EE 110B - Signals and Systems
Spring 2017
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 $n > 99$. You can use `rand` or `randn` for this purpose.

    (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. They should be the same. Why?

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. They should be the same. Why?