HW I CENG 5131 Fall 2014 Due Sept 3

August 25, 2014

MATLAB programs. Be sure to document it well-See class handout. Hand in program with comments and the result higlighted with explanation if needed.

Problem 1 25 Points

(a) Compute the radian frequency ω and the period T in seconds of the sinewave

$$x(t) = \sin \pi t.$$

(b) Plot the function for each of the 4 cases for sampling times listed below for $t = 0$ to 20 seconds. Estimate what should happen for the 4 cases,

$$\Delta t = 0.1,\ 0.5,\ 0.9,\ 1.5 \text{ seconds}$$

(c) Make a comment for each of the plots stating the number of points in the entire plot and your conclusions. The point is to plot the wave by sampling at least 2 points per cycle ($\Delta t < \pi/\omega$) over a large number of cyles. You will find that even with that only the first plot ($\Delta t = 0.1$ sec) is good to view the sine wave.

```
Here is a start for your MATLAB program. Note the use of SUBPLOT and NUM2STR.
% Plot a sine wave for different spacing
% Test time spacing
dt=[0.1 0.5 0.9 1.5]    % Seconds between samples
% Plot x(t)=sin(pi*t)   Here w=pi and T=2 sec so dt << 1 sec
t1=0:dt(1):20;          % We expect 10 cycles of the sine wave
x1=sin(pi*t1);
figure(1)
subplot(2,2,1), plot(t1,x1) % Make a 2x2 matrix of plots to save space
title(['\Delta t1 = ', num2str(dt(1)), ' sec'])
.
.
.  (Continue with other cases)
```

Problem 2 25 Points

Write a program to evaluate e^x approximately as

$$e^x \approx \sum_{n=0}^{N} \frac{x^n}{n!} \;=\; 1 + x + \frac{x^2}{2!} + \cdots + \frac{x^N}{N!}.$$

Compare the 10th and 20th partial sums for e^1 with the numerical value returned by MATLAB's built-in **exp** function. Use the command **format long** to get the full decimal representation. The printout results should look something like the following:

```
x =     1
n      Series               error
10   2.7182815255731922     3.02886e-007
20   2.7182818284590455     0
```

Various Hints:

1. Use the **input** command to input the value of x.
2. Get help on the **fprintf** command to output the heading and the numerical results. The FORMAT of the output is a string containing ordinary characters and/or C language conversion specifications.
3. `Explore the Variable Precision Arithmetic function to yield the following:`

   ```
   digits(25);vpa('exp(1)')
    ans = 2.7182818284590452353602874
     digits(30);vpa('exp(1)')
     ans =2.71828182845904523536028747135
   ```

4. `Remember that MATLAB indices go from 1 to N,`
   `but the expansion formula starts with n=0.`

Problem 3 25 Points
Solve the equation

$$ax^2 + bx + c = 0$$

using symbolic MATLAB. Commands of interest are **syms** and **solve**. The result will be symbolic.

Problem 4 25 Points
Solve the system of equations

$$\begin{aligned} x + 2y &= 1 \quad (1) \\ 3x + 7y &= 5 \quad (2) \end{aligned}$$

using MATLAB. Commands of interest are **syms** and **solve**. Here the values are numerical. Check your answer.