ICE503 DSP-Homework#3

1. An LTI system is described as

$$y[n] + y[n-1] - 12y[n-2] = x[n]$$

and the initial conditions are

$$y[-1] = -1, \qquad y[-2] = -0.5$$

(a) If the input sequence is $x[n] = 10\mu[n]$, determine the LCCDE of y[n] for n ≥ 0.

(b) If the input sequence is $x[n] = 10\delta[n]$, determine the LCCDE of y[n] for n ≥ 0.

2. For each of the following systems, determine whether the system is stable.

(a) $y[n] = (x[n])^2$

(b) $y[n] = nx[n]$

(c) $y[n] = \frac{1}{n}x[n]$

(d) $y[n] = \sum_{k=0}^{n} x[k]$

3. MATLAB simulation: Use the same LTI system as question 1(a)

(a) Implement the LCCDE for 1(a), and determine the output y[n] for $0 \le n \le 4$.

(b) Use for loop to implement the system

$$y[n] + y[n-1] - 12y[n-2] = x[n]$$

and determine the output y[n] for $0 \le n \le 4$.

(c) Use filtic and filter function to determine the output y[n] for $0 \le n \le 4$.

(The result of (a), (b) and (c) should be the same.)

4. MATLAB simulation:

(a) Generate a sinusoidal signal.

$$x[n] = \begin{cases} \sin(\frac{1}{10}\pi n), & \text{for } -10 \le n \le 10 \\ 0, & \text{for } -20 \le n < -10 \text{ and } 10 < n \le 20 \end{cases}$$

(b) Use stem function to plot the autocorrelation of $x[n]$.

(c) Use stem function to plot $conv(x[n], x[n])$.

(d) Compare (b) and (c).