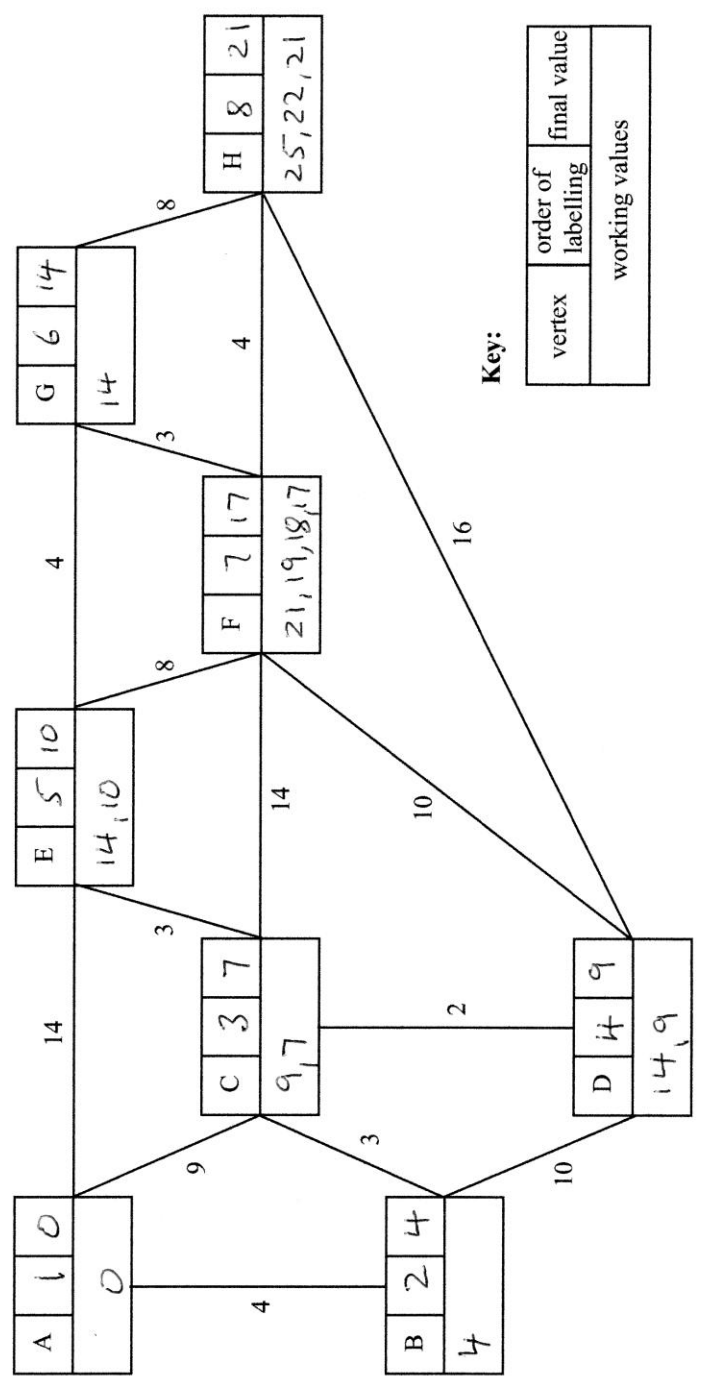




1. (a)



Shortest distance A to H: 21

Question 1 continued

(b) A B C E G F H

(c) H F G E C = 14 miles

Leave
blank

Q1

(Total 8 marks)



2.

~~23~~ ~~29~~ ~~11~~ ~~34~~ ~~10~~ ~~14~~ ~~35~~ ~~17~~

a) Total size = 173 Mb
 $173 \div 50 = 3.46$ so 4 discs are needed

b) $23 + 29 = 52$ X 1st disc = 23, 11, 10
 $23 + 11 = 34$ ✓
 $34 + 34 = 68$ X
 $34 + 10 = 44$ ✓

$29 + 34 = 63$ X 2nd disc = 29, 14
 $29 + 14 = 43$ ✓

$34 + 35 = 69$ X 3rd disc = 34
 $34 + 17 = 51$ X

$35 + 17 = 52$ X 4th disc = 35

5th disc = 17

c)

23	29	11	34	10	14	35	17
29	23	34	11	14	35	17	10
29	34	23	14	35	17	11	10
34	29	23	35	17	14	11	10
34	29	35	23	17	14	11	10
34	35	29	23	17	14	11	10
35	34	29	23	17	14	11	10

d) 1st disc = 35, 14
 2nd disc = 34, 11
 3rd disc = 29, 17
 4th disc = 23, 10



3.

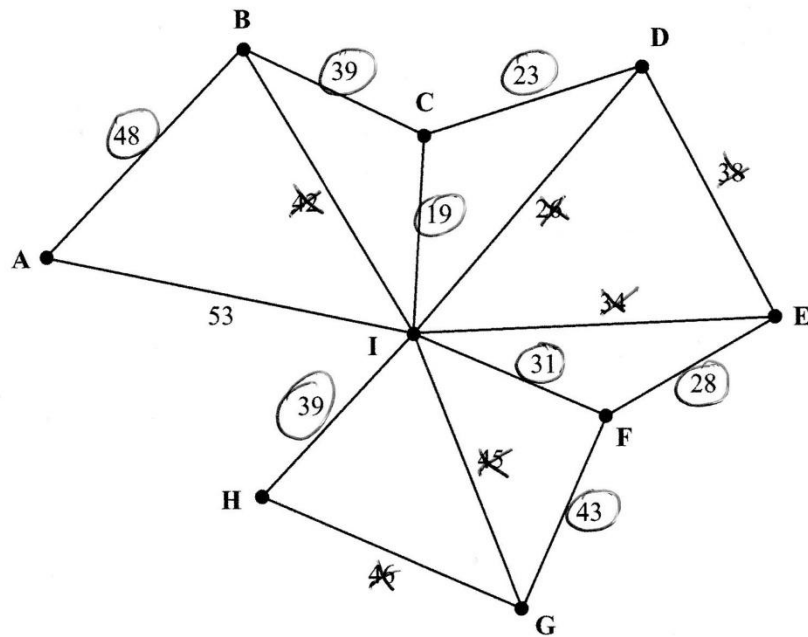


Figure 2

(a)	IC	add	19	✓
	CD	add	23	✓
	ID	reject	26	
	EF	add	28	✓
	IF	add	31	✓
	IE	reject	34	
	ED	reject	38	
	BC	add	39	✓
	IH	add	39	✓
	BI	reject	42	
	FG	add	43	✓
	IG	reject	45	
	GH	reject	46	
	AB	add	48	✓



Question 3 continued

- (b) AB
BC
CI
CD
FI
EF
IH
FG

(c)

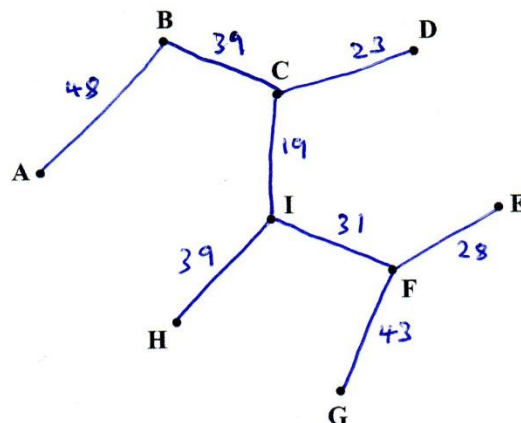


Diagram 1

Weight of minimum spanning tree: 270

- (d) Kruskal's algorithm can be used if starting
with DI and HG

Q3

(Total 10 marks)



4.

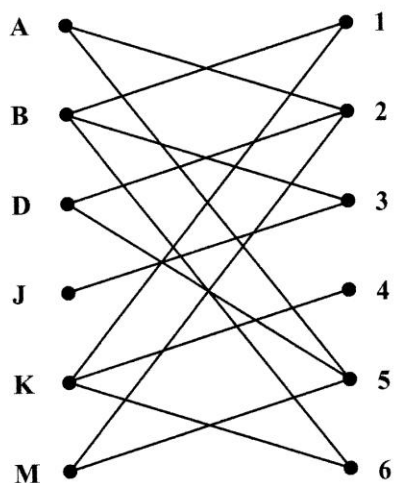


Figure 3

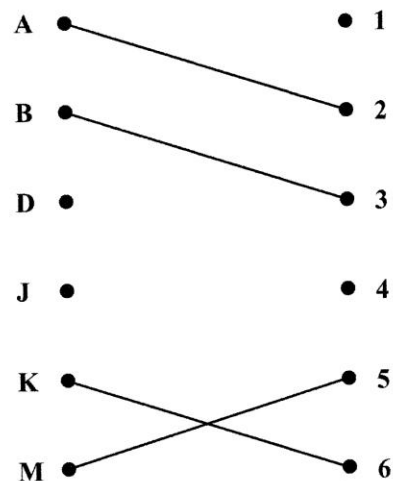


Figure 4

a) This is a bipartite graph

b) 4 - K add
K - 6 remove
6 - B add
B - 3 remove
3 - J add

A - 2 stays

M - 5 stays

$\therefore$ A - 2

B - 6

D unmatched

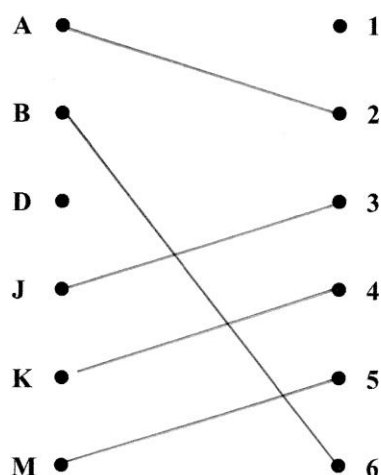
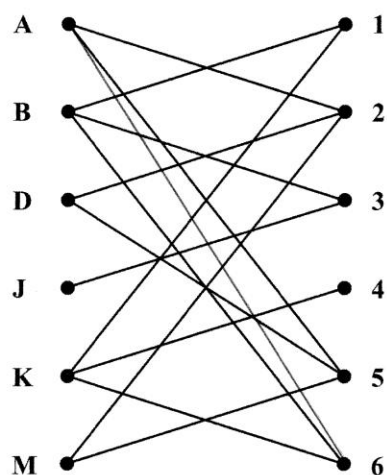
J - 3

K - 4

M - 5



Question 4 continued



c) 1-B add
B-6 remove
6-A add
A-2 remove
2-D add

J-3 stays
K-4 stays
M-5 stays

1. A-6
B-1
D-2
J-3
K-4
M-5

(Total 7 marks)

Q4

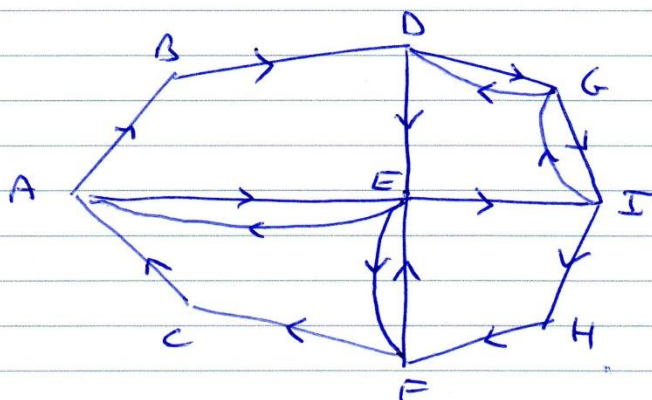


5. a) $AD = 4.5$ (AED)
 $AF = 5.8$ (AEF)
 $AI = 5.9$ (AEI)
 $DI = 3.9$ (DGI)
 $DF = 5.1$ (DEF)
 $FI = 5.3$ (FHI)

$$AI \setminus DF = 5.9 + 5.1 = 11$$

$$AO \setminus FI = 4.5 + 5.3 = 9.8$$

$$AF \setminus DI = 5.8 + 3.9 = 9.7 \text{ smallest}$$



e.g. AEABDEIGDGIHFEFCA

- b) AE, EF, DG, GI

$$\text{length is } 3.6 + 2.6 + 3.2 + 1.9 + 2.0 = 41.3 \text{ km}$$

- c) D may now be an odd vertex so we should only consider

$$AF = 5.8$$

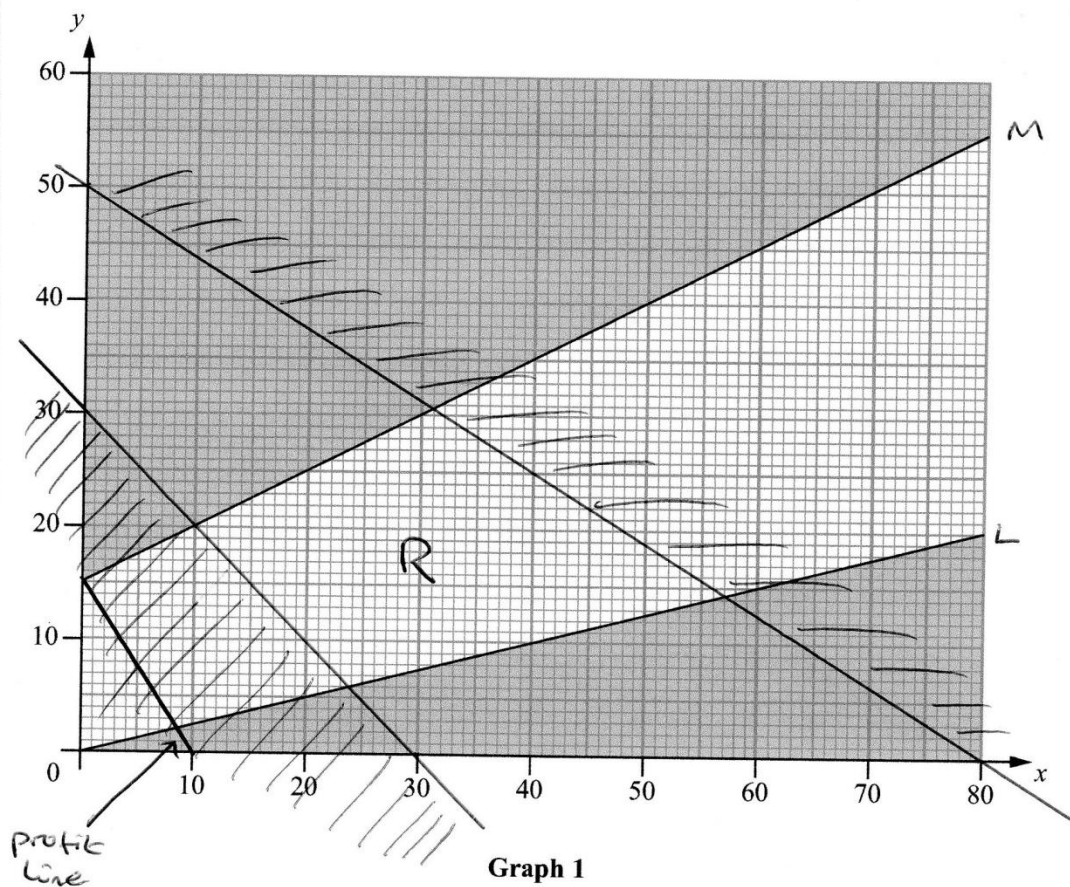
$$AI = 5.9$$

$$IF = 5.3$$

As IF is the smallest, we should repeat IF, or more explicitly, FIH, thus making F and I even. This leaves A as the finishing point.



6.



Line L goes through $(0,0)$ and $(80,20)$

$\therefore$ Its equation is $y = \frac{1}{4}x$

$\therefore$ the constraint is $y \leq \frac{1}{4}x$ (e.g. $(10,40)$
 $10 \leq \frac{1}{4} \times 60$)

Line M goes through $(0,15)$ and $(50,40)$

gradient is $\frac{25}{50} = \frac{1}{2}$ y-intercept is $(0,15)$

$\therefore$ Its equation is $y = \frac{1}{2}x + 15$

$\therefore$ the constraint is $y \geq \frac{1}{2}x + 15$ (e.g. $(40,40)$
 $40 \geq 20 + 15$)



Question 6 continued

b) $x + y = 30$ passes through $(0, 30)$ and $(30, 0)$

$5x + 8y = 400$ passes through $(80, 0)$ and $(0, 50)$

c) profit line is of the form $P = 15x + 10y$

e.g. passes through $(10, 0)$ and $(0, 15)$

minimum profit occurs at $x = 10, y = 20$

Q6

(Total 11 marks)



7. (a)

Activity	Immediately preceding activities
A	-
B	-
C	A
D	A
E	A
F	B, C
G	B, C
H	E, F
I	D, E, F
J	G, H
K	G, H, I
L	G, H, I

Precedence table

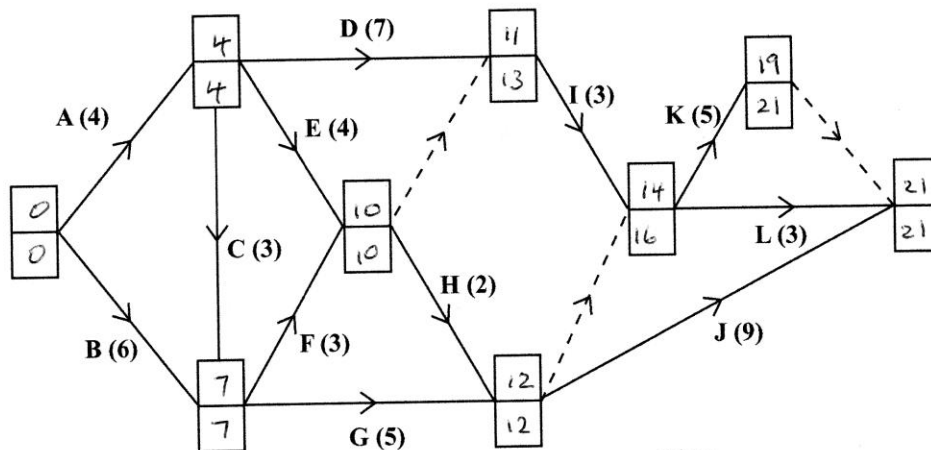
- (b) The dummy event from 6 to 7 is needed because J depends on G and H but L (and K) depends on G, H and I

The dummy event from 8 to 9 is needed because otherwise K and L would have the same start and finish number



Question 7 continued

(c)



Key:

Early event time

Late event time

Diagram 2

(d) Critical Activities: A C F H G J

(e) 21 - 14 - 5 = 2

(f) Total number of days = 54

Critical path = 21

$\therefore \frac{54}{21} = 2.5714 \therefore 3$ workers needed

(Total 16 marks)

Q7

TOTAL FOR PAPER: 75 MARKS

END

