Digital Signal Processing Lab Assignment 2

**Name:** Ahmed Wael Mohamed

**ID:** 6071

**Group:** 3

**Question 1:**

**Code:**

nx =[-3:7];

x = zeros(length(nx),1);

x(4) = 2;

x(6) = 1;

x(7) = -1;

x(8) = 3;

figure

stem(nx,x);

title('x(n)');

y1 = nx+2;

figure

stem(y1,x);

title('Y1(n)');

y2 = nx-1;

figure

stem(y2,x);

title('Y2(n)');

y3 = -nx;

figure

stem(y3,x);

title('Y3(n)');

y4 = -nx+1;

figure

stem(y4,x);

title('Y4(n)');

Chart

Description automatically generated

Chart, box and whisker chart

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**Question 2:**

**Code:**

n = [0:23];

X4 = sin (2\*pi\*4\*(n/12));

X5 = sin (2\*pi\*5\*(n/12));

X7 = sin (2\*pi\*7\*(n/12));

X10 = sin (2\*pi\*10\*(n/12));

figure

stem(n,X4);

title('X4(n)');

figure

stem(n,X5);

title('X5(n)');

figure

stem(n,X7);

title('X7(n)');

figure

stem(n,X10);

title('X10(n)');

figure

stem(n,X20);

title('X20(n)');

Chart, box and whisker chart

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Chart

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Chart, box and whisker chart

Description automatically generated

**The Fundamental Period**

* Fundamental period in Discrete Signal is = M
* Fundamental period in Continuous Signal is = N/M
* At N = 4 (In Discrete = 3 ,, In Continuous = 12/4 = 3)
* At N = 5 (In Discrete = 12 ,, In Continuous = 12/5 = 2.4)
* At N = 7 (In Discrete = 12 ,, In Continuous = 12/7 = 1.714)
* At N = 10 (In Discrete = 6 ,, In Continuous = 12/10 = 1.2)
* At N = 20 (In Discrete = 3 ,, In Continuous = 12/20 = 0.6)

**Question 3:**

**Part (a)**

**Code:**

n = 1:51;

x1 = sin(2\*pi\*0.1\*n);

j=0;

for N1=1:10:41

j=j+1;

Etot1(j)=sum(x1(N1:N1+9).^2);

Pav1(j)=sum(x1(N1:N1+9).^2)/10;

end;





**Part (b)**

**Code:**

n2 = 0:12;

x2 = sin(2\*pi\*0.1\*n2);

Etot2 = sum(x2.^2);

Pav2 = sum(x2.^2)/13;



* As shown in the average power results the average power of the second signal is nearly equal to the average power of the first signal.

**Part (c)**

**Code:**

n3 = 0:1005;

x3 = sin(2\*pi\*0.1\*n3);

Etot3 = sum(x3.^2);

Pav3 = sum(x3.^2)/1006;

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****

* As shown in the average power of the third signal by increasing the number of the samples the average power is much more equal to the average power of the first signal.

**Observation**

By increasing the number of Samples, the power average becomes nearly the same.

**Question 4:**

**Code(a):**

nx = 0:11;

x = ones(1,10);

y1 = [x 0 0];

y2 = (0.5)\*[0 x 0];

y3 = 2\*[0 0 x];

y = y1+y2+y3;

figure

stem(nx,y);

title('Graph a');

Chart

Description automatically generated

* The steady state output is = 3.5

**Code(b):**

nx2 = 0:10;

x = ones(1,10);

y1b = [x 0];

y2b = (0.8)\*[0 x];

yb = y1b+y2b;

figure

stem(nx2,yb);

title('Graph b');

**Chart, histogram

Description automatically generated**

**Code(c):**

nx3 = 0:11;

x = ones(1,10);

y1c = [0 x 0];

y2c = (0.8)\*[0 0 x];

yc = y1c+y2c;

figure

stem(nx3,yc);

title('Graph c');

Chart, histogram

Description automatically generated

* The relationship between the two graphs is that graph (c) is shifted by one to the right with respect to graph (b)

**Code of filtered graph:**

x = [1 1 1 1 1 1 1 2 1 1 1 1];

n = 0:11;

y = (1/5) \* (x + [0 x(1:end-1)] + [0 0 x(1:end-2)] + [0 0 0 x(1:end-3)] + [0 0 0 0 x(1:end-4)]);

figure

stem(n,y);

title('Filtered Output');

Chart

Description automatically generated

* The output tends to rise until it becomes steady. The output is much more stable by increasing the number of samples.

**Question 5:**

**Code (a):**

nx1=[0 1 2];

nh1=[-2 -1 0 1 2];

x=[1 2 4];

h=[1 1 1 1 1];

M=length(x);

N=length(h);

ny1= -2:4;

y=zeros(1, M+N-1);

for u=1:N

x1 = h(u)\*[zeros(1,u-1) x zeros(1,M-u+2)];

y = y+x1;

end

figure

stem (ny1,y);

title('Convolved Signal a');

**Chart

Description automatically generated**

**Code (b):**

nx2=[0 1 2 3 4];

nh2=[-2 -1 0 1 2];

x=[0 1 -2 3 -4];

h=[0.5 1 2 1 0.5];

M=length(x);

N=length(h);

ny2= -2:6;

y=zeros(1, M+N-1);

for u=1:N

x1 = h(u)\*[zeros(1,u-1) x zeros(1,M-u)];

y = y+x1;

end

figure

stem (ny2,y);

title('Convolved Signal b');

Chart, box and whisker chart

Description automatically generated

**Code (c):**

nx3=[0 1 2 3];

nh3=[0 1 2 3];

x=[1 2 3 4];

h=[4 3 2 1];

M=length(x);

N=length(h);

ny3= 0:6;

y=zeros(1, M+N-1);

for u=1:N

x1 = h(u)\*[zeros(1,u-1) x zeros(1,M-u)];

y = y+x1;

end

figure

stem (ny3,y);

title('Convolved Signal c');

Chart, bubble chart

Description automatically generated

**Code (d):**

nx4=[0 1 2 3];

nh4=[0 1 2 3];

x=[1 2 3 4];

h=[1 2 3 4];

M=length(x);

N=length(h);

ny4= 0:6;

y=zeros(1, M+N-1);

for u=1:N

x1 = h(u)\*[zeros(1,u-1) x zeros(1,M-u)];

y = y+x1;

end

figure

stem (ny4,y);

title('Convolved Signal d');

Chart

Description automatically generated