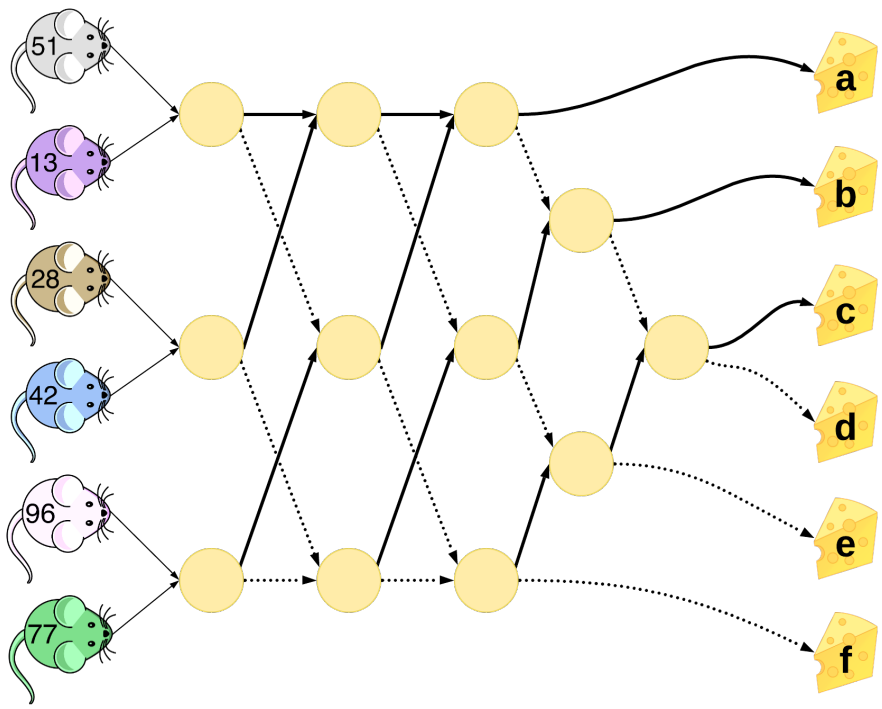
CEMC at Home

Grade 9/10 - Wednesday, May 27, 2020

Mixed Up Mice

Six numbered mice are moving through the network of paths shown below in order to reach the cheese. To start, the mice line up randomly on the left side of the network. Then, each mouse moves along a path by following the arrows. When a mouse reaches a yellow circle it waits for another mouse to arrive. When another mouse arrives at the circle, the two mice compare their numbers. The mouse with the smaller number follows the solid arrow out of the circle, while the mouse with the larger number follows the dotted arrow out of the circle.



Questions

1. After all of the mice move through the network of paths shown above, which mouse ends up with which piece of cheese?

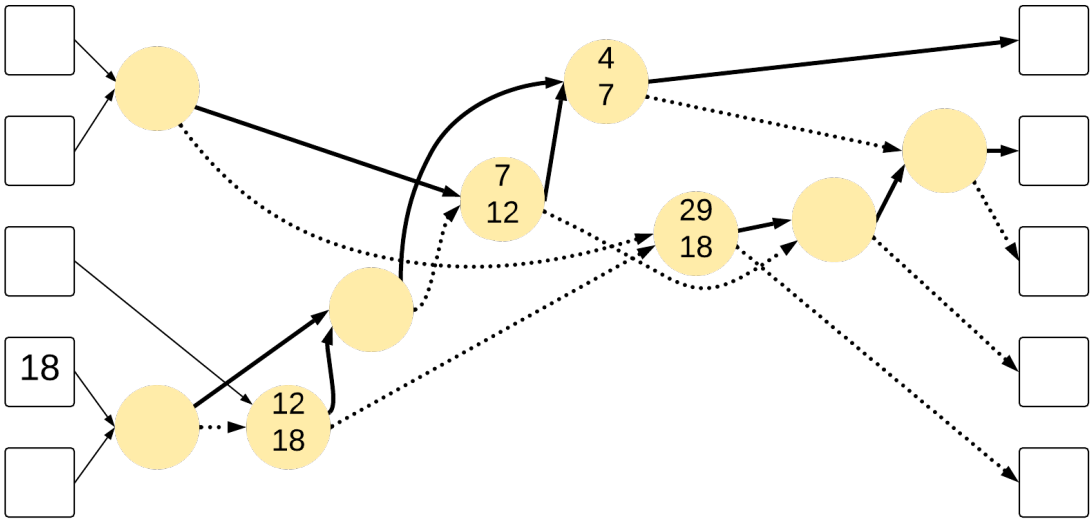
2. Now, line up the mice again at the start of the network, but change their starting order. After all of the mice move through the network of paths again, which mouse ends up with which cheese? Try repeating this a few times, each time with a different starting order for the mice. What do you notice?

3. What would happen if, upon leaving the circles, the mice with the smaller numbers followed the dotted arrows and the mice with the larger numbers followed the solid arrows? Explain.

Think about questions 1, 2, and 3 before moving on to the next page.

The network shown on the first page is an example of a *sorting network* for six numbers. There are six *inputs* on the left side of the network and six *outputs* on the right side of the network. Each yellow circle represents a *comparison* between two inputs (i.e. which number is larger?) and produces two outputs as demonstrated by the arrows. As the inputs move through the network, they are reordered (or *sorted*) according to their relative sizes.

4. Suppose you were given the following sorting network for five numbers. This network follows the same rules as the network on the first page. The inputs on the left side of the network are the numbers 4, 7, 12, 18, and 29, in some order. Using the information given below about how the numbers moved through the network, is it possible to determine the starting order of the five input numbers?



5. Draw a possible sorting network that sorts exactly four numbers.

   Can you draw two different sorting networks that sort exactly four numbers?

   Activity: Try drawing out your sorting network on a driveway with sidewalk chalk, or find a way to lay it out on a floor (what can you use for the circles and the arrows?). Ask your family members to pick a card from one suit in a deck of cards and randomly line up at the start. Play through a few rounds to convince yourself that you have a proper sorting network.

More Info:

Check out the CEMC at Home webpage on Wednesday, June 3 for a solution to Mixed Up Mice.