Lab #3

Objectives

- Review lecture notes of discrete-time signal and system
- Implement script-based manipulation functions in SciLab for discrete-time signals

Report

1. Your report must include all script's source codes.
2. For each function, you have to try with an example and capture the output screen as evidence.
3. Finally, you upload your report to BKeL on time. You should down-size the image file to reduce the report file in order to be able to submit in BKeL.

PART 1. SCILAB SCRIPT

A script function in Scilab will be declared under the following format

function [rv1 rv2.... rvn] = **Function_Name** (pv1, pv2,..., pvn)

    [function body]

endfunction

where

rv1, rv2: return values

pv1, pv2: input parameters

Further references:

- https://help.scilab.org/doc/5.5.2/en_US/function.html
- https://help.scilab.org/doc/5.5.2/en_US/deff.html

PART 2. EXERCISES

Students implement the following functions in SciLab for discrete-time signals

Exercise 1. function [yn, yorigin] = **delay** (xn, xorigin, k) performs delay operation y(n) = x(n - k), where k > 0,

- The discrete-time signal x(n) is presented by vector xn
- xorigin indicates the origin's position of signal x(n).
- yn is vector of the output signal
- yorigin indicates the origin's position of signal y(n).
- x(n) and y(n) are graphically displayed in the same figure.

For example: To determine the delay signal **y(n) = x(n – 1)** where **x(n)={1, -2, 3↑,**

6}. You can use your own function by calling

[yn, yorigin] = delay ([1, -2, 3, 6], 3, 1)**.**

Then, the output will be

- yn = [1, -2, 3, 6]
- yorigin = 2

Additionally, you have to graphically display x(n) and y(n) in the same figure.

Exercise 2. **function** [yn, yorigin] = **advance** (xn, xorigin, k) performs advance operation y(n) = x(n + k), where k > 0 and

- The discrete-time signal x(n) is presented by vector xn
- xorigin indicates the origin's position of signal x(n).
- yn is vector of the output signal
- yorigin indicates the origin's position of signal y(n).
- x(n) and y(n) are graphically displayed in the same figure.

Exercise 3. **function** [yn, yorigin] = **fold** (xn, xorigin) performs folding operation y(n) = x(-n), where

- The discrete-time signal x(n) is presented by vector xn
- xorigin indicates the position of origin in vector x(n).
- yn is vector of the output signal
- yorigin indicates the position of origin in vector y(n).
- x(n) and y(n) are graphically displayed in the same figure.

Exercise 4. **function** [yn, yorigin] = **add** (x1n, x1origin, x2n, x2origin) performs addition operation $y(n) = x_1(n) + x_2(n)$, where

- The discrete-time signal $x_1(n)$ and $x_2(n)$ are presented by vectors x1n and x2n, respectively.
- x1origin and x2origin indicates the origin's position of signal $x_1(n)$ and $x_2(n)$, respectively.
- yn is vector of the output signal
- yorigin indicates the origin's position of signal y(n).
- $x_1(n)$, $x_2(n)$ and y(n) are graphically displayed in the same figure.

For example: To determine $\mathbf{y(n) = x_1(n) + x_2(n)}$, where $\mathbf{x_1(n) = \{0\uparrow, 1, 3, -2\}}$ and $\mathbf{x_2(n)=\{1, 1\uparrow, 2, 3\}}$**.** You can use your own function by calling

[yn, yorigin] = add ([0, 1, 3, -2], 1, [1, 1, 2, 3], 2)**.**

Then, the output will be

- yn = [1, 1, 3, 6, -2]
- yorigin = 1

Additionally, you have to graphically display $x_1(n)$, $x_2(n)$ and y(n) in the same figure.

Exercise 5. **function** [yn, yorigin] = **multi** (x1n, x1origin, x2n, x2origin) performs multiplication operation $y(n) = x_1(n).x_2(n)$, where

- The discrete-time signal $x_1(n)$ and $x_2(n)$ are presented by vectors x1n and x2n, respectively.
- x1origin and x2origin indicates the origin's position of signal $x_1(n)$ and $x_2(n)$, respectively.
- yn is vector of the output signal
- yorigin indicates the origin's position of signal y(n).
- $x_1(n)$, $x_2(n)$ and y(n) are graphically displayed in the same figure.

Exercise 6. **function** [yn, yorigin] = **convolution** (xn, xorigin, hn, horigin) performs convolution y(n) = x(n)*h(n), where

- x(n) is the input signal and h(n) is system characteristic's function.
- xorigin and horigin indicates the origin's position of x(n) and h(n), respectively.
- yn is vector of the output signal
- yorigin indicates the origin's position of signal y(n).

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