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

**1.**

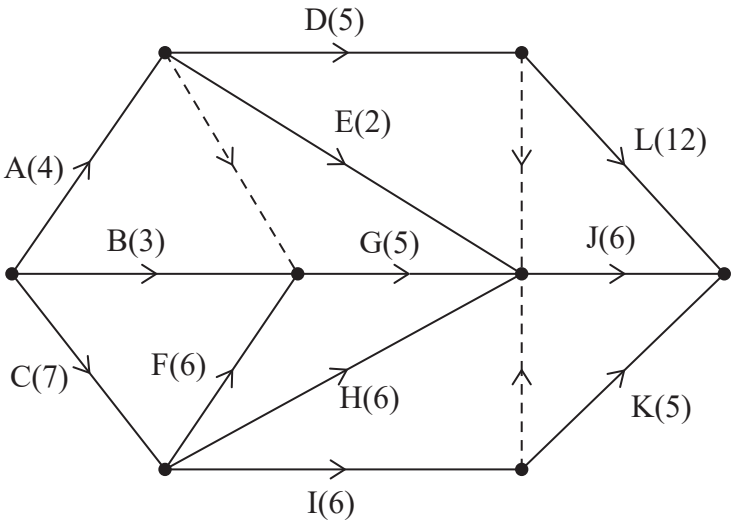



**Figure 1**

A project is modelled by the activity network shown in Figure 1. The activities are represented by the arcs. The number in brackets on each arc gives the time, in hours, to complete the corresponding activity. Each activity requires one worker. The project is to be completed in the shortest possible time using as few workers as possible.

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

**(4)**

(b) Calculate the total float for activity D. You must make the numbers used in your calculation clear.

**(1)**

(c) Calculate a lower bound for the minimum number of workers required to complete the project in the shortest possible time. You must show your working.

**(2)**

(d) Draw a cascade chart for this project on Grid 1 in the answer book.

**(4)**

(e) Use your cascade chart to determine the minimum number of workers needed to complete the project in the shortest possible time. You must make specific reference to time and activities. (You do not need to provide a schedule of the activities.)

**(2)**

**(Total for Question 1 is 13 marks)**