Paper Reference(s)

6689/01

Edexcel GCE

Decision Mathematics D1

Advanced/Advanced Subsidiary

Wednesday 23 January 2013 – Morning

Time: 1 hour 30 minutes

Materials required for examination
Nil

Items included with question papers
D1 Answer Book

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation or symbolic differentiation/integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

Write your answers for this paper in the D1 answer book provided.
In the boxes on the answer book, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.
Do not return the question paper with the answer book.

Information for Candidates

Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 7 questions in this question paper. The total mark for this paper is 75.
There are 8 pages in this question paper. The answer book has 16 pages. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

Printer's Log. No.
P41490A



Turn over

W850/R6689/57570 5/5/5/5/6/6/

This publication may be reproduced only in accordance with Pearson Education Ltd copyright policy. ©2013 Pearson Education Ltd.

PEARSON

Write your answers in the D1 answer book for this paper.

1.

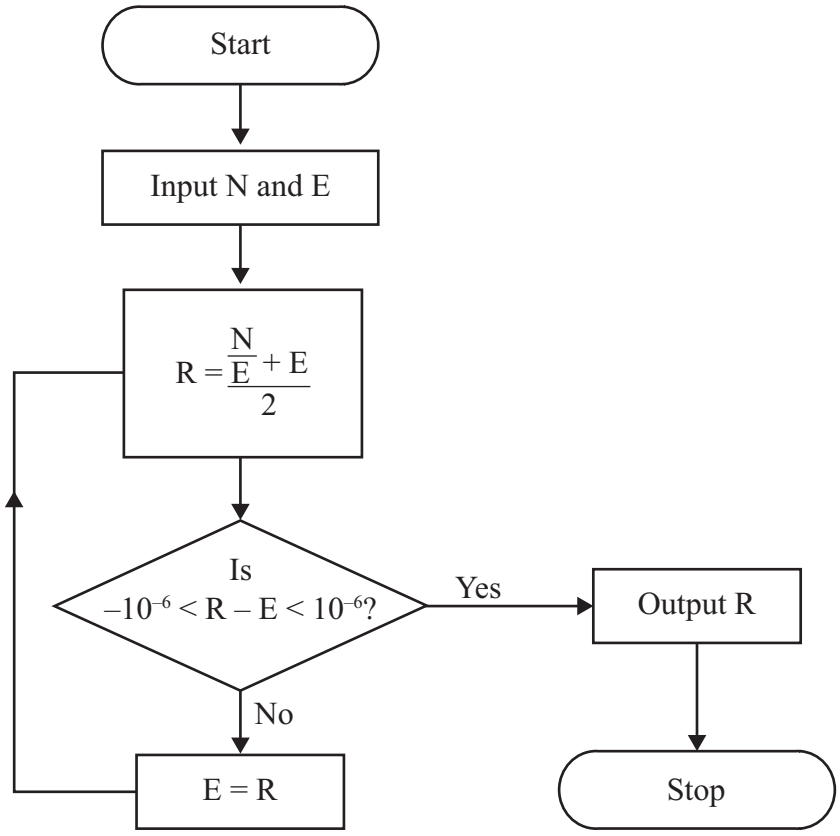


Figure 1

Hero's algorithm for finding a square root is described by the flow chart shown in Figure 1.

Given that N = 72 and E = 8,

(a) use the flow chart to complete the table in the answer book, working to at least seven decimal places when necessary. Give the final output correct to seven decimal places.

(4)

The flow chart is used with N = 72 and E = – 8,

(b) describe how this would affect the output.

(1)

(c) State the value of E which cannot be used when using this flow chart.

(1)

(Total 6 marks)

2. (a) Starting with a list of all the letters of the alphabet in alphabetical order, demonstrate how a binary search is used to locate the letter P. In each iteration, you must make clear your pivot and the part of the list you are retaining.

(4)

(b) Find the maximum number of iterations needed to locate any particular letter of the alphabet. Justify your answer.

(2)

(Total 6 marks)

3.

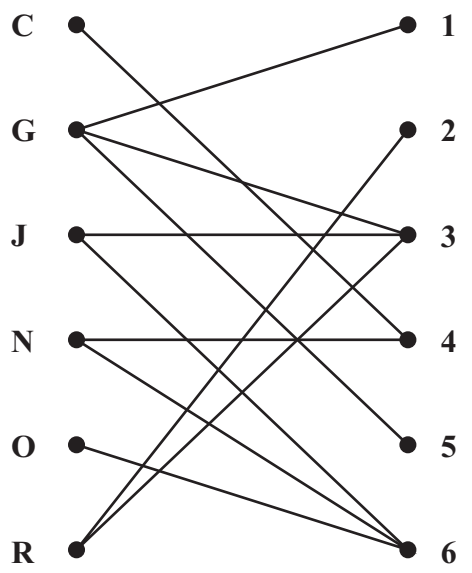


Figure 2

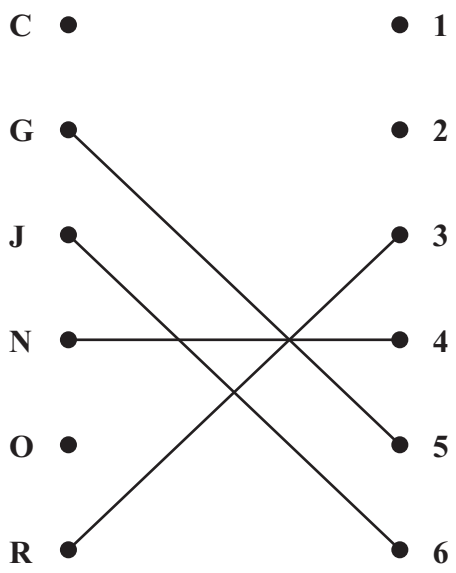


Figure 3

Figure 2 shows the possible allocations of six workers, Charlie (C), George (G), Jack (J), Nurry (N), Olivia (O) and Rachel (R), to six tasks, 1, 2, 3, 4, 5 and 6.

Figure 3 shows an initial matching.

(a) Starting from this initial matching, use the maximum matching algorithm to find an improved matching. You should give the alternating path you use and list your improved matching.

(3)

(b) Explain why it is not possible to find a complete matching.

(2)

After training, Charlie adds task 5 to his possible allocations.

(c) Taking the improved matching found in (a) as the new initial matching, use the maximum matching algorithm to find a complete matching. Give the alternating path you use and list your complete matching.

(3)

(Total 8 marks)

4.

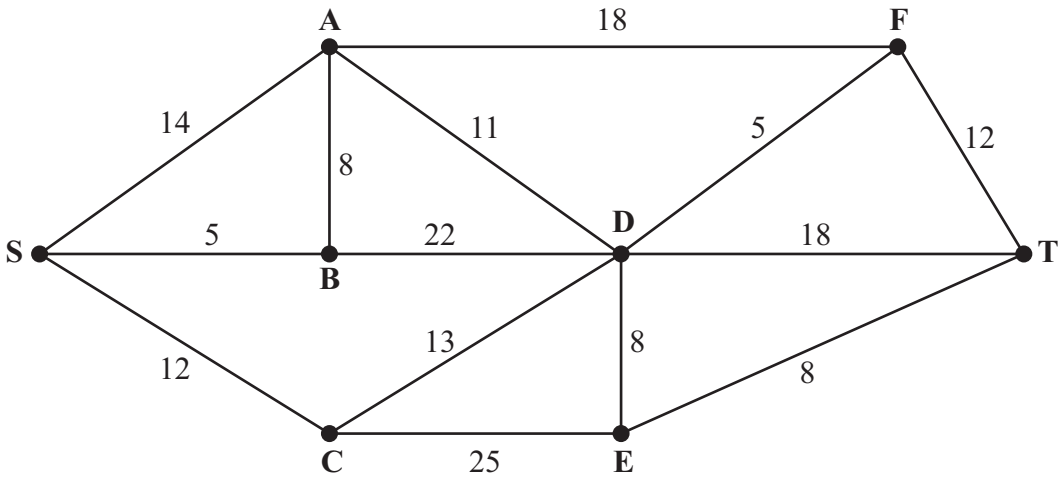


Figure 4

(a) Explain what is meant, in a network, by the term **path**.

(2)

Figure 4 represents a network of canals. The number on each arc represents the length, in miles, of the corresponding canal.

(b) Use Dijkstra's algorithm to find the shortest path from S to T. State your path and its length.

(6)

(c) Write down the length of the shortest path from S to F.

(1)

Next week the canal represented by arc AB will be closed for dredging.

(d) Find a shortest path from S to T avoiding AB and state its length.

(2)

(Total 11 marks)

5.

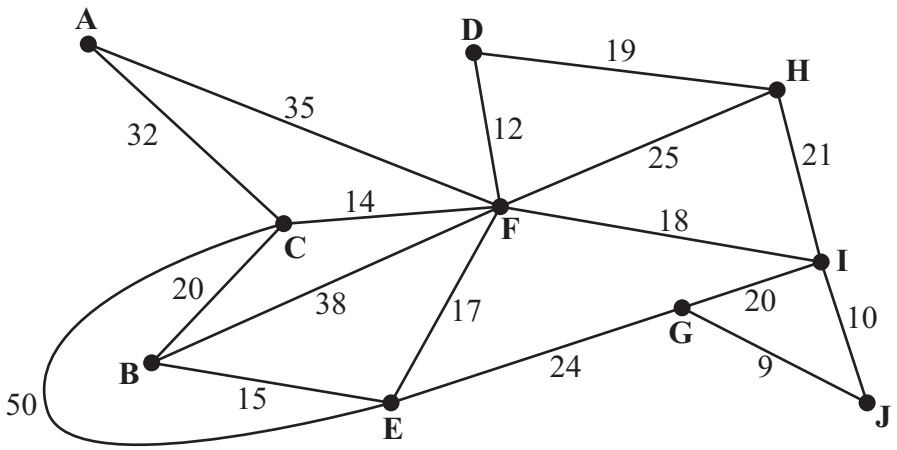


Figure 5

[The weight of the network is 379]

Figure 5 represents the roads in a highland wildlife conservation park. The vertices represent warden stations. The number on each arc gives the length, in km, of the corresponding road.

During the winter months the park is closed. It is only necessary to ensure road access to the warden stations.

(a) Use Prim's algorithm, starting at A, to find a minimum connector for the network in Figure 5. You must state the **order** in which you include the **arcs**.

(3)

(b) Given that it costs £80 per km to keep the selected roads open in winter, calculate the minimum cost of ensuring road access to all the warden stations.

(2)

At the end of winter, Ben inspects all the roads before the park re-opens. He needs to travel along each road at least once. He will start and finish at A, and wishes to minimise the length of his route.

(c) Use the route inspection algorithm to find the roads that will be traversed twice. You must make your method and working clear.

(6)

(d) Find the length of the shortest inspection route.

(1)

If Ben starts and finishes his inspection route at different warden stations, a shorter inspection route is possible.

(e) Determine the two warden stations Ben should choose as his starting and finishing points in order that his route has minimum length. Give a reason for your answer and state the length of the route.

(3)

(Total 15 marks)

6.

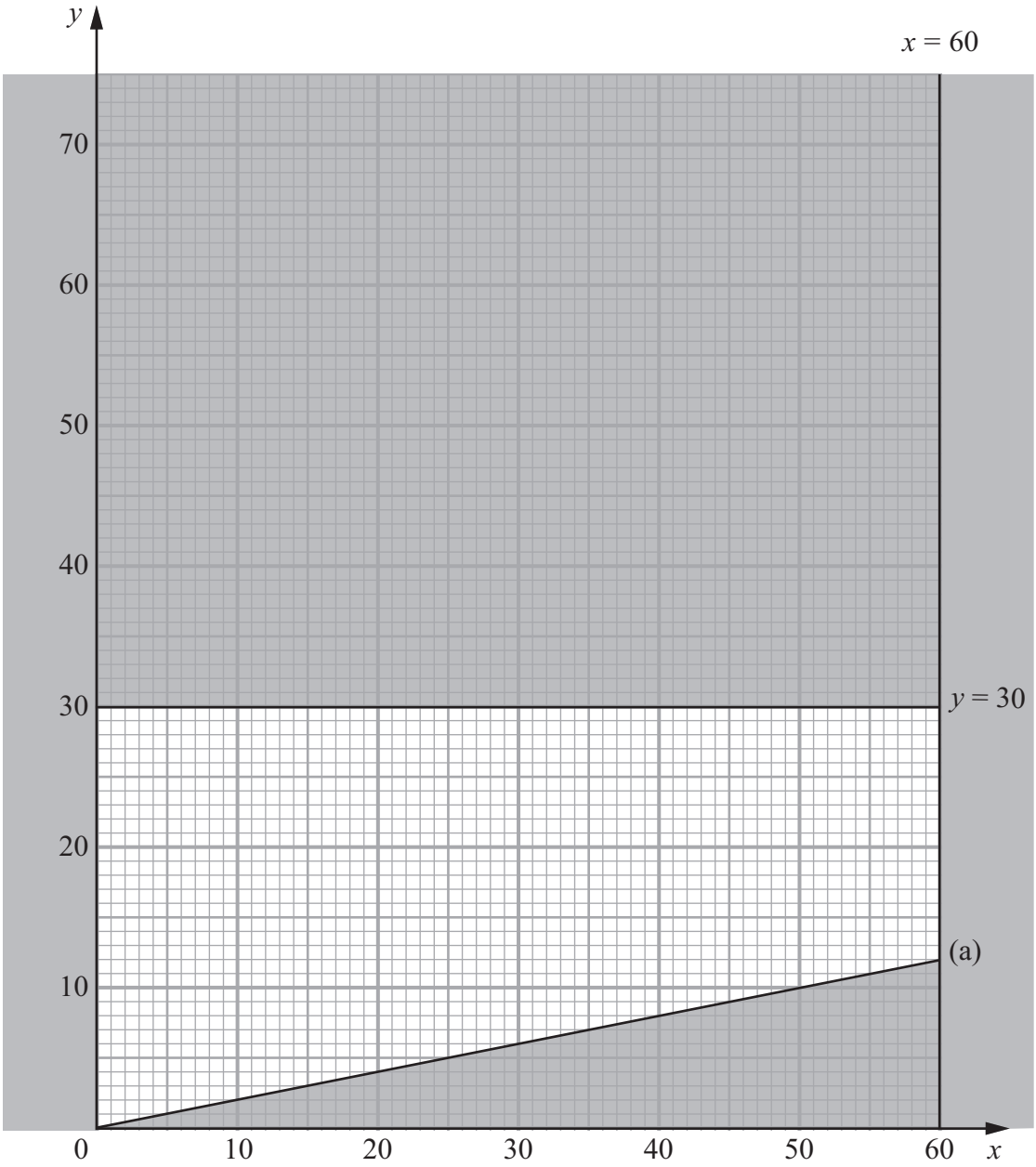


Figure 6

Lethna is producing floral arrangements for an awards ceremony.
She will produce two types of arrangement, Celebration and Party.
Let x be the number of Celebration arrangements made.
Let y be the number of Party arrangements made.

Figure 6 shows three constraints, other than $x, y \geqslant 0$

The rejected region has been shaded.

Given that two of the three constraints are $y \leqslant 30$ and $x \leqslant 60$,

(a) write down, as an inequality, the third constraint shown in Figure 6.

(2)

Each Celebration arrangement includes 2 white roses and 4 red roses.
Each Party arrangement includes 1 white rose and 5 red roses.

Lethna wishes to use at least 70 white roses and at least 200 red roses.

(b) Write down two further inequalities to represent this information.

(3)

(c) Add two lines and shading to Diagram 1 in the answer book to represent these two inequalities.

(2)

(d) Hence determine the feasible region and label it R.

(1)

The times taken to produce each Celebration arrangement and each Party arrangement are 10 minutes and 4 minutes respectively. Lethna wishes to minimise the total time taken to produce the arrangements.

(e) Write down the objective function, T, in terms of x and y.

(1)

(f) Use point testing to find the optimal number of each type of arrangement Lethna should produce, and find the total time she will take.

(4)

(Total 13 marks)

7.

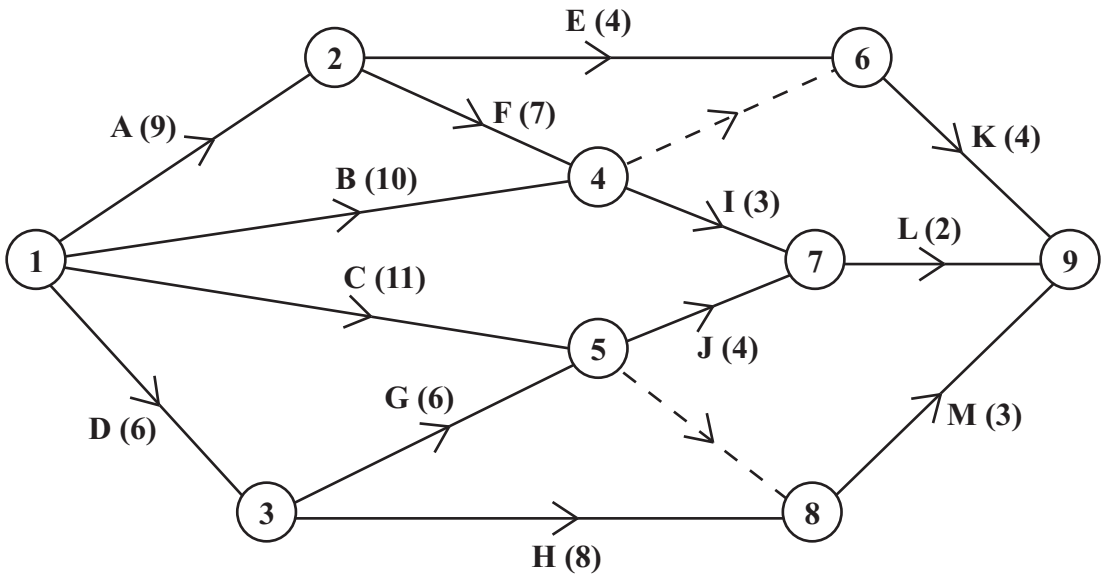


Figure 7

Figure 7 is the activity network relating to a building project. The activities are represented by the arcs. The number in brackets on each arc gives the time to complete the activity. Each activity requires one worker.

The project **must** be completed in the shortest possible time.

(a) Explain the reason for the dotted line from event 4 to event 6 as shown in Figure 7.

(2)

(b) Complete Diagram 1 in the answer book to show the early event times and the late event times.

(4)

(c) State the critical activities.

(1)

(d) Calculate the total float for activity G. You must make the numbers you use in your calculation clear.

(2)

(e) Draw a Gantt chart for this project on the grid provided in the answer book.

(4)

(f) State the activities that **must** be happening at time 5.5

(1)

(g) Use your Gantt chart to determine the minimum number of workers needed to complete the project in the minimum time. You must justify your answer.

(2)

(Total 16 marks)

TOTAL FOR PAPER: 75 MARKS

END

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	9	/	0	1	Signature	

Paper Reference(s)

6689/01

Edexcel GCE

Decision Mathematics D1

Advanced/Advanced Subsidiary

Wednesday 23 January 2013 – Morning

Answer Book

Do not return the question paper with the answer book

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

This publication may be reproduced only in accordance with Pearson Education Ltd copyright policy.
©2013 Pearson Education Ltd.

Printer's Log. No.
P41490A
W850/R6689/57570 5/5/5/5/6/6/

P 4 1 4 9 0 A 0 1 1 6

Turn over

PEARSON

Leave blank

1. *You may not need to use all the rows in this table*

N	E	R	Is $-10^{-6} < R - E < 10^{-6}$?

Final output _____

Leave blank

Question 1 continued

Q1

(Total 6 marks)

Leave blank

2.

Leave blank

Question 2 continued

Q2

(Total 6 marks)

Leave blank

3.

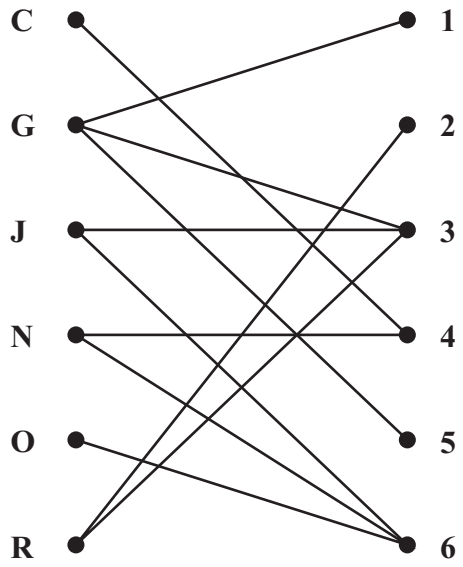


Figure 2

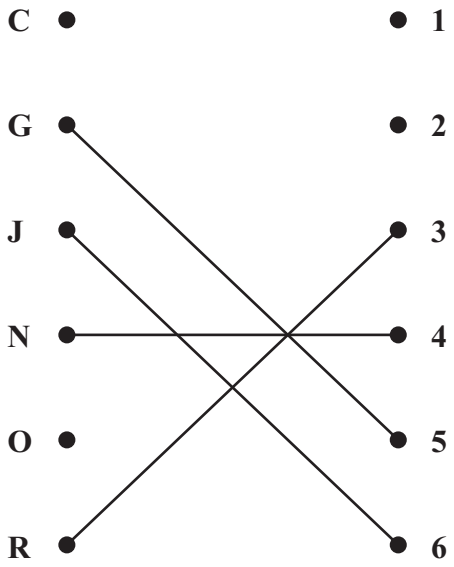


Figure 3

Leave blank

Question 3 continued

C ●	● **1**	**C** ●	● **1**
G ●	● **2**	**G** ●	● **2**
J ●	● **3**	**J** ●	● **3**
N ●	● **4**	**N** ●	● **4**
O ●	● **5**	**O** ●	● **5**
R ●	● **6**	**R** ●	● **6**

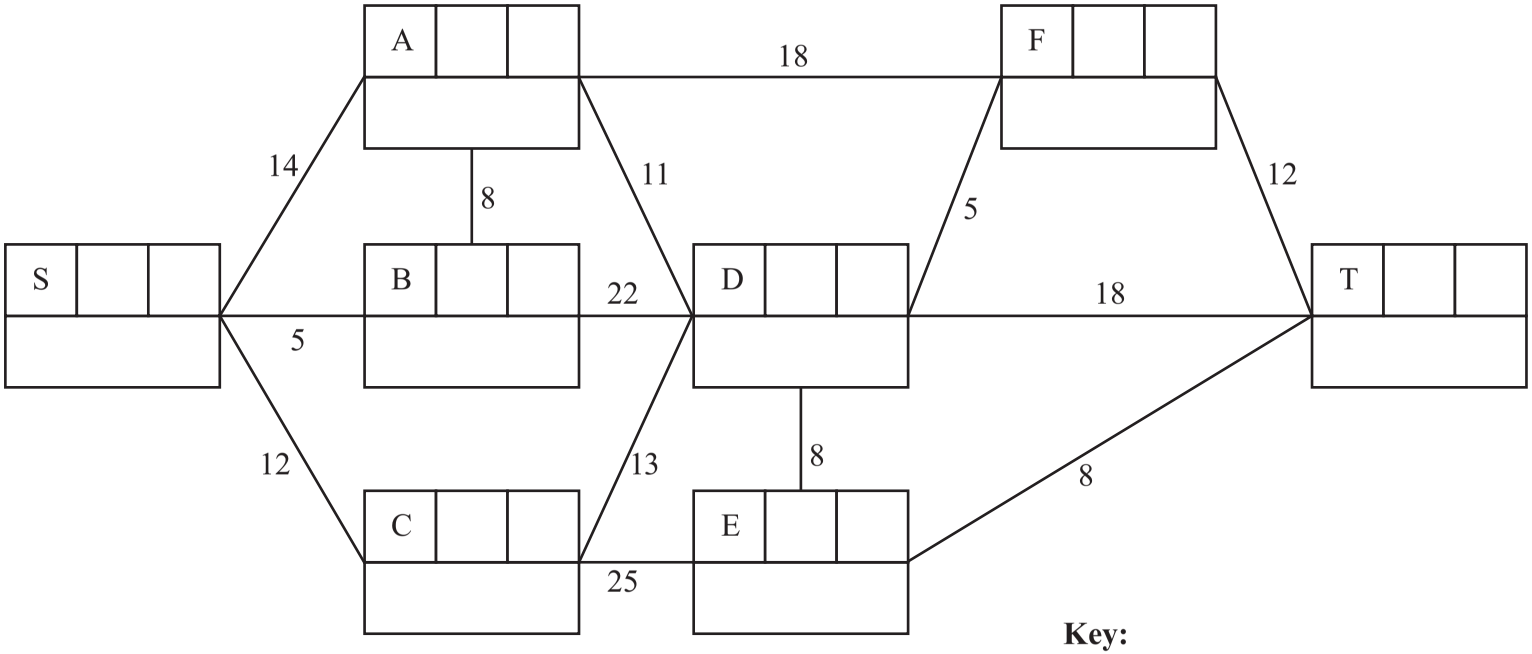
Q3

(Total 8 marks)

4. (a) _____

_____

(b)



Key:

Vertex	Order of labelling	Final value
Working value		

Shortest path _____

Length of shortest path _____

Leave blank

P 4 1 4 9 0 A 0 8 1 6

Leave blank

Question 4 continued

(c) Shortest distance from S to F _____

(d)

Q4

(Total 11 marks)

Leave blank

5.

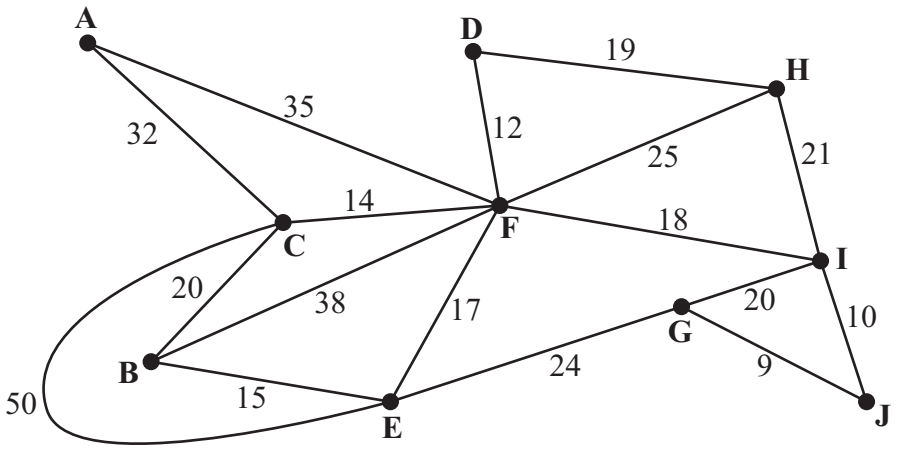


Figure 5

[The weight of the network is 379]

Leave blank

Question 5 continued

Q5

(Total 15 marks)

Leave blank

6.

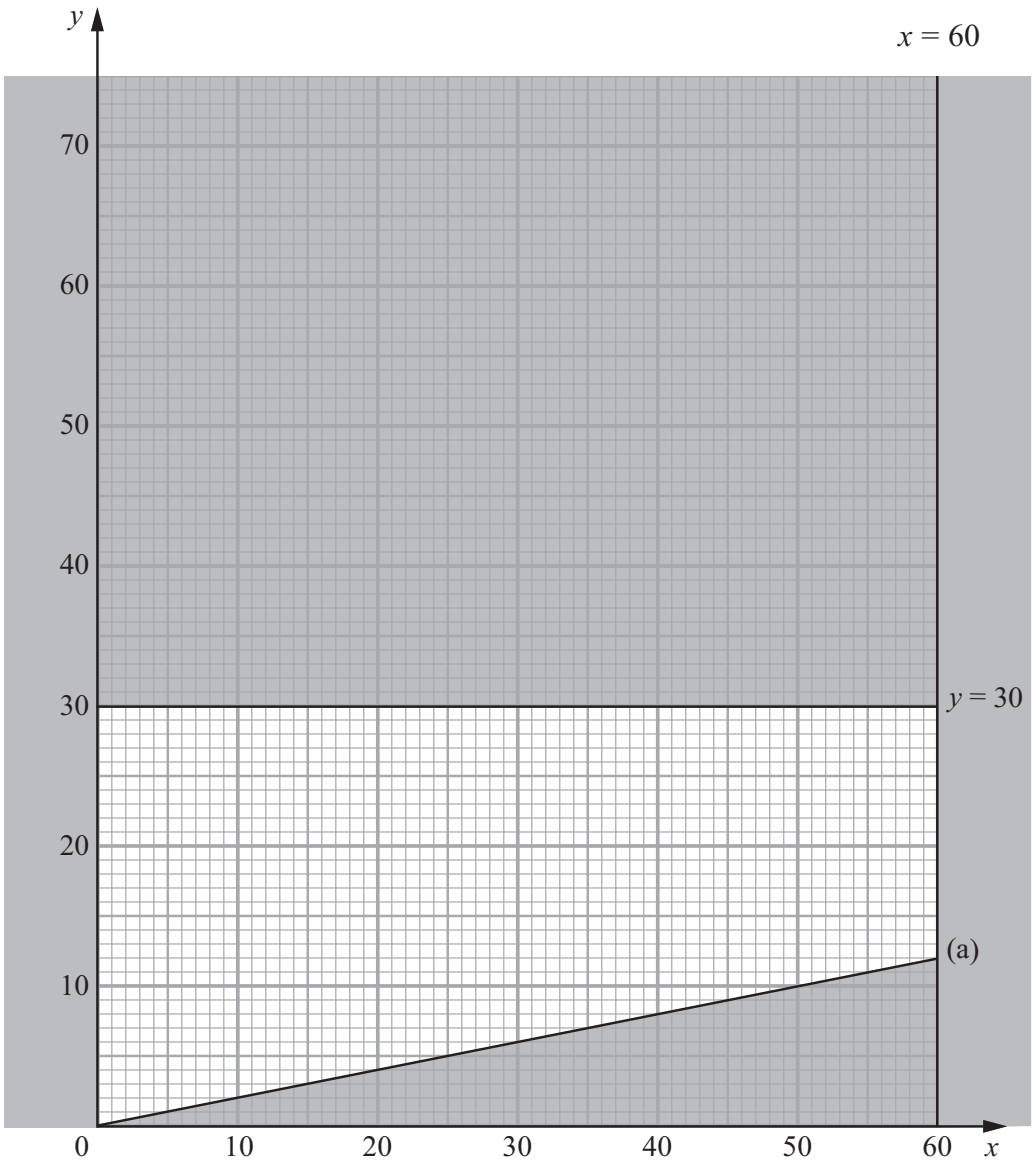


Diagram 1

Leave blank

Question 6 continued

Q6

(Total 13 marks)

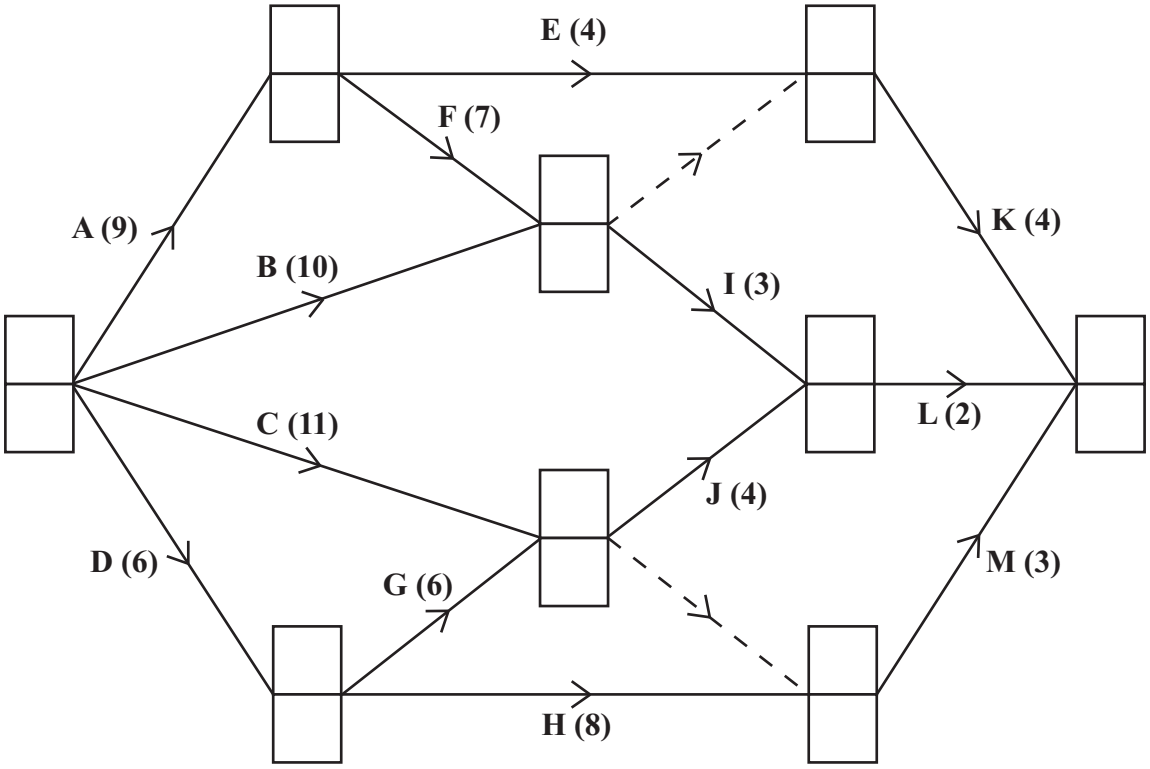
Leave blank

7. (a) _____

_____

_____

(b)



Key:

Early event time
Late event time

Diagram 1

Leave blank

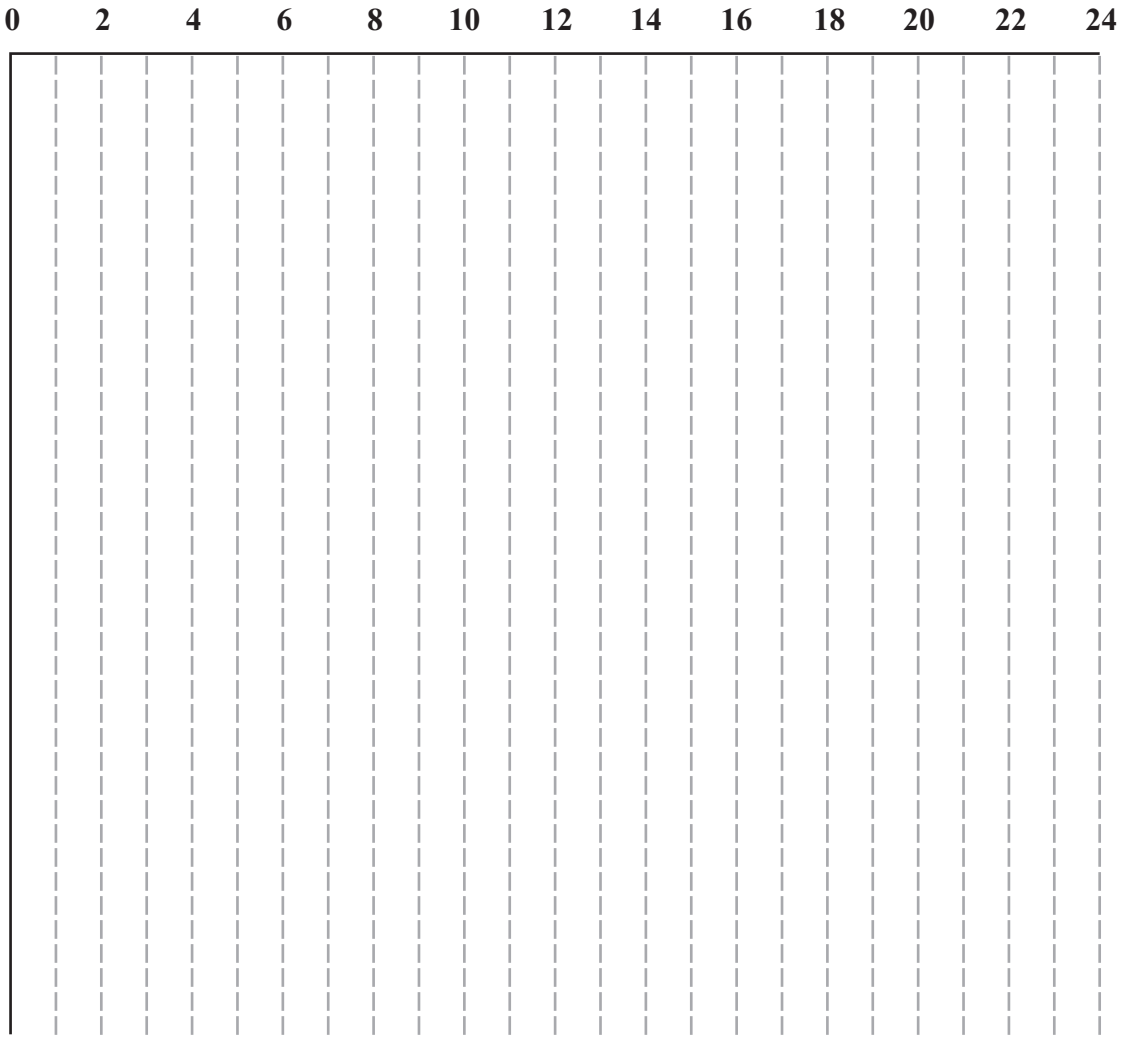
Question 7 continued

(c) Critical activities _____

(d) _____

_____

(e)



(f) Activities that must be happening at time 5.5 _____

(g) _____

_____

_____

_____

Q7

(Total 16 marks)

TOTAL FOR PAPER: 75 MARKS

END

BLANK PAGE