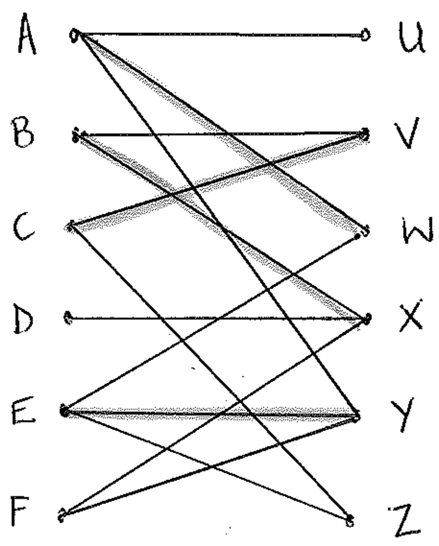
Jan '06

1a)



b)

D - X + B - V + C - Z

F - Y + E - W + A - U

AU
BV
CZ
DX
EW
FY

2)

18	23	12	7	26	19	16	24
12	7	16	18	23	26	19	24
7	12	16	18	19	23	26	24
7	12	16	18	19	23	24	26

3a i) 9

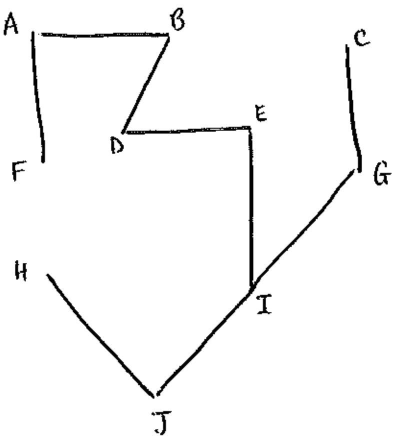
ii) n-1

b i)

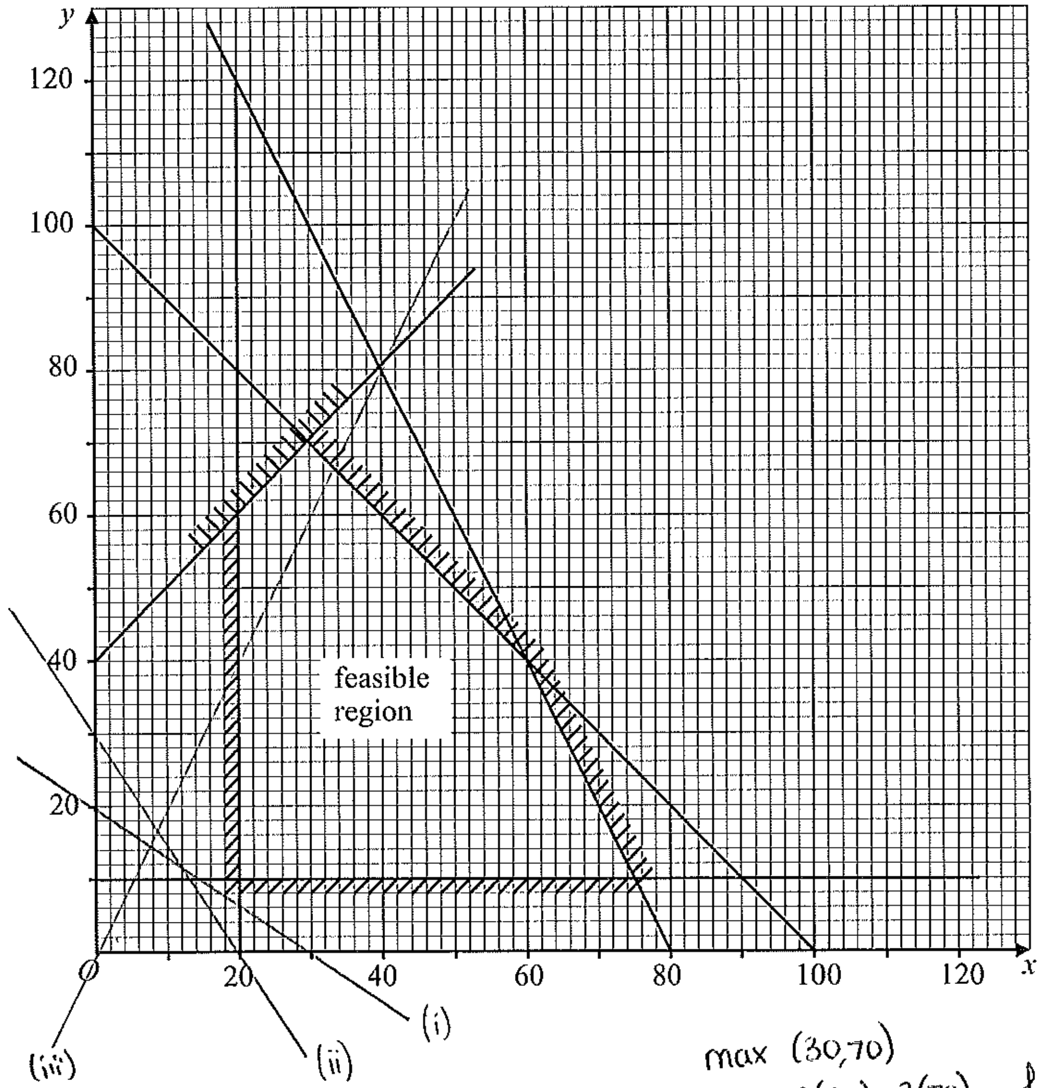
GI	5
AB	6
EI	7
BD	8
IJ	10
HJ	11
AF	13
CG	15
ED	14
	89

ii) 89

iii)



4 The diagram shows the feasible region of a linear programming problem.



max (30,70)
$2(30)+3(70) = £270$

(a) On the feasible region, find:

(i) the maximum value of $2x + 3y$; $2x+3y = 60$ *(2 marks)*

max (60,40)

(ii) the maximum value of $3x + 2y$; $3x+2y = 60$ $3(60)+2(40)$ *(2 marks)*
$= £260$

(iii) the minimum value of $-2x + y$. $-2x+y = 0$ *(2 marks)*
$y = 2x$ min ~~max~~ (75,10)

(b) Find the 5 inequalities that define the feasible region. $-2(75)+10 =$ *(6 marks)*
$-£140$

$x \geqslant 20$

$y \geqslant 10$

$x+y \leqslant 100$

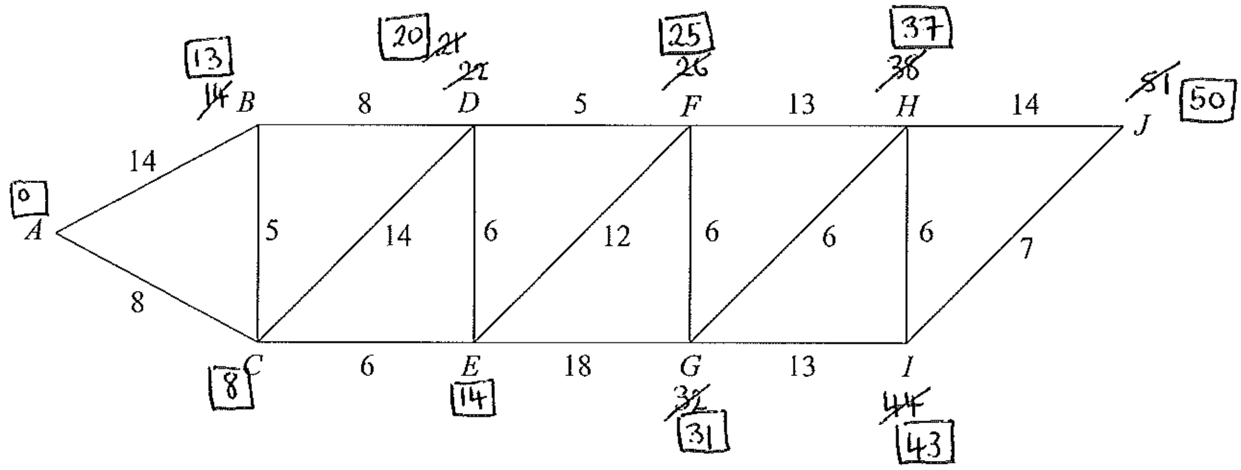
$y \leqslant x+40$

(80,0) and (0,160)

so $2x+y \leqslant 160$

5 [**Figure 1**, printed on the insert, is provided for use in this question.]

The network shows the times, in minutes, to travel between 10 towns.



(a) Use Dijkstra's algorithm on **Figure 1** to find the minimum time to travel from A to J. *(6 marks)*

(b) State the corresponding route. *(1 mark)*

A C E D F G H I J

6 Two algorithms are shown.

Algorithm 1

Line 10	Input P
Line 20	Input R
Line 30	Input T
Line 40	Let $I = (P * R * T)/100$
Line 50	Let $A = P + I$
Line 60	Let $M = A/(12 * T)$
Line 70	Print M
Line 80	Stop

Algorithm 2

Line 10	Input P
Line 20	Input R
Line 30	Input T
Line 40	Let $A = P$
Line 50	$K = 0$
Line 60	Let $K = K + 1$
Line 70	Let $I = (A * R)/100$
Line 80	Let $A = A + I$
Line 90	If $K < T$ then goto Line 60
Line 100	Let $M = A/(12 * T)$
Line 110	Print M
Line 120	Stop

In the case where the input values are $P = 400$, $R = 5$ and $T = 3$:

(a) trace **Algorithm 1**; *(3 marks)*

(b) trace **Algorithm 2**. *(4 marks)*

Turn over ▶

Q5 see sheet

Q6a)

P	R	T	I	A	M
400	5	3			
			60		
				460	
					12.8

b)

P	R	T	A	K	I	M
400	5	3				
			400			
				0		
				1		
					20	
			420			
				2		
					21	
			441			
				3		
					22.05	
			463.05			
						12.9

7a) A, B, C, I are vertice with odd order

b)

AB	100	
AC	150	
AI	380	(ADGI)
BC	120	
BI	450	(BEGI)
CI	440	(CFJI)

AB + CI = 100 + 440 = 540

AC + BI = 150 + 450 = 600

AI + BC = 380 + 120 = 500

2090 + 500 = 2590

c)

station	order	times see statue
B	4	2
C	4	2
D	6	3
E	4	2
F	4	2
G	6	3
H	2	1
I	4	2
J	2	1
		18

8ai) $L \rightarrow N \rightarrow O \rightarrow L$

35 20 15 $= 70$

ii) $L \rightarrow O \rightarrow N \rightarrow L$

30 40 25 $= 95$

b) LNOPRSL

ci) $S \rightarrow P \rightarrow O \rightarrow L \rightarrow N \rightarrow R \rightarrow S$

20 25 15 35 25 25 $= 145$

ii) This is a possible cycle that could be improved

iii) $S \rightarrow R \rightarrow O \rightarrow L \rightarrow N \rightarrow P \rightarrow S$

30 17 15 35 21 20 $= 138$

9. $5x + 4y + 3z \leq 180$

$12x + 8y + 10z \leq 240 \longrightarrow 6x + 4y + 5z \leq 120$

$24x + 12y + 18z \leq 540 \longrightarrow 4x + 2y + 3z \leq 90$

$x > y$

$y > z$

$x \geqslant 0.4(x+y+z) \longrightarrow x \geqslant 0.4x + 0.4y + 0.4z$

$0.6x \geqslant 0.4y + 0.4z$

$6x \geqslant 4y + 4z$

$3x \geqslant 2y + 2z$