# 1 Instructions

Please save your code for the following exercises to an m-file and send it to me via email (`suadusum@ucsd.edu`). To help you get started, download a file called `lab5start.m` (`http://topex.ucsd.edu/rs/lab5/lab5start.m`). This file has a few lines of code with hints at the solutions.

# 2 Exercises

## 2.1 Exercise 1

1) Go to `http://topex.ucsd.edu/rs/lab5/` and download individual files for the 7 bands of a Landsat image of San Diego, acquired in August 1990 (`*.raw` files). The spectral range and other file characteristics are provided in the NLAPS header file (See Appendix A of image processing notes.) Here is a summary of the spectral bands.

| band # | min ( $\mu$m ) | center ( $\mu$m ) | color |
|---|---|---|---|
| 1 | 0.45 | 0.485 | Blue-Green |
| 2 | 0.52 | 0.56 | Green |
| 3 | 0.63 | 0.66 | Red |
| 4 | 0.76 | 0.83 | Near-IR |
| 5 | 1.55 | 1.65 | Mid-IR |
| 5 | 10.40 | 11.45 | Thermal-IR |
| 7 | 2.08 | 2.255 | Mid-IR |

**Table 2.1:** Landsat Spectral Bands

## 2.2 Exercise 2

Display the thermal infrared band three ways: a) no contrast enhancement; b) linear stretch; c) histogram equalization. Display results as grayscale. What do you see in the ocean areas? Compare the original image histogram with the equalized image histogram (use `imhist()` to display histograms).

## 2.3 Exercise 3

Use the appropriate bands and contrast enhancement to make a natural looking RGB image. Without histogram equalization the picture looks blue. Why? Combine the processed RGB images into a single image using the `cat()` command, then proceed to plot them with `imshow()`, as in Lab 3.

## 2.4 Exercise 4

Apply the following operations to band 1: a) image smoothing; b) image sharpening; c) southwest illumination (Sobel). Display results as grayscale. Follow pages 285-287 in the textbook *Physical Principles of Remote Sensing* by Rees. The convolution is done with `filter2()`.

## 2.5 Exercise 5

Compute and display the vegetation index. Does it match what you would expect? See page 292 in Rees. You will need to convert the integer bytes to `double()`, then compute the NDVI ratio between -1 and 1 and finally map the numbers back between 0 and 255 with `imagesc()`.

## 2.6 OPTIONAL: Exercise 6

For extra credit, follow the methods in Rees (374-380) to decompose the 7 bands into their principal components.