Mathematics-Standard
Network flow transcript
<https://web.microsoftstream.com/video/88259d93-18cd-4d75-b122-2b387461fc5e>

(Duration 5 minutes 42 seconds)

This is the HSC Hub, Mathematics curriculum support from the New South Wales Department of Education. My name is Sarah Warry. Today we will look through question 40 from the 2019 Mathematics Standard Two examination paper. This question covers content found in N3 Critical Path Analysis from the Mathematics Standard Two syllabus. Question 40 is about the flow of people moving through a museum. Please pause this video to allow yourself time to read through the scenario and part A as shown on the screen.

You will see on your screen that Part A is worth one mark, which indicates that you only need to provide the marker with one piece of information. In this case, it is the capacity of the cut shown on the diagram. In order to determine the capacity of the cut, we first need to determine which side is the source of the flow and which side is the sink. In this question, the source is the entry which is on the left hand side and the sink is the exit which is on the right hand side. Now we look at which of the edges directly cross over the cut from the source side to the sink side. In this question, edges AD, AC and BE all cross the cut. Adding the weights of these edges together will result in a capacity of two hundred and ninety people per hour. A common mistake in this question is for students to include the edge that leads from vertex C to vertex B. This edge is not included as it moves across the cut from the sink side back to the source side. Now let's look at Part B of the question. Please pause this video to allow yourself time to read through the question as shown on your screen.

The first thing you will notice is that Part B is worth two marks. One mark will be awarded for drawing the minimum cut and the second mark will be rewarded for providing a suitable recommendation. This is outlined in the marking criteria that was produced by NESA as seen on your screen. In order to determine the minimum cut and make a recommendation, we need to have a close look at the network and determine which edges are causing the flow issue. We have two hundred and forty people entering the museum and we have the capacity for two hundred and forty people to pass through the exit. Which means that something needs changing on one or more of the other eight edges.

One method to determine the minimum cut is through trial and error. We have already established that the two ends of the network have a capacity of two hundred and forty and if we draw two more cuts moving towards the centre of the diagram, we will see that they also have a capacity of two hundred and forty. So we need to try drawing cuts somewhere else. On your screen you will see two more cuts drawn diagonally across the diagram. These cuts actually have a capacity of more than two hundred and forty thus they are definitely not the minimum cut. Looking at some more possible cuts across the diagram drawn on the opposite diagonal. You can see that the bottom cut shown on the screen has a capacity of two hundred and forty, however, the other cut has a capacity of two hundred and thirty. There are other possible cuts through the network, however none of them have a lower capacity than two hundred and thirty. This makes this cut the minimum cut and so far you would have received one mark.

Now, in order to get the other mark, we need to make a recommendation to increase the flow capacity of this cut to two hundred and forty people. The first thing we should do before making a recommendation is to look at which edges are crossing the cut from the source side to the sink. Currently the capacity of this cut is two hundred and thirty and we want it to be two hundred and forty. This means that we need to add ten to the weight of one of these edges. The sample recommendation is to increase edge CB by ten to a weight of fifty people per hour. Obviously this is not the only possible recommendation, as ten could have been added to edges, AB, CE or even DE. This is the HSC Hub for the New South Wales Department of Education.

End of Transcript