In Class Exercise for Week 2

Create a script file and include all of the following problems with each one being on section. Use the MATLAB publish feature to publish script to a word or pdf file. For problem 1-4, provide an input, call the function and then publish the result.

Problem 1 Write a function called even_index that takes a matrix, M, as input argument and returns a matrix that contains only those elements of M that are in even rows and columns.

Problem 2 Write a function called flip_it that has one input argument, a row vector v, and one output argument, a row vector w that is of the same length as v. The vector w contains all the elements of v, but in the exact opposite order. For example, is v is equal to [1 2 3] then w must be equal to [3 2 1]. You are not allowed to use the built-in function flip.

Problem 3 Write a function called top_right that takes two inputs: a matrix N and a scalar non-negative integer n, in that order, where each dimension of N is greater than or equal to n. The function returns the n-by-n square subarray of N located at the top right corner of N.

Problem 4 Write a function called peri_sum that computes the sum of the elements of an input matrix A that are on the "perimeter" of A. In other words, it adds together the elements that are in the first and last rows and columns. Note that the smallest dimension of A is at least 2, but you do not need to check this. Hint: do not double count any elements!

Problem 5 The power series for sin(x) is given by

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

The script on the next slide will compute this power series for a given value of x
What causes the loop to terminate?

How accurate is the series for $x = \frac{\pi}{2}$? How many terms were needed?

Problem 6 A ball is dropped from a height h of 2 meters. The velocity when it strikes the floor is given by $v^2 = 2gh$ and rebounds with a velocity that is 85% of the impact velocity. The ball then rebounds to a height of $h = v^2/2g$. What is the height after the 8^{th} bounce?

Problem 7 The ideal gas law is given by

$$P = \frac{nRT}{V}$$

The van der Waals equation corrects for high pressure effects and is given by

$$P = \frac{nRT}{V - nb} - \frac{n^2 a}{V^2}$$

Plot pressure vs. volume for n=1, T=300K, R=0.08206 L-atm/mol-K, a=1.39 L^2-atm/mol^2, and b=0.039 L/mol. Use 0.08<V<6 liters

Problem 8

a. Generate a random sized array of random numbers using:
```
x = 10*rand(ceil(10*rand)+2,1)
```
b. Use "for" loop to add up all the values in the array and assign the result to the variable mysum.
   i. For example, if the array is x = [1 1 1 1 1 1 1 1 1 2], then the sum of all the elements would be mysum = 11.

c. Check your answer using the built-in MATLAB sum( ) function by adding the following code snippet to the end of your script.
```
if mysum == sum(x)
    disp('Congratulations!!, you did it right')
    load handel;sound(y,Fs)
else
    fprintf('Sorry, %.2f ~= %.2f.  Please try
again.\n',mysum,sum(x))
end
```
d. Repeat but use a "while" loop this time.