

Problem of the Week
Problem C
Count Down to Zero

Every year there is a countdown to the New Year in Problemville. The timer starts at 20 and counts down to 0.

The display for the digits on the timer is made up of seven segments that are either lit or unlit. When the digit 8 is displayed, all seven segments are lit.

When the digit 1 is displayed, only two segments are lit and five segments are unlit.

In changing from digit to digit, a segment can change from lit to unlit, from unlit to lit, or could remain unchanged. For example, in changing from 5 to 4, three of the segments that were lit stay lit, one segment that was unlit stays unlit, one segment that was unlit becomes lit, and two of the segments that were lit become unlit. Therefore, there is a total of three changes of state when the timer changes from 5 to 4.

In counting down from 20 to 0, how many changes of state are there? In other words, determine the number of times segments are turned from unlit to lit plus the number of times segments are turned from lit to unlit. (Note that, in changing from 10 to 9, the left digit is turned completely off.)

The ten digits are shown below for your reference.



Problem of the Week
Problem D
Counting Lights, Not Sheep

Some nights it is difficult to get to sleep. On one such night, John counted the number of LEDs (Light-Emitting Diodes) on his clock radio that were on to make each individual time from 10:00 PM to 12:59 AM. He did this instead of counting sheep. When it was 11:11, for example, he noted that 8 of the LEDs were on.

During the time that John was awake from 10:00 PM to 12:59 AM, how many of the times had exactly 20 of the LEDs on?

Here is some information about John's clock radio:

- Only times from 12:00 to 11:59 can be displayed.
- Each digit is made up of seven LEDs which are turned off or on depending on the particular digit to be displayed. The digit 2 has five of the seven LEDs on while the digit 8 has all seven LEDs on. All of the digits are shown in the diagram below.
- For times from 10:00 to 12:59, all four digits are used.
- For times from 1:00 to 9:59, only three digits are displayed. The leftmost digit is completely off for these times.



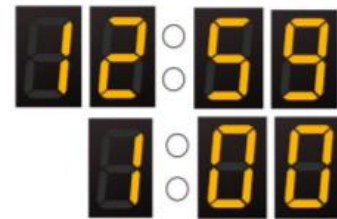
Around the Clock

The digits are displayed on a clock in the following way. Each of the four digit spots consists of seven LEDs (Light-Emitting Diodes) which are turned off or on depending on the digit to be displayed.

When the time changes from “12:00” to “12:01”, the first three digits of the time remain in their same state but four of the LEDs in the final digit change from on to off.



Many more things happen when the clock changes from “12:59” to “1:00”. In the first digit spot, the two LEDs used to display the 1 turn off. In the second digit spot, four of the LEDs that are on to make the 2 turn off and another LED turns on. In the third digit spot, to change from a 5 to a 0, two LEDs need to turn on and one LED needs to turn off. In the fourth digit spot, to change from a 9 to a 0, one LED must turn off and one LED must turn on. In total, to change from “12:59” to “1:00”, a total of $2 + 5 + 3 + 2 = 12$ changes occur.



If the initial time displayed on the clock is “12:00”, how many changes have occurred once the clock displays “12:00” again?

Each of the digits is shown below for your reference.

