Scilab Manual for Digital Signal Processing by Ms E. Sangeetha Devi Electronics Engineering Periyar Maniammai University[1]

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August 17, 2022

[1]Funded by a grant from the National Mission on Education through ICT, http://spoken-tutorial.org/NMEICT-Intro. This Scilab Manual and Scilab codes written in it can be downloaded from the "Migrated Labs" section at the website http://scilab.in

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Experiment: 1

GENERATION OF CONTINUOUS SIGNALS

Scilab code Solution 1.1 sinewave

```
clc;
clf;
clear all;
//Caption:generation of sine wave
f=0.2;
t=0:0.1:10;
x=sin(2*%pi*t*f);
plot(t,x);
title('sine wave');
xlabel('t');
ylabel('x');
```

Scilab code Solution 1.2 cosine wave

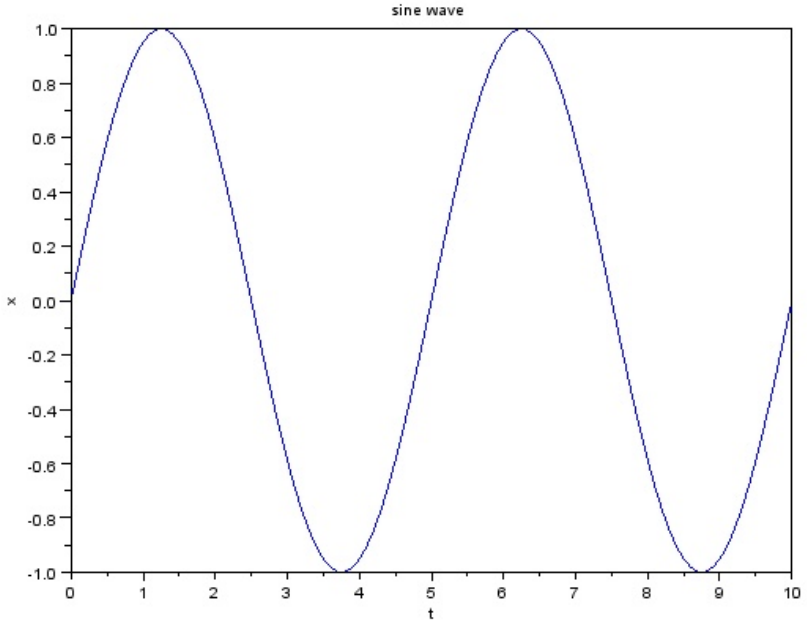

Figure 1.1: sinewave

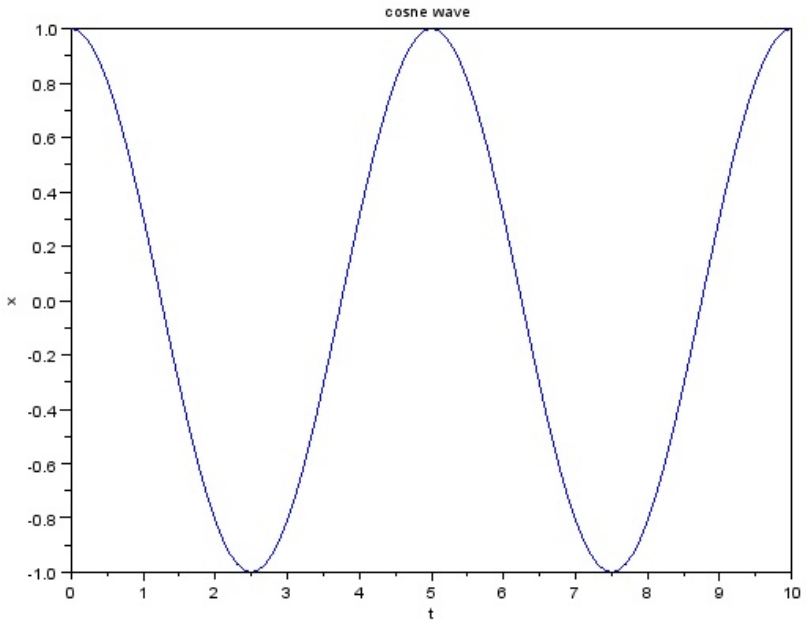

Figure 1.2: cosine wave

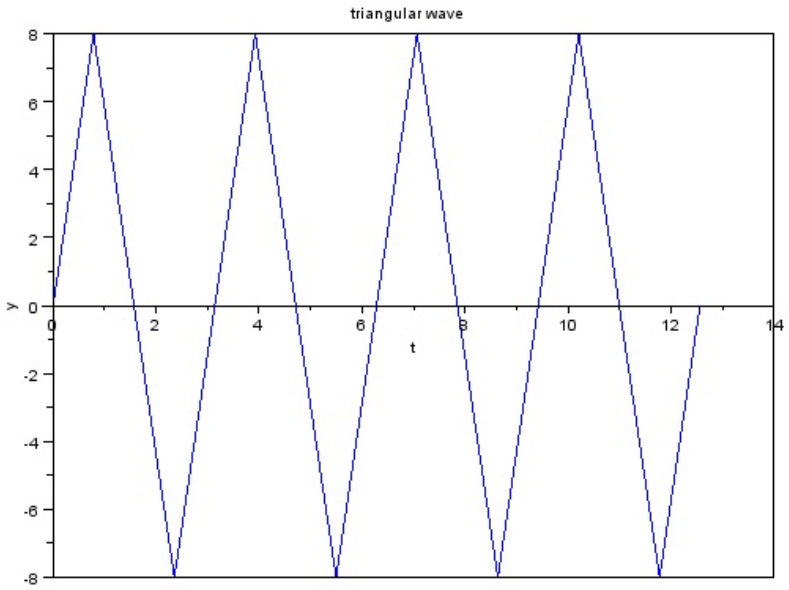

Figure 1.3: triangular wave

```
clc;
clf;
clear all;
//Caption:generation of cosine wave
f=0.2;
t=0:0.1:10;
x=cos(2*%pi*t*f);
plot(t,x);
title('cosne wave');
xlabel('t');
ylabel('x');
```

Scilab code Solution 1.3 triangular wave

```
clc;
clf;
clear all;
//Caption:generation of triangular wave
a=8;
t=0:(%pi/4):(4*%pi);
y=a*sin(2*t);
a=gca();
a.x_location="middle"
plot(t,y);
title('triangular wave');
xlabel('t');
ylabel('y');
```

Scilab code Solution 1.4 signum function

```
clc;
clf;
clear all;
//Caption:signum function
t =-5:0.1:5
a=gca();
a.x_location="middle"
x=sign(t);
b =gca();
b.y_location="middle"
plot(t,x);
title('signum function');
```

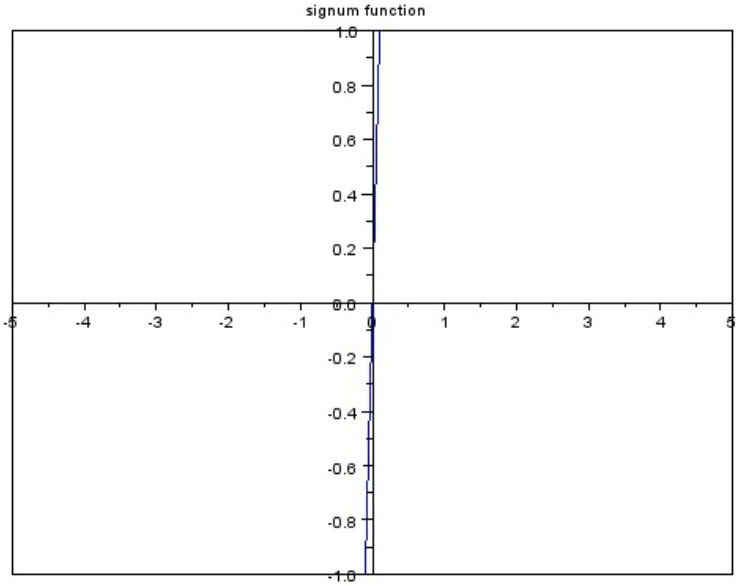

Figure 1.4: signum function

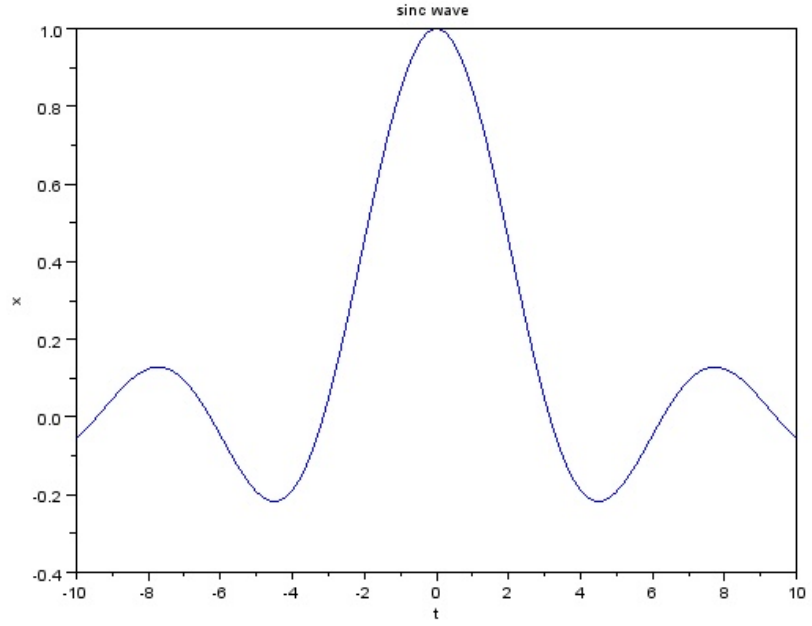

Figure 1.5: sinc function

Scilab code Solution 1.5 sinc function

```
clc;
clf;
clear all;
//Caption:sinc function
t=-10:0.1:10
x=sinc(t);
plot(t,x);
title('sinc wave');
xlabel('t');
ylabel('x');
```

Scilab code Solution 1.6 Exponential wave

```
clc;
clf;
clear all;
//Caption:generation of exponential wave
t=-2:0.1:2;
x=exp(t);
plot(t,x);
title('exponential wave');
xlabel('t');
ylabel('x');
```

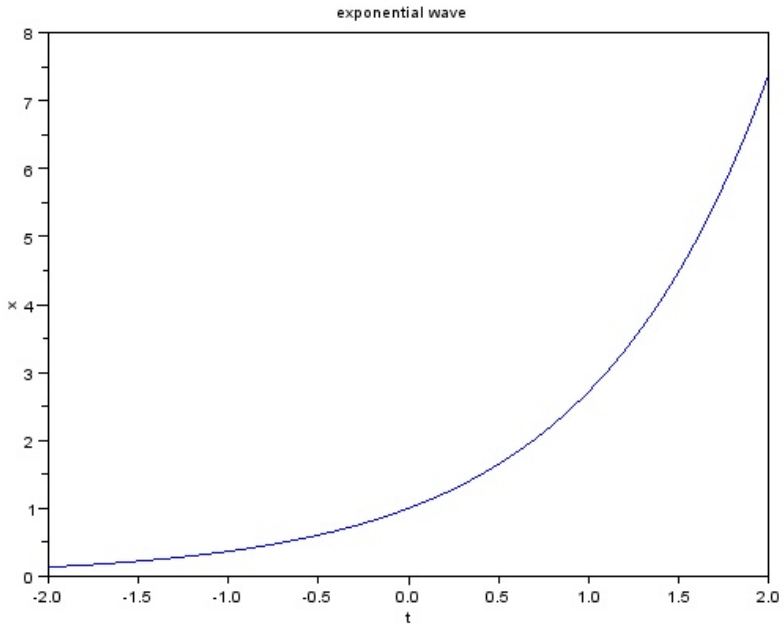

Figure 1.6: Exponential wave

Experiment: 2

GENERATION OF DISCRETE SIGNALS

Scilab code Solution 2.1 unit impulse signal

```
clc;
clf;
clear all;
//unit impulse
L=5;
n=-L:L;
x=[zeros(1,L),ones(1,1),zeros(1,L)];
a=gca();
a.y_location="middle"
plot2d3(n,x);
title('unit impulse');
```

Scilab code Solution 2.2 unitstepsignal

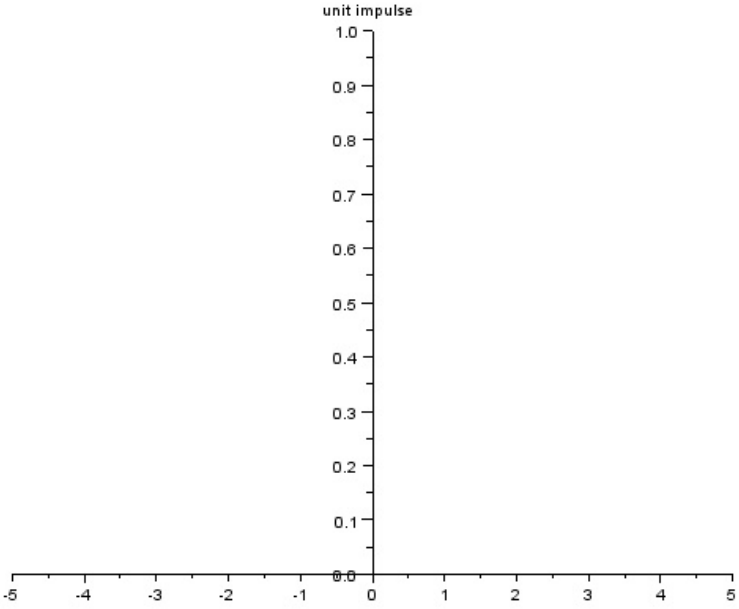

Figure 2.1: unit impulse signal

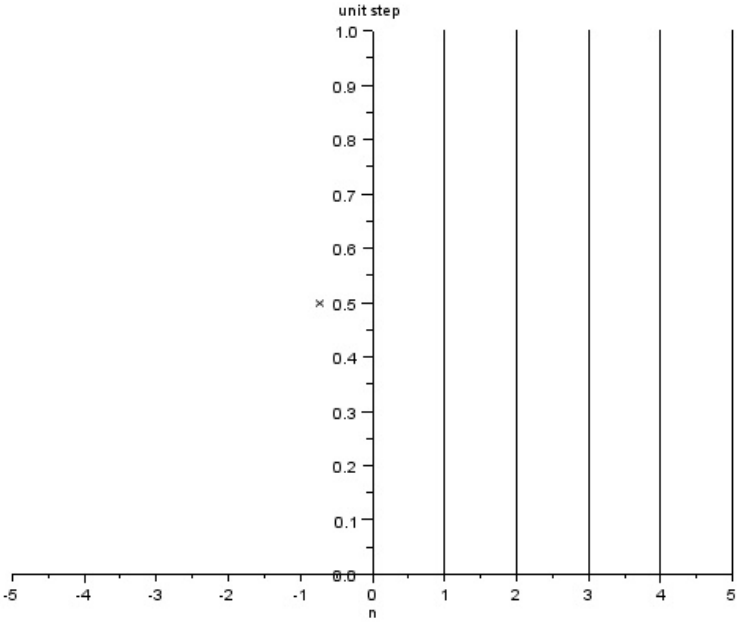

Figure 2.2: unitstepsignal

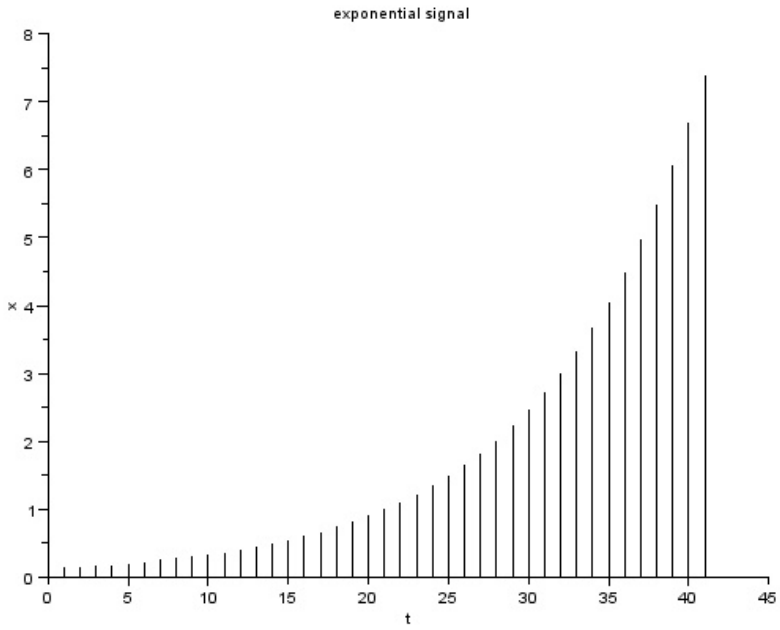

Figure 2.3: discreteexponentialwave

```
clc;
clf;
clear all;
L=5;
n=-L:L;
x=[zeros(1,L),ones(1,L+1)];
a=gca();
a.y_location="middle";
plot2d3(n,x);
title('unit step');
xlabel('n');
ylabel('x');
```

Scilab code Solution 2.3 discreteexponentialwave

```
1  //unit exponential
2  clc;
3  clf;
4  clear all;
5  a=1;
6  x=exp(a*t);
7  plot2d3(x);
8  title('exponential signal');
9  xlabel('t');
10 ylabel('x');
```

Scilab code Solution 2.4 unit ramp

```
1  //unit ramp
2  clc;
3  clf;
4  clear all;
5  L=5;
6  n=-L:L;
7  x=[zeros(1,L),0:L];
8  a =gca();
9  a.y_location='middle';
10 plot2d3(n,x);
11 xtitle('unit ramp signal');
12 xlabel('-->n');
13 ylabel('-->x(n)');
```

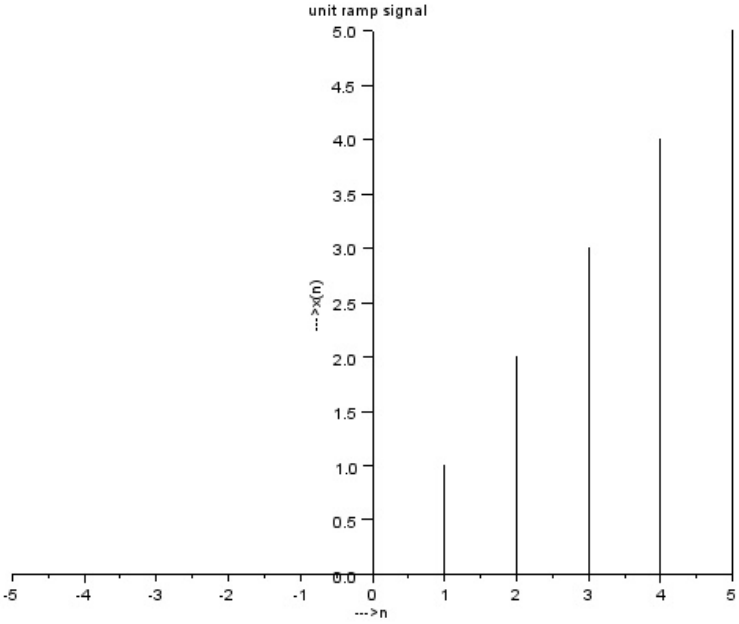

Figure 2.4: unit ramp

Experiment: 3

GENERATION OF SINUSOIDAL SIGNALS

Scilab code Solution 3.1 Generation of sinusoidal signals

```
clc;
clear all;
tic;
t=0:.01:%pi;
//generation of sine signals
y1=sin(t);
y2=sin(3*t)/3;
y3=sin(5*t)/5;
y4=sin(7*t)/7;
y5=sin(9*t)/9;
y = sin(t) + sin(3*t)/3 + sin(5*t)/5 + sin(7*t)/7 +
   sin(9*t)/9;
plot(t,y,t,y1,t,y2,t,y3,t,y4,t,y5);
legend('y','y1','y2','y3','y4','y5');
title('generation of sum of sinusoidal signals');
xgrid(1);
ylabel('---> Amplitude');
```

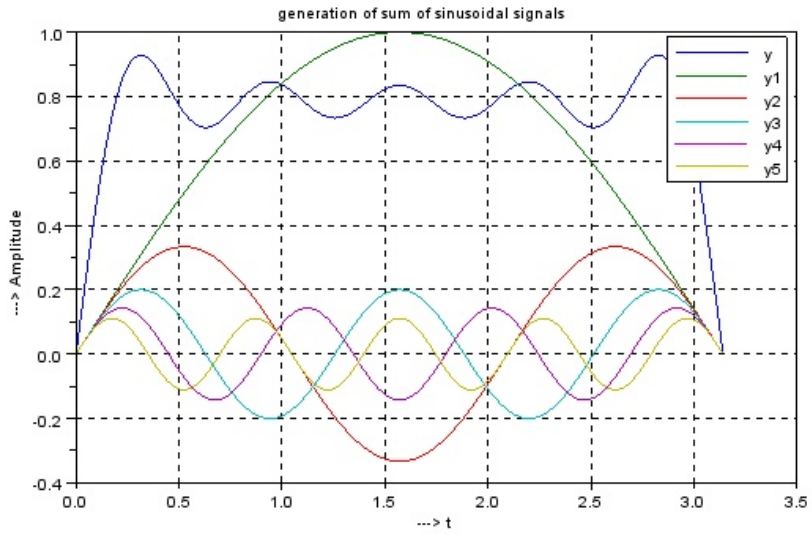

Figure 3.1: Generation of sinusoidal signals

```
17 xlabel('---> t');
18 toc;
```

Experiment: 4

GENERATION OF COMPLEX EXPONENTIAL SIGNALS

Scilab code Solution 4.1 generation of complex exponential signals

```
1 //program for generation of complex exponential
     signals
2 clc;
3 clf;
4 clear all;
5 n=-10:0.1:10;
6 a=0.8;
7 b=-0.8;
8 c=1.25;
9 d=-1.25;
10 x1=a^n;
11 subplot(2,2,1);
12 plot2d3(n,x1);
13 xlabel('n');
14 ylabel('amplitude');
```

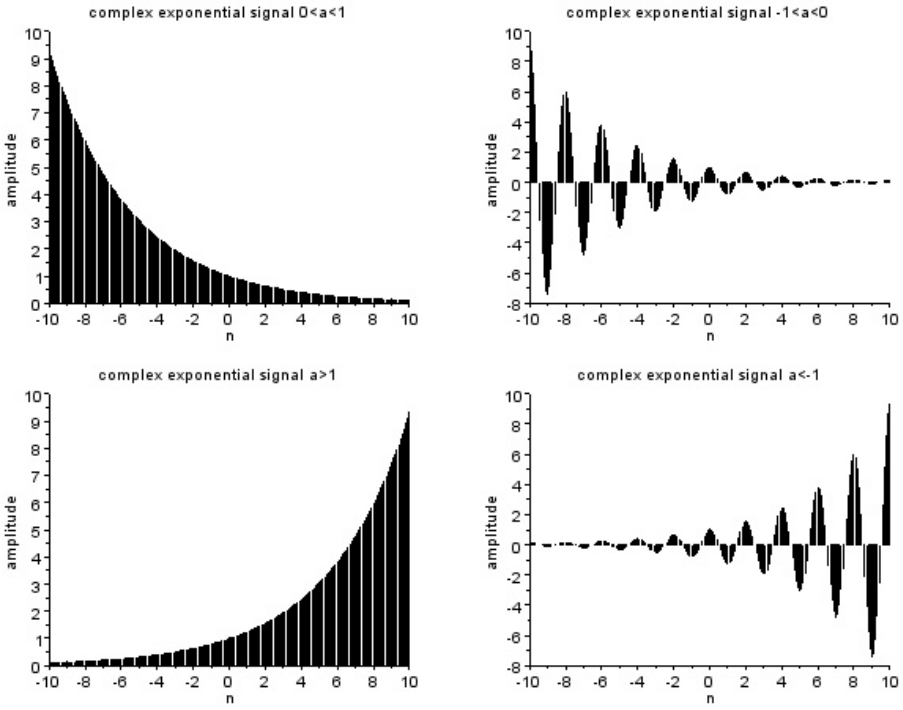

Figure 4.1: generation of complex exponential signals

```
15 title('complex exponential signal 0<a<1');
16 x2=b^n;
17 subplot(2,2,2);
18 plot2d3(n,x2);
19 xlabel('n');
20 ylabel('amplitude');
21 title('complex exponential signal -1<a<0');
22 x3=c^n;
23 subplot(2,2,3);
24 plot2d3(n,x3);
25 xlabel('n');
26 ylabel('amplitude');
27 title('complex exponential signal a>1');
28 x4=d^n;
29 subplot(2,2,4);
30 plot2d3(n,x4);
31 xlabel('n');
32 ylabel('amplitude');
33 title('complex exponential signal a<-1');
```

Experiment: 5

EXPONENTIALLY GROWING & DECAYING SIGNAL

Scilab code Solution 5.1 Exponentially Growing signals

```
1  //Exponentially decaying signal
2  clc;
3  clf;
4  clear all;
5  disp('Exponentially Decaying signal');
6  N=2;
7  a= 0.1;
8  n=0:0.1:N;
9  x=a.^-n;
10 disp('Exponentially growing signal');
11 disp(x);
12 plot2d3(n,x);
13 xlabel('Time');
14 ylabel('Amplitude');
15 title('Exponentially growing Signal Response');
```

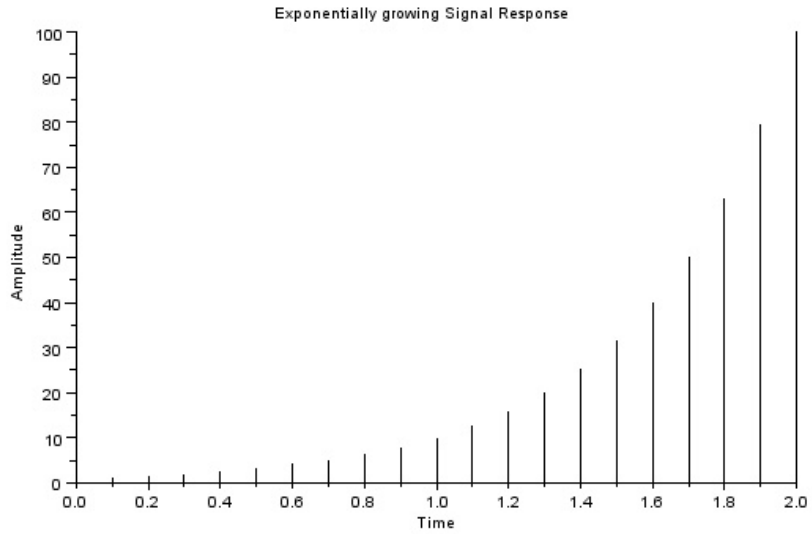

Figure 5.1: Exponentially Growing signals

Scilab code Solution 5.2 Exponentially decaying signals

```
1
2  clc;
3  clf;
4  clear all;
5  disp('Exponentially Decaying signal');
6  N=5;
7  a= 0.1;
8  n=0:0.1:N;
9  x=a.^n;
10 disp('Exponentially decaying signal');
11 disp(x);
```

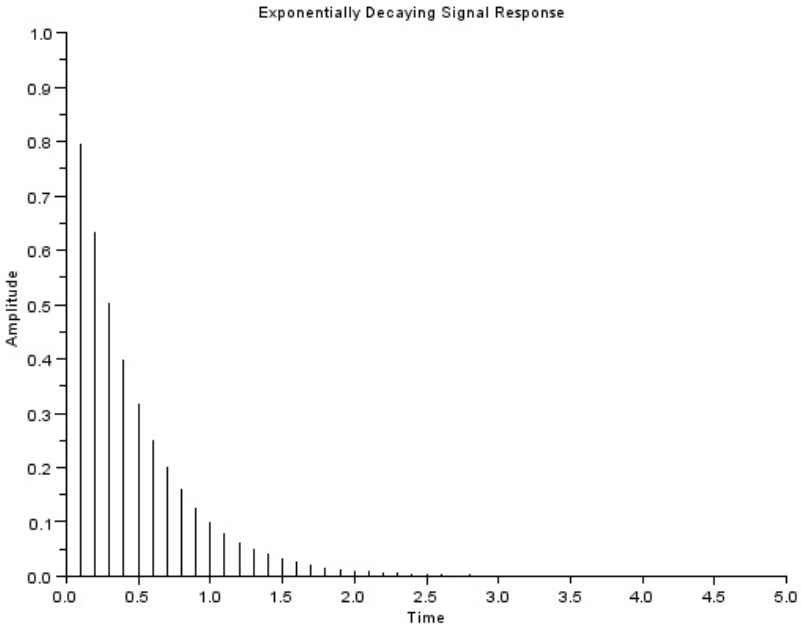

Figure 5.2: Exponentially decaying signals

```
12 plot2d3(n,x);
13 xlabel('Time');
14 ylabel('Amplitude');
15 title('Exponentially Decaying Signal Response');
```

Experiment: 6

ADDITION OF TWO CONTINUOUS SIGNALS

Scilab code Solution 6.1 Addition of two continuous signals

```
1  //program for addition of two continuous signals
2  clc;
3  clf;
4  clear all;
5  t=0:0.1:30
6  x1=sin(2*%pi*t/9);
7  x2=sin(2*%pi*t/2);
8  x3=x1+x2;
9  subplot(1,3,1);
10 plot(t,x1);
11 title('sinewave1')
12 xlabel('t');
13 ylabel('x1(t)');
14 subplot(1,3,2);
15 plot(t,x2);
16 title('sinewave2');
17 xlabel('t');
```

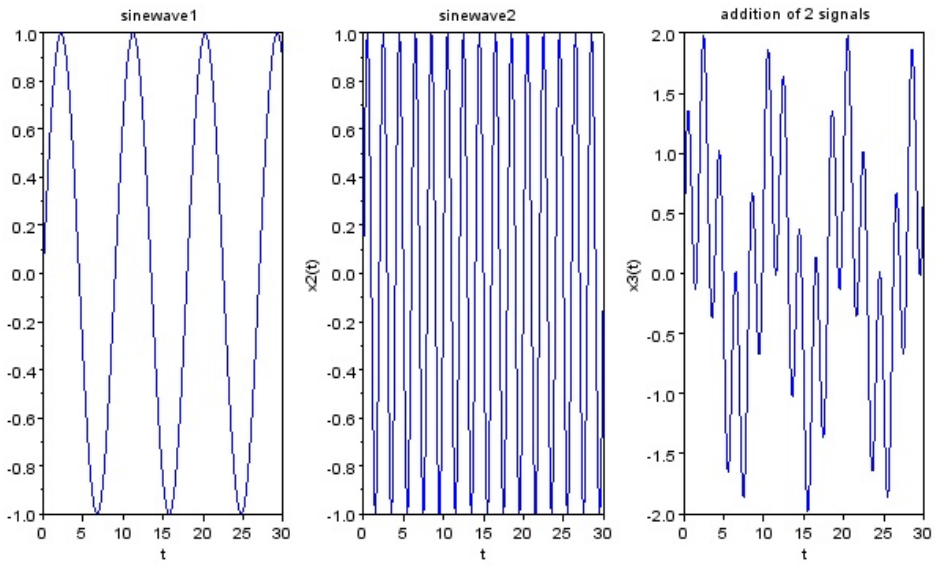

Figure 6.1: Addition of two continuous signals

```
18 ylabel('x2(t)');
19 subplot(1,3,3);
20 plot(t,x3);
21 title('addition of 2 signals');
22 xlabel('t');
23 ylabel('x3(t)');
```

Experiment: 7

ADDITION OF TWO DISCRETE SIGNALS

Scilab code Solution 7.1 Addition of two discrete signals

```
1  //program for addition of two discrete signals
2  N=5;
3  n=0:0.1:N-1;
4  x1=sin(1*%pi*n);
5  x2=sin(2*%pi*n);
6  x3=x1+x2;
7  figure(1);
8  subplot(1,3,1);
9  plot2d3(n,x1);
10 title('sine wave1')
11 xlabel('n');
12 ylabel('x1(n)');
13 subplot(1,3,2)
14 plot2d3(n,x2);
15 title('sinewave2')
16 xlabel('n');
17 ylabel('x2(n)');
```

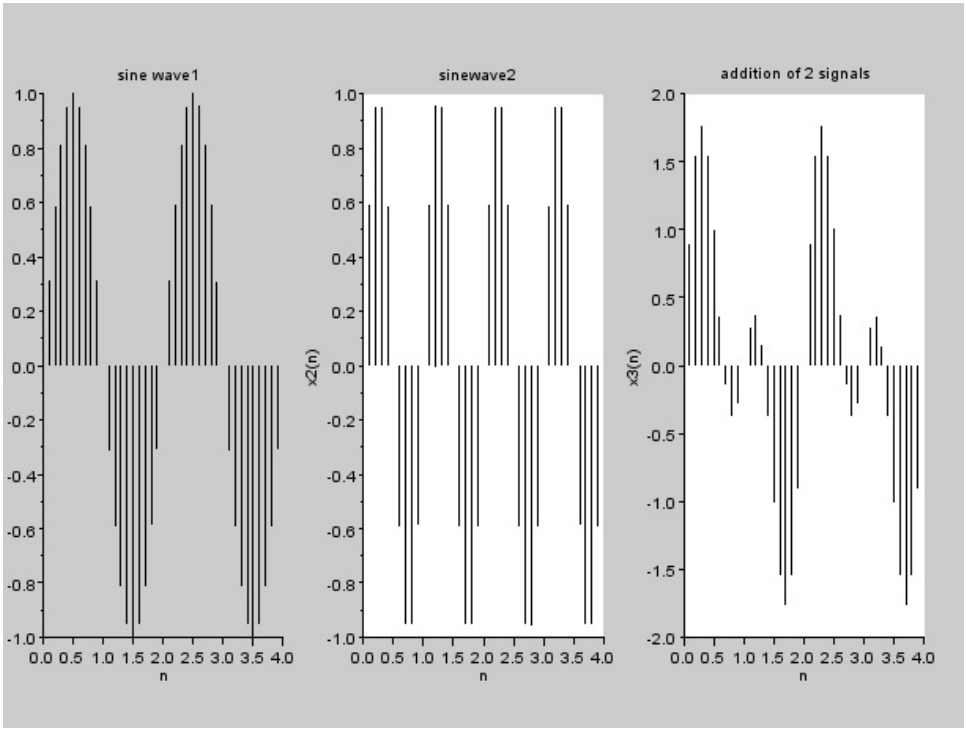

Figure 7.1: Addition of two discrete signals

```
18 subplot(1,3,3);
19 plot2d3(n,x3);
20 title('addition of 2 signals')
21 xlabel('n');
22 ylabel('x3(n)');
```

Experiment: 8

PROGRAM FOR SAMPLING PROCESS

Scilab code Solution 8.1 sampling

```
1  //program for sampling
2  clc;
3  clf;
4  clear all;
5  t=0:0.01:100;
6  fm=0.02;
7  x=cos(2*%pi*fm*t);
8  subplot(2,2,1);
9  plot(t,x);
10 title('continious time signal');
11 fs1=0.002;
12 n=0:1:50;
13 x1=cos(2*%pi*fm*n/fs1);
14 subplot(2,2,2);
15 plot2d3(n,x1);
16 title('time signal fs1<2fm');
17 fs2=0.04;
```

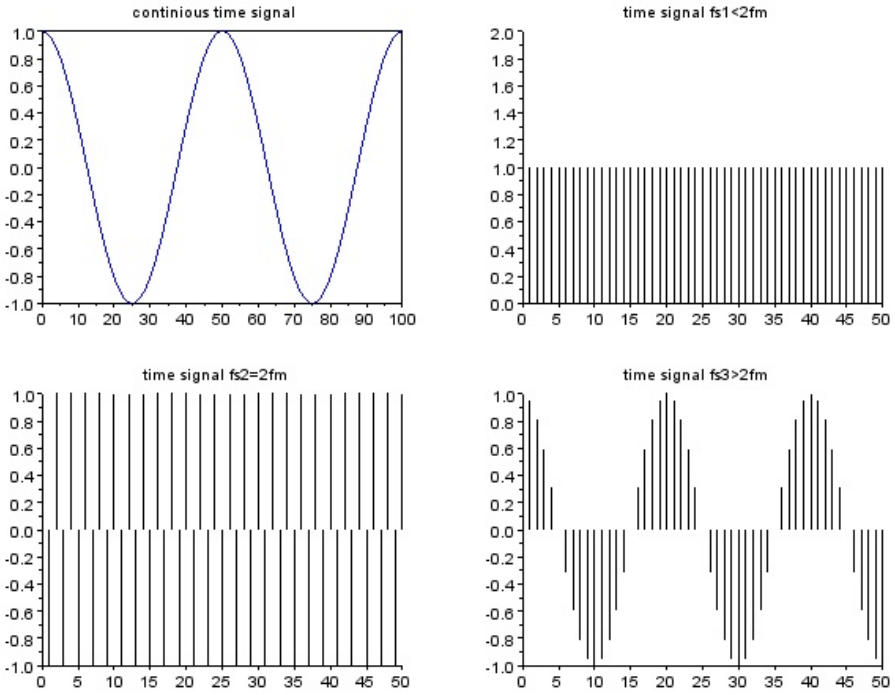

Figure 8.1: sampling

```
18 x2=cos(2*%pi*fm*n/fs2);
19 subplot(2,2,3);
20 plot2d3(n,x2);
21 title('time signal fs2=2fm');
22 fs3=0.4;
23 x3=cos(2*%pi*fm*n/fs3);
24 subplot(2,2,4);
25 plot2d3(n,x3);
26 title('time signal fs3>2fm');
```

Experiment: 9

PROGRAM FOR ALIASING PROCESS

Scilab code Solution 9.1 Aliasing process

```
1  //program for effect of aliasing
2  clc;
3  clf;
4  clear all;
5  fs=8000;
6  t=0:1/fs:0.01;
7  f=[1000,2000,3000,3500,4000,4500,8000,8500,9000];
8  i=1;
9  while i<7
10     y=sin(2*%pi*f(i)*t);
11     subplot(3,2,i);
12     plot(t,y);
13     xlabel('frequency');
14     ylabel('amplitude');
15     i=i+1;
16 end
```

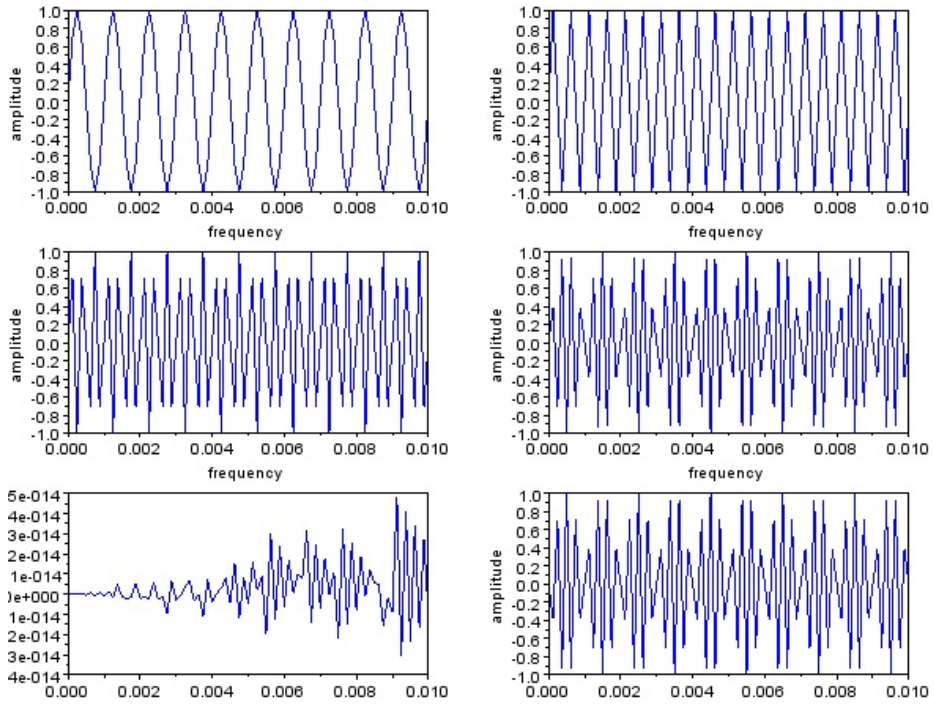

Figure 9.1: Aliasing process

Experiment: 10

LINEAR CONVOLUTION OF TWO SEQUENCES

Scilab code Solution 10.1 linear convolution of two sequences

```
1  //program for linear convolution
2  clc;
3  clf;
4  clear all;
5  x=input('Enter the first sequence:');
6  y=input('Enter the second Sequence:');
7  n=convol(x,y);
8  subplot(2,2,1);
9  plot2d3(x);
10 title('first sequence');
11 xlabel('n------->');
12 ylabel('amp----->');
13 subplot(2,2,2);
14 plot2d3(y);
15 title('second sequence');
16 xlabel('n------->');
17 ylabel('amp----->');
18 subplot(2,2,3);
19 plot2d3(n);
```

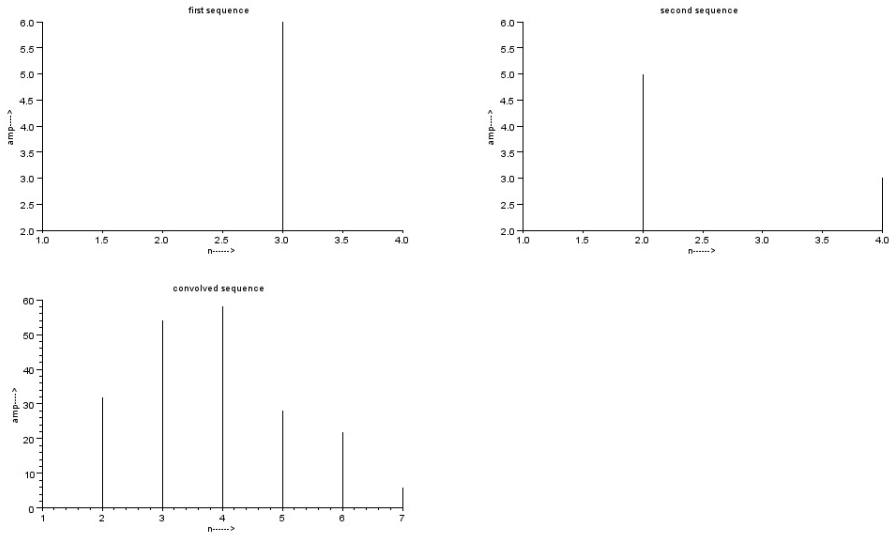

Figure 10.1: linear convolution of two sequences

```
20 title('convolved sequence');
21 xlabel('n------->');
22 ylabel('amp------>');
23 disp('The convolved sequence is');
24 disp(n);
25
26 //result:
27 //Enter the first sequence:[4 2 6 2]
28 //Enter the second Sequence:[6 5 2 3]
29 //
30 // The convolved sequence is
31 //
32 //    24.    32.    54.    58.    28.    22.    6.
```

Experiment: 11

CIRCULAR CONVOLUTION OF TWO SEQUENCES

Scilab code Solution 11.1 circular convolution

```
1  //program for circular convolution
2  clc;
3  clf;
4  clear all;
5  g=input('Enter the first sequence:');
6  h=input('Enter the second sequence:');
7  N1=length(g);
8  N2=length(h);
9  N=max(N1,N2);
10 N3=N1-N2;
11 if(N3>=0)  then
12    h=[h,zeros(1,N3)];
13 else
14     g=[g,zeros(1,-N3)];
15 end
16 for n=1:N
17     y(n)=0;
```

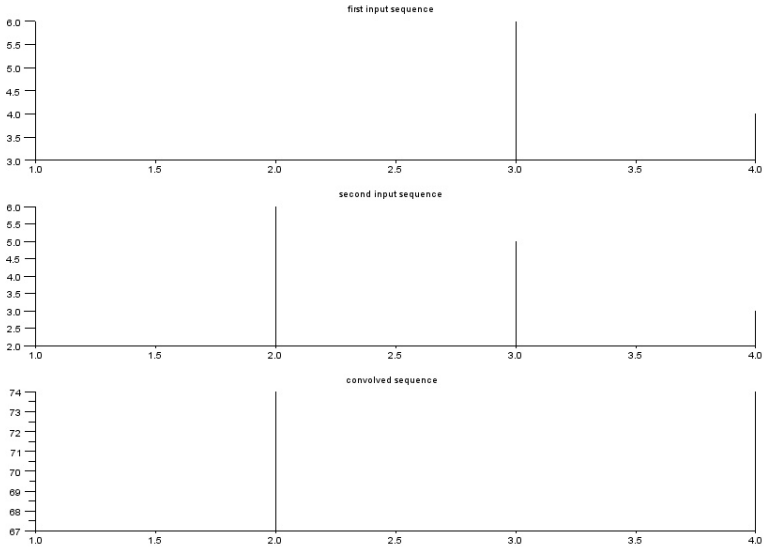

Figure 11.1: circular convolution

```
for i=1:N
        j=n-i+1;
        if(j<=0)
            j=N+j;
end
   y(n)=y(n)+g(i)*h(j);
end
end
disp('The resultant signal is:');
disp(y);
subplot(3,1,1);
plot2d3(g);
title('first input sequence');
subplot(3,1,2);
plot2d3(h);
title('second input sequence');
subplot(3,1,3);
plot2d3(y);
title('convolved sequence');

```

```
38
39
40 //result
41 //Enter the first sequence:[5 3 6 4]
42 //Enter the second sequence:[2 6 5 3]
43 //
44 // The resultant signal is:
45 //
46 //    73.    74.    67.    74.
```

Experiment: 12

DFT OF A SIGNAL

Scilab code Solution 12.1 DFT

```
1  //program for calculation of DFT of a signal
2  clc;
3  clf;
4  clear all;
5  N=input('Enter the value of N:');
6  x=input('enter input sequence');
7  for k=1:N
8      y(k)=0;
9      for n=1:N
10         y(k)=y(k)+x(n).*exp(-%i*2*%pi*(k-1)*(n-1)/N)
               ;
11         A=real(y);
12         B=imag(y);
13     end;
14 end;
15 mag=abs(y);
16 x1=atan(imag(y),real(y));
17 phase=x1*(180/%pi);
18 disp('the resultant DFT sequence is');
```

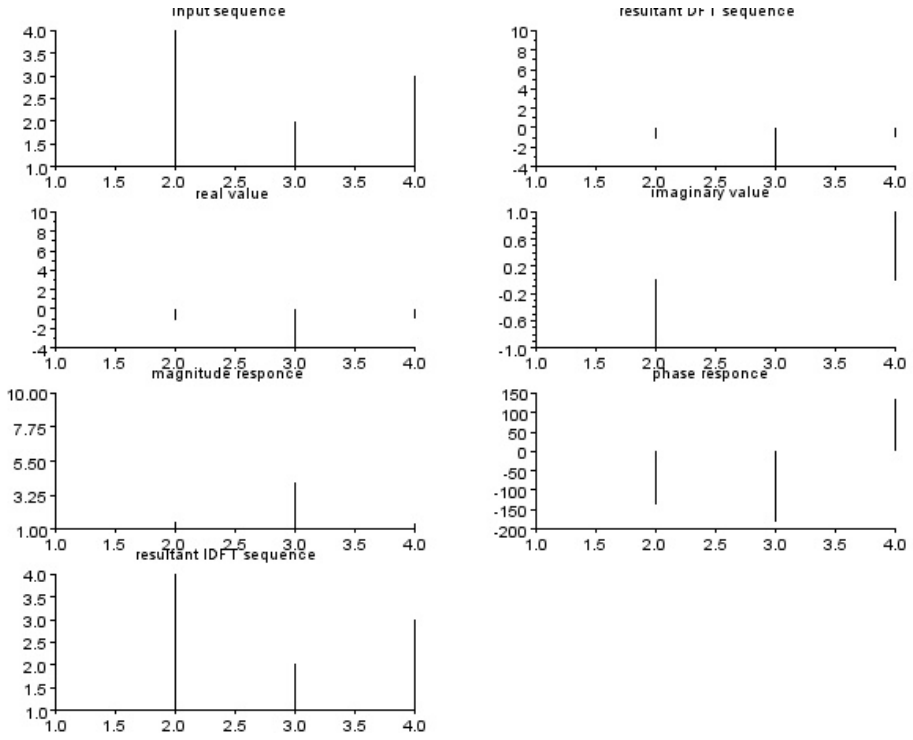

Figure 12.1: DFT

```
disp(y);
disp('the resultant real value is');
disp(A);
disp('the resultant imaginary value is');
disp(B);
disp('the magnitude response is');
disp(mag);
disp('the phase response is');
disp(phase);
for n=1:N
    y(n)=0;
    for k=1:N
        y(n)=y(n)+(1/N)*(y(k).*exp(%i*2*%pi*(k-1)*(n
           -1)/N));
        C=real(x);
    end;
end;
disp('the resultant IDFT sequence is');
disp(C);
subplot(4,2,1);
plot2d3(x);
title('input sequence');
subplot(4,2,2);
plot2d3(A);
title('resultant DFT sequence');
subplot(4,2,3);
plot2d3(A);
title('real value');
subplot(4,2,4);
plot2d3(B);
title('imaginary value');
subplot(4,2,5);
plot2d3(mag);
title('magnitude responce');
subplot(4,2,6);
plot2d3(phase);
title('phase responce');
subplot(4,2,7);
```

```
56 plot2d3(C);
57 title('resultant IDFT sequence');
58
59
60 //result
61 //Enter the value of N:4
62 //enter input sequence[1 4 2 3]
63
64 // the resultant DFT sequence is
65
66 //    10.  - 1. - i    - 4. - 1.102D-15i  - 1. + i
67
68 // the resultant real value is
69 //    10.  - 1.  - 4.  - 1.
70
71 // the resultant imaginary value is
72
73 //    0.  - 1.  - 1.102D-15    1.
74
75 // the magnitude response is
76
77 //    10.    1.4142136    4.    1.4142136
78
79 // the phase response is
80
81 //    0.  - 135.  - 180.    135.
82
83 // the resultant IDFT sequence is
84
85 //    1.    4.    2.    3.
```

Experiment: 13

FFT OF A SIGNAL

Scilab code Solution 13.1 fast fourier transform

```
1  //program for calculation of FFT of a signal
2  clc;
3  clf;
4  clear all;
5  N=input('Enter the value of N:');
6  x=input('enter input sequence');
7  y=fft(x);
8  A=real(y);
9  B=imag(y);
10 mag=abs(y);
11 x1=atan(imag(y),real(y));
12 phase=x1*(180/%pi);
13 disp('the resultant FFT sequence is');
14 disp(y);
15 disp('the magnitude response is');
16 disp(mag);
17 disp('the phase response is');
18 disp(phase);
19 z=ifft(y);
```

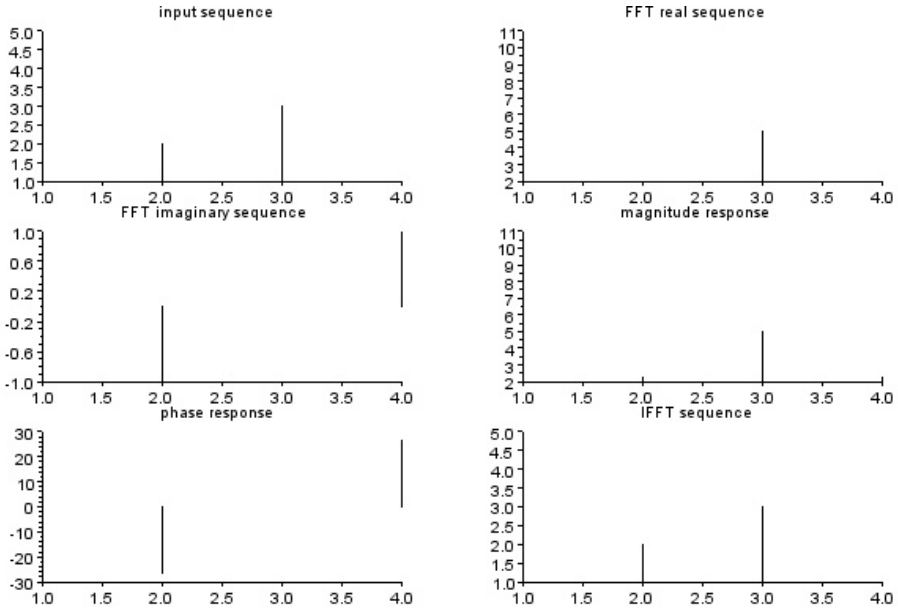

Figure 13.1: fast fourier transform

```
20 disp('the resultant IFFT sequence is');
21 disp(z);
22 subplot(3,2,1);
23 plot2d3(x);
24 title('input sequence');
25 subplot(3,2,2);
26 plot2d3(A);
27 title('FFT real sequence');
28 subplot(3,2,3);
29 plot2d3(B);
30 title('FFT imaginary sequence');
31 subplot(3,2,4);
32 plot2d3(mag);
33 title('magnitude response');
34 subplot(3,2,5);
35 plot2d3(phase);
36 title('phase response');
37 subplot(3,2,6);
38 plot2d3(x);
```

```
39 title('IFFT sequence');
40
41
42 //result
43 //Enter the value of N:4
44 //enter input sequence[5 2 3 1]
45
46 //the resultant FFT sequence is
47
48 //     11.     2. - i       5.     2. + i
49
50 //the magnitude response is
51
52 //     11.     2.236068     5.     2.236068
53
54 //the phase response is
55
56 //0.  - 26.565051     0.     26.565051
57
58 //the resultant IFFT sequence is
59
60 //     5.     2.     3.     1.
```