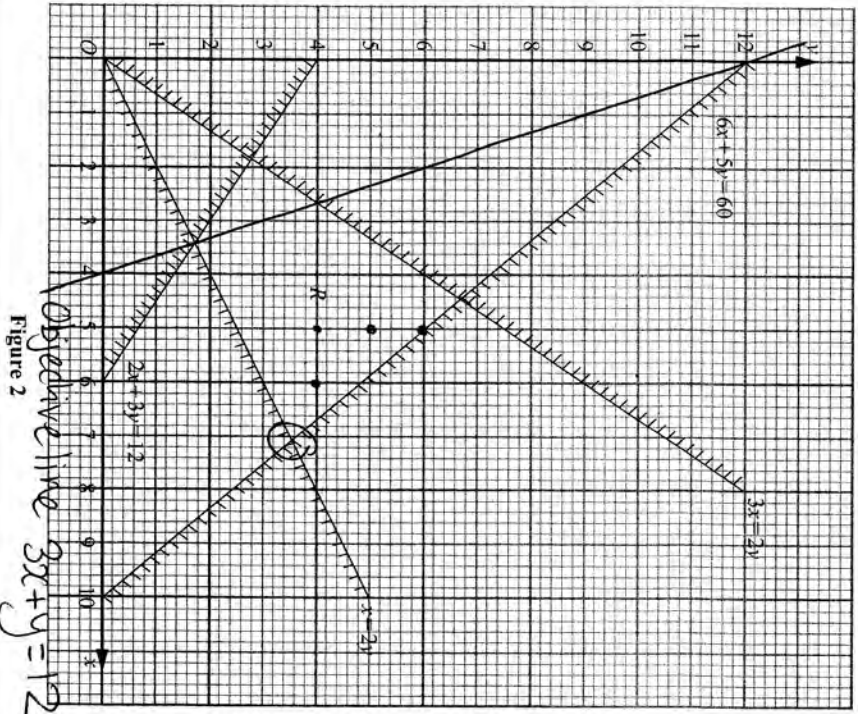


Figure 2

Question 3 continued

$$\underline{\underline{y = \frac{60}{17}}} \Rightarrow \underline{\underline{x = \frac{120}{17}}}$$

$$c) P = 3 \times \frac{120}{17} + \frac{60}{17} = \underline{\underline{\frac{420}{17}}}$$

$$d) \underline{\underline{x = 6}} \quad \underline{\underline{y = 4}}$$

Leave blank

(Total 8 marks)

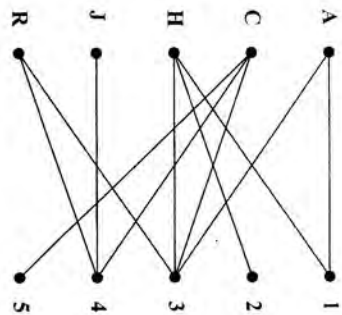


Figure 3

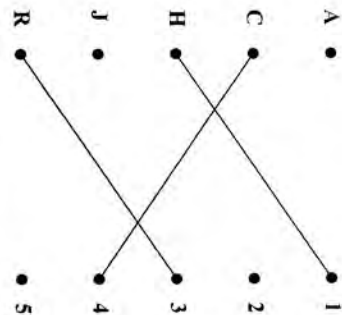


Figure 4

a) ~~A-B-B-R-R-C-S~~

~~A-B-B-R-R-C~~

$A-1=H-2$

$A-1=H-3=R-4=C-5$

b)  $A-3=R-4=C-S$

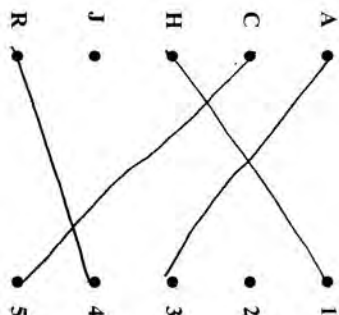
CS

$A=3-R=4-C=5$

Improved match

$A=3, C=5, H=1, R=4$

Question 4 continued



$J-4=R-3=A-1=H-2$

CS  $J=4-R=3-A=1-H=2$

Improved match

$A=1, C=5, H=2, J=4, R=3$

5.

a) Odd vertices F, C, D, A

Pairings	$FC = 8$	$FD = 13$	$FA = 17$
	$DA = 16$	$CA = 9$	$CD = 7$
	<u>24</u>	<u>22</u>	<u>24</u>

min pairing FD, CA

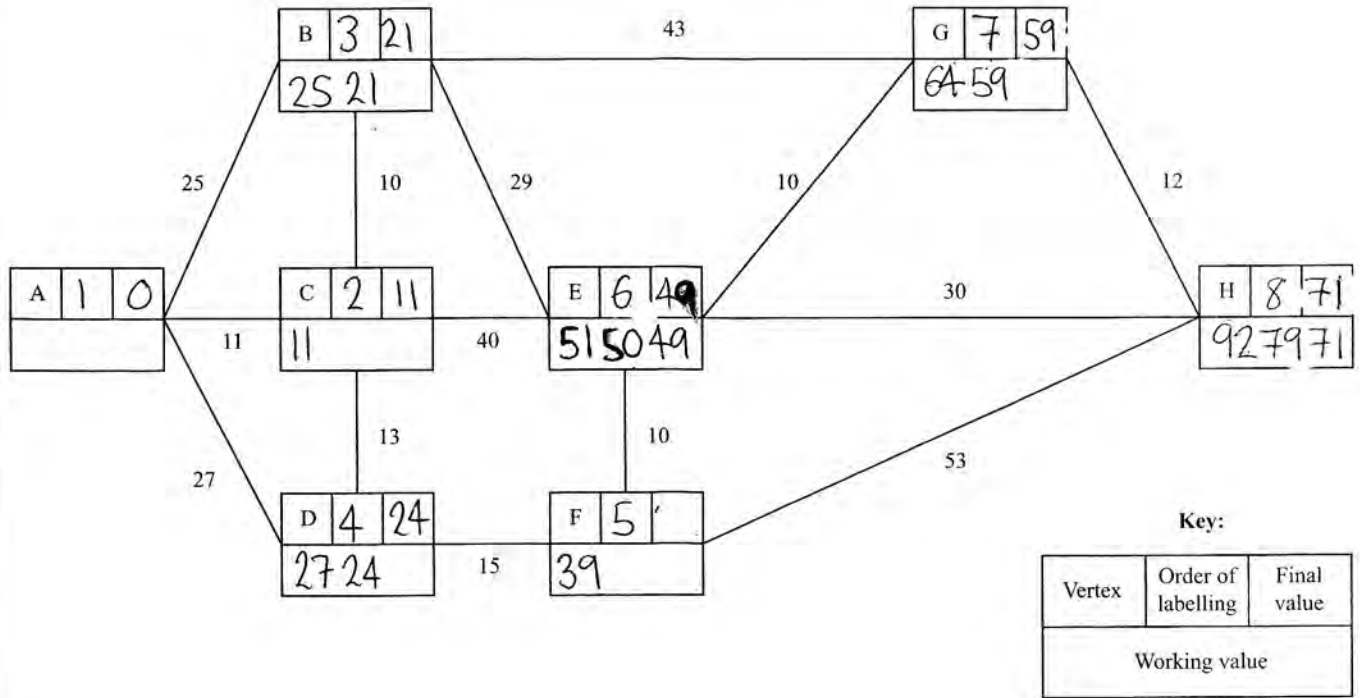
Repeat F-G, G-D, CA.

b) ADCABCEBFEGFGDQCA

c) Start at D finish at A as now only  
FC is ~~needed~~<sup>needs</sup> to be traversed twice

$$\text{length} = 98 + 8 = \underline{\underline{106 \text{ km}}}$$

6.



Leave blank

Question 6 continued

Shortest route:

ACDFEGH

Length of shortest route:

71km

b) Work backwards from H to A e.g

H:  $71 - 12 = 59$  go to G

G:  $59 - 10 = 49$  go to E etc.

c) ACBEQH length ~~70km~~ 71km

7. (a)

Activity	Preceded by	Activity	Preceded by	Activity	Preceded by
A	-	E	A, B	I	C, D, E
B	-	F	B	J	C, D, E
C	AB	G	B	K	F, H, I
D	B	H	C, D	L	F, G, H, I

(b)

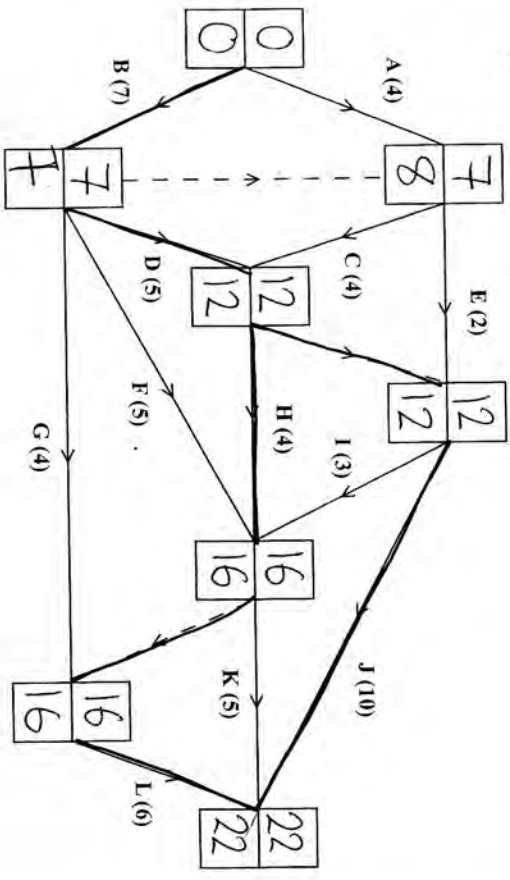


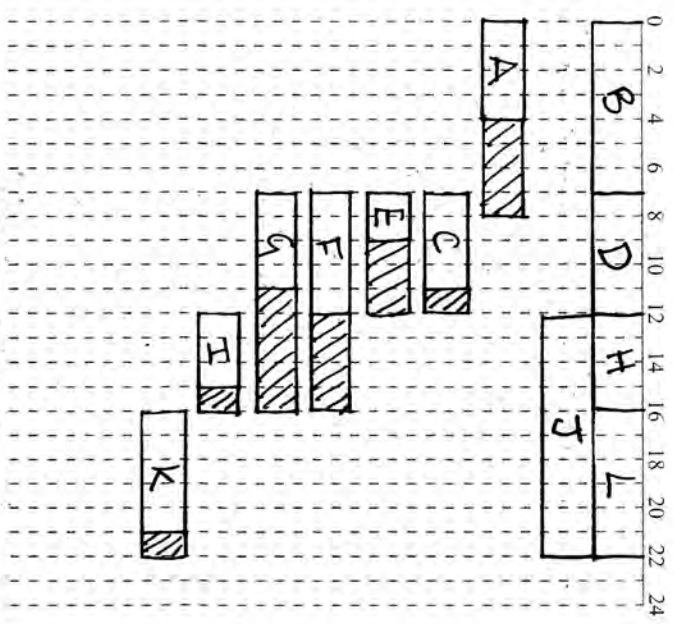
Diagram 1

Key:

Early event time
Late event time

Question 7 continued  
 (c) B, D, H, J, L

(d)



(e)

Between 7 and 16 there are 31 days of activities taking place in 9 days

$31 = 3.4$  Therefore the lower bound for the number of workers needed in this time is 4.

$\Rightarrow$  That you need more than 3 to complete the project in time.

$x$  = No. of type A radios to produce

$y$  = No. of type B radios to produce

At least 50 type A  $\Rightarrow$   $x \geq 50$

No. A between 20% and 40% of the total  $\Rightarrow 0.2(x+y) \leq x < 0.4(x+y)$

$$\Rightarrow x \leq 0.4(x+y)$$

$$5x \leq 2x + 2y$$

$$\underline{3x \leq 2y}$$

and  $x \geq 0.2(x+y)$

$$5x \geq x + y$$

$$\underline{4x \geq y}$$

No. of switches  $\Rightarrow$   $3x + 2y \leq 200$

Profit  $\Rightarrow P = 15x + 12y$

Question 8 continued

∴

Maximise  $P = 15x + 12y$

Subject to:  $x \geq 50$

$$2y \geq 3x$$

$$y \leq 4x$$

$$3x + 2y \leq 200$$

$$y \geq 0$$