D1 Jan 2010

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1.

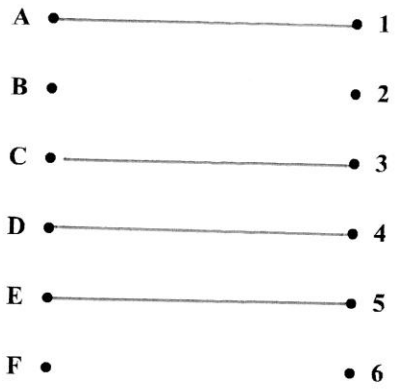
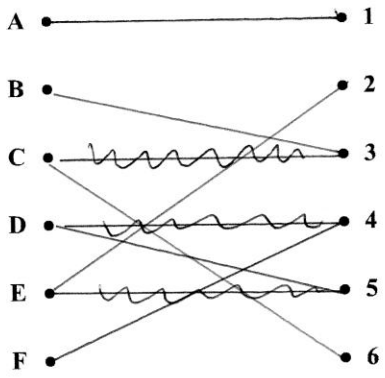
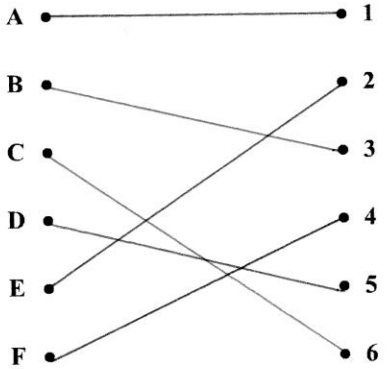


Diagram 1

Leave blank

(Question 1 continued)





6 → C add
C → 3 reject
3 → B add

2 → E add
E → 5 reject
5 → D add
D → 4 reject
4 → F add

Final matching
A – 1
B – 3
C – 6
D – 5
E – 2
F – 4

Q1

(Total 6 marks)

Turn over

2. (a) (i) A connected graph is one where, for any two vertices, a path can be found connecting the two vertices

(ii) A tree is a connected graph with no cycles

(iii) A spanning tree is a tree which connects all the nodes (vertices)

(b) Kruskals algorithm

	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	-

Figure 2

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(Question 2 continued)

(c) (i) L → O 56
L → C 60
C → N 62
O → S 63
S → P 43
C → Y 156

Weight of tree: 440

(ii)

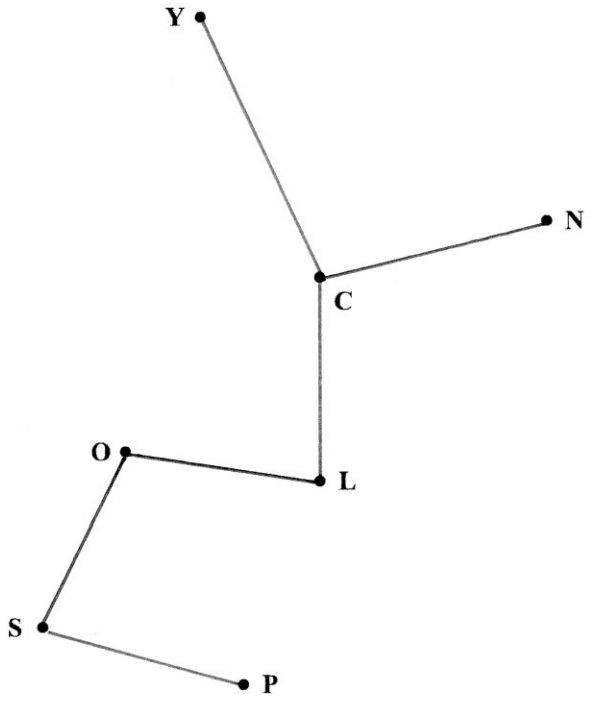
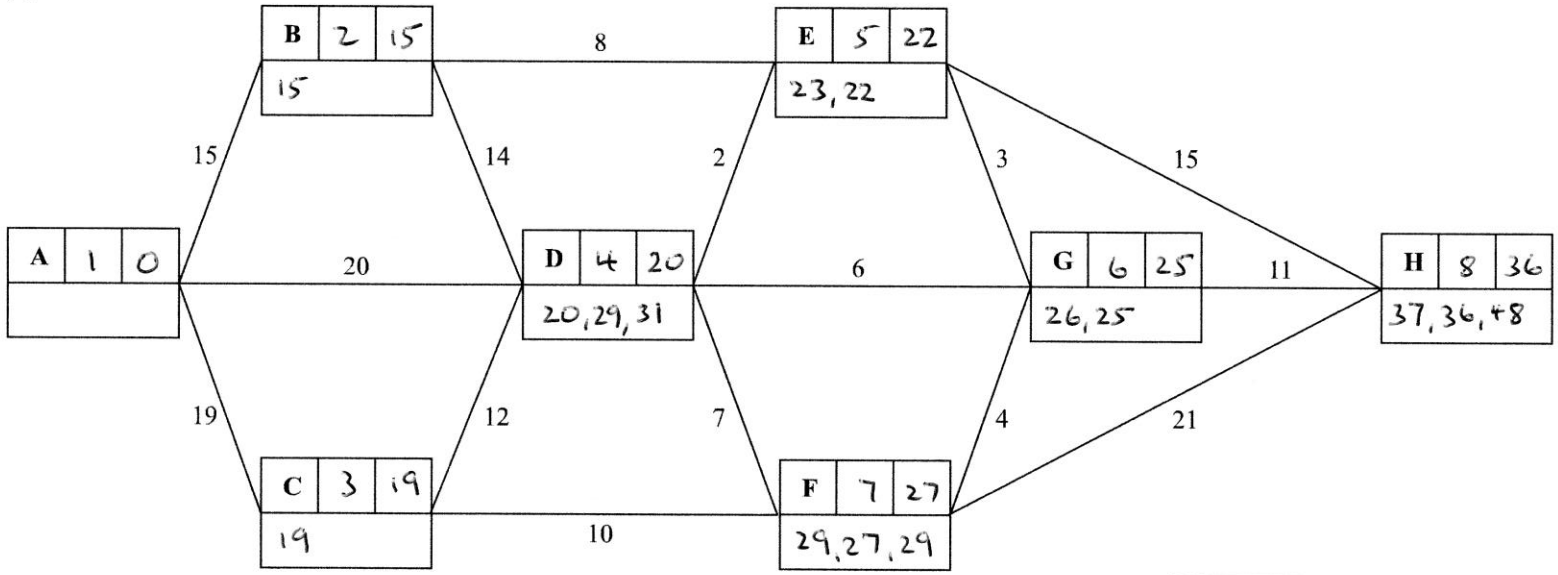


Diagram 2

(Total 9 marks)

Q2

3. (a)



Key:

Vertex	Order of labelling	Final value
Working values		

Quickest route: A D E G H

Time taken: 36

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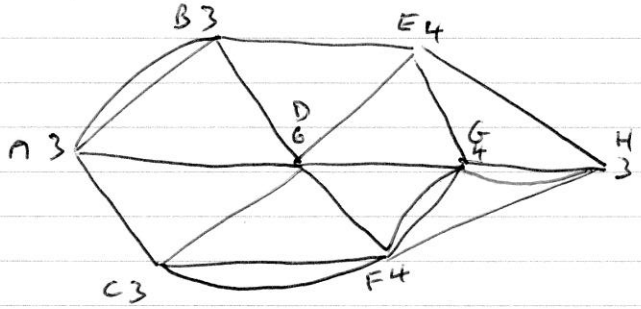
(Question 3 continued)

(b)



odd nodes A B C H

AB = 15	CH = 25	40
AC = 19	BH = 22	41
AH = 36	BC = 22	58

∴ Quickest Route = 167 + 40 = 207

(Total 10 marks)

Q3

Leave blank

Turn over

4. 0.6, 4.0, 2.5, 3.2, 0.5, 2.6, 0.4, 0.3, 4.0, 1.0

a) pivot = 2.6

4.0, 3.2, 4.0 (2.6) 0.6, 2.5, 0.5, 0.4, 0.3, 1.0

pivots = 3.2, 0.4

4.0, 4.0 (3.2) (2.6) 0.6, 2.5, 0.5, 1.0, (0.4) 0.3

pivots = 4.0, 0.5

4.0, (4.0), (3.2), (2.6) 0.6, 2.5, 1.0 (0.5) (0.4), 0.3

pivots = 2.5

4.0, (4.0), (3.2) (2.6) (2.5) 0.6, 1.0, (0.5), (0.4), 0.3

pivot = 1.0

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

b) length 1 : 4.0
length 2 : 4.0
length 3 : 3.2, 0.6
length 4 : 2.6, 1.0, 0.4
Length 5 : 2.5, 0.5, 0.3

c) Total length = 19.1

$\frac{19.1}{4}$ = 4.775 so at least 5 lengths are needed

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5. (a) *You may not need to use all the lines in this table*

S	T	R	R>0?	Output
25000	0	17000	Yes	
	3400	7000	Yes	
	4450	-5000	NO	4450

(b) £4450

(c) To make T=0, the first decision box must answer NO.
∴ S=8000

Q5

(Total 7 marks)

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6.

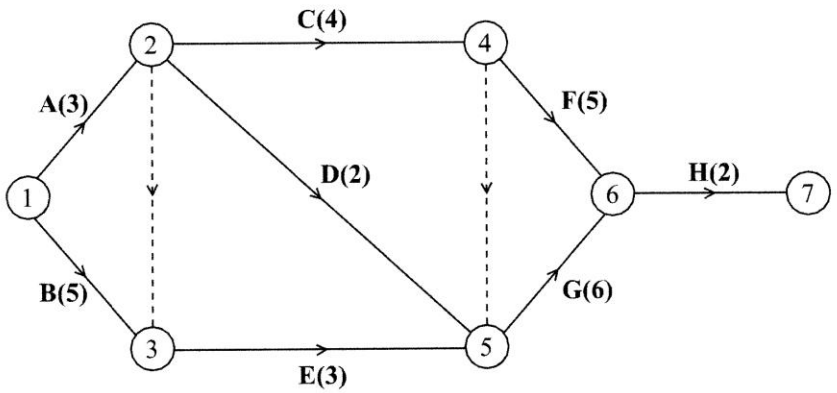


Figure 5

(a) The dotted line represents a dummy activity. C and D depend on A but E depends on A and B

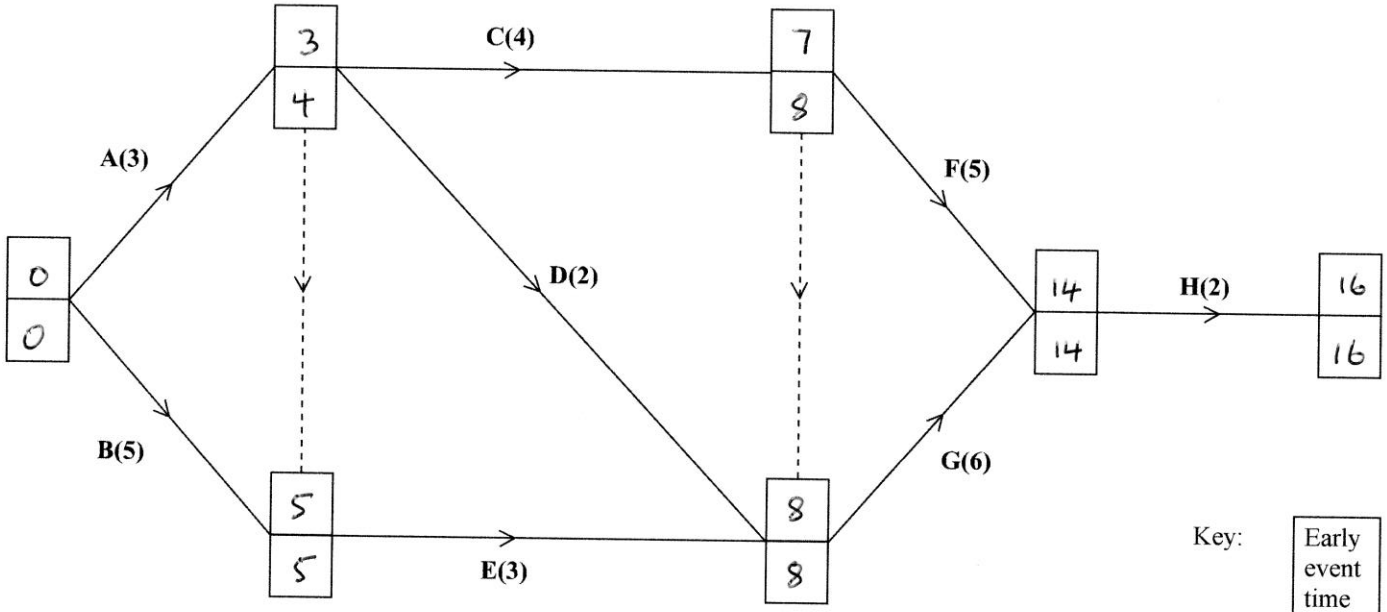
(b)

Event	Immediately preceding activity
A	-
B	-
C	A
D	A
E	A, B
F	C
G	C, D, E
H	F, G

Question 6 continues on the next page

(Question 6 continued)

(c)

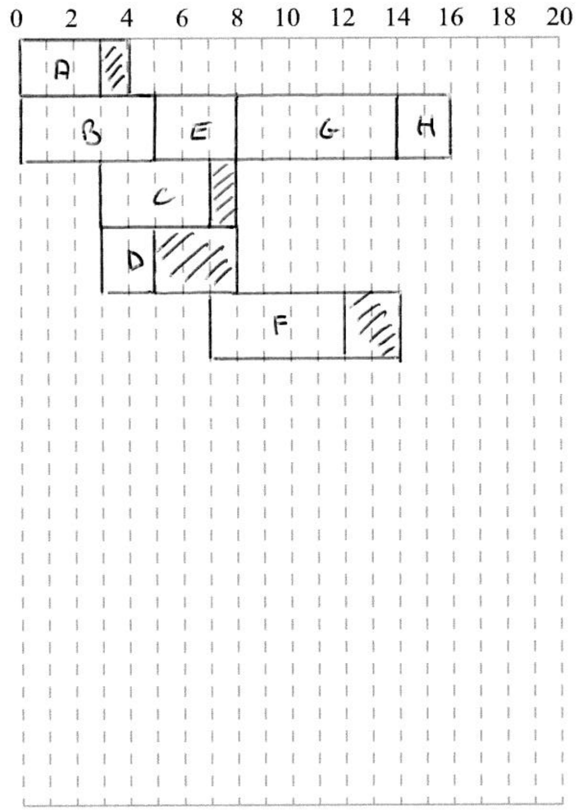


(d) Critical activities: B, E, G, H

Length of critical path: 16

(Question 6 continued)

(e)



(Total 15 marks)

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

$\Rightarrow x + 2y \leq 12 \quad (\div 150)$

b) $90x + 120y \leq 900$

$\Rightarrow 3x + 4y \leq 30 \quad (\div 30)$

c) There must be at least 2 large cupboards

d) If the capacity of a standard cupboard is C, then the capacity of a large cupboard is $1.4C$

$\therefore$ Total capacity is $Cx + 1.4Cy$

$= \frac{C}{5}(5x + 7y)$

So we need to maximise $5x + 7y$

(Question 7 continued)

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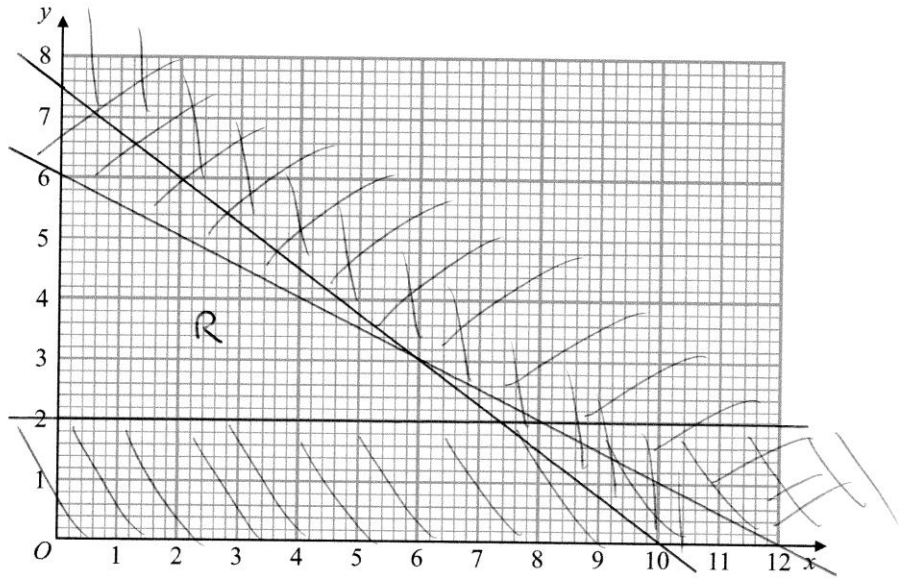

$x + 2y = 12$

x	y
0	6
12	0

$(0,0)$ is in $x + 2y \leq 12$

$3x + 4y = 30$

x	y
10	0
0	7.5

$(0,0)$ is in $3x + 4y \leq 30$

Max $5x + 7y$ occurs at either $(0,6)$
$(6,3)$
or $(7,2)$

$0,6 \Rightarrow 42$
$6,3 \Rightarrow 30 + 21 = 51$
$7,2 \Rightarrow 35 + 14 = 49$

$\therefore$ 6 standard cupboards and 3 large cupboards

Q7

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS

END