MAE 376

Homework 1

Please submit all the m-files and the screenshots of each plot.

1- Write a script file that uses any combination of the flow control commands to generate the following matrix. You must have nested loops and if statement in your codes.

$$\mathbf{A}=\begin{bmatrix} 1 & 0 & 3 & 0 & 0 & 0 \\ 0 & 2 & 0 & 3 & 0 & 0 \\ -1 & 0 & 3 & 0 & 3 & 0 \\ 0 & -1 & 0 & 4 & 0 & 3 \\ 0 & 0 & -1 & 0 & 5 & 0 \\ 0 & 0 & 0 & -1 & 0 & 6 \end{bmatrix}$$

2- Plot the two functions $x_1(t)=\frac{1}{\sqrt{3}}e^{-t/2}\sin\left(\frac{\sqrt{3}}{2}t\right)$ and $x_2(t)=te^{-t}$ versus $0\le t\le 10$ in the same graph. Adjust the limits of the vertical axis to -0.1 and 0.4. Add grid and label.
Use ezplot() to plot your graphs.

3- Plot the three functions $y_{1,2,3}(t)=e^{-\alpha/2}\cos\left(\frac{1}{2}t\right)$, corresponding to $\alpha=1,\ 1.5,\ 2$, versus $0\le t\le 10$ in the same graph. Adjust the limits of the vertical axis to -0.8 and 0.8. Add grid and label.
Use ezplot() to plot your graphs.

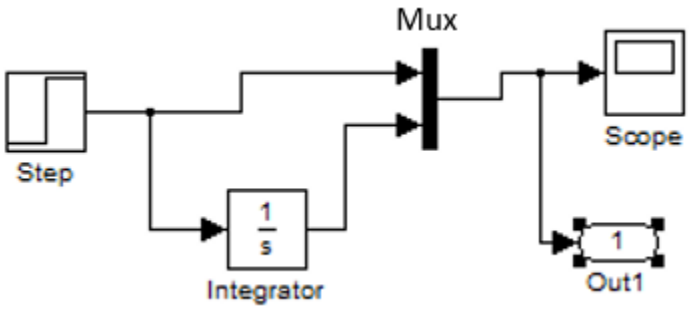
4- Write a user-defined function with function call `P=partial_eval(f,g,a)` where `f` and `g` are functions defined symbolically, and `a` is a constant. The function returns the value of $f'+g'$ at $x=a$. Execute the function for $f=x^2+e^{-x/3}$, $g=\cos x$, and $a=0.65$.

5- Differentiate $h(x)=3^{x-2}\sin x-e^{3-2x}$ with respect to x, and evaluate at $x=0.75$.

6- Write a user-defined function with function call `val=evalf(f,a,b)` where `f` is an inline function, and `a` and `b` are constants such that `a<b`. The function calculates the midpoint m of the interval $[a,b]$ and returns the value of $\frac{1}{2}f(a)+\frac{1}{3}f(m)+\frac{1}{4}f(b)$. Execute the function for $f(x)=e^{-x}\cos 2x$, $a=-1$, $b=3$.

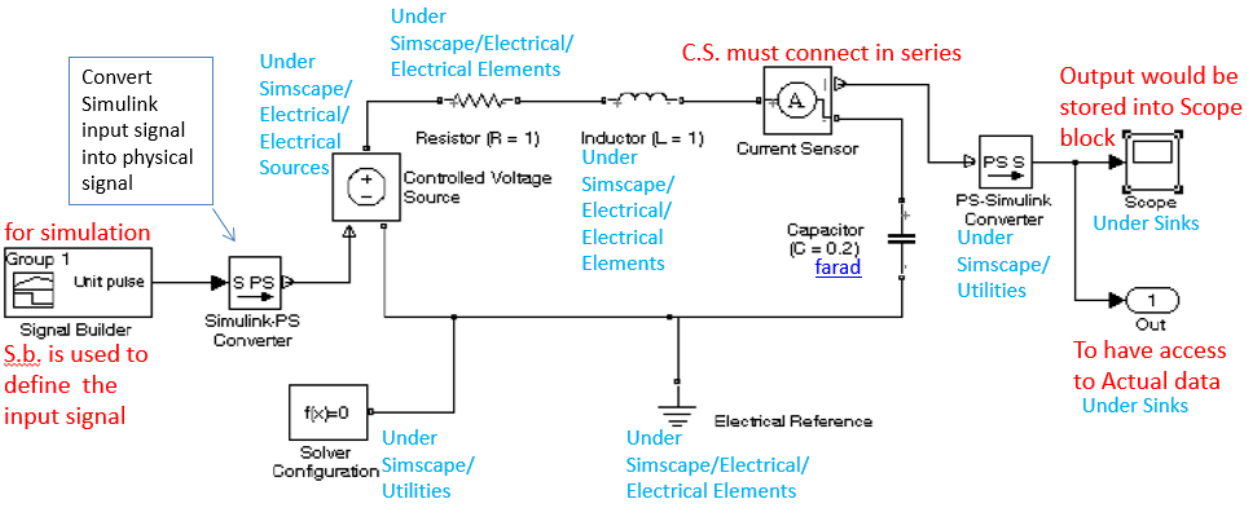
7-

Create the following block diagram using Simulink. Run this Simulink without the “out1” component to generate a plot from Simulink. Run it one more time with “out1” component to generate a plot in MATLAB format. Add a title, x-label and y-label to your graph.



8-

Create the following block diagram using Simscape. Run it to generate a plot in MATLAB format. Add a title, x-label and y-label to your graph.



9-

Plot $\int_0^t e^{x-t}\sin\left(\frac{1}{3}x\right)dx$ versus $0.1 \le t \le 7$.

10-

Write a user-defined function with function call `Q = laplace_eval(f,a,b)` where `f` is a function defined symbolically, and `a` and `b` are constants. The function calculates $f_{xx} + f_{yy}$, and evaluates the result at $x = a$, $y = b$. Execute the function for $f = x^2 \cos y - 1/y$, $a = 0$, $b = 1$.