

①a)

A ————— 1

B 2

C ————— 3

D ————— 4

E ————— 5

F 6

b) $B - 3 = C - 1 = A - 2$

c.s $B = 3 - C = 1 - A = 2$

improved match

A ————— 1

B ————— 2

C ————— 3

D ————— 4

E ————— 5

F 6

$F - 4 = D - 5 = E - 1 = C - 6$

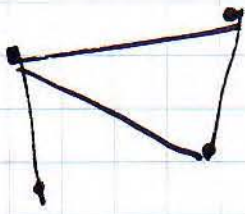
c.s $F = 4 - D = 5 - E = 1 - C = 6$

Complete match:

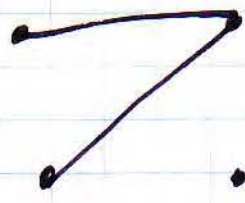
$$A=2, B=3, C=6, D=5, E=1, F=4$$

② a) I) A connected graph is a finite number of vertices connected by edges so that it is possible to find a path between any pair of vertices.

Eg)



connected



unconnected

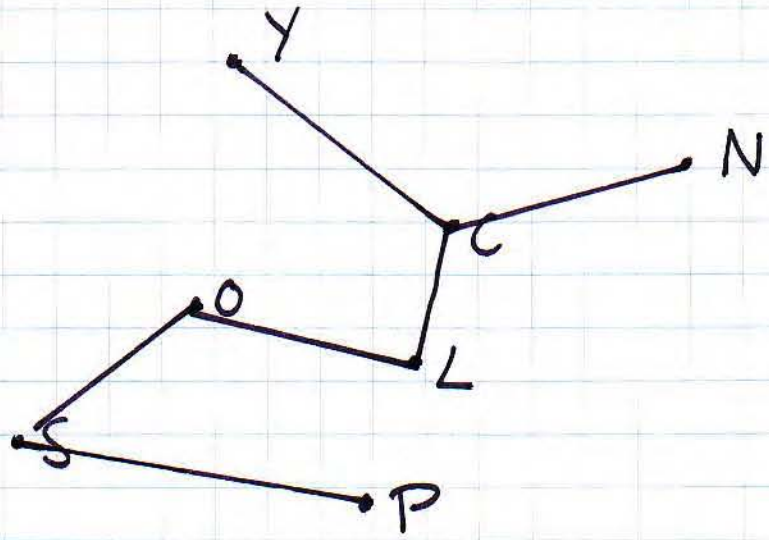
II) A tree is a graph with no cycles

III) A spanning tree is a tree that connects all vertices.

b) Kruskal's algorithm.

c) I) Next page.

II)



	Cambridge	London	Norwich	Oxford	Portsmouth	Salisbury	York
Cambridge (C)	60	62	81	132	139	156	
London (L)	60	-	116	56	74	88	211
Norwich (N)	62	116	-	144	204	201	181
Oxford (O)	81	56	144	-	84	63	184
Portsmouth (P)	132	74	204	84	-	43	269
Salisbury (S)	139	88	201	63	43	-	248
York (Y)	156	211	181	184	269	248	-

(3) (1) (4) (2) (6) (5) (7)

Order
LO LC CN OS SP CY

Figure 2

weight of tree = $60 + 62 + 56 + 156 + 63 + 43$
= 440 miles

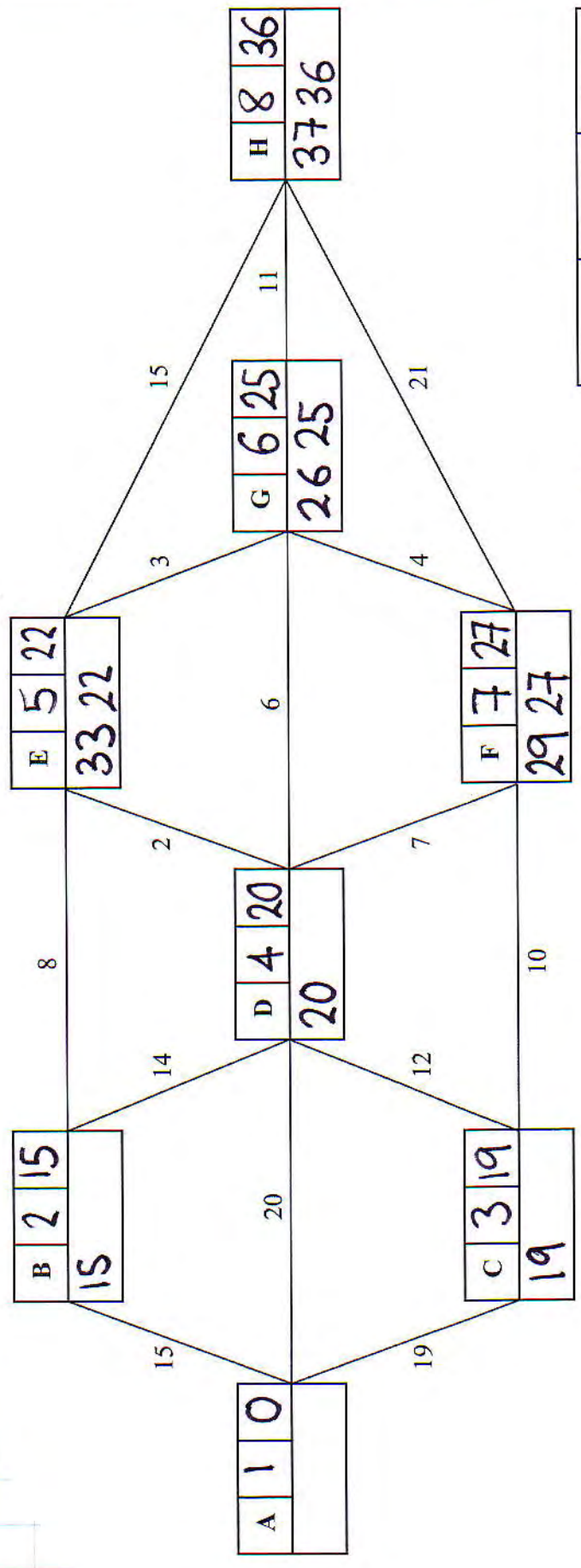
③ a) see page 4.

b) odd vertices A, C, B, H

AC = 19	AB = 15	AH = 36
BH = $\frac{22}{41}$	CH = $\frac{25}{40}$	CB = $\frac{22}{58}$

↑
min pairing

∴ Shortest time = $167 + 40 = \underline{\underline{207 \text{ mins}}}$



Key:

Vertex	Order of labelling	Final value
Working values		

Quickest route: ADEGH
 Time taken: 36 mins.

④ a) 0.6 ~~4.0~~ 2.5 3.2 0.5 2.6 0.4 0.3 4.0 1.0

4.0 3.2 4.0 2.6 0.6 2.5 0.5 0.4 0.3 1.0

4.0 4.0 3.2 2.6 ~~2.5~~ 0.6 2.5 0.5 1.0 0.4 0.3

4.0 4.0 3.2 2.6 0.6 2.5 1.0 0.5 0.4 0.3

4.0 4.0 3.2 2.6 2.5 0.6 1.0 0.5 0.4 0.3

4.0 4.0 3.2 2.6 2.5 1.0 0.6 0.5 0.4 0.3

all sublists size 1 so stop.

b)

Bin1	Bin2	Bin3	Bin4	Bin5
4	4	3.2 0.6	2.6 1 0.4	2.5 0.5 0.3

c) total length = 19.1 $\frac{19.1}{4} = 4.775$ so 5 bins needed

∴ solution is optimal.

⑤ a)

S	T	R	R > 0?	Output
25000	0	17000	Y	
	3400	7000	Y	
	4450	-5000	N	4450

b) ~~4450~~

c) ~~8000~~

⑥ a) this shows that E is dependent on A and B while C and D are dependent on A only.

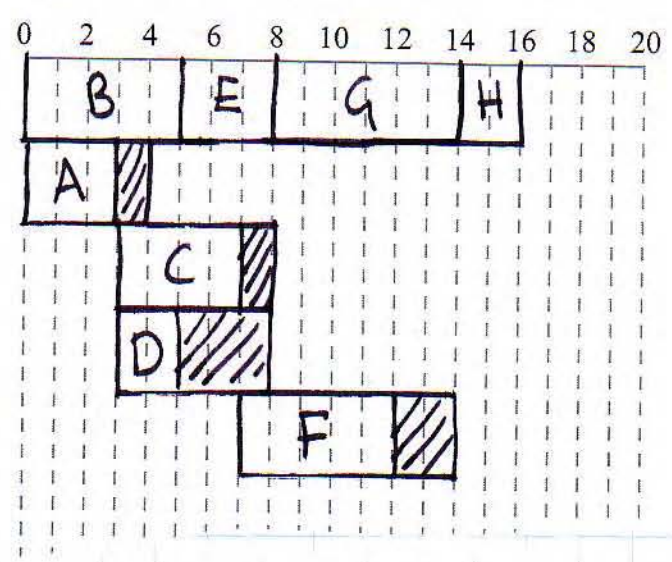
b)

Event	Preceding activity
A	—
B	—
C	A
D	A
E	A A, B
F	C
G	C, D, E
H	F, G

c) see page 7

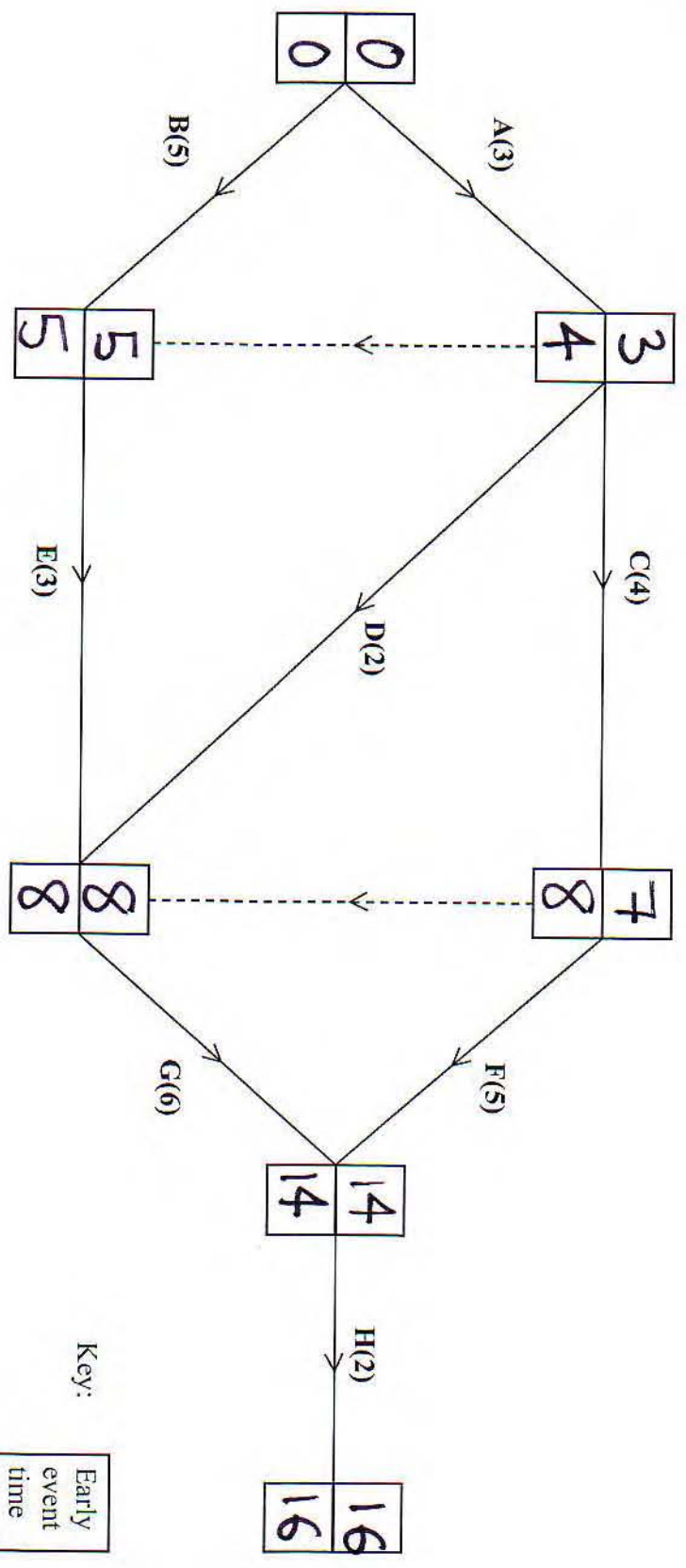
d) see page 7

e)



(c) d)

(c)



(d) Critical activities: B, E, G, H
Length of critical path: 16 days.

7) a) $150x + 300y \leq 1800$

$x + 2y \leq 12$

b) $90x + 120y$ must be less than or equal to 900

$90x + 120y \leq 900$

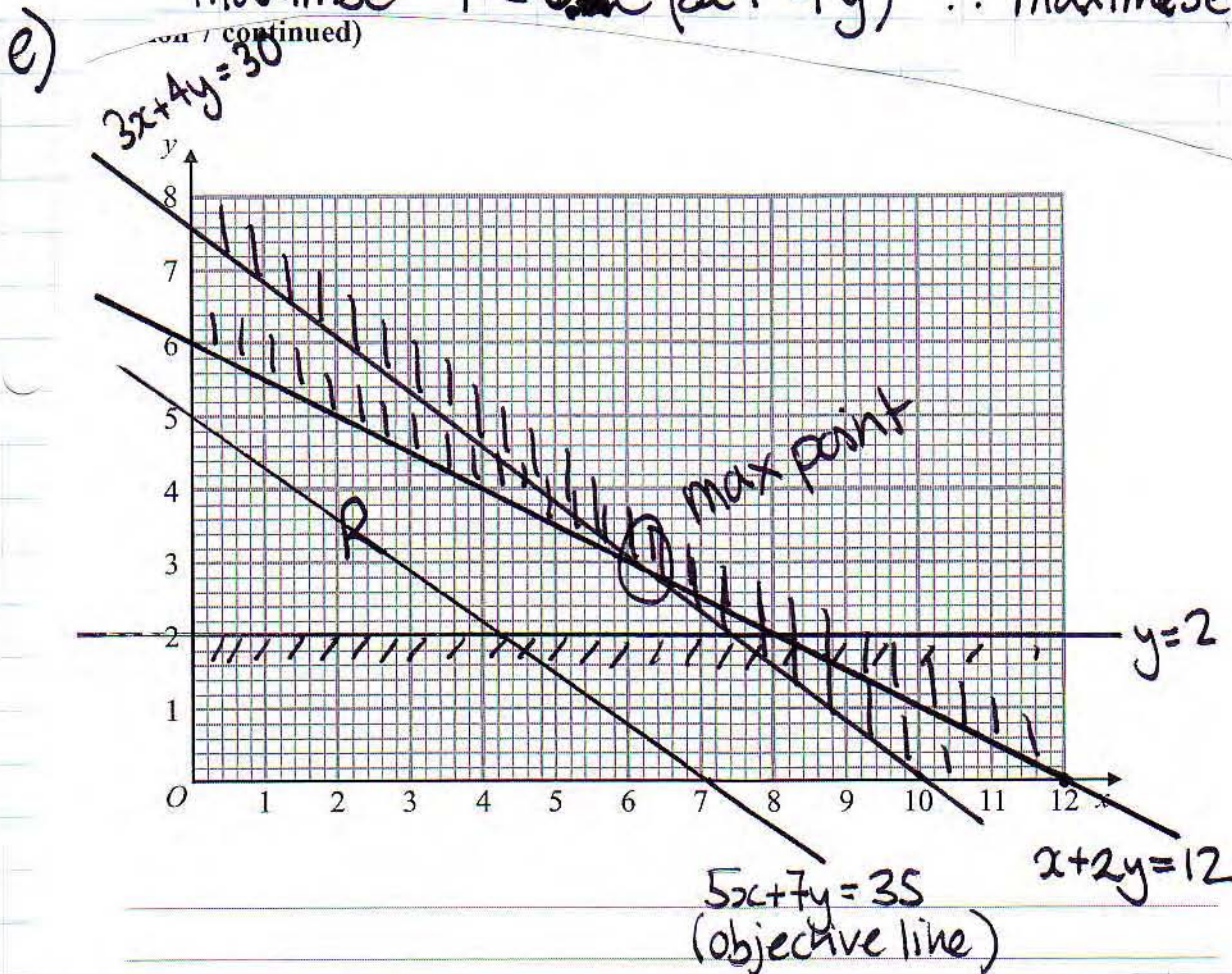
$3x + 4y \leq 30$ #

c) You must have 2 or more large cupboards.

d) capacity of $x = C \therefore$ capacity of $y = 1.4C$

$\therefore Cx + 1.4Cy = \text{total capacity}$

maximise $P = 0.2C(5x + 7y) \therefore$ maximise $5x + 7y$ #



f) max at intersection of $x + 2y = 12$ and $3x + 4y = 30$
 $(6, 3)$ so 6 std and 3 large.