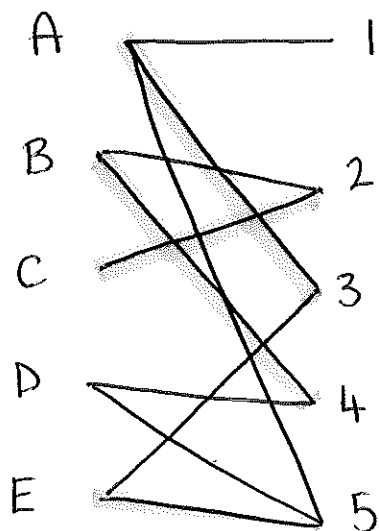


June '06

1a)



$$D - 5 + E - 3 + A - 1$$

- A 1
- B 4
- C 2
- D 5
- E 3

2a)

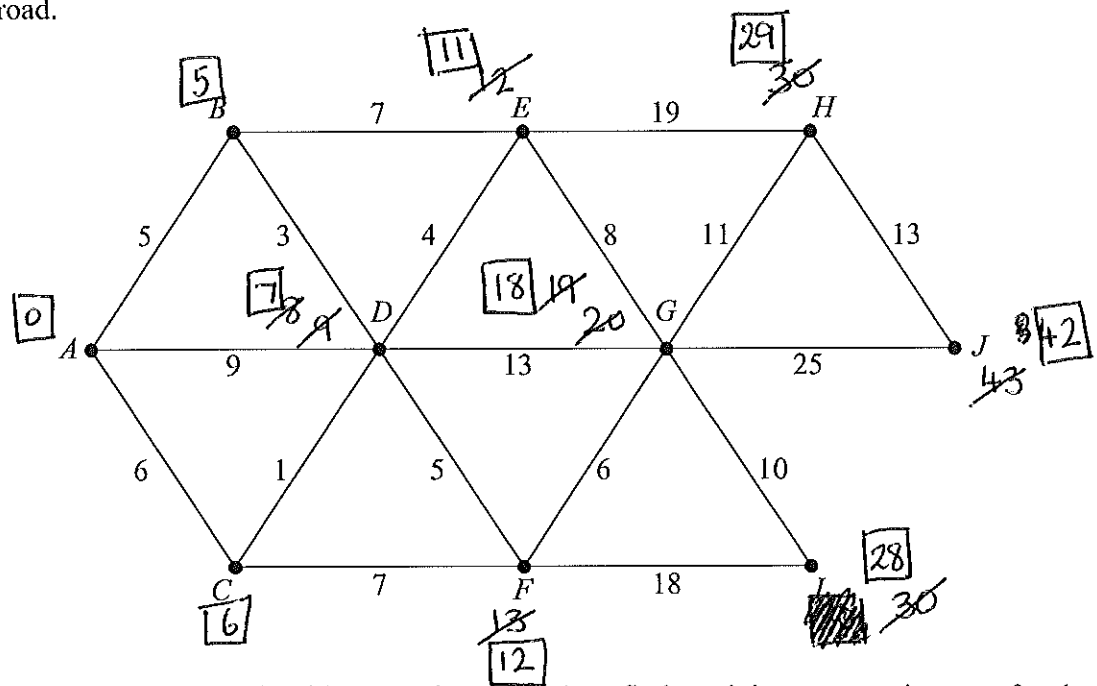
	18	2	12	7	26	19	16	24	C	S
P1	2	18	12	7	26	19	16	24	I	I
P2	2	12	18	7	26	19	16	24	II	I
P3	2	7	12	18	26	19	16	24	III	II
P4	2	7	12	18	26	19	16	24	I	0
P5	2	7	12	18	19	26	16	24	II	I
P6	2	7	12	16	18	19	26	24	IIII	III
P7	2	7	12	16	18	19	24	26	II	I

b)

- Pass 1 1 comparison 1 swap
- Pass 2 2 comparisons 1 swap
- Pass 3 3 comparisons 2 swaps

3 [Figure 1, printed on the insert, is provided for use in part (b) of this question.]

The diagram shows a network of roads. The number on each edge is the length, in kilometres, of the road.



- (a) (i) Use Prim's algorithm, starting from A , to find a minimum spanning tree for the network. (5 marks)
- (ii) State the length of your minimum spanning tree. (1 mark)
- (b) (i) Use Dijkstra's algorithm on Figure 1 to find the shortest distance from A to J . (6 marks)
- (ii) A new road, of length x km, is built connecting I to J . The minimum distance from A to J is reduced by using this new road. Find, and solve, an inequality for x . (2 marks)

Turn over for the next question

Turn over ►

3ai)

AB	5
BD	3
DC	1
DE	4
DF	5
FG	6
GI	10
GH	11
HJ	13
	<hr/>
	58

ii) 58

bi) see sheet 42

$$\begin{aligned} \text{ii)} \quad 28 + x &< 42 \\ x &< 14 \end{aligned}$$

4a) odd = A, C, D, F

$$AC = 18 \quad (ABC)$$

$$AD = 32 \quad (ABED)$$

$$AF = 12$$

$$DF = 22 \quad (DEF)$$

$$CF = 30 \quad (CBAF)$$

$$CD = 30$$

$$AC + DF = 18 + 22 = 40$$

$$AD + CF = 32 + 30 = 62$$

$$AF + CD = 12 + 30 = 42$$

$$164 + 40 = 204$$

b) A and C must be odd so add DF

$$164 + 22 = 186$$

ci) shortest pairing of odd vertices (see above)
is 12 (AF)

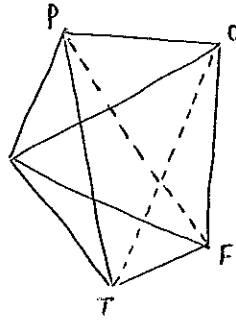
$$\text{so } 164 + 12 = 176$$

ii) if A & F now odd, can start at C or D

5ai) 7

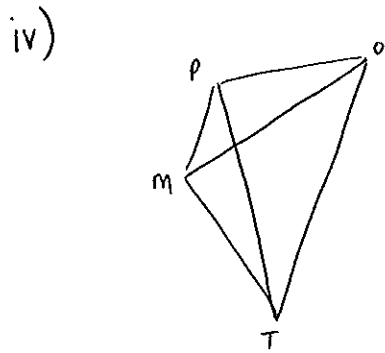
ii) 7

bj) PF (PMF) 3
OT (OPT/OMT) $3\frac{1}{4}$



ii) $F \rightarrow T \rightarrow P \rightarrow O \rightarrow M \rightarrow F$
 $\frac{1}{4} \quad 2\frac{1}{4} \quad 1 \quad 1\frac{3}{4} \quad 2 = 8\frac{1}{4}$

iii) $F \rightarrow T \rightarrow M \rightarrow P \rightarrow O \rightarrow F = 7$
 $\frac{1}{4} \quad 1\frac{1}{2} \quad 1 \quad 1 \quad 2\frac{1}{4}$



OP	1
PM	1
MT	$1\frac{1}{2}$
	<u>$3\frac{1}{2}$</u>

+ FT FM
 $\frac{1}{4} + 2 = \underline{\underline{3\frac{1}{4}}}$
 $= 6\frac{3}{4}$

6a)

$$10 \leq x \leq 80$$
$$5 \leq y \leq 40$$
$$x + y \leq 100$$

$$20x + 60y \leq 3000 \quad \Rightarrow \quad x + 3y \leq 150$$

$$P = 2x + y$$

b) see next sheet

c) maximum at $(80, 20)$

$$P = 2(80) + (20) = 160 + 20 = \pounds 180$$

d)

$$P = x + 4y$$

maximum now at $(30, 40)$

$$P = 30 + 4(40) = 30 + 160 = \pounds 190$$

7ai) $m - 1$

ii) $n \geq m - 1$

b) Hamiltonian = ~~graph~~ ~~with~~ m edges

c)

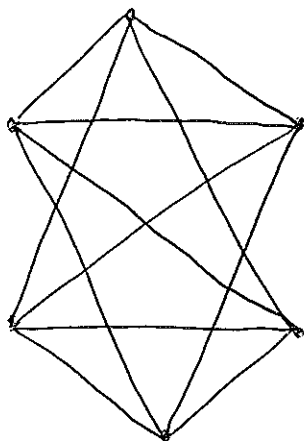
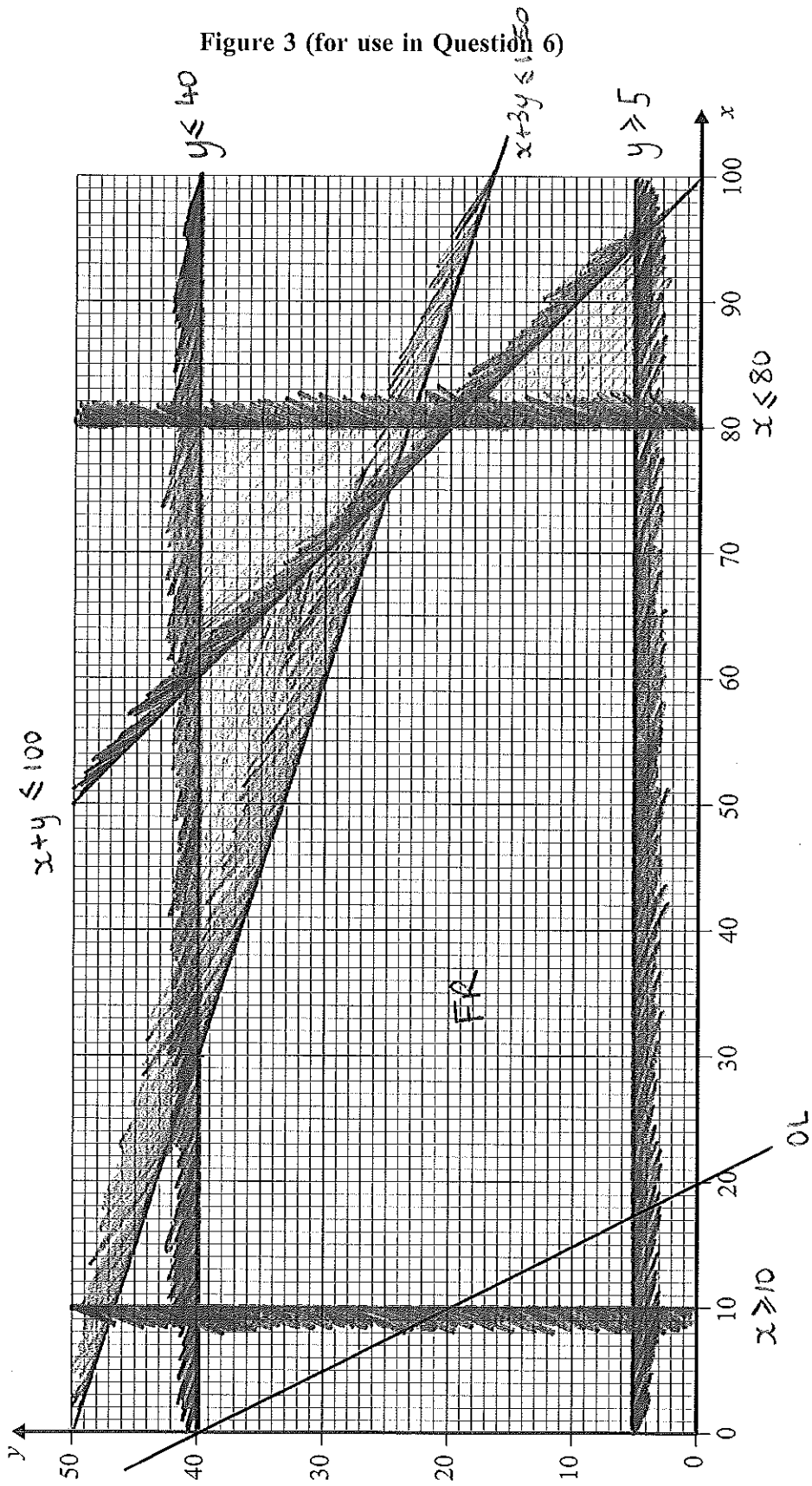


Figure 3 (for use in Question 6)



$$P = 2x + y$$

$$40 = 2x + y$$

$(0, 40)$
 $(20, 0)$