CS1112 Lab Exercise 8

1 Subarrays

Type the following expressions in the MATLAB *Command Window*. Write the resulting array or answer the question on the blank.

```
m= rand(6,5)

a= m(:,2)      % What does the colon specify when used in place of an index? _____


b= m(2:3,:)    % _____

p= rand(6,5,3) % This is a 3-dimensional array

c= p(:,:,2)    % Is this a matrix (2-d) or a 3-d array? _____

d= p(4,:,2)    % Is this a vector, matrix, or 3-d array? _____
```

2 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 non-vectorized code; (b) use vectorized code (work with whole rows and/or whole columns) at a time.

```
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.
```

If you haven't completed the section exercise from last week, be sure to do it now!
Please delete your files from the computer before leaving the lab.