JUNE 2010

1 **Figure 1** below shows an activity diagram for a construction project. The time needed for each activity is given in days.

(a) Find the earliest start time and latest finish time for each activity and insert their values on **Figure 1**. *(4 marks)*

(b) Find the critical paths and state the minimum time for completion of the project. *(3 marks)*

(c) On **Figure 2** opposite, draw a cascade diagram (Gantt chart) for the project, assuming that each activity starts as early as possible. *(3 marks)*

(d) A delay in supplies means that Activity *I* takes 9 days instead of 2 .

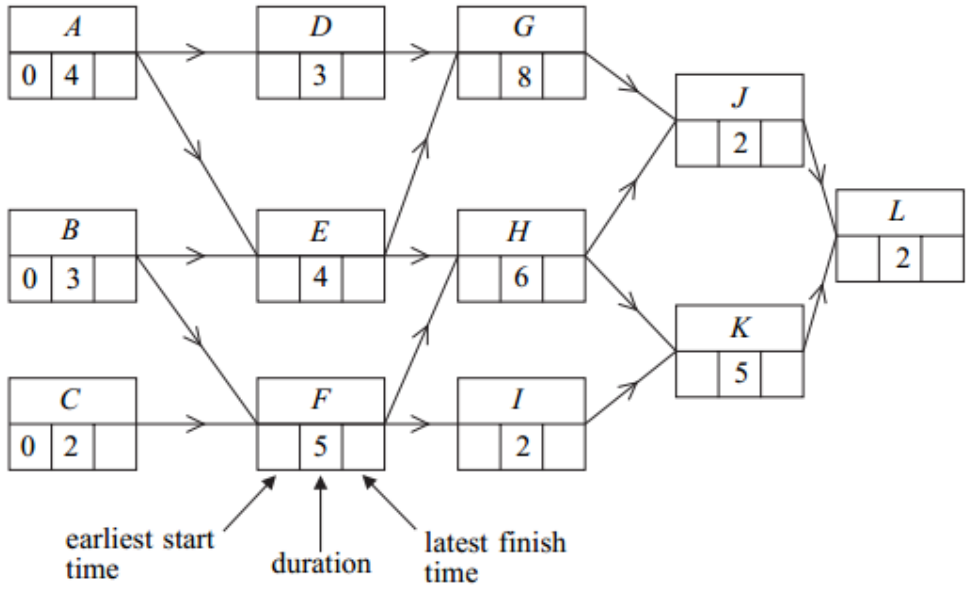
(i) Determine the effect on the **earliest** possible starting times for activities *K* and *L*. *(2 marks)*

(ii) State the number of days by which the completion of the project is now delayed. *(1 mark)*

JESTION PART FERENCE

(a)

Figure 1

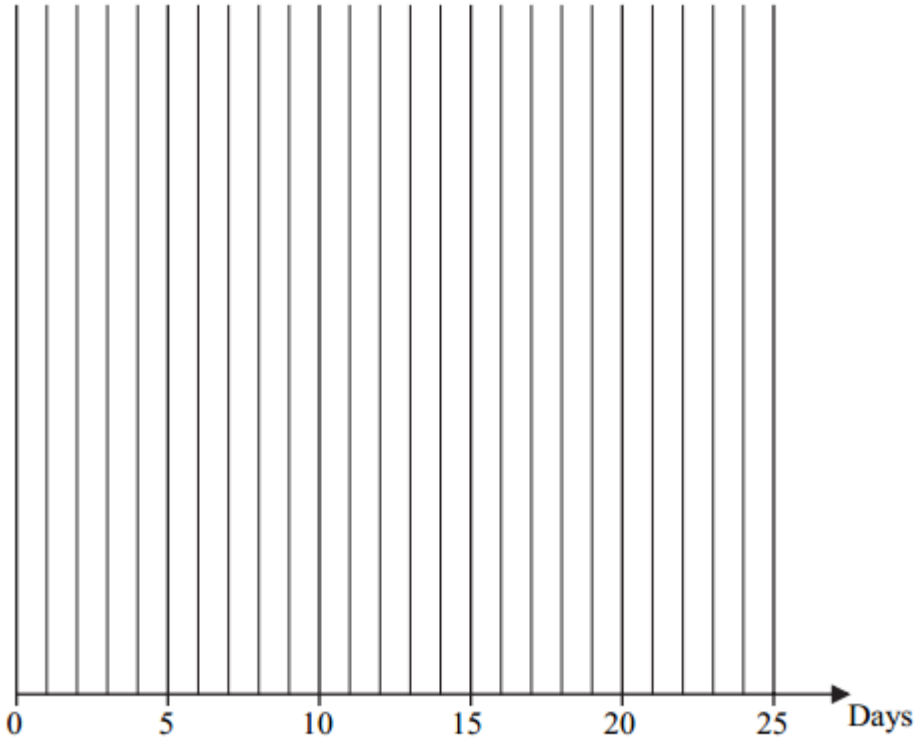


(b) Critical paths are .....

.....

Minimum completion time is ..... days.

Figure 2



JAN 2011

1 A group of workers is involved in a decorating project. The table shows the activities involved. Each worker can perform any of the given activities.

Activity	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*
Duration (days)	2	5	6	7	9	4	3	2	3	2	3	1
Number of workers required	6	3	5	2	5	2	4	4	5	3	2	4

The activity network for the project is given in **Figure 1** below.

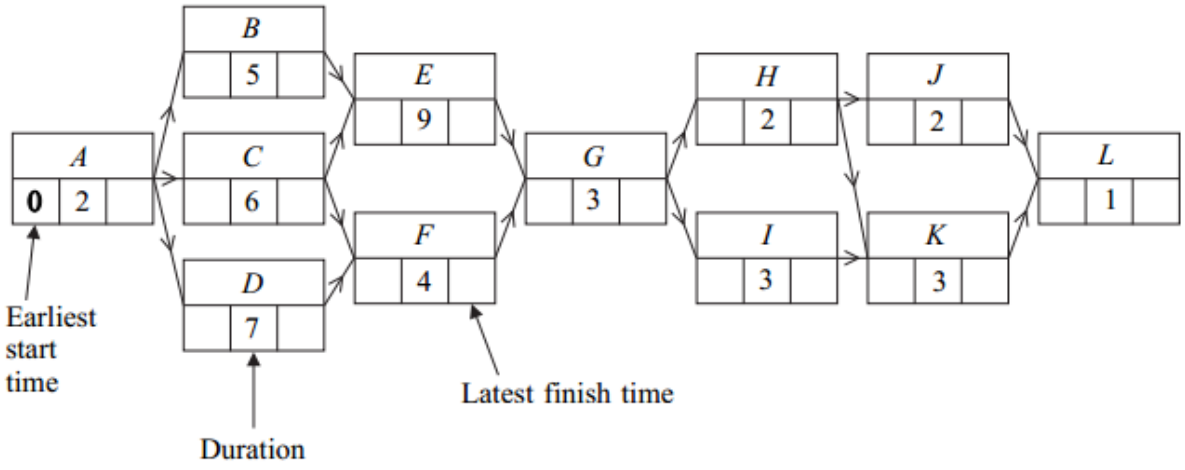
(a) Find the earliest start time and the latest finish time for each activity, inserting their values on **Figure 1**. *(4 marks)*

(b) Hence find:

(i) the critical path;

(ii) the float time for activity *D*. *(3 marks)*

(a) **Figure 1**



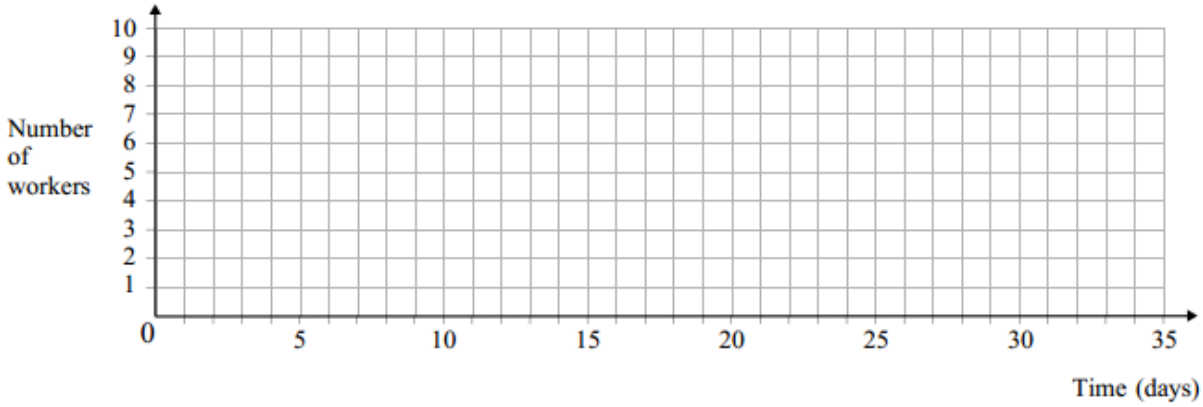
(b) (i) The critical path is .....

(ii) The float time for activity *D* is .....

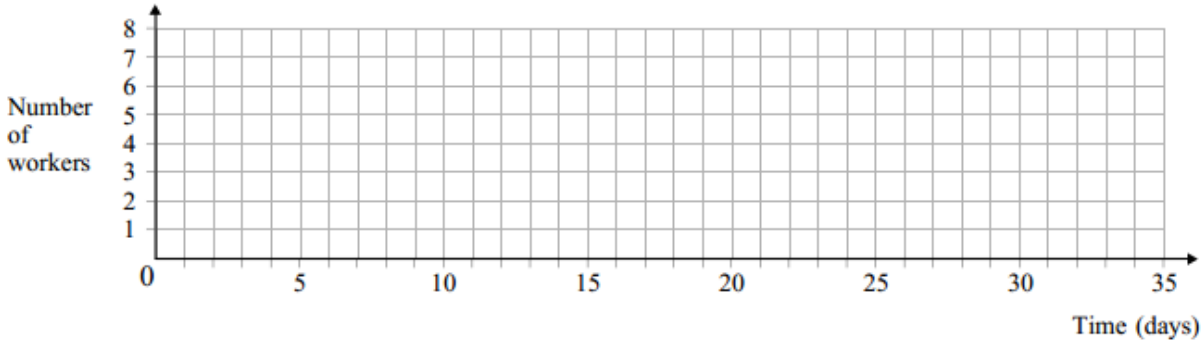
(c) Given that each activity starts as early as possible and assuming that there is no limit to the number of workers available, draw a resource histogram for the project on **Figure 2** below, indicating clearly which activities are taking place at any given time. *(4 marks)*

(d) It is later discovered that there are only 8 workers available at any time. Use resource levelling to construct a new resource histogram on **Figure 3** below, showing how the project can be completed with the minimum extra time. State the minimum extra time required. *(3 marks)*

(c) **Figure 2**



(d) **Figure 3**



The minimum extra time required is .....

JUNE 2011

1 **Figure 1** below shows an activity diagram for a cleaning project. The duration of each activity is given in days.

(a) Find the earliest start time and the latest finish time for each activity and insert their values on **Figure 1**. *(4 marks)*

(b) Find the critical paths and state the minimum time for completion of the project. *(3 marks)*

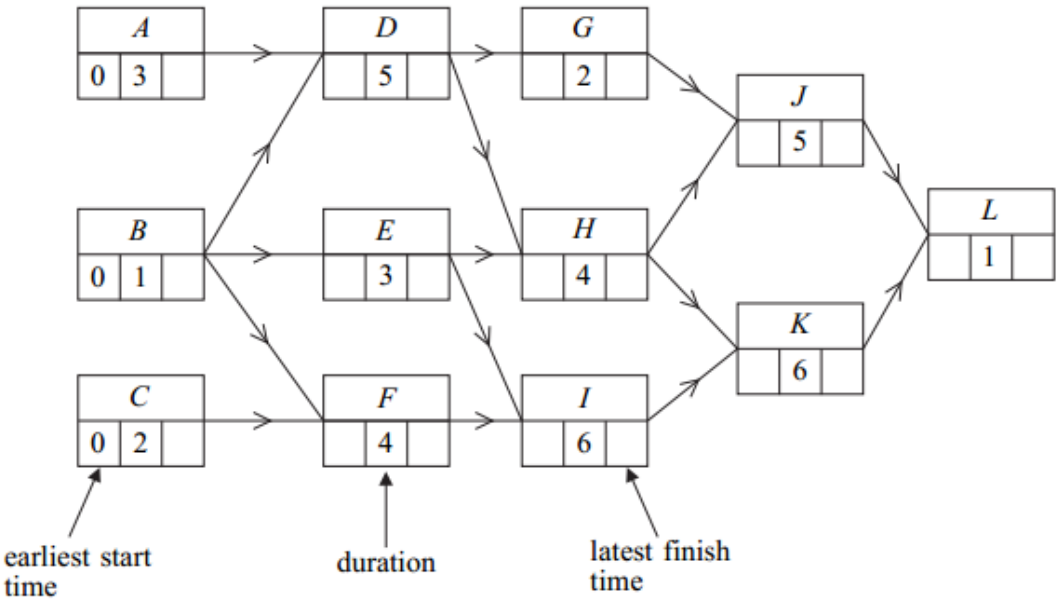
(c) Find the activity with the greatest float time and state the value of its float time. *(2 marks)*

(d) On **Figure 2** opposite, draw a cascade diagram (Gantt chart) for the project, assuming that each activity starts as **late** as possible. *(4 marks)*

QUESTION PART REFERENCE

(a)

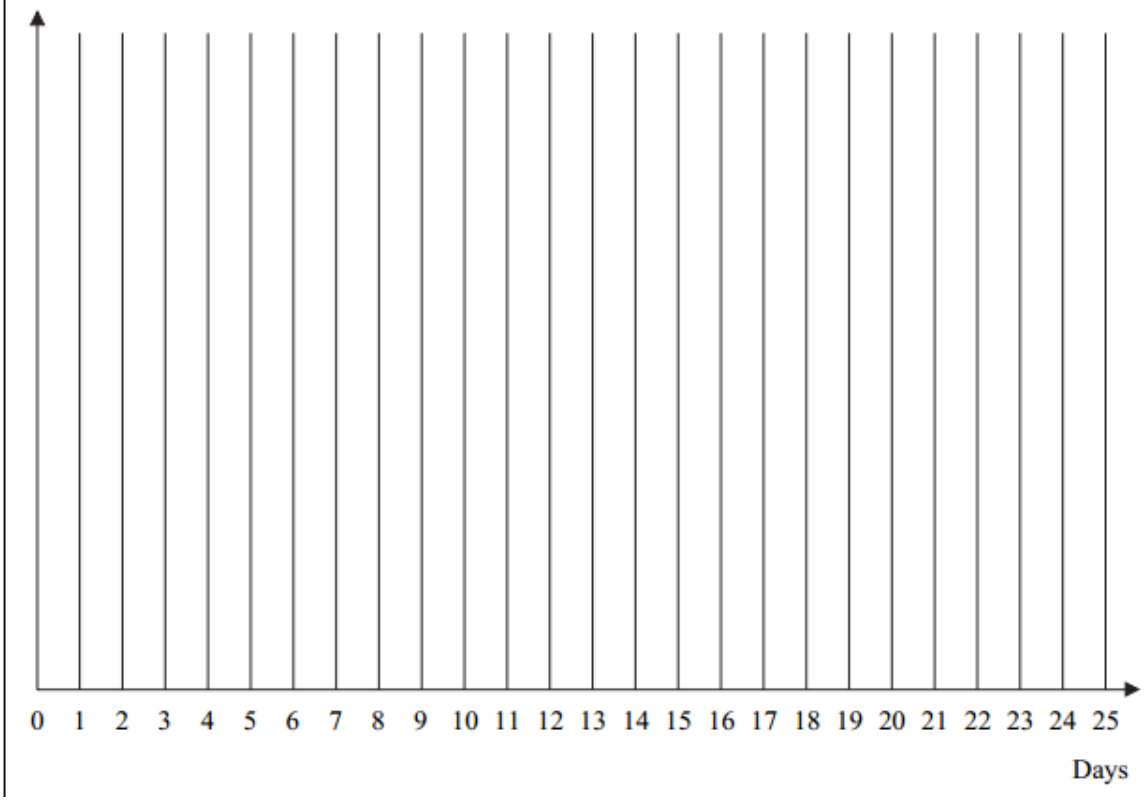
Figure 1



JUNE 11 – FIGURE 2

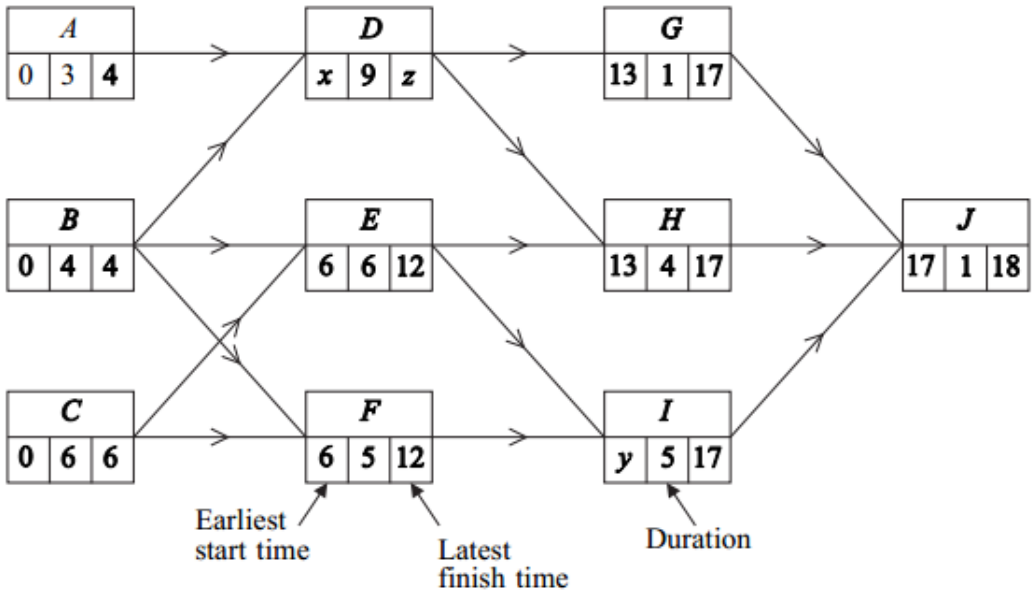
(d)

Figure 2



JAN 2012

1 The diagram shows the activity network and the duration, in days, of each activity for a particular project. Some of the earliest start times and latest finish times are shown on the diagram.



(a) Find the values of the constants x, y and z. *(3 marks)*

(b) Find the critical paths. *(2 marks)*

(c) Find the activity with the largest float and state the value of this float. *(2 marks)*

(d) The number of workers required for each activity is shown in the table.

Activity	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Number of workers required	4	2	3	4	2	4	3	3	5	6

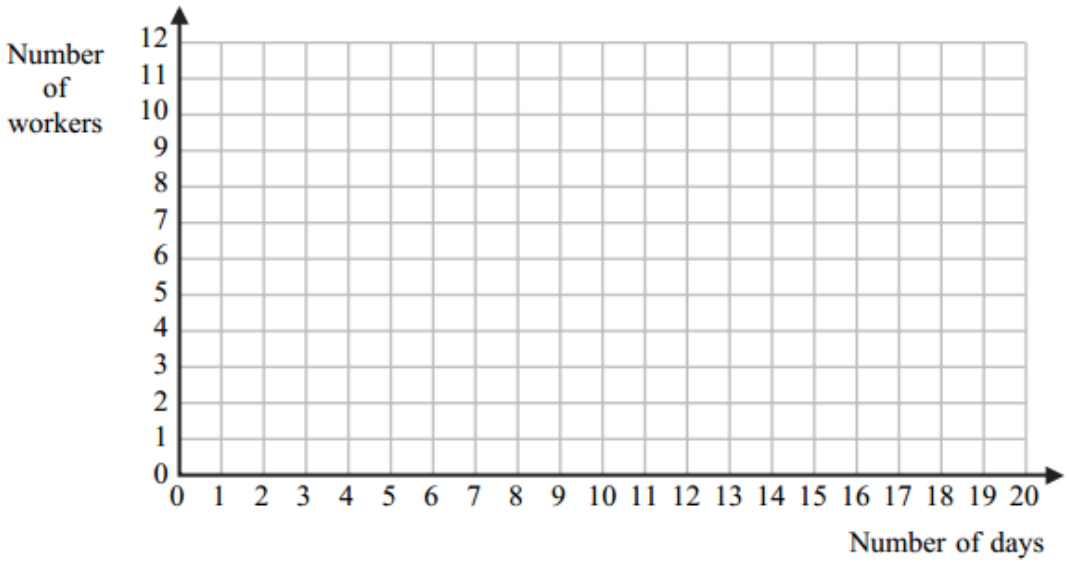
Given that each activity starts as **early** as possible and assuming that there is no limit to the number of workers available, draw a resource histogram for the project on **Figure 1** below, indicating clearly which activities are taking place at any given time. *(5 marks)*

(e) It is later discovered that there are only 9 workers available at any time. Use resource levelling to find the new earliest start time for activity *J* so that the project can be completed with the minimum extra time. State the minimum extra time required. *(2 marks)*

QUESTION PART REFERENCE

(d)

Figure 1



JUNE 2012

1 **Figure 1** below shows an activity diagram for a construction project. The time needed for each activity is given in days.

(a) Find the earliest start time and the latest finish time for each activity and insert their values on **Figure 1**. *(4 marks)*

(b) Find the critical paths and state the minimum time for completion of the project. *(3 marks)*

(c) On **Figure 2** opposite, draw a cascade diagram (Gantt chart) for the project, assuming that each activity starts as early as possible. *(5 marks)*

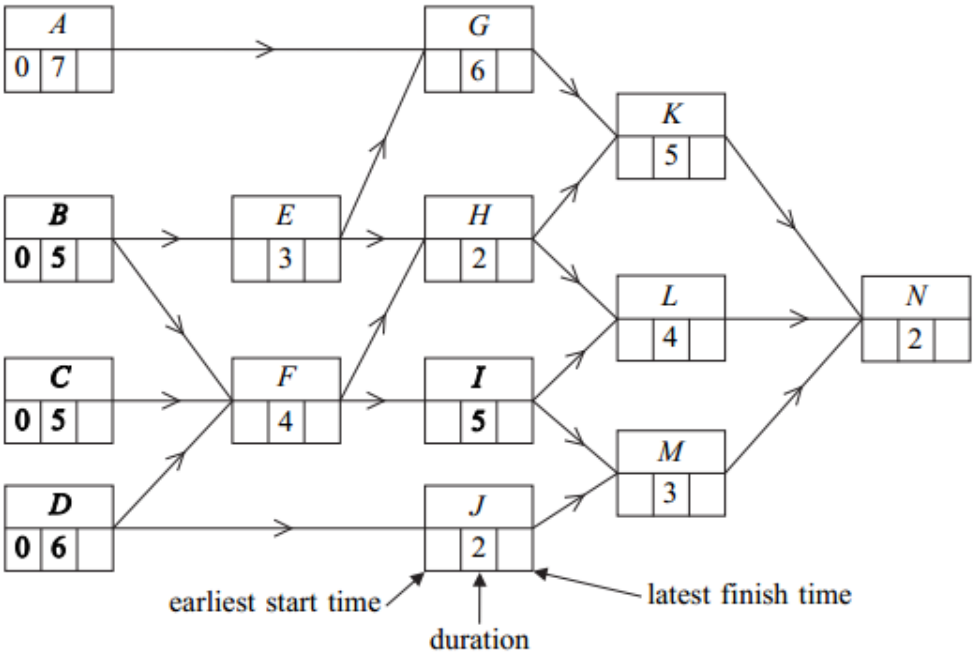
(d) Activity J takes longer than expected so that its duration is x days, where $x \geqslant 3$. Given that the minimum time for completion of the project is unchanged, find a further inequality relating to the maximum value of x. *(2 marks)*

UESTION PART FERENCE

Answer space for question 1

(a)

Figure 1



(b) Critical paths are .....

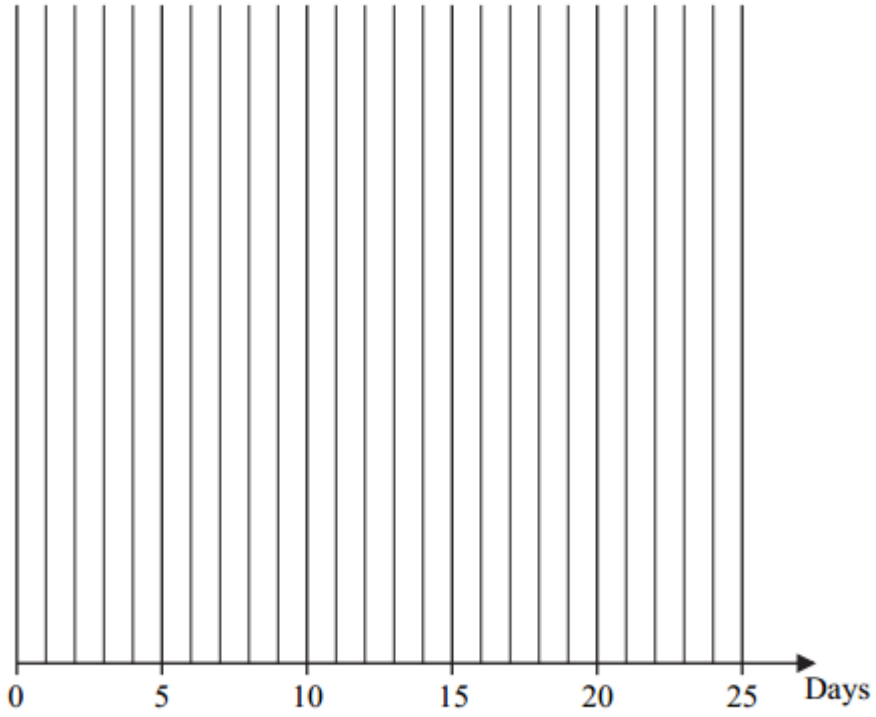
.....

Minimum completion time is ..... days.

JUNE 2012 – FIGURE 2

Answer space for question 1

Figure 2



JAN 2013

1 **Figure 1** below shows an activity diagram for a project. Each activity requires one worker. The duration required for each activity is given in hours.

(a) Find the earliest start time and the latest finish time for each activity and insert their values on **Figure 1**. *(4 marks)*

(b) On **Figure 2** opposite, complete the precedence table. *(2 marks)*

(c) Find the critical path. *(1 mark)*

(d) Find the float time of activity *E*. *(1 mark)*

(e) Using **Figure 3** on page 5, draw a resource histogram to illustrate how the project can be completed in the minimum time, assuming that each activity is to start as early as possible. *(3 marks)*

(f) Given that there are two workers available for the project, find the minimum completion time for the project. *(1 mark)*

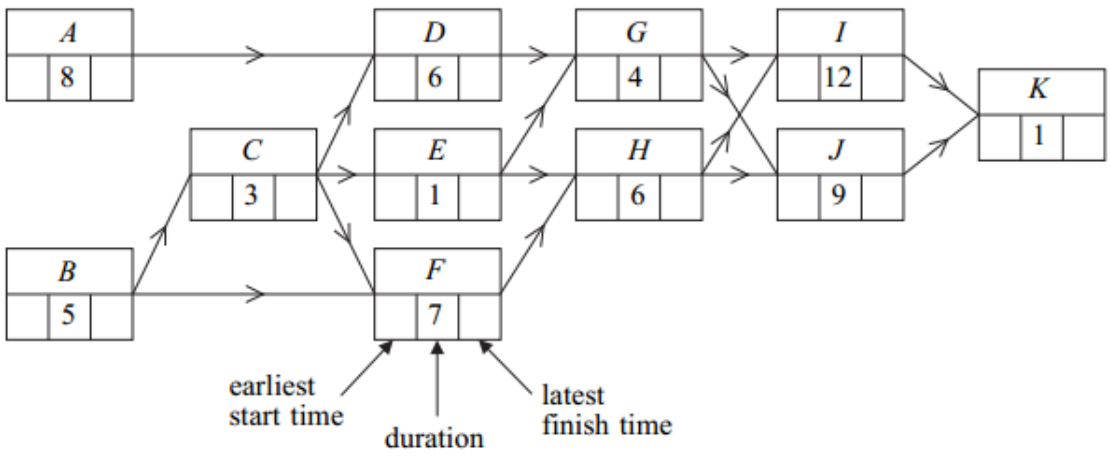
(g) Given that there is only one worker available for the project, find the minimum completion time for the project. *(1 mark)*

QUESTION PART REFERENCE

Answer space for question 1

(a)

Figure 1



JAN 2013 – FIGURES 2 &3

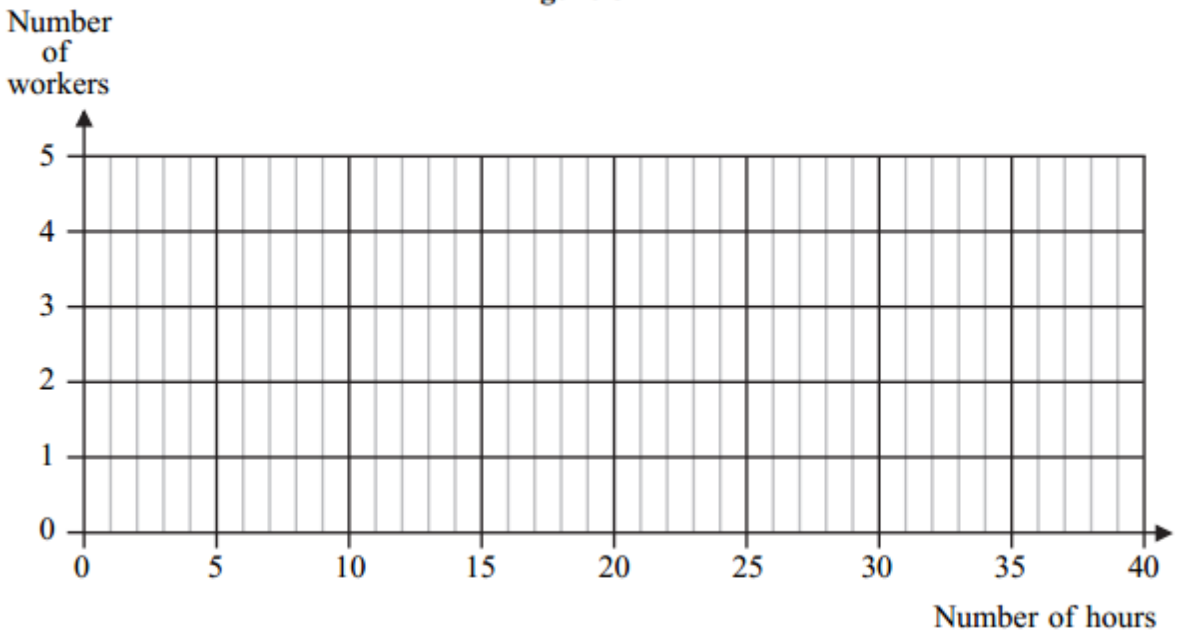
Answer space for question 1

Figure 2

Activity	Immediate predecessor(s)
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	

Answer space for question 1

Figure 3



JUNE 2013

1 **Figure 1** opposite shows an activity diagram for a project. The duration required for each activity is given in hours. The project is to be completed in the minimum time.

(a) Find the earliest start time and the latest finish time for each activity and insert their values on **Figure 1**. *(4 marks)*

(b) Find the critical path. *(1 mark)*

(c) Find the float time of activity *E*. *(1 mark)*

(d) Given that activities *H* and *K* will both overrun by 10 hours, find the new minimum completion time for the project. *(3 marks)*

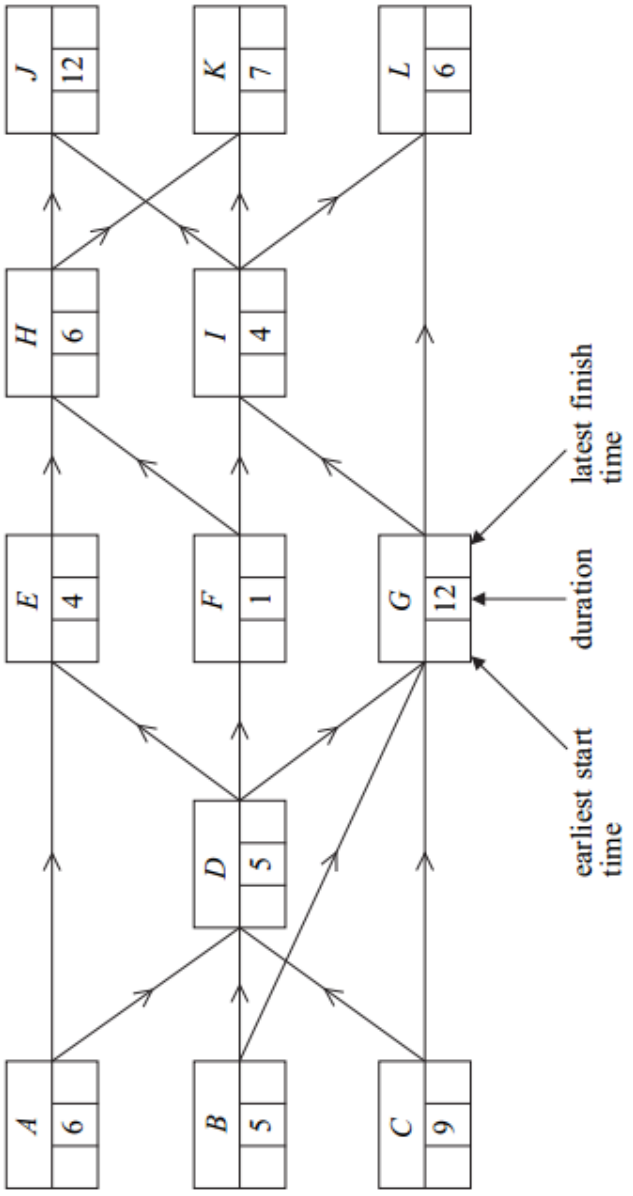


Figure 1

JUNE 2014

1 A major project has been divided into a number of tasks, as shown in the table. The minimum time required to complete each task is also shown.

Activity	Immediate predecessor	Duration (hours)
A	–	3
B	A	3
C	A	4
D	B, C	6
E	B, C	5
F	C	2
G	C	1
H	A	15
I	D, E	4
J	F	6
K	G	10
L	H, I, J, K	1

(a) On the page opposite, construct an activity network for the project. (Activity A has already been drawn.)

[3 marks]

(b) Find the earliest start time for each activity.

[2 marks]

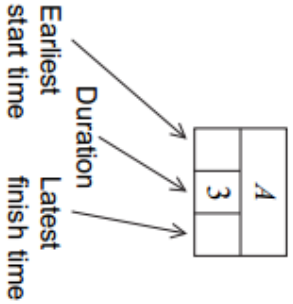
(c) Find the latest finish time for each activity.

[2 marks]

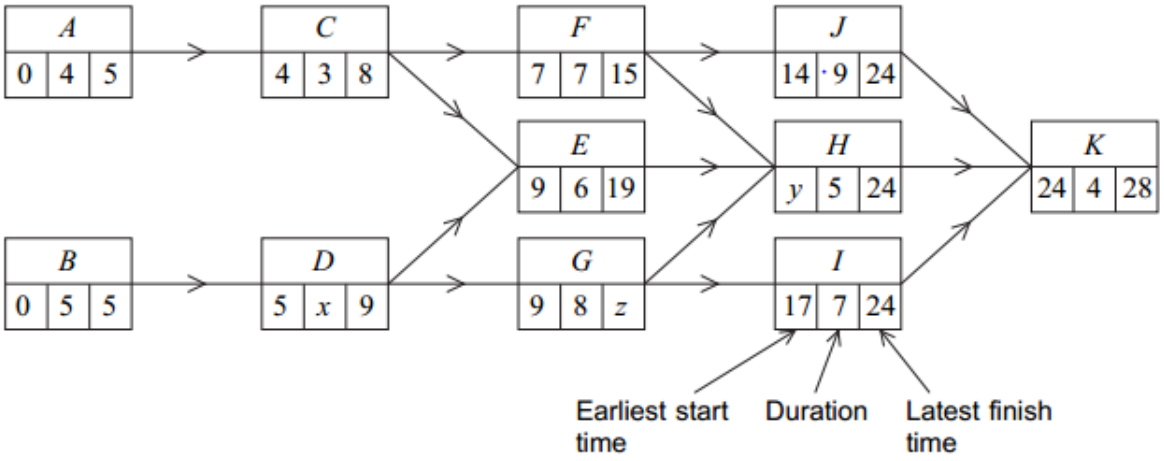
(d) List the critical activities.

[2 marks]

Answer space for question 1



8 An activity diagram for a project is shown below. The duration of each activity is given in weeks. The earliest start time and the latest finish time for each activity are shown on the diagram.



(a) Find the values of x, y and z.

[2 marks]

(b) State the critical path.

[1 mark]

(c) Some of the activities can be speeded up at an additional cost. The following table lists the activities that can be speeded up together with the minimum possible duration of these activities. The table also shows the additional cost of reducing the duration of each of these activities by one week.

Activity	Additional cost per week (£)	Minimum completion time (weeks)
E	8000	1
F	7000	4
G	6000	5

The company wishes to complete the project as soon as possible.

(i) Find which activities should be speeded up. For **each** such activity, state, with justification, the reduction in the number of weeks.

(ii) Hence state the revised minimum time for the completion of the whole project.

(iii) Calculate the total additional cost that the company would incur in meeting this revised completion time.

[7 marks]