For parts 1 and 2, use the “lenna” and “peppers” images; note that each one of them is a 256 x 256, 8 bits/pixel image.

1. **[25 pts] Image Sampling**
   Write a program to change the spatial resolution to 128 x 128, 64 x 64, and 32 x 32 pixels. Resize the images back to the original size 256 x 256 images and print them for comparison purposes. Explain how your algorithm works.

2. **[25 pts] Image Quantization**
   Write a program that would reduce the number of gray levels in a PGM image from 256 to: (i) 128, (ii) 32, (iii) 8, and (iv) 2. Explain how your algorithm works.

3. **[50 pts] Histogram Equalization**
   (a) Write a program to compute the histogram of an image.
   (b) Implement the histogram equalization technique. It is suggested that you debug your algorithm using a small “test” image (e.g., 5 x 5) to make sure that it works correctly.
   (c) Perform histogram equalization on the “boat” and “f_16” images.
   (d) Show and discuss your results (i.e., original images/histograms, output images/histograms).

4. **Graduate Students Only: [30 pts] Histogram Specification**
   (a) Implement the histogram specification technique. It is suggested that you debug your algorithm using a small “test” image (e.g., 5 x 5) to make sure that it works correctly.
   (b) Perform histogram specification on “boat” and “f_16” images. Assume that the specified histogram for the “boat” image is the histogram of the “sf” image while the specified histogram for the “f_16” image is the histogram of the “peppers” image.
   (c) Show and discuss your results (i.e., original images/histograms, specified histograms, output images/histograms).
Laboratory Write-up

For each programming assignment, you are to turn in a brief report (see instructions posted on the course’s website). The report is very important in determining your grade for the programming assignment. Be well organized, type your reports, and include figure captions with a brief description for all the figures included in your report. Motivation and initiative are greatly encouraged and will earn extra points.