EE 399 SPRING QUATER 2023
Instructor: **J. Nathan Kutz**

HOMEWORK #1:
DUE: 5pm on 4/7

I Set up your own GitHub account (private) and share your Git with me and the TAs (Trung Le and Nithin Joseph): kutz@uw.edu, tle45@uw.edu, nphilipj@uw.edu

II Consider the data from lecture on 3/31:

```
X=np.arange(0,31)
Y=np.array([30, 35, 33, 32, 34, 37, 39, 38, 36, 36, 37, 39, 42, 45, 45, 41,
40, 39, 42, 44, 47, 49, 50, 49, 46, 48, 50, 53, 55, 54, 53])
```

Fit the following model to the data with least-squares error ($E = \sqrt{(1/n)\sum_{j=1}^{n}(f(x_j)-y_j)^2}$)

$$f(x) = A\cos(Bx) + Cx + D$$

(i) Write a code to find the minimum error and determine the parameters A, B, C, D

(ii) With the results of (i), fix two of the parameters and sweep through values of the other two parameters to generate a 2D loss (error) landscape. Do all combinations of two fixed parameters and two swept parameters. You can use something like **pcolor** to visualize the results in a grid. How many minima can you find as you sweep through parameters?

(iii) Using the first 20 data points as *training data*, fit a line, parabola and 19th degree polynomial to the data. Compute the least-square error for each of these over the training points. Then compute the least square error of these models on the *test data* which are the remaining 10 data points.

(iv) Repeat (iii) but use the first 10 and last 10 data points as training data. Then fit the model to the test data (which are the 10 held out middle data points). Compare these results to (iii)

NOTE: You will write a narrative report about this homework on your github page. You will also upload your python code to canvas with a comment at the top indicating your github page so the TAs can look at your narrative on github.