Assignment 2
Deadline: 12th Sept, 4:00 PM

Instructions:

- Write down all the steps
- Represent the symbols in your answers as per question
- Theory – Q1.a.
- Rest are programming (Matlab/Python).

Q1. a. Using bilinear interpolation, find the value at Q={x,y}, x=2.4,y=1.8.

Y/X	0	1	2	3
0	10	10	13	17
1	11	12	7	11
2	10	13	5	19
3	23	17	9	8

I. You must clearly explain the four nearest neighbor coordinates and corresponding pixel values.
II. Clearly highlight the obtained coefficients of bilinear interpolation that you obtain via equation $v(x, y) = ax + by + cxy + d$
III. Using these coefficients, find the value at Q.

b. Write a code (Matlab/Python) which takes input as Q and gives out the pixel value at Q.
Note: your code must clearly show

I. how the nearest neighbors are selected
II. the step where coefficients are obtained

Q2. Apply scaling of the form

$$\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

a. What is the dimension of output?
b. Perform the inverse mapping, i.e., find out which points in input correspond to the defined output.
c. Run a for loop for finding all pixels in output. When output pixel coordinates are mapped to input and the input coordinates are integers, these values can be directly populated in output grid using input pixels. When these coordinates are real, use bilinear interpolation to determine pixel value. **Note**: you are **not** allowed to use any inbuilt function which takes input/output grid coordinates and known pixel values, and gives interpolated pixels values.
d. Extend this to cameraman image.

Q3. Perform image registration between referenceIm.jpg and cameraman.tif. Consider the unregistered image to be cameraman.tif.

- You would need to manually identify the points that correspond to each other in the two images. Identify atleast 3 non-collinear points.
- Using these points, estimate the transformation matrix T between reference and unregistered image.

e. Using T, register the cameraman.tif image. **Note**: you are **not** allowed to use any inbuilt function which takes input/output grid coordinates and known pixel values, and gives interpolated pixels values.

- You would need to create and output grid and do inverse mapping from output to input grid. You can then use the code of Q2-c to register the image.