EE110B Lab 2

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

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

   $$h[n] = 0.9^{n-1}\{u[n-1] - u[n-99]\}.$$

   Compute and plot the output $y[n] = x[n] * h[n]$ for $n = 0, 1, \cdots, 100$.

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

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

   where $y[-1] = 0$. Use this recursive equation to compute and then plot $y[n]$ for $n = 0, 1, \cdots, 100$.

   c) Compare the above results. Are they close to each other? Why?

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

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

   $$h[n] = 0.9^{n-1}\cos(\frac{\pi}{5}(n-1))\{u[n-1] - u[n-100]\}.$$

   Compute and plot the output $y[n] = x[n] * h[n]$ for $n = 0, 1, \cdots, 100$.

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

   $$y[n+1] = 1.8\cos(\frac{\pi}{5})y[n+1] - 0.81y[n] + x[n+1] - 0.9\cos(\frac{\pi}{5})x[n]$$

   and the initial condition $y[-1] = y[-2] = 0$. Compute and plot the output $y[n]$ for $n = 0, 1, \cdots, 100$ using the recursive equation.

   c) Compare the above two results. Are they close to each other? (We will learn the technique which allows to explain why these two systems are equivalent.)