**Assignment 2 (20 points)**

**Problem 1: *Zooming/Oversampling* and *Shrinking/Subsampling Images* by Pixel Replication (15/15)**

Write your own function capable of shrinking and zooming an image by pixel replication and decimation. Assume that the desired zoom/shrink factors will be the inputs for your function and will have integer values: a negative input means shrink and a positive input means expand. Do not use MatLab built in functions (or other language libraries) for decimation and replication, although you can use other MatLab functions.

(a) Use your program to shrink an image by a factor of 4 in each dimension. Show the shrunk image.

(b) Use your program to zoom the image back to its original size.  Show the zoomed image and explain how and why the original image and the shrunk/zoomed images are different.

**Problem 2: Basic Grey Level Transformations (5/5)**

(a) Read and display an image.

(b) Calculate the negative of the image and display it.

(c) Perform contrast stretching. You can use the imadjust.m function to perform the image transformation.

**Work by hand:**

**Some basic relationships between pixels (5 points)** Note: You do not need to use Matlab code to solve this problem.

Consider the image segment shown below (the values in blue represent the p and q pixels):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 3 | 1 | 2 | 1 | (q) |
|  | 2 | 2 | 0 | 2 |  |
|  | 1 | 2 | 1 | 1 |  |
| (p) | 1 | 0 | 1 | 2 |  |

(a) Let V= {0,1} and compute the lengths of the shortest 4-, 8- paths between p and q. If a particular path does not exist between these two points, explain why.

(b) Calculate the D4 distance (city-block distance) and the D8 distance (chessboard distance) between pixels p and q. Do these two distances depend on which path you choose between p and q? Explain your answer.

**General submission instructions:**

1. Be kind to your aging, over-worked professor and submit only a single document. This can be pdf, MS Word, OpenOffice, etc. Do not submit a zip file.
2. Your single document should include the input image for your problem, if required, and answers to each of the sub-problems (text, image or both, as appropriate). Your document should also include code that you wrote to generate your answers.
3. You may use any images you like for the programming; I encourage you to use images that might be useful/interesting for your final project.
4. Feel free to use whatever functions MatLab supplies, except where otherwise specified. Also feel free to write your own, if you are so inclined; it will take more time, but you will gain a deeper understanding of the material. It is one thing, for example, to use imadjust.m and quite another to write your own contrast stretching function.
5. Point values for each question are indicated as ***x/y*** in which ***x*** is the point value for 481 students and ***y*** is the point value for 381 students.