Assignment 3

- You will be completing many of the same questions as in Assignment 2 using MatLab rather than python
- So, you should be able to focus on the MatLab syntax because the logic of what you need to do will be nearly identical
- Class time will be available December 6 and during the final period for this course, Monday December 10, 1-3 PM
- The assignment is **due Friday, 11:59 PM, December 14**
- You will create a MatLab script `assignment3_LASTNAME_uXXXXXXX.m`
- You will turn in both the code and output from running the code (`assignment3_LASTNAME_uXXXXXXX.pdf`) to both Brian and John via Slack

If you needed to makeup missing the trip to the Utah Data Center, complete the assignment and send via slack by Wednesday, 11:59 PM, December 12

Question 1: Find max and min with loop

The purpose of this question is to demonstrate your knowledge of how loops, conditional statements, and variable assignments work.

Write a loop that finds and prints the maximum and minimum number in a list of random numbers **WITHOUT USING BUILT-IN MAX or MIN FUNCTIONS**

This should require:

- Generate a row vector 'a' of 100 uniformly distributed random numbers between 0 and 100 (this is slightly different from Assignment 2 and you will create floating values between 0 and 100)
- Use a loop with nested if statements to find the maximum and the minimum values of the row vector
- Use a variable to store max value, amax
- Create a variable to store min value, amin
- Write out the min and max values using fprintf in a format similar to (your numbers will be different):
  min and max values are: 0.19 97.46
- Verify your results by including code to check your answers using the max and min functions in MatLab (this is something not required in Assignment 2), assign those to the variable bmax and bmin, and print those out.

Question 2: Great Salt Lake Level

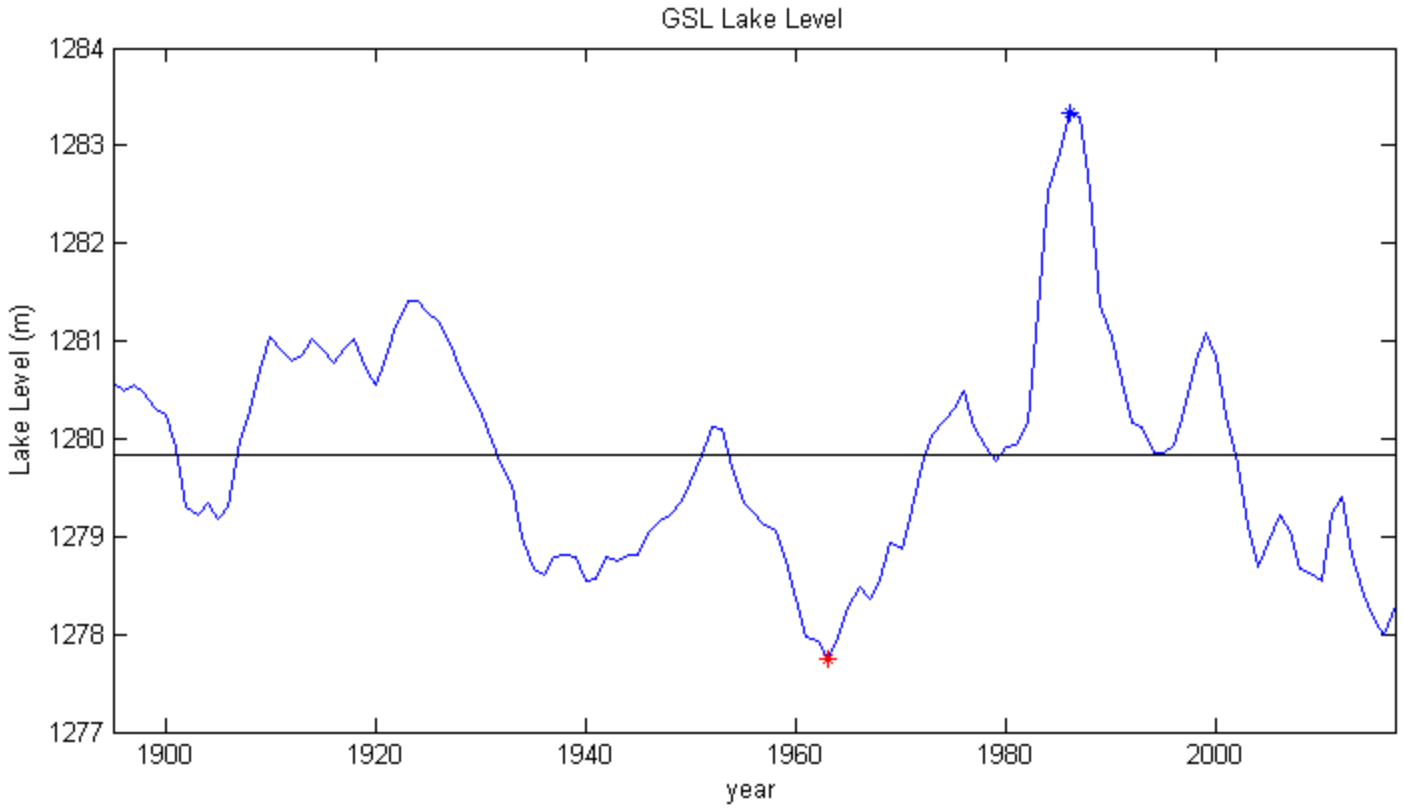
Observed levels of the Great Salt Lake have been recorded since 1896 and are available in the file `data/gsl_yr.csv`.

The first column is the year, the second column is the number of observations used to calculate the average lake level, and the third column is the average lake level for that year in feet.

Load the data into a 2d array gsl using the csvread function and complete and answer the following:

- Plot a line graph of the data.
  - x axis is year
  - y axis is lake level in meters
  - Apply appropriate axis labels and add a title
- What was the highest lake level and what year did that occur? Add a blue star to the plot to indicate the year and level. (note: use the max function to return both the max value and the vector index of the max value)
- What was the lowest lake level and what year did that occur? Add a red star to the plot to indicate the year and level.
- What is the average lake level? Draw a black line from the first year to the last year in order to show the average lake level on the figure (hints: you need to define a 2-element vector with the first and last year and another 2-element vector repeating the average value. Also, limit the plotting area to the start and end years)
- How many years during the period of record were the lake levels above average and print that number out using fprintf (use the function find and then determine the length of the vector returned from find)

Your result should look like



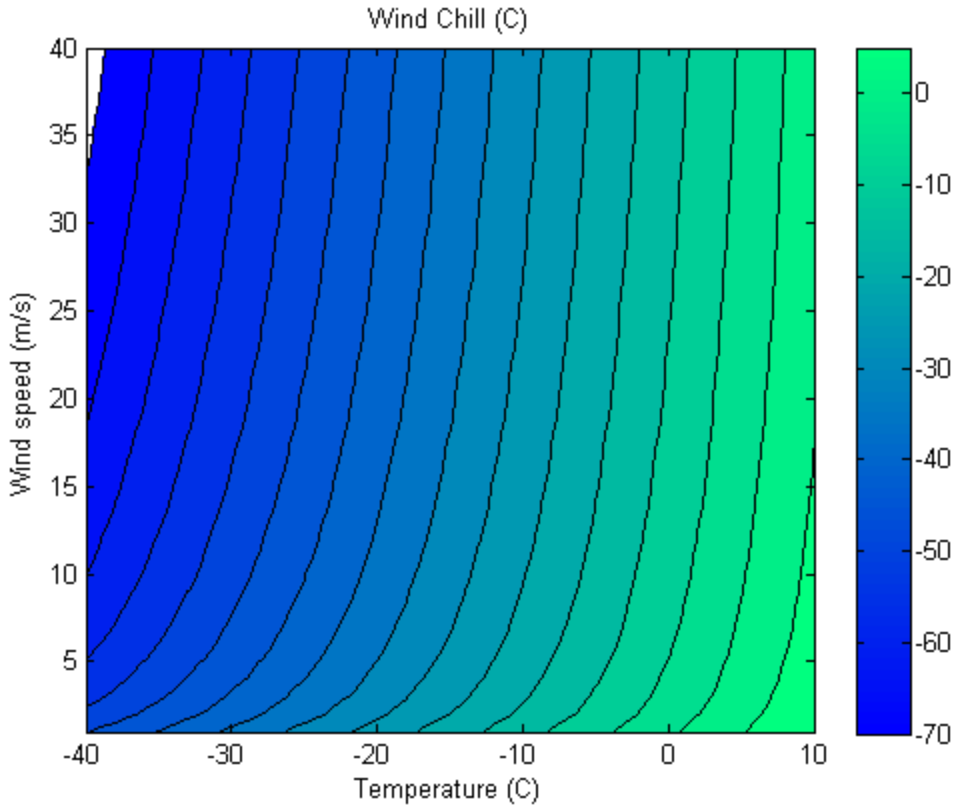
Question 3: Wind chill

The apparent air temperature changes with wind speed, also known as wind chill,follows where the temperature is given in degrees Fahrenheit and the wind speed is given in miles per hour.

$$WindChill = 35.74 + (0.6215 \times T) - (35.75 \times Wind_{sfc}^{0.16}) + (0.4275 \times T \times Wind_{sfc}^{0.16})$$

- Compute the wind chill for all integer Celsius temperatures between [-40, 10] and all integer wind speeds between [1, 40].
- Create a row vector for temperatures (temp) and row vector for wind speeds (speed)
- Use meshgrid to create 2D arrays of temperatures and speeds (tm and sm) in metric units
- Convert tm to array tf in F and array sm to sp in mph
- Perform elementwise array math to compute wind chill using the above equation (will be a 2D array, wcf)
- Convert wcf to wind chill wc in Celsius
- Generate a filled, contour image of wc as a function of tm and sm . Use the winter colormap and contour at 5 C intervals from -70 to 5C. Add a colorbar
- Add appropriate labels and a title
- Check that the results makes sense and answer the following.
  - Does the wind chill temperature decrease with increasing wind speed?
  - Does the wind chill for a given temperature change more for a change in wind from 1-20 MPH or from 61-70 MPH?

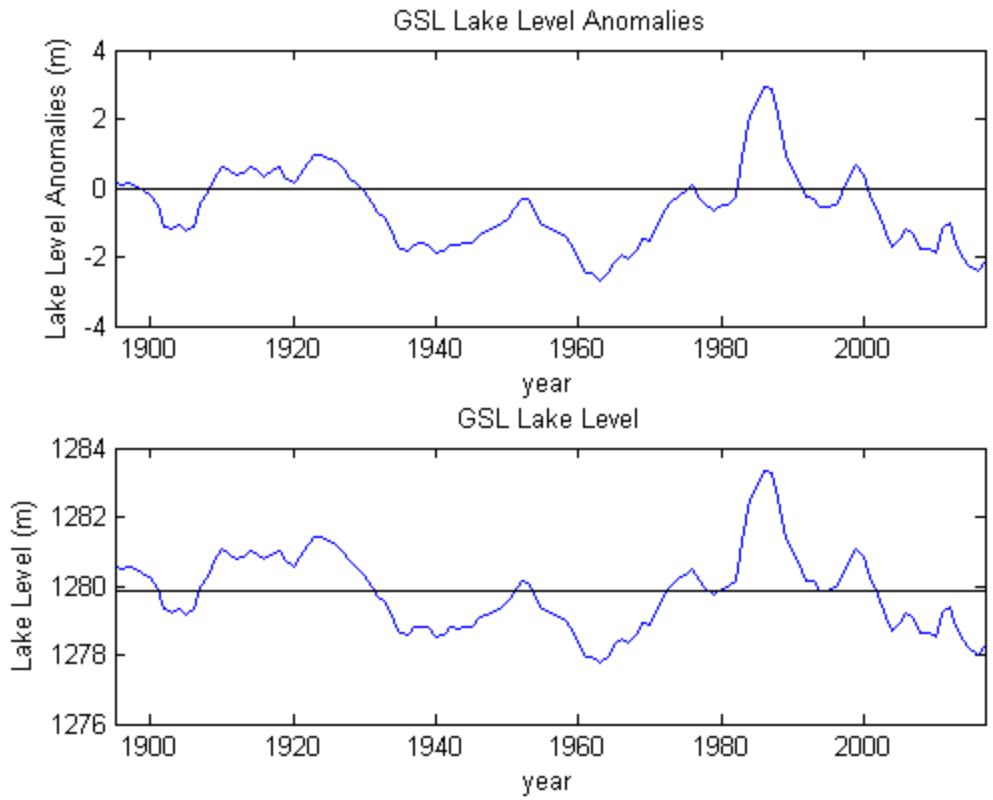
Your result should look like



Question 4: Multiple plots & indexing

- Compute the lake level anomalies relative to the 1981-2010 mean (common to use the most-recent 30-year period)
- Find the index values for yr 1981 and 2010 and then compute the mean (mean_30y) for that 30-year period only
- Compute the anomalies of the lake level every year from that 30-yr mean
- Create a two-panel plot as shown on the next page where the lower plot is identical to that in Figure 1.
- The upper panel shows the lake level anomalies relative to the 1981-2010 mean

Your result should look like



LAST STEP: Publish your results

- Go to publish
- Go to Edit Publishing Options
  - Change output file format to pdf
- Select Publish
- Your code should run. Check that all the figures are correctly embedded
- Submit your **code** *and* **pdf** to Brian and John via Slack