

Jan 2005

1.

A	B	C	D	E	F
5	3				
		2			
			8		
				60	
					15

2a)

	19	3	7	20	2	6	5	15
P1:	3	7	19	2	6	5	15	(20)
P2:	3	7	2	6	5	15	(19)	(20)
P3:	3	2	6	5	7	(15)	(19)	(20)
P4:	2	3	5	6	(7)	(15)	(19)	(20)
P5:	(2)	(3)	(5)	(6)	(7)	(15)	(19)	(20)

b) Comparisons : $8-1 = 7$

Swaps : (see above) = 6

3a) A has an odd order

b) odd vertices A, D, F, I

$$AD = 14 \quad (AED)$$

$$AF = 14 \quad (ACF)$$

$$AI = 11 \quad (AEI)$$

$$FI = 14 \quad (FEI)$$

$$DI = 13 \quad (DEI)$$

$$DF = 17 \quad (DEF)$$

$$AD + FI = 14 + 14 = 28$$

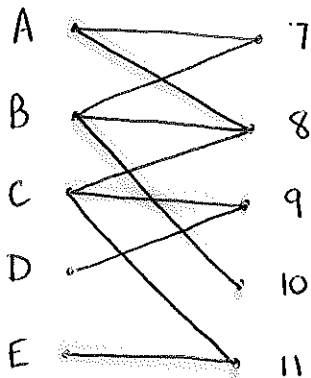
$$AF + DI = 14 + 13 = 27$$

$$AI + DF = 11 + 17 = 28$$

$$87 + 27 = 114 \text{ miles}$$

ABDGIHFCACFEIEDEA

4a)



b)

$$(D-9) + (C-8) + (A-7)$$

A7

B10

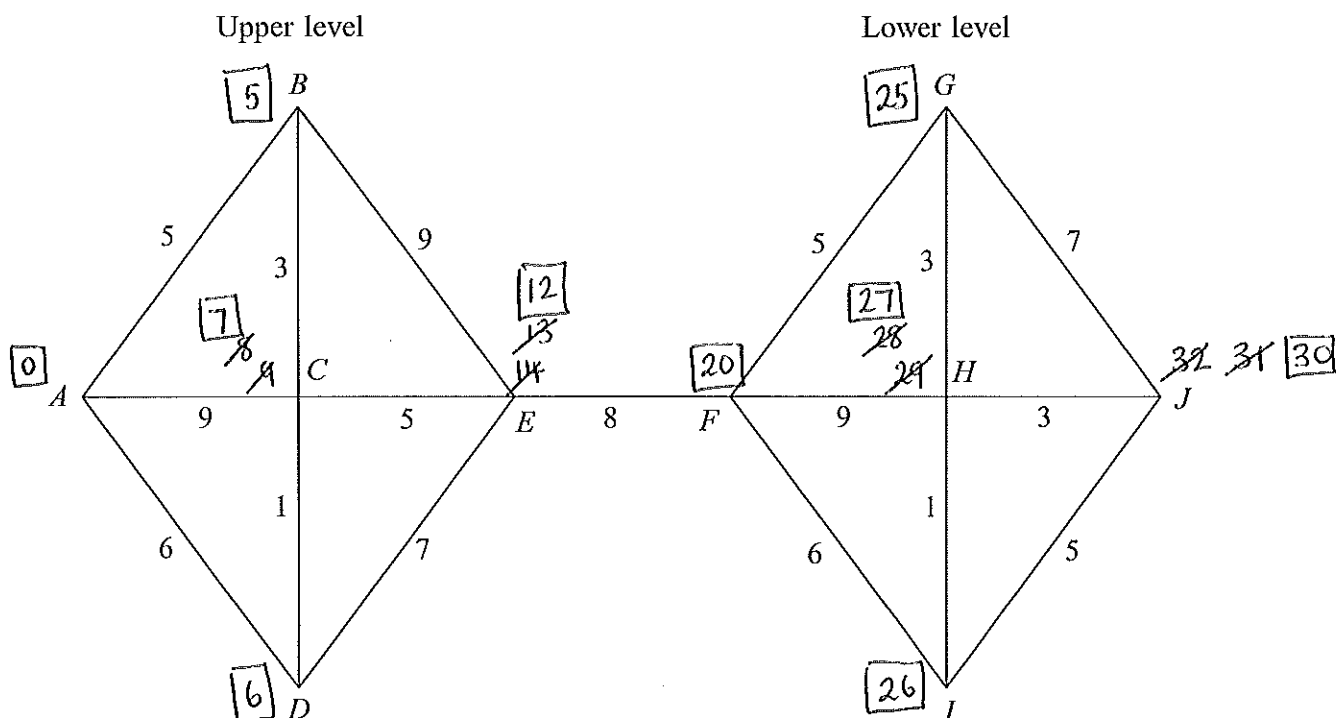
C8

D9

E11

6 [Figure 1, printed on a separate sheet, is provided for use in this question.]

A theme park is built on two levels. The levels are connected by a staircase. There are five rides on each of the levels. The diagram shows the ten rides: A, B, \dots, J . The numbers on the edges represent the times, in minutes, taken to travel between pairs of rides.



- (a) Use Dijkstra's algorithm on Figure 1 to find the minimum time to travel from A to J .
(6 marks)
- (b) A new staircase is built connecting rides B and G . The time taken to travel from B to G using this staircase is x minutes, where x is an integer. The time taken to travel from A to G is reduced, but the time taken to travel from A to J is not reduced.

Find two inequalities for x and hence state the value of x .
(4 marks)

$AG=25$ $AB=5$
so BG must
be less than 20

$$x < 20$$

$$A \rightarrow B \rightarrow G \rightarrow H \rightarrow J$$

$$5 + x + 3 + 3 \geq 30$$

$$x + 11 \geq 30$$

$$x \geq 19$$

$$\text{so } x = 19$$

Turn over ►

7ai)

$$A \rightarrow B \rightarrow C \rightarrow D \rightarrow E \rightarrow F \rightarrow A$$

$$8 \quad 10 \quad 7 \quad 15 \quad 11 \quad 7 = 58$$

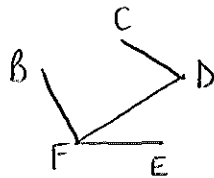
ii)

$$A \rightarrow C \rightarrow D \rightarrow F \rightarrow B \rightarrow E \rightarrow A$$

$$6 \quad 7 \quad 5 \quad 8 \quad 13 \quad 12 = 51$$

b)

$$\begin{array}{r} DF \quad 5 \\ CD \quad 7 \\ BF \quad 8 \\ EF \quad 11 \\ \hline 31 \end{array}$$



$$\begin{array}{r} AC \quad 6 \\ AF \quad 7 \\ \hline 13 \end{array}$$

$$31 + 13 = 44 \text{ miles}$$

c)

$$\frac{45}{\cancel{45}} \leq T \leq 51$$

8a)

Time to make :

$$4x + 2y \leq 4 \times 5 \times 60$$

$$4x + 2y \leq 1200$$

$$2x + y \leq 600 \text{ as required}$$

b)

$$\begin{array}{l} 2x + y \leq 600 \\ x \geq 40 \quad y \geq 40 \\ x + y \geq 120 \\ x + y \leq 400 \\ P = 3x + y \end{array}$$

c)

see next sheet

d)

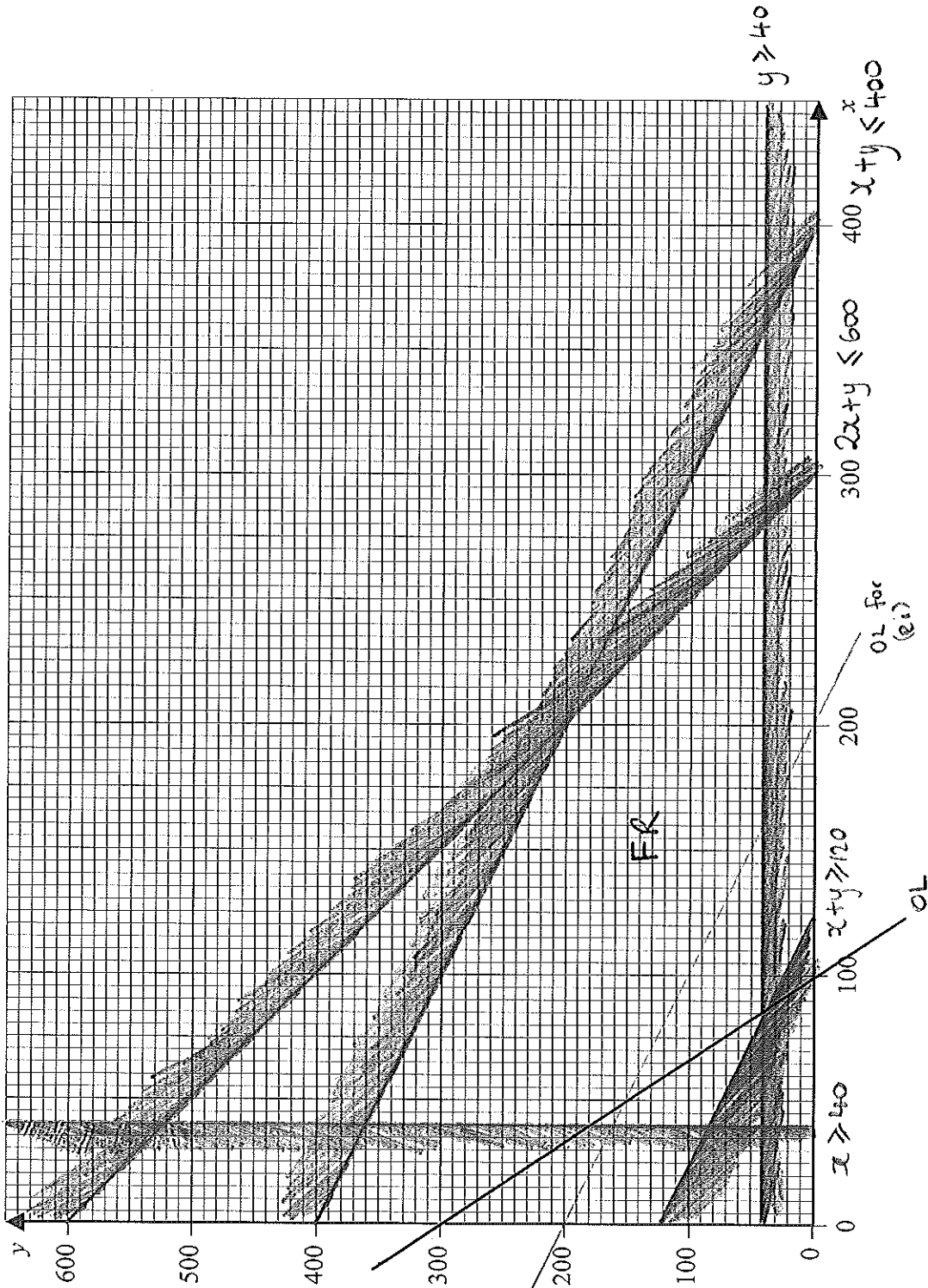
maximum at ~~200~~ (280, 40) $P = 3(280) + 40 = \text{£}880$

e i)

$P = 2x + 2y$
 maximum at (200, 200) eg $P = 2(200) + 2(200) = \text{£}800$
 through to (40, 360)

ii)

combinations: $200 - 40 + 1 = \underline{\underline{161}}$



$P = 3x + y$
 $300 = 3x + y$
 $(0, 300)$ $(100, 0)$

$P = 2x + 2y$
 $400 = 2x + 2y$
 $(0, 200)$ $(200, 0)$

Figure 2 (for Question 8)