

## 1 Where to put your long-burning light bulb?

Refer to the dot-matrix examples from the lecture on 4/8. Suppose you have one extra-long-life light bulb that can be used in a  $7 \times 5$  board for displaying a digit (0 to 9; all are equally likely to be displayed). In which positions of the  $7 \times 5$  board would you put this special long-life light bulb? Assume that a bulb  $(i,j)$  that is in a lit part of the board simply stays on—instead of first turning off and then back on—when the display changes to another digit that requires bulb  $(i,j)$  to be on. Consider the following cases:

1. The longer that a bulb is on, the more it degrades.
2. Switching a bulb on (and off) frequently causes it to degrade. (Take the extreme case—assume that continuous burning doesn't degrade the bulb.)

Function `TheDigits` returns a 10-by-1 cell array `D` such that `D{k}` is the matrix encoding digit `k`. *Part of* the function is shown below:

```
function D = TheDigits
% D is a 10-by-1 cell array.
% D{k} is a 7-by-5 matrix that encodes the digit k. (D{10} encodes 0.)

D = cell(10,1);
D{1} = [0 0 1 0 0;...
        0 1 1 0 0;...
        0 0 1 0 0;...
        0 0 1 0 0;...
        0 0 1 0 0;...
        0 0 1 0 0;...
        0 1 1 1 0];

D{2} = [0 1 1 1 0;...
        1 0 0 0 1;...
        0 0 0 0 1;...
        0 0 0 1 0;...
        0 0 1 0 0;...
        0 1 0 0 0;...
        1 1 1 1 1];

:

D{10} = [0 1 1 1 0;...
         1 0 0 0 1;...
         1 0 0 0 1;...
         1 0 0 0 1;...
         1 0 0 0 1;...
         1 0 0 0 1;...
         0 1 1 1 0];
```

## 2 Challenge question

Refer to the question above. What if you have five extra-long-life light bulbs? Determine in which positions you should place these special light bulbs in the two cases described above.