Mathematics-Standard2 Critical-path-analysis transcript

(Duration 10minutes 44 seconds)

This is the HSC Hub, Mathematics curriculum support for the New South Wales Department of Education. My name is Sarah Warry. Today we will look through question 26 from the 2019 Mathematics Standard Two examination paper. This question covers the content found in N3 Critical Path Analysis from the Mathematics Standard Two syllabus. Question 26 is about a project that includes six activities labelled A through to F. Please pause this video to allow yourself time to read through the question and analyse the activity chart shown on the screen.

Part A of this question asked students to determine the minimum time for the project to be completed by drawing a network diagram. The first thing that you will notice is that Part A is worth three marks. The breakdown of those marks is outlined in the NESA marking criteria and is shown on your screen. Before we get started, it is important to remember that there are three different ways to draw a network diagram as outlined in the topic guide released by NESA. The sample solutions provided by NESA for this question show the activities and the durations attached to the vertices. In this video I will show you another method known as activity on arrow where the activities and the durations are written along the edges.

There are six activities listed in this activity chart. As I'm going to use the activity on arrow method for my network diagram, my network diagram will contain six arrows. I've written the arrows at the top of the screen just to remind myself of the elements that my diagram will contain. Whilst you are learning how to create network diagrams it is a good idea that if you're having trouble drawing the network that you could cut these arrows out and manipulate them on your desk before drawing your final diagram.

The first step in drawing a network diagram is to look at the activities that do not have any immediate prerequisites. In our question, Activity A does not have any immediate prerequisites. So this will be the first activity. To keep track of my activities, I'll cross them off as I use them. Now we will look at the table and see which activities have an Activity A listed as an immediate prerequisite. From the table we can see that both activities B and C have Activity A listed as a prerequisite. This means that both B and C lead from the end of A. Now we need to look for the activities that have B as a prerequisite. From the table we can say that Activity D leads from Activity B. OK, now we have hit a problem Activity E lists both activities C and D as immediate prerequisites, however, they are both ending in different spots.

You have two options here. The first option is to draw a dummy activity. You would need to draw a dummy activity between the ends of activities C and D and then draw in activity E. Alternatively, you can move arrows C and D so that they end at the same vertex as shown on your screen and then add activity E on to the end. For the purpose of this video I'll leave the network diagram like this and add the last activity F on to the end of activity E.

Now that we have completed on network diagram, we need to perform a forward scan to determine the minimum completion time. To perform a forward scan, we add the durations together as we move through the network. This helps to determine the earliest starting time or EST for each of the activities. The EST for each of the activities will be written in blue font for the purpose of this video and the LST or latest starting times will be written next to the EST in red font. When we start our project, no time has passed, so we write the zero above the word 'start'. Activity A has a duration of two hours, which means that the earliest starting time for activities B and C will be after two hours. Activity B has a duration of six hours. Adding this to the two hours we've already spent completing activity A means that activity D will not be able to start until after eight hours has passed. Determining the EST for activity E is tricky. If we follow the path along the bottom via activity C the earliest starting time for activity E would be two plus five, which is seven. However, if we followed the path along activity A then B and then D, the earliest start time for activity E would be ten hours. As activity E cannot commence until both activities C and D are completed, we have to choose the later time of ten hours. Activity E has a duration of four hours, which means activity F has an earliest start time of fourteen hours. This will result in an overall completion time of fifteen hours. Therefore, the minimum completion time for this project is fifteen hours.

In Part B of this question, you need to determine the float time of the non-critical activity. You will notice that this part is only worth one mark. This means that the marker is only looking for the float time. As a reminder, NESA have defined float time to mean the amount of time that a task in a project network can be delayed without causing a delay in subsequent tasks. To determine the float time of non-critical activities, we need to perform a backward scan. As it suggests, we're going to start at the end of the project at fifteen hours and work our way backwards through the network to determine the LST of each of the activities. As mentioned earlier, the LST will be written in red font for the purpose of this video and shown to the right of the EST for each activity. Starting with the completion time of fifteen hours, the first thing we will do is subtract the duration of activity F to get an LST for F as fifteen takeaway one which is fourteen hours. As both the EST and LST for activity F is the same, there is no float time for this activity and thus it will lie on the critical path. Activity E has a duration of four hours. Subtracting this from the fourteen we found earlier will result in activity E having an EST of ten hours. Like activity F as the EST and LST are equivalent. this means that activity E must also be critical and thus does not have a float time attached to it. Following up the path through activity D will result in an LST of ten subtract two which equals eight hours. This makes activity D also a critical activity.

Going back to activity E, if we follow the path along activity C, we will find it to have an LST of five hours, yet the earliest start time for activity C was in fact two hours. This indicates that activity C is a non-critical activity, and the float time for this activity is 5, subtract 2, which equates to three hours. Just to check the remaining activities, if we had followed the path via activity be we would have resulted in an LST for activity be as being 2 hours, indicating that it is also a critical activity. Finally, completing the backward scan, we subtract the duration of activity A from the earlier of the LSTs for activities B and C to find out that activity A is also critical, having an EST and LST of zero. Now that we have finished the backward scan, let's have another look at what the question was asking us to do. So Part B wanted us to determine the float time of the non-critical activity. As we found out earlier the non-critical activity was in fact activity C and it had a float time of three hours.

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