DIGITAL SIGNAL PROCESSING
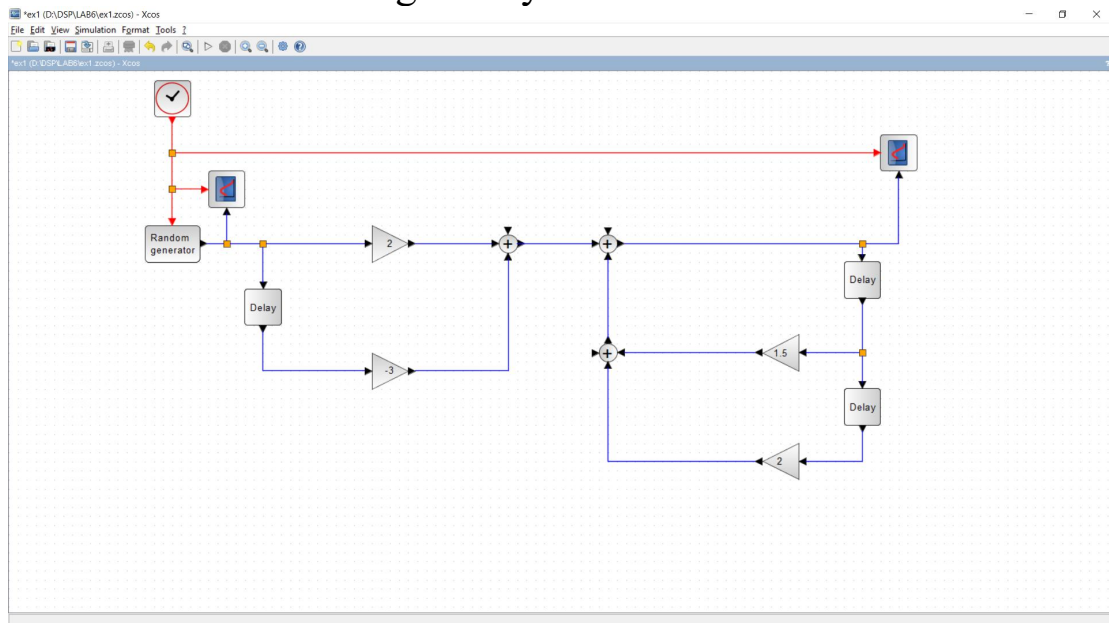
REPORT06

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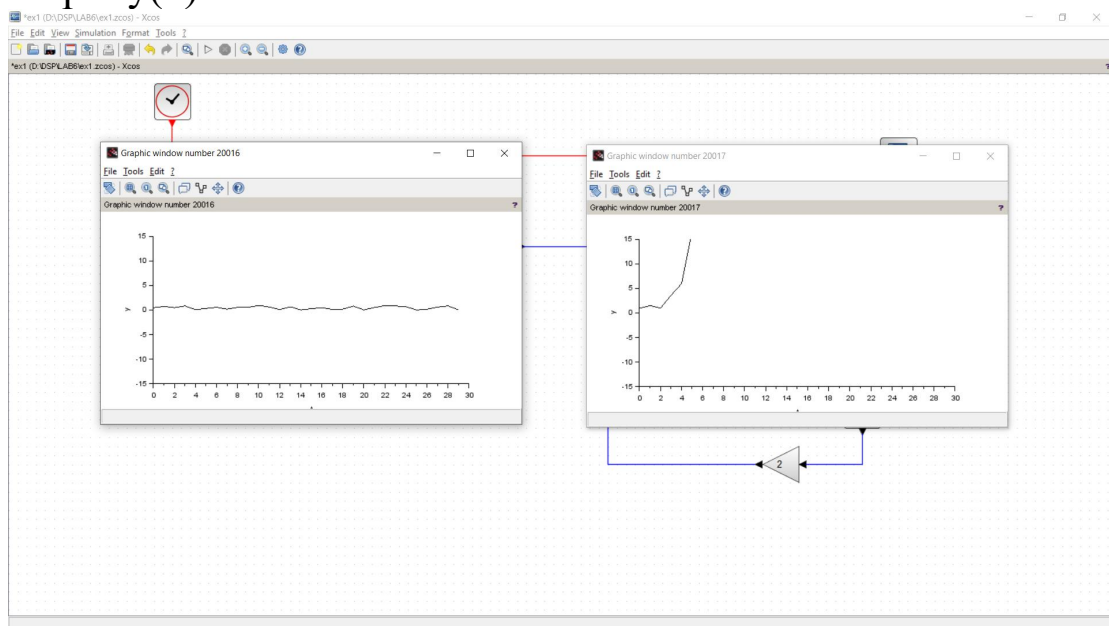- ID: 1814582.

Ho Chi Minh, 25/11/2020.

1. Exercises: Investigate XCOS in Scilab for signal processing:

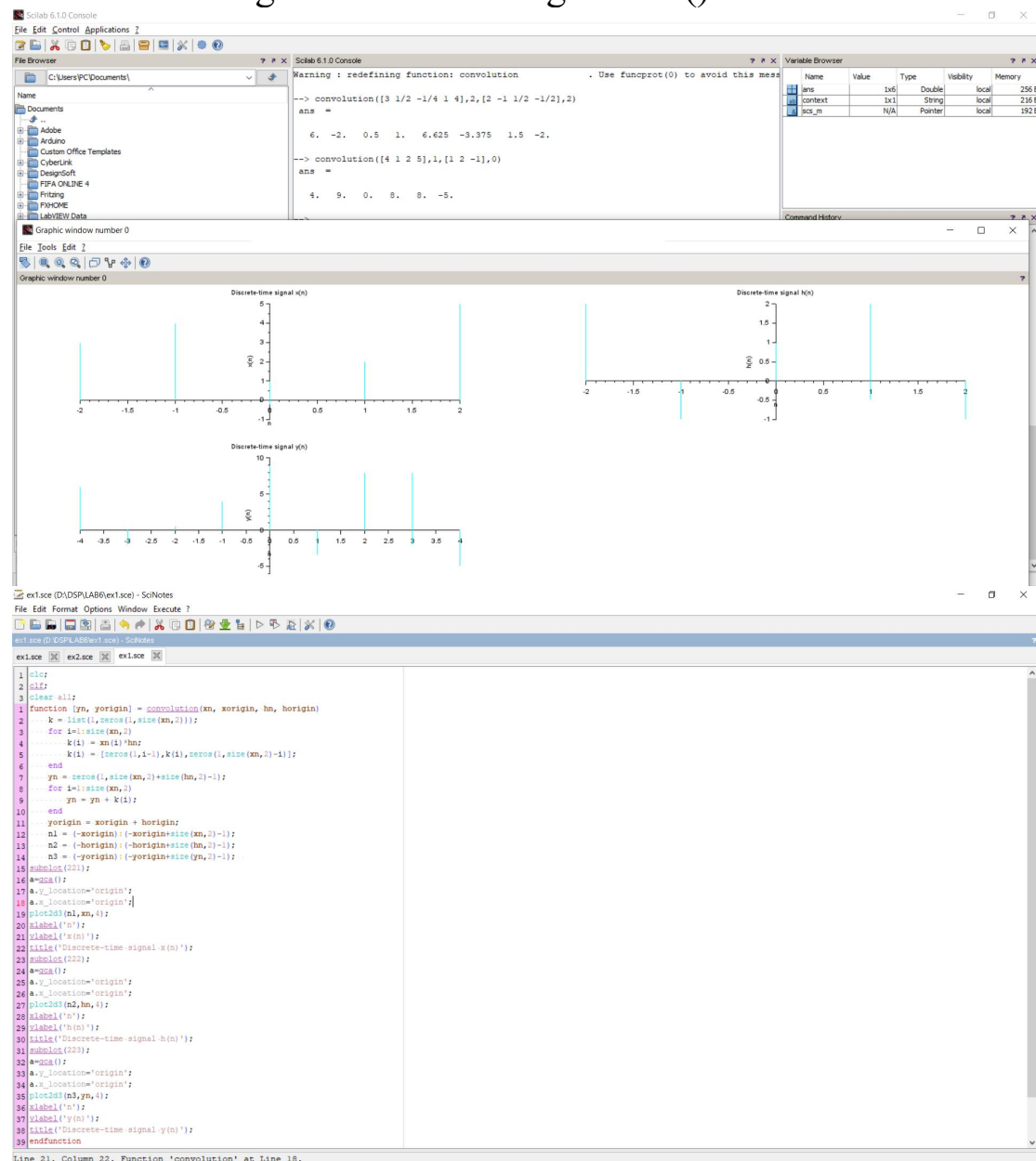## 1.1 Draw the following LTI system in Scilab:

1.2 Generate an input signal x(n) randomly and observe the output y(n):

2. Additional Exercises:

2.1 Students implement the following function in SciLab for discrete-time signals without using convol() built-in function:



```
1  clc;
2  clf;
3  clear all;
1  function [yn, yorigin] = convolution(xn, xorigin, hn, horigin)
2      k = list(1,zeros(1,size(xn,2)));
3      for i=1:size(xn,2)
4          k(i) = xn(i)*hn;
5          k(i) = [zeros(1,i-1),k(i),zeros(1,size(xn,2)-i)];
6      end
7      yn = zeros(1,size(xn,2)+size(hn,2)-1);
8      for i=1:size(xn,2)
9          yn = yn + k(i);
10     end
11     yorigin = xorigin + horigin;
12     n1 = (-xorigin):(-xorigin+size(xn,2)-1);
13     n2 = (-horigin):(-horigin+size(hn,2)-1);
14     n3 = (-yorigin):(-yorigin+size(yn,2)-1);
15 subplot(221);
16 a=gca();
17 a.y_location='origin';
18 a.x_location='origin';
19 plot2d3(n1,xn,8);
20 xlabel('n');
21 ylabel('x(n)');
22 title('Discrete-time signal x(n)');
23 subplot(222);
24 a=gca();
25 a.y_location='origin';
26 a.x_location='origin';
27 plot2d3(n2,hn,4);
28 xlabel('n');
29 ylabel('h(n)');
30 title('Discrete-time signal h(n)');
31 subplot(223);
32 a=gca();
33 a.y_location='origin';
34 a.x_location='origin';
35 plot2d3(n3,yn,4);
36 xlabel('n');
37 ylabel('y(n)');
38 title('Discrete-time signal y(n)');
39 endfunction
```

2.2 Calculate the convolution y(n) = x(n) * h(n) of two signals:

A) x(n) = {3, 1/2 , − 1/4 ↑, 1, 4}, h(n) = {2, −1, 1/2↑, − 1/2}

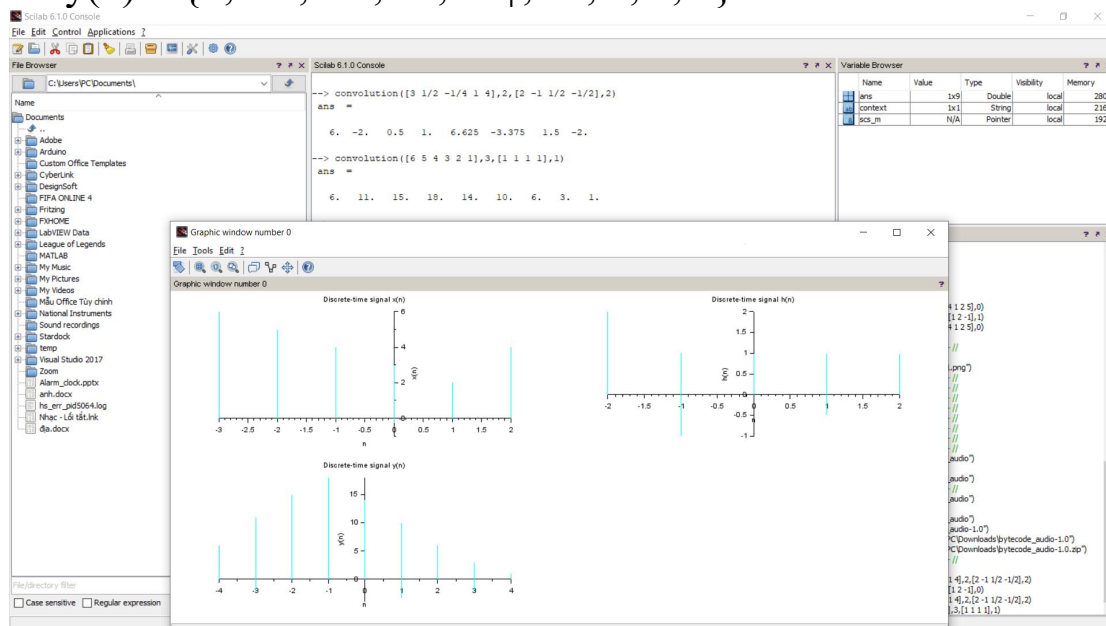| 3	1/2	-1/4↑	1	4			
2	-1	1/2↑	-1/2				
6	-3	3/2	-3/2				
	1	-1/2	1/4	-1/4			
		-1/2	1/4	-1/8	1/8		
			2	-1	1/2	-1/2	
				8	-4	2	-2
6	-2	1/2	1	53/8↑	-27/8	3/2	-2

y(n) = {6, -2 , − 1/2 , 1, 53/8↑, -27/8, 3/2, -2}
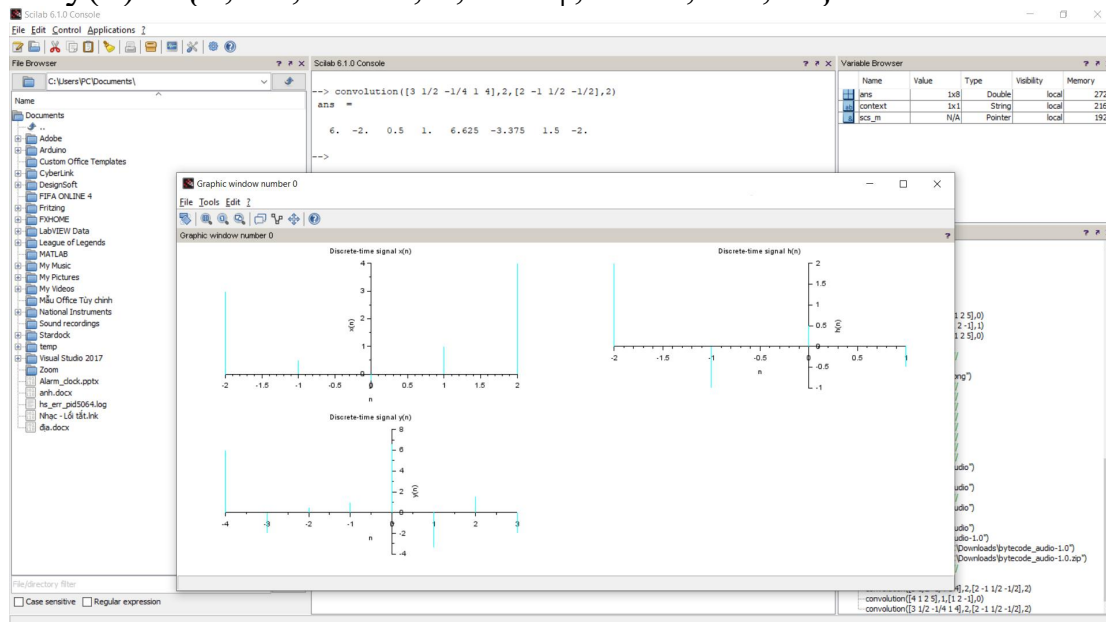
B) $x(n) = \{6, 5, 4, 3\uparrow, 2, 1\}$, $h(n) = \{1, 1\uparrow, 1, 1\}$

6	5	4	3↑	2	1			
	1	1↑	1	1				
6	5	4	3	2	1			
	6	5	4	3	2	1		
		6	5	4	3	2	1	
			6	5	4	3	2	1
6	11	15	18	14↑	10	6	3	1

$y(n) = \{6, 11, 15, 18, 14\uparrow, 10, 6, 3, 1\}$

C) x(n) = {−1, 3 ↑, −1, −2}, h(n) = {−2, 2 ↑, 0, −1, 1}

-1	3↑	-1	-2				
-2	2↑	0	-1	1			
2	-6	2	4				
	-2	6	-2	-4			
		0	0	0	0		
		1	-3	1	2		
			-1	3	-1	2	
2	-8	8↑	3	-8	4	1	2

y(n) = {2, -8, 8↑, 3, -8, 4, 1, 2}