CMPE 362 - Introduction to Signals for Computer Engineers
Exercise 1

Grading

There is no submission. You will have a quiz at 4 pm (class time) on 22.04.2021, and you will need MATLAB to solve questions. Make sure that you saved your code that solves the questions below and MATLAB is running on your computer before the quiz.

Problems

Problem 1

Let t is vector of real numbers (-2:0.01:2). Plot y1 = sin(2*pi*t), y2= sin(2*pi*10*t), y3=10*sin(2*pi*t), y4= sin(2*pi*t)+10, y5= sin(2*pi*(t-0.5)), y6= 10*sin(2*pi*10*t), y7= t* sin(2*pi*t), y8= sin(2*pi*t)/t, y9= y1+...+y8. Use 5x2 subplot to fit all subfigures belong to a single figure (Hint: write help for SUBPLOT in MATLAB). For more information about these functions, you can look Chapter 2: Sinusoids in your textbook.

Problem 2

randn generates zero-mean, unit variance Gaussian distributed random number. Generate 401 random numbers following Gaussian distributed random numbers, call this as vector z. Multiply all z with 0.1. Plot y10= z, y11 = z+t , y12= z+y1, y13= z*y1, y14=t*sin(2*pi*z), y15= sin(2*pi*(t+z)), y16= z*y2, y17= sin(2*pi*(t+10*z)), y18=y1/z, y19= y11+...+y18. Use 5x2 subplot to fit all subfigures belong to a single figure.

Problem 3

randn generates uniformly distributed random number between 0 and 1. Generate 401 random numbers following uniformly distributed random numbers, call this as vector z. Multiply all z with 0.1. Plot y20= z, y21 = z+t , y22= z+y1, y23= z*y1, y24=t*sin(2*pi*z), y25= sin(2*pi*(t+z)), y26= z*y2, y27= sin(2*pi*(t+10*z)), y28=y1/z, y29= y21+...+y28. Use 5x2 subplot to fit all subfigures belong to a single figure.

Problem 4

Starting with z (0,1) Gaussian (Normal) Random variable. (Use help menu for hist)

(a) Generate 5000 random variables with mean 0, variance 1; call it r1 vector

(b) Generate 5000 random variables with mean 0, variance 8; call it r2 vector

(c) Generate 5000 random variables with mean 0, variance 64; call it r3 vector

(d) Generate 5000 random variables with mean 0, variance 256; call it r4 vector

Plot hist(r1), hist(r2), hist(r3), hist(r4) on the same figure for comparison purposes.

Problem 5

Starting with z (0,1) Gaussian (Normal) Random variable. (Use help menu for hist)

(a) Generate 5000 random variables with mean 10, variance 1; call it r6 vector

(b) Generate 5000 random variables with mean 20, variance 4; call it r7 vector

(c) Generate 5000 random variables with mean -10, variance 1; call it r8 vector

(d) Generate 5000 random variables with mean -20, variance 4; call it r9 vector

Plot hist(r6), hist(r7), hist(r8), hist(r9) on the same figure for comparison purposes.

Problem 6

Starting with z uniformly distributed random variable.

(a) Generate 5000 random variables with between -4 and 4; call it r11 vector

(b) Generate 5000 random variables with between -20 and 20; call it r21 vector

Plot hist(r11), hist(r21) on the same figure.

Problem 7

z= 9+6i

(a) Convert the complex number z from rectangular form to polar form. (You can use abs(z) and angle(z) functions or cart2pol(real(z), imag(z)) function.)

(b) Convert the complex number that you found in part a from polar form to back the rectangular form. (You can use the formula z=r*exp(j*theta) or the function pol2cart (theta,r) where r denotes the amplitude and theta denotes the angle.)

Problem 8

Please load the workspace called "**mysignal.mat**" There, you will find a x-signal, time vector and sample frequency. Using **fft** and **fftshift** functions, please find the mathematical formula of the signal.

Problem 9

You are provided an image with the name lena.png which is commonly used in image processing studies. First read the image with **imread** function. After that, convert this rgb image into a grayscale image by using **rgb2gray** method. Then you will compute the mean, standard deviation, maximum (and location of maximum), minimum (and location of minimum) of the matrix you obtained from the image.