

1.

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 K Q F M R T

B C H 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

Leave blank

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

6. Jenny $\frac{7}{2}$ discard 8

7. Kim $\frac{7}{2}$ discard 8

8. Merry $\frac{7}{2}$ discard 8

9. Richard $\frac{7}{2}$ discard 8

10. Toby $\frac{7}{2}$ discard 8

7 = Kim Found #

Leave blank

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 ^{AC} BE ^{CE} CF ^{EF}

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

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

Leave blank

Question 2 continued

(c)

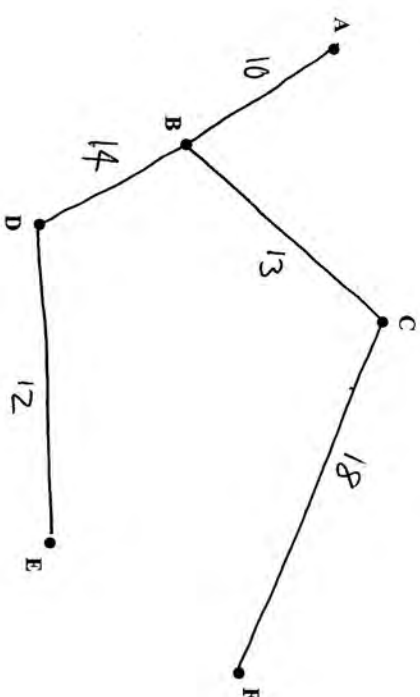


Diagram 1

(d)

No as you can have CF or ~~FE~~ in your min spanning tree.

Leave blank

3. (a)

$$\begin{aligned} 6x + 5y &\leq 60 \\ 2x + 3y &\geq 12 \\ x &\leq 10 \\ 3x &\geq 2y \end{aligned}$$

b) $P = 3x + y$

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

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

$$17y = 60$$

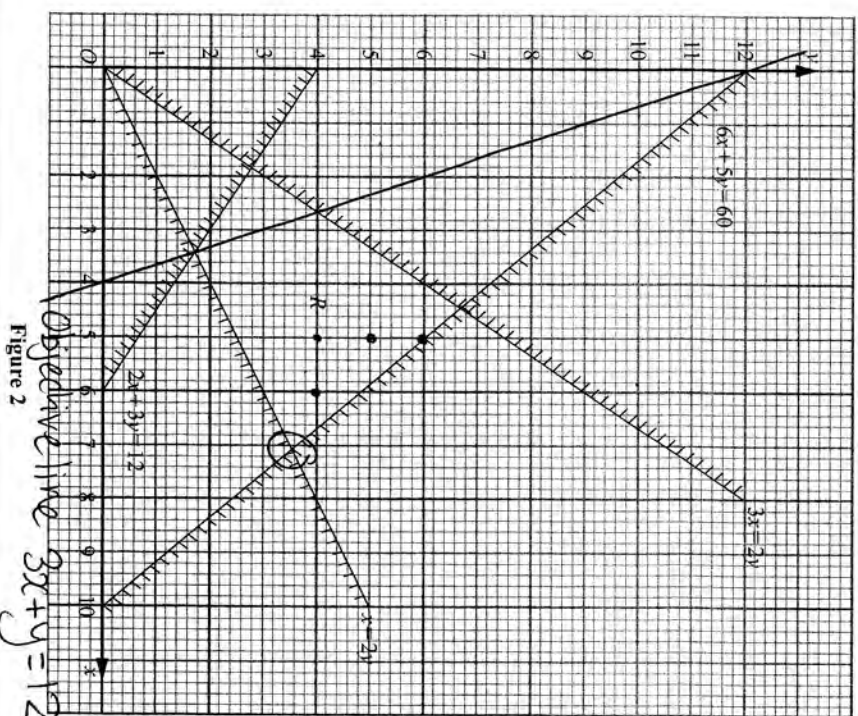


Figure 2

Question 3 continued

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

$$c) P = 3 \times \frac{120}{17} + 60 \times \frac{1}{17} = \underline{\underline{\frac{420}{17}}}$$

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

4.

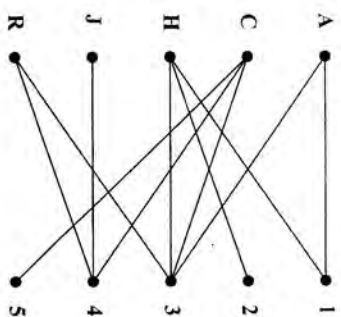


Figure 3

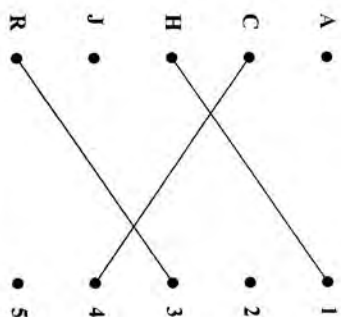


Figure 4

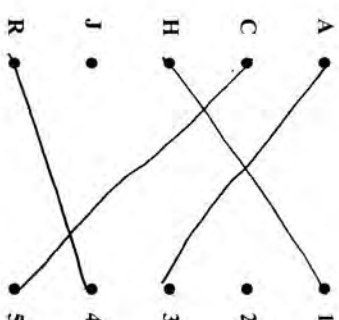
a) ~~$A-1=H-2$~~ ~~$A-3=R-4=C-5$~~ $A-1=H-2$ $A-1=H-3=R-4=C-5$ b) $A-3=R-4=C-5$ CS $A=3-R=4-C=5$

Improved match

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

Leave blank

Question 4 continued

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

Improved match

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

Leave blank

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

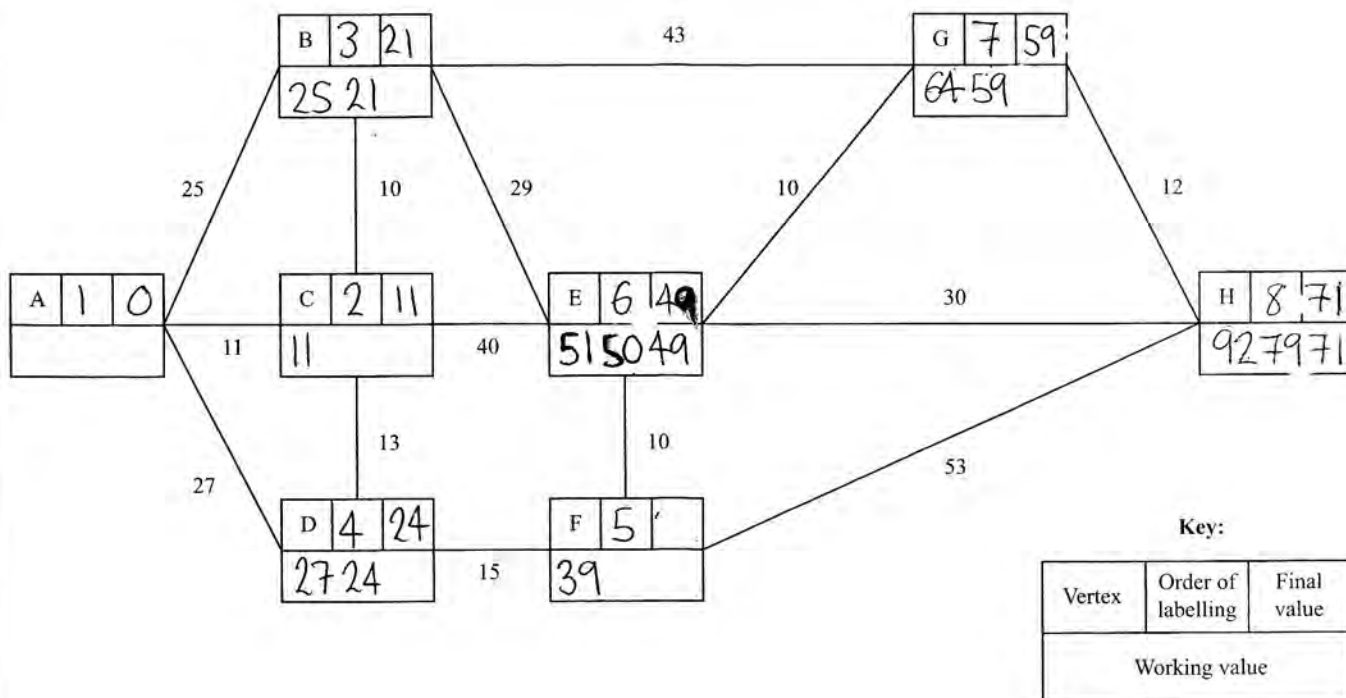
Repeat FQ, QD, CA.

b) ADCABCEBFEGFQDQCA

c) Start at D finish at A as now only
FC is ^{needs} ~~needed~~ to be traversed twice

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

6.



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 GG: $59 - 10 = 49$ go to E etc.c) ACBEFH 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	A, B	G	B	K	F, H, I
D	B	H	C, D	L	F, G, H, I

(b)

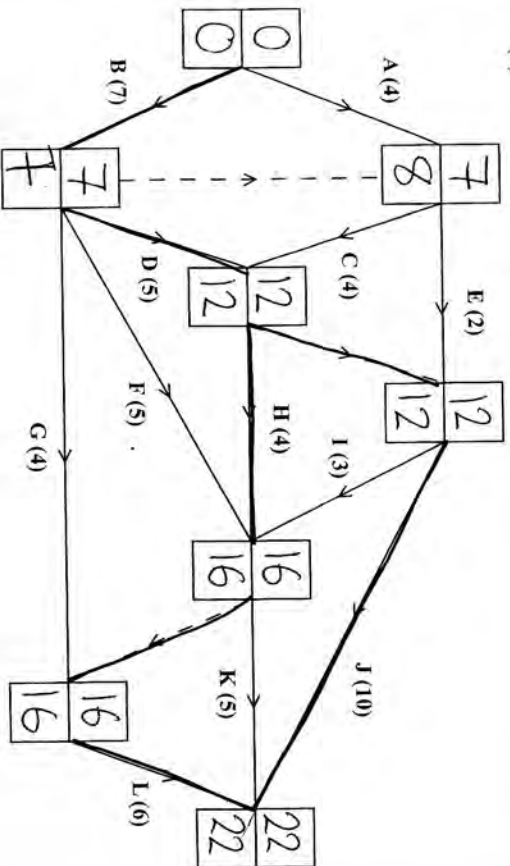


Diagram 1

Key:

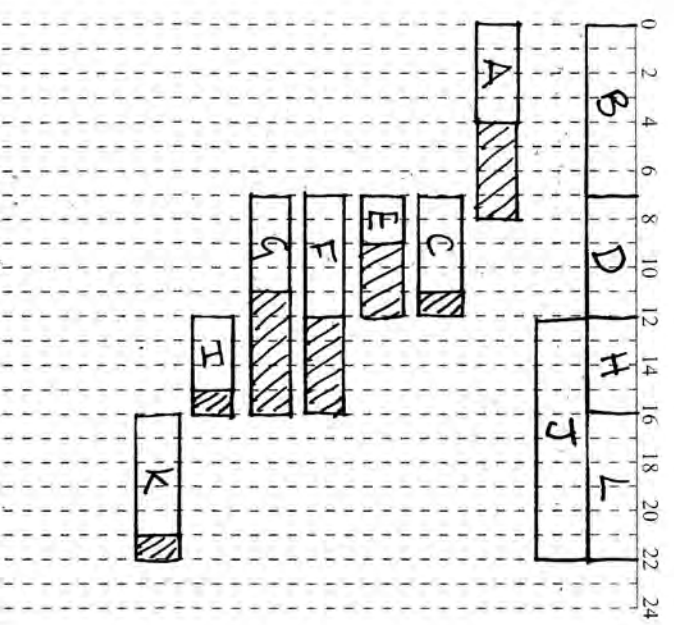
Early event time
Late event time

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

$\frac{31}{9} = 3.4$ 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.

8.

 x = no. of type A radios to produce y = no. of type B radios to produceAt least 50 type A $\Rightarrow \underline{x \geq 50}$ no. A between 20% and 40% $\Rightarrow 0.2(x+y) \leq x \leq 0.4(x+y)$
of the total

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

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

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

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

$$5x \geq x + y$$

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

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

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

Question 8 continued

 $\therefore$ Maximise $P = 15x + 12y$ Subject to: $x \geq 50$

$$y \geq 3x$$

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

$$y \geq 0$$

(Total 7 marks)

TOTAL FOR PAPER: 75 MARKS