

2021A21

(DELAY, PATHFINDING)

Level 1: The formula ends up with two parts: one that deals with propagation delay and one that deals with processing delay. The propagation delay happens each time the information hops. However, the processing delay happens when the information reaches a machine; the number of machines is one less than the number of hops. The following equation is the result:

$$\text{Total Delay} = \text{Num of Hops} * \text{Propagation Delay} + (\text{Num of Hops} - 1) * \text{Processing Delay}$$

This formula gets the following table of results:

Scenario 1	$\text{Total Delay} = 3 * 150 + (3 - 1) * 200$ $\text{Total Delay} = 850\text{ms}$
Scenario 2	$\text{Total Delay} = 4 * 150 + (4 - 1) * 150$ $\text{Total Delay} = 1,050\text{ms}$
Scenario 3	$\text{Total Delay} = 3 * 200 + (3 - 1) * 150$ $\text{Total Delay} = 900\text{ms}$

The top of this tower holds a camera, anemometer, and wind vane, all of which communicate to the OE office via a secure network.



Level 2: We cannot use the formula from the previous problem because all the delays are different in this network. The best way to calculate the quickest path for a map of this size is to try all possibilities and pick the fastest. Doing so results in the paths shown. The quickest total delay through the path is 70 milliseconds.

Potential Paths	Delay (ms)
	<p><i>Sum of Propagation Delays = 250ms</i> <i>Sum of Processing Delays = 0 ms</i> <i>Total Delay = 250ms</i></p>
	<p><i>Sum of Propagation Delays</i> $= 20ms + 25ms + 15ms$ $= 60ms$ <i>Sum of Processing Delays = 10ms + 10ms</i> $= 20ms$ <i>Total Delay = 80ms</i></p>
	<p><i>Sum of Propagation Delays</i> $= 20ms + 30ms + 5ms$ $= 55ms$ <i>Sum of Processing Delays = 10ms + 10ms</i> $= 20ms$ <i>Total Delay = 75ms</i></p>
	<p><i>Sum of Propagation Delay = 30ms + 40ms</i> $= 70ms$ <i>Sum of Processing Delays = 5ms</i> <i>Total Delay = 75ms</i></p>
	<p><i>Sum of Propagation Delays</i> $= 30ms + 10ms + 10ms$ $= 50ms$ <i>Sum of Processing Delays = 5ms + 15ms</i> $= 20ms$ <i>Total Delay = 70ms</i></p> <p><u>This path is the fastest path!</u></p>

<p>A network diagram with 'Start' and 'End' nodes in blue boxes. The path is Start → 5 (30) → 15 (10) → 10 (5) → End (25).</p>	<p><i>Sum of Propagation Delays</i> $= 30ms + 10ms + 5ms + 25ms$ $= 70ms$</p> <p><i>Sum of Processing Delays</i> $= 5ms + 15ms + 10ms$ $= 30ms$</p> <p><i>Total Delay = 100ms</i></p>
<p>A network diagram with 'Start' and 'End' nodes in blue boxes. The path is Start → 5 (30) → 10 (10) → End (25).</p>	<p><i>Sum of Propagation Delays</i> $= 30ms + 10ms + 25ms$ $= 65ms$</p> <p><i>Sum of Processing Delays</i> = 5ms + 10ms $= 15ms$</p> <p><i>Total Delay = 80ms</i></p>
<p>A network diagram with 'Start' and 'End' nodes in blue boxes. The path is Start → 5 (30) → 10 (10) → 15 (5) → End (10).</p>	<p><i>Sum of Propagation Delays</i> $= 30ms + 10ms + 10ms + 5ms$ $= 55ms$</p> <p><i>Sum of Processing Delays</i> $= 5ms + 10ms + 15ms$ $= 30ms$</p> <p><i>Total Delay = 85ms</i></p>

Below is the fastest path in the context of the entire network.

