

Digital Signal Processing

<http://kom.aau.dk/~zt/courses/DSP/>

Exercises of Lecture 1 (MM1)

Exercise 1.1:

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

↑

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

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 ($x_1(n) * x_2(n) = x_2(n) * x_1(n)$). Use the `conv_m` function.

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

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

Matlab functions available at: <http://kom.aau.dk/~zt/courses/DSP/MM1/Matlab/>