Lab 2

Task 1: Use MATLAB to generate a random sequence $x[n]$ for $n = 0,1,\cdots,99$ and set $x[n] = 0$ for $n < 0$ and $n > 99$.

(a) Consider a discrete-time LTI system with the impulse response

$$h[n] = 0.9^n u[n]$$

and the output

$$y[n] = h[n] * x[n].$$

Compute and plot the output $y[n]$ for $n = 0,1,\cdots,200$ using the convolution sum.

(b) Consider another discrete-time LTI system governed by the recursive difference equation

$$y[n] = 0.9y[n-1] + x[n]$$

and the initial condition $y[-1] = 0$. Compute and plot the output $y[n]$ for $n = 0,1,\cdots,200$ using the recursive equation

(c) Compare and discuss the two outputs above. Are they the same? Why or why not?

Task 2: Use MATLAB to generate another random sequence $x[n]$ for $n = 0,1,\cdots,99$ and set $x[n] = 0$ for $n < 0$ and $n > 99$.

(a) Consider a discrete-time LTI system with the impulse response

$$h[n] = 0.9^n \cos\left(\frac{\pi}{3}n\right)u[n]$$

and the output $y[n] = h[n] * x[n]$. Compute and plot the output $y[n]$ for $n = 0,1,\cdots,200$ using the convolution.

(b) Consider another discrete-time LTI system governed by the recursive difference equation

$$y[n] = 0.9y[n-1] - 0.81y[n-2] + x[n] - 0.45x[n-1]$$

and the initial conditions $y[-1] = y[-2] = 0$. Compute and plot the output $y[n]$ for $n = 0,1,\cdots,200$ using the recursive equation

(c) Compare and discuss the above two outputs. Are they the same? Why or why not?