Birzeit University

Faculty of Information Technology

Computer System Engineering

Digital Signal Processing (DSP)

Assignment No1

Instructor: Dr. Abualsoud Hanani Fall semeter 2013/2014

Office: TEC221

Exercise 1.1:

Let $x(n) = \{1, -2, 4, 6, -5, 8, 10\}$. Generate and plot the samples (use the stem function) of
$\uparrow$
n=0
the following sequences.

a. $x_1(n) = 3x(n+2) + x(n-4) - 2x(n)$

b. $x_2(n) = 5x(5+n) + 4x(n+4) + 3x(n)$

c. $x_3(n) = x(n+4)x(n-1) + x(2-n)x(n)$

d. $x_4(n) = 2e^{0.5n}x(n) + \cos(0.1\pi n)x(n+2), \ -10 \le n \le 10$

e. $x_5(n) = \sum_{k=1}^{5} nx(n-k)$

Exercise 1.2: For the three systems below, determine whether they are:

a. time-invariant
b. stable
c. causal
d. linear

$$T_1[x(n)] = \sum_{k=0}^{n} x(k); \quad T_2[x(n)] = \sum_{k=n-10}^{n+10} x(k); \quad T_3[x(n)] = x(-n)$$

Exercise 1.3 : For the two sequences below verify the commutation property (x1(n) * x2(n) = x2(n) * x1(n)). Use the `conv` function.

$x_1(n) = n[u(n+10) - u(n-20)]$

$x_2(n) = \cos(0.1\pi n)[u(n) - u(n-30)]$

Exercise 1.4:

$$x_M[n] = \sin\frac{2\pi Mn}{N},$$

and assume N = 12. For M = 4, 5, and 10, plot $x_M[n]$ on the interval $0 \le n \le 2N-1$. Use ***stem*** in MATLAB to create your plots, and be sure to appropriately label your axes. (You can copy your plots by selecting Edit > Copy Figure at the top of the figure pane.) Using Insert > Arrow at the top of the figure pane, insert an arrow to indicate the end of the first period and beginning of the next period.

Questions:

What is the fundamental frequency of each signal?

Exercise 1.5:

Consider the following two signals:

$$x_1[n] = \cos\left(\frac{2\pi n}{N}\right) + 2\cos\left(\frac{3\pi n}{N}\right),$$

$$x_2[n] = \cos\left(\frac{\pi n^2}{2}\right),$$

and assume N = 6 for signal $x_1[n]$. Plot each signal separately for the interval of $0 \le n \le 24$. Use *stem* and label your axes.

Questions:

Are the signals periodic? Explain?