Episode 7 Homework

1. Exercise. You may use the Spyder or qtconsole iPython console rather than creating a program script.

Use the zeros function for the following:

- Initialize an array A1 of rank 1 with size 4 and type double.
- Initialize an array IU of rank 1 with size 4 and type integer.
- Initialize an array M1 of rank 1 with size 4 and type Boolean.

Print each of the arrays you just created.
Initialize a rank-3 array to arbitrary elements.

2. Exercise. You may need to refer to NumPy documentation at www.numpy.org. The generic variable name is A but you may use different variable names of your choice.
   - Initialize a rank-1 array of size 12 to all ones (use the numpy `ones` function), and then set the 10th element to 0.
   - Initialize a rank-1 array of size 12 to values from 2 to 13 inclusive. Convert the rank-1 array into a 4x3 array. Print the values of the 2nd column of this array. Print the array represented by A[:-1,:]. How is it different from A[-1,:] and why? Extract (i.e. store) and print the subarray from the second to third rows and first to last columns.
   - Create a 5x4 array with values from 1 to 20 inclusive. Find the maximum, minimum, and mean values. Find the sum of all elements. Find the sums along the first (zeroth) axis (dimension). What is the rank of the resulting array?
   - Create a 10x10 array with all interior values set to 75, one border set to 0, and the other three borders set to 100. (Two corners will be ambiguous so set them either way.)

3. Write a program that evaluates the function

$$f(x) = \frac{1}{\pi(1+x^2)}$$

For 401 values of x equally spaced between -4.0 and 4.0 *inclusive*. Use the linspace function of numpy to generate the x values. Linspace takes a start, an endpoint, and a number of points to generate. By default the endpoint is included. Write a Python function that takes a single value of x and returns the corresponding value of f. It should not print anything.

   a. Start off by creating an array f1 of all zeros of the appropriate size. Call your function within a loop to generate each value of f by its index.
   b. Pass the entire x array and return it into a variable f2, which will then also be an array of the same size and shape as x. Congratulations, you have written a **ufunc** or *universal function*.