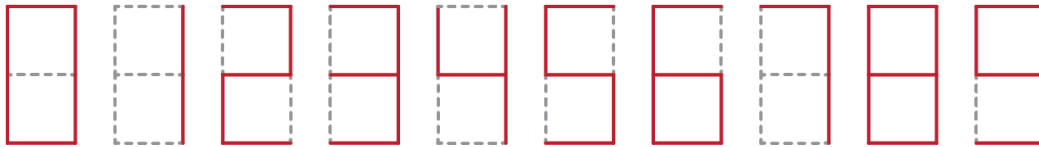# Problem of the Week
Problem D and Solution
The Clock Works

Problem

Halina's clock uses a digital LED display where each digit is represented by seven LED segments that are either on or off, as shown.

Sometimes some of the LED segments stop working. When the topmost horizontal LED segment stopped working, both the digit 1 and the digit 7 appeared as shown. This was a problem because Halina couldn't distinguish between them.

Halina replaced the broken LED segment, but then a week later found that a different LED segment had stopped working. However, this time, she was still able to distinguish between all ten digits.

What is the largest number of LED segments that can be broken at the same time, while still allowing Halina to distinguish between all ten digits?

Solution

First we will label the seven LED segments as shown.
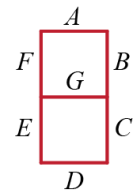
If segment A is broken, Halina cannot distinguish between digits 1 and 7.
If segment B is broken, Halina cannot distinguish between digits 6 and 8.
If segment E is broken, Halina cannot distinguish between digits 5 and 6, and also between digits 8 and 9.
If segment F is broken, Halina cannot distinguish between digits 3 and 9.
If segment G is broken, Halina cannot distinguish between digits 0 and 8.

If both segments C and D are broken, the ten digits would appear as shown.
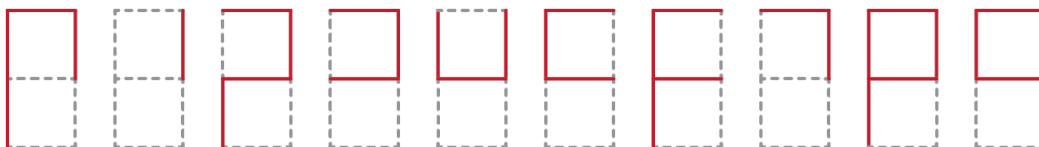
Since each of these digits are unique, Halina can distinguish between them. Therefore, at most 2 LED segments can be broken at the same time.