

May 2010
D1

Le
bl:

1.

Hajra (H)	Vicky (V)	Leisham (L)	Alice (A)	Nicky (N)	June (J)	Sharon (S)	Tom (T)	Paul (P)
--------------	--------------	----------------	--------------	--------------	-------------	---------------	------------	-------------

a)

STEP 1

choose N as pivot

H V L A (N) J S T P

sort into sublists

H L A J (N) V S T P

STEP 2

choose A and T as pivots

H L (A) J (N) V S (T) P

sort into sublists

(A) H L J (N) S P (T) V

STEP 3

choose L and P as pivots

(A) H (L) J (N) S (P) (T) V

sort into sublists

(A) H J (L) (N) (P) S (T) V

STEP 4

choose J as a pivot

(A) H (J) (L) (N) (P) S (T) V

sort into sublists

(A) H (J) (L) (N) (P) S (T) V



Question 1 continued

b) 9 names

accept 1-9

$$\frac{1+9}{2} = 5$$

consider 5th name: Nicky

PAUL is after Nicky so reject 1-4
accept 6-9

$$\frac{6+9}{2} = 7.5$$

consider 8th name: TOM

PAUL is before TOM so reject 8-9
accept 6-7

$$\frac{6+7}{2} = 6.5$$

consider 7th name: SHARON

PAUL is before SHARON so reject 7
accept 6

PAUL is the 6th name

Q1

(Total 8 marks)



2.

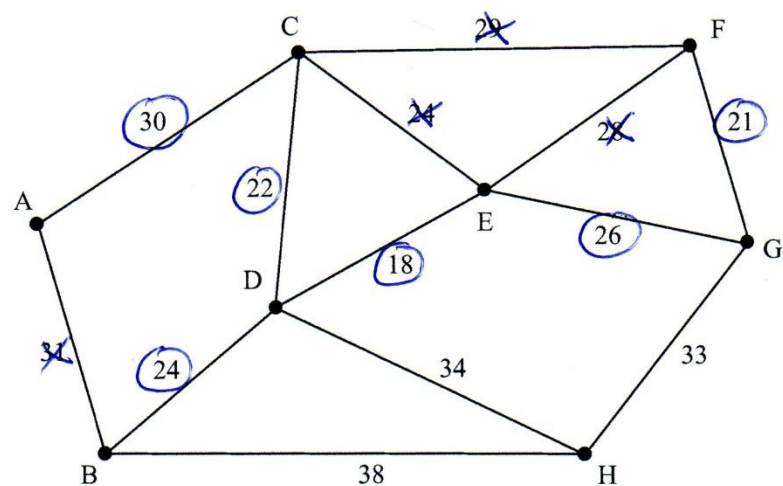


Figure 1

(a)

- | | | | |
|---|----|------|--------|
| ① | DE | (18) | add |
| ② | FG | (21) | add |
| ③ | DC | (22) | add |
| ④ | CE | (24) | reject |
| | BD | (24) | add |
| ⑤ | EG | (26) | add |
| ⑥ | EF | (28) | reject |
| | CF | (29) | reject |
| | AC | (30) | add |
| ⑦ | AB | (31) | reject |
| | GH | (33) | add |

∴ DE, FG, DC, BD, EG, AC, GH



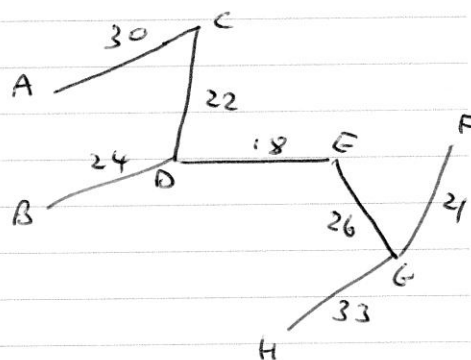
(b)

	A	B	C	D	E	F	G	H
A	-	31	30	-	-	-	-	-
B	31	-	-	24	-	-	-	38
C	30	-	-	22	24	29	-	-
D	-	24	22	-	18	-	-	34
E	-	-	24	18	-	28	26	-
F	-	-	29	-	28	-	21	-
G	-	-	-	-	26	21	-	33
H	-	38	-	34	-	-	33	-

Matrix 1

(c)

AC (30)
 CD (22)
 DE (18)
 BD (24)
 GE (26)
 GF (21)
 GH (33)



(d) Weight of minimum spanning tree: 174

(Total 9 marks)

Q2



3.

a) Total weight = 239

$$\frac{239}{6} = 39.8\bar{3} \quad \text{so a lower bound is 4}$$

b) CRATE 1 : 41

CRATE 2 : 28, 31

CRATE 3 : 42

CRATE 4 : 36

CRATE 5 : 32

CRATE 6 : 29

c) $28 + 32 = 60$

$31 + 29 = 60$

CRATE 1 : 28, 32

CRATE 2 : 31, 29

CRATE 3 : 42

CRATE 4 : ~~3~~ 41

CRATE 5 : 36

d) Any two statues over 30 must be transported in separate crates.

As there are five statues over 30, five crates are needed.



4.

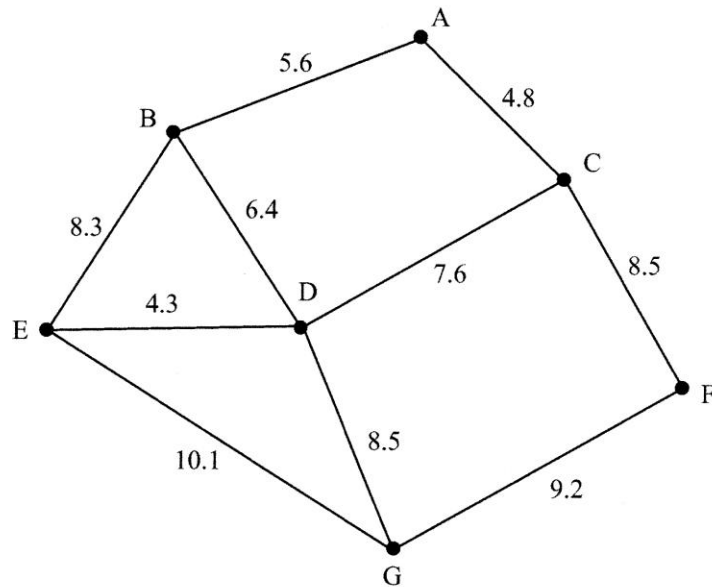


Figure 2

[The total weight of the network is 73.3 km]

a) odd vertices B, C, E, G

$$BC = 10.4$$

$$BE = 8.3$$

$$BG = 14.9$$

$$CE = 11.9$$

$$CG = 16.1$$

$$EG = 10.1$$

$$BC + EG = 20.5$$

$$BE + CG = 24.4$$

$$BG + CE = 26.8$$

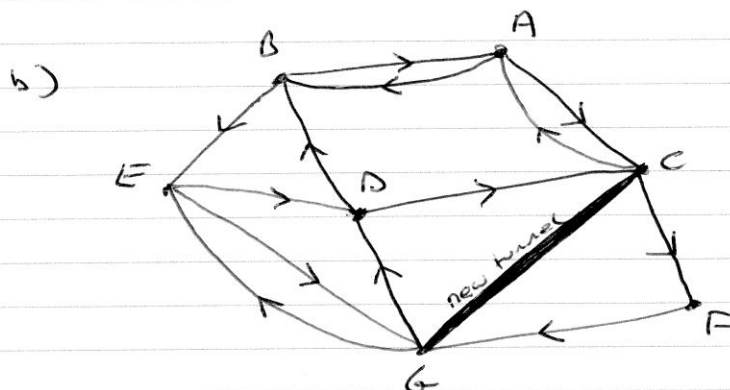
So the minimum is 20.5, i.e. BC and EG need to be traversed twice

$$\text{But, } BC = BA + AC$$

so BA, AC and EG need to be traversed twice



Question 4 continued



ABACFGDBEGEDCA

$$\text{Length} = 73.3 + 20.5 = 93.8$$

- c) G and C are now not odd
This leaves B and E as odd vertices, so
repeat BE

$$\begin{aligned} \therefore \text{Total length} &= \text{weight of network} \\ &\quad + BE + CG \\ &= 73.3 + 8.3 + 10 \\ &= 91.6 \end{aligned}$$

so the total length is reduced by 2.2 km

(Total 10 marks)

Q4



5.

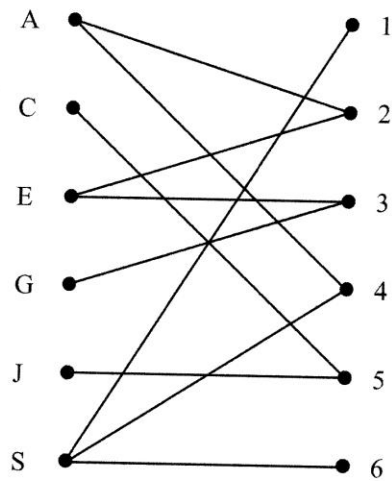


Figure 3

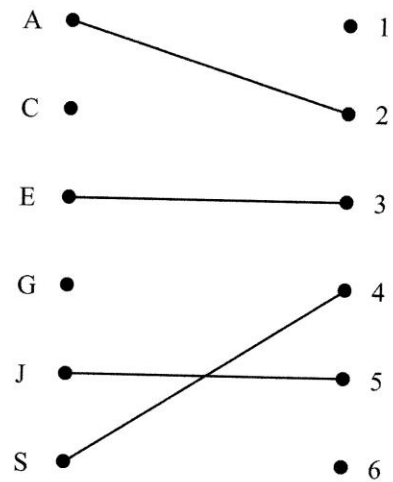


Figure 4

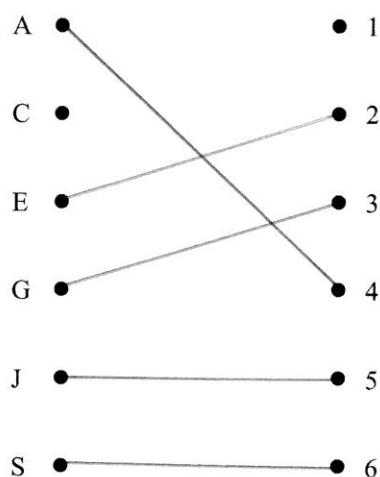
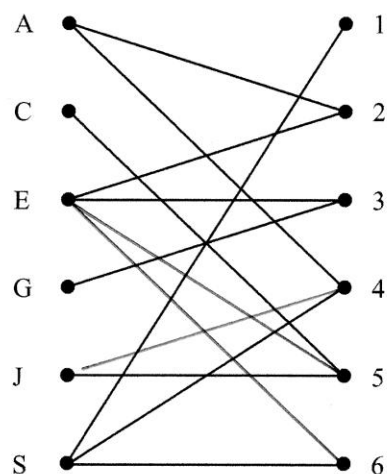
a) 6-S add
 S-4 remove
 4-A add
 A-2 remove
 2-E add
 E-3 remove
 3-G add

Improved matching

A-4
 C
 E-2
 G-3
 J-5
 S-6



Question 5 continued



b) A complete matching is impossible because C will only do task 5 and J will only do task 5

c) 1-S add
5-6 remove
6-E add
E-2 remove
2-A add
A-4 remove
4-J add
J-5 remove
5-C add

complete matching is A-2
C-5
E-6
G-3
J-4
S-1

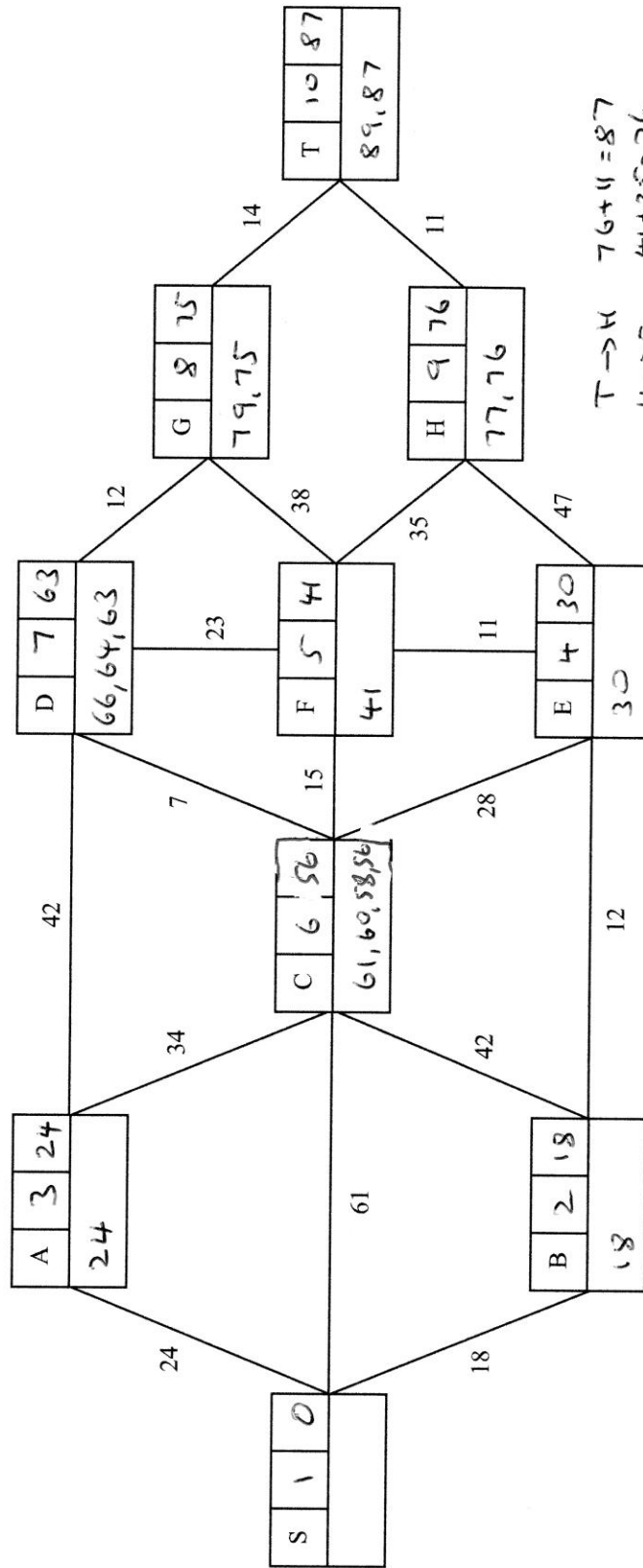
Q5

(Total 8 marks)



6.

(a)



$T \rightarrow H$ $76 + 11 = 87$
 $H \rightarrow F$ $41 + 35 = 76$
 $F \rightarrow E$ $30 + 11 = 41$
 $E \rightarrow B$ $18 + 12 = 30$
 $B \rightarrow S$ $0 + 18 = 18$

Route S to T: S B E F H T

Time taken for route: 87

Le:
bla

Question 6 continued

(b)

$$\begin{aligned} T &\rightarrow H & 76 + 11 &= 87 \\ H &\rightarrow F & 41 + 35 &= 76 \\ F &\rightarrow E & 30 + 11 &= 41 \\ E &\rightarrow B & 18 + 12 &= 30 \\ B &\rightarrow S & 0 + 18 &= 18 \end{aligned}$$

(c) Route E to T: E F H T

(Total 9 marks)

Q6

Leave blank

7.

a) a dotted line shows $y > 6$ and not $y \geq 6$

b) $3x \geq 2y$

$3x = 2y$

e.g. $x=2, y=3$

or $x=10, y=15$

or $x=0, y=0$

$x=4, y=0$ is in region

$5x + 4y \geq 80$

$5x + 4y = 80$

e.g. $x=16, y=0$

or $x=0, y=20$

$x=0, y=0$ is outside region

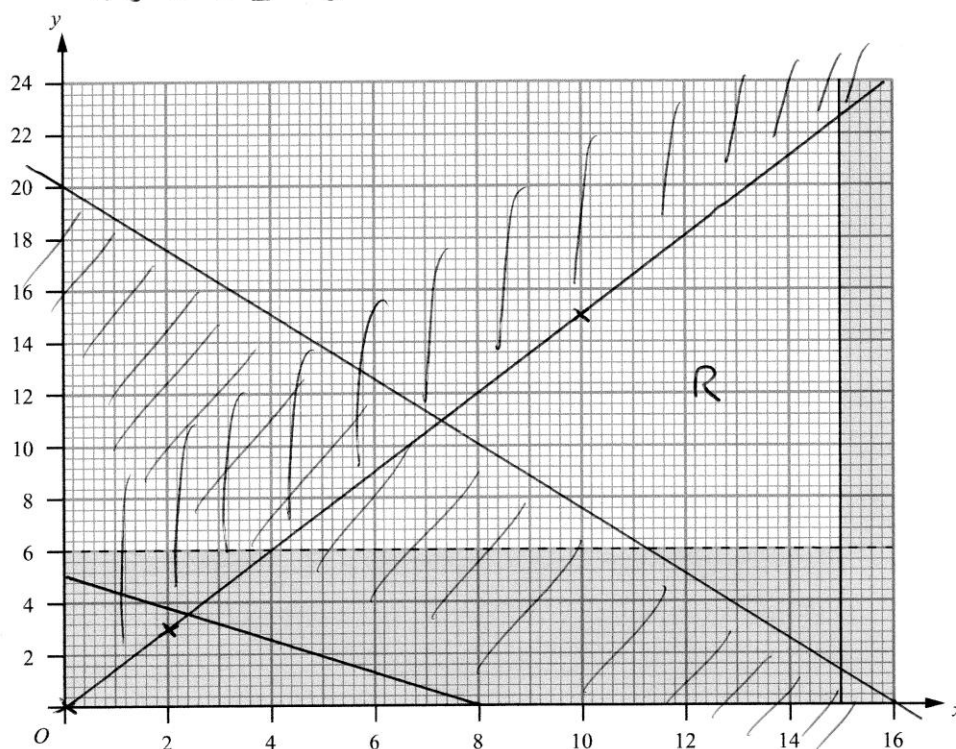


Diagram 1

c) $500x + 800y$

d) cost is of the form $C = 500x + 800y$

LCM of 500 and 800 is 4000

so show $500x + 800y = 4000$

e.g. $x=8, y=0$ and $x=0, y=5$

Lines parallel to $C = 500x + 800y$ first intersect R at either (1, 7) or (10, 8) (since $y \geq 6$)



Question 7 continued

$$x=11, y=7 \text{ gives cost} = 5500 + 5600 = 11100$$

$$x=10, y=8 \text{ gives cost} = 5000 + 6400 = 11400$$

so 11,7 minimises cost

Number of 'Sports Mad' activities (x): 11

Number of 'Circus Fun' activities (y): 7

Total cost: 11100

(Total 11 marks)

Q7



8. (a)

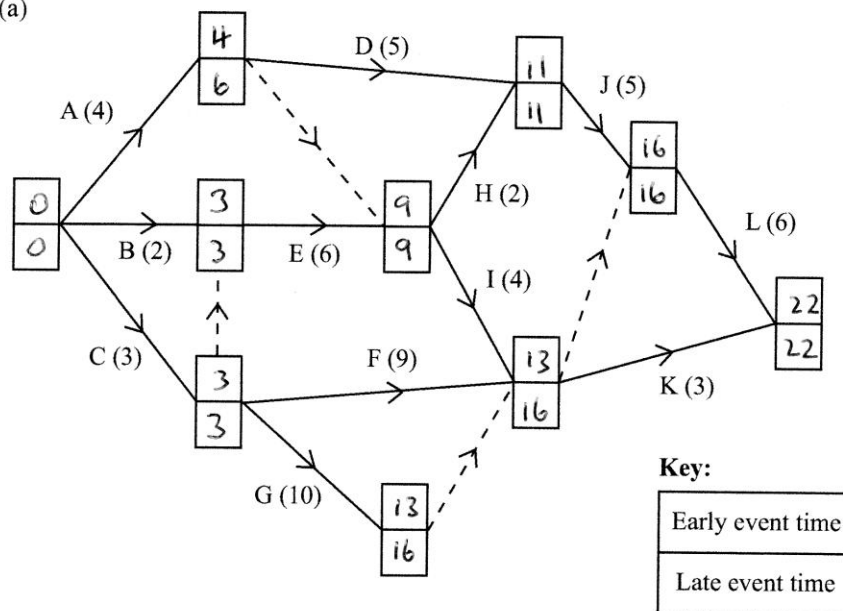
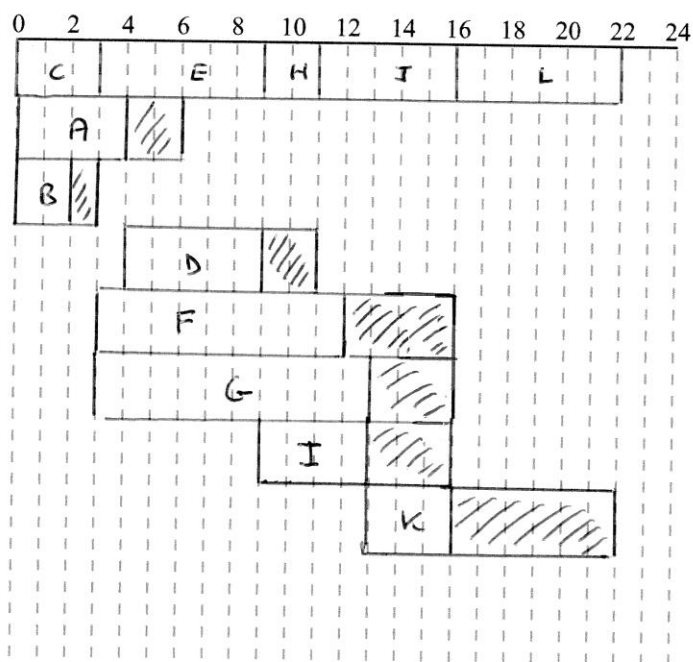


Diagram 2

(b) Critical activities: C E H J L



(c)



Grid 1

(d)

At 8 hours, activities E, D, F and G are taking place, so 4 workers are needed.

Q8

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

END

