CS100M Section Exercise 9

1 Two-dimensional interpolation

When you enlarge an image, you are actually adding data points among the existing data (pixels). How do you get the additional data points? One way is to interpolate from the neighboring points—take the average value. First, consider a simple case of one-dimensional interpolation, we add a data point between neighboring pairs of existing data points by taking the simple average. For example,

`2.0 1.0 1.0 2.0` becomes `2.0 1.5 1.0 1.0 1.0 1.5 2.0`.

In 2-d interpolation, work with one dimension at a time. For example, given a matrix

```
2.0  1.0  1.0  2.0
6.0  5.0  4.0  3.0
5.0  5.0  5.0  4.0
```

First we can add a column between two neighboring columns, so the matrix becomes 3×7:

```
2.0  1.5  1.0  1.0  1.0  1.5  2.0
6.0  5.5  5.0  4.5  4.0  3.5  3.0
5.0  5.0  5.0  5.0  5.0  4.5  4.0
```

Then add a row between neighboring rows, so the final matrix will be 5×7:

```
2.0  1.5  1.0  1.0  1.0  1.5  2.0
4.0  3.5  3.0  2.8  2.5  2.5  2.5
6.0  5.5  5.0  4.5  4.0  3.5  3.0
5.5  5.2  5.0  4.8  4.5  4.0  3.5
5.0  5.0  5.0  5.0  5.0  4.5  4.0
```

Write two versions of the following function `Interpolate2D`: (a) use vectorized code (work with whole rows and/or whole columns) at a time; (b) use non-vectorized code.

```
function newM = Interpolate2D(M)
% Perform 2-d interpolation on the real-valued data in nr-by-nc matrix M.
% The interpolated data are added between existing data points so newM is
%   (2*nr-1)-by-(2*nc-1).  Use the simple average as the interpolated value.
```

2 Bounded random walk

[If you haven't completed the lab questions from last week, be sure to work on them! Here is the last question from Lab 8.] In a bounded random walk, a set number of steps are taken within a bounded area. For example, when the right boundary (excluding the corners) is reached, the next step can go left, up, or down only. Similarly, when a corner is reached, the next steps can be in two directions only. For a 100-step bounded random walk in a 21×21 grid, which "square" is visited most often?

3 Review Prelim 2

Look over your Prelim 2. *Re-do the questions that you messed up on!* Don't just look at the solutions—re-do the questions and ask for help as necessary.