Scilab Manual for Signals and Systems by Prof Ishit Shah Electrical Engineering Venus International College of Technology, GTU[1]

Solutions provided by
Prof Ishit Shah
Electrical Engineering
Venus International College of Technology - GTU

January 31, 2025

[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

Contents

List of Scilab Solutions 3

1 Generation of unit step and unit ramp signals in Scilab 5

2 Generation of the sinusoidal wave in discrete time mode through Scilab code 8

3 Plotting of exponential sequence and complex exponential sequence 11

4 Performing cross correlation operation using SCILAB code 17

5 Performing auto correlation operation using Scilab code 21

6 A Scilab program to perform addition of sequences 23

7 A Scilab program to perform multiplication and folding of sequences 26

8 Scilab code to demonstrate amplitude Modulation concept 29

9 Scilab code to demonstrate frequency Modulation concept 32

List of Experiments

Solution 1.1	Exp1	5
Solution 2.2	Exp2	8
Solution 3.3	Exp3	11
Solution 4.4	Exp4	17
Solution 5.3	Exp5	21
Solution 6.6	Exp6	23
Solution 7.7	Exp7	26
Solution 8.8	Exp8	29
Solution 9.9	Exp9	32

List of Figures

1.1 Exp1 7

2.1 Exp2 10

3.1 Exp3 15
3.2 Exp3 16

4.1 Exp4 20
4.2 Exp4 20

5.1 Exp5 22

6.1 Exp6 25

7.1 Exp7 28

8.1 Exp8 31

9.1 Exp9 34

Experiment: 1

Generation of unit step and unit ramp signals in Scilab

Scilab code Solution 1.1 Exp1

```
1  //Experiment-1
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5
6  //AIM: Generation of Unit step and Unit ramp signals
       in SCILAB.
7
8
9  //Unit Step Signal
10
11 clear; clc;
12 t=-6:0.01:6;
13 u=ones(t).*(t>=0);
14 subplot(2,1,1);                  //plotting multiple
      graph in one window
15 plot(t,u);
16 xgrid(4,1,7);                    // xgrid([color] [,
      thickness] [, style])
```

```
17 xlabel("t","fontsize",4);                    // Label of
       X-Axis
18 ylabel("u(t)","fontsize",4);                 // Label of
       Y-Axis
19 title("Unit step","fontsize",4);             // Title of
       graph
20
21 set(gca(),"data_bounds",matrix([-6,6,-0.1,1.1],2,-1)
     );  // Range of axis
22
23 //Ramp Signal
24 r=t.*(t>=0);
25 subplot(2,1,2);
26 plot(t,r);
27 xgrid(4,1,7);
28 xlabel("t","fontsize",4);
29 ylabel("r(t)","fontsize",4);
30 title("Ramp","fontsize",4);
31 set(gca(),"data_bounds",matrix([-6,6,-0.1,7],2,-1));
       // Range of axis
```

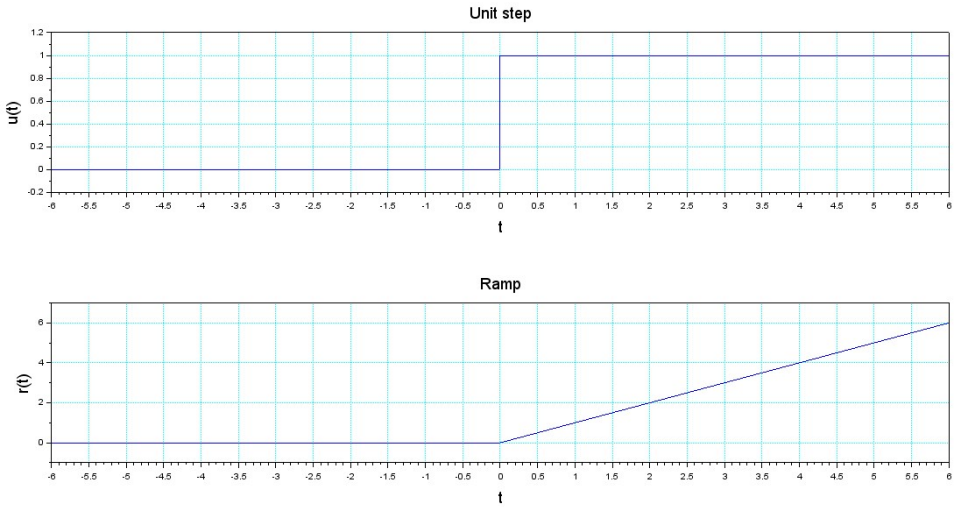

Figure 1.1: Exp1

Experiment: 2

Generation of the sinusoidal wave in discrete time mode through Scilab code

Scilab code Solution 2.2 Exp2

```
1  //Experiment-2
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5
6  //AIM: Generation of the Sinusoidal wave in Discrete
       time mode through SCILAB code
7
8
9  //Generation of a sinusoidal sequence
10 clear; clc;
11 n=0:40; //Length of sequence
12 f=0.05; // Frequency
13 phase=0;
14 A=1.5;//Amplitude
15 x1=A*sin(2*%pi*f*n-phase);
16 subplot(3,1,1);
```

```
17 plot2d3('gnn',n,x1);                                    //
      plot2d3('gnn',n,x1) in discrete form
18 a = gca();                                              //
      get the current axes
19 a.x_location = "origin";                                //
      To Change reference axis
20 a.y_location = "origin";
21 title("sinusoidal sequence","fontsize",4)
22 xlabel("Time in (ms)","fontsize",4)
23 ylabel("Amplitude","fontsize",4)
24 set(gca(),"data_bounds",matrix([0,40,-2,2],2,-1));
      // Range of Axis
25
26 x2=A*cos(2*%pi*f*n-phase);
27 subplot(3,1,2);
28 plot2d3('gnn',n,x2);
29 a = gca();                                              //
      get the current axes
30 a.x_location = "origin";                                //
      To Change reference axis
31 a.y_location = "origin";
32 title("cosine sequence","fontsize",4)
33 xlabel("Time in (ms)","fontsize",4)
34 ylabel("Amplitude","fontsize",4)
35 set(gca(),"data_bounds",matrix([0,40,-2,2],2,-1));
36
37 x3=A*cos(2*%pi*f*n+120);
38 subplot(3,1,3);
39 plot2d3('gnn',n,x3);
40 a = gca();                                              //
      get the current axes
41 a.x_location = "origin";                                //
      To Change reference axis
42 a.y_location = "origin";
43 title("phase shifted cosine sequence","fontsize",4)
44 xlabel("Time in (ms)","fontsize",4)
45 ylabel("Amplitude","fontsize",4)
46 set(gca(),"data_bounds",matrix([0,40,-2,2],2,-1));
```

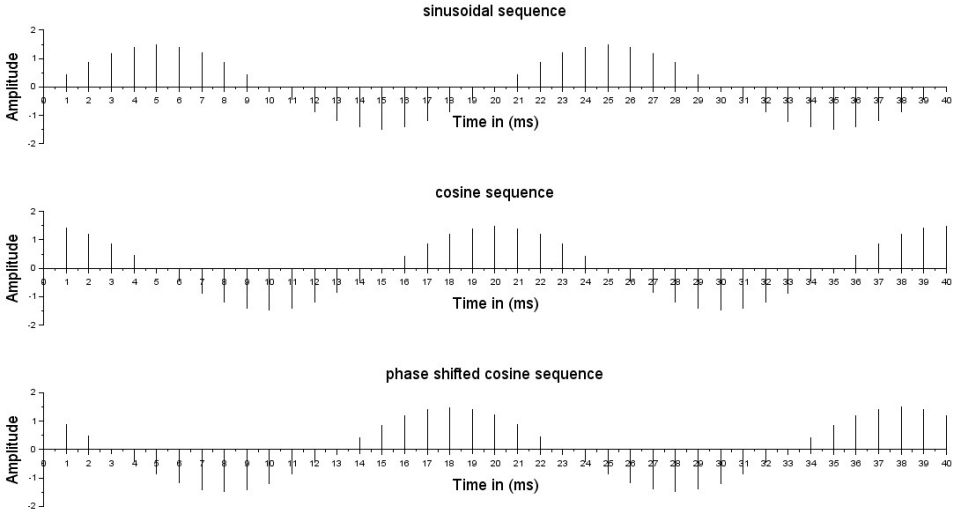

Figure 2.1: Exp2

Experiment: 3

Plotting of exponential sequence and complex exponential sequence

Scilab code Solution 3.3 Exp3

```
1  //Experiment-3
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5
6  //Plotting of exponential sequence and complex
       exponential sequence
7
8  // Generation of exponential sequence
9  clear; clc;
10 n=0:20;
11 a1=2;
12 k=0.5;
13 x1=k*a1.^n;
14 f4=scf(1);
15 figure(1)
16 subplot(2,2,1)
```

```
17 plot2d3('gnn',n,x1);          // graph in discrete
      form
18 xlabel("Time in (sec.)","fontsize",4);
19 ylabel("Amplitude","fontsize",4);
20 a2=0.9;
21 x2=k*a2.^n;
22 subplot(2,2,2)
23 plot2d3('gnn',n,x2);
24 xlabel("Time in (sec.)","fontsize",4);
25 ylabel("Amplitude","fontsize",4);
26 a3=-2;
27 x3=k*a3.^n;
28 subplot(2,2,3)
29 plot2d3('gnn',n,x3);
30 a = gca();                                          //
      get the current axes
31 a.x_location = "origin";                           //
      To Change reference axis
32 a.y_location = "origin";
33 xlabel("Time in (sec.)","fontsize",4);
34 ylabel("Amplitude","fontsize",4);
35 a4=-0.9;
36 x4=k*a4.^n;
37 subplot(2,2,4)
38 plot2d3('gnn',n,x4);
39 a = gca();                                          //
      get the current axes
40 a.x_location = "origin";                           //
      To Change reference axis
41 a.y_location = "origin";
42 xlabel("Time in (sec.)","fontsize",4);
43 ylabel("Amplitude","fontsize",4);
44
45
46
47
48 //Generatioin of a complex exponential sequence
49
```

```
clear; clc;
n=0:20;
w=%pi/6;
x=exp(%i*w*n);
f4=scf(2);
figure(2)
subplot(2,1,1);
plot2d3('gnn',n,real(x));
a = gca();                                          //
   get the current axes
a.x_location = "origin";                            //
   To Change reference axis
a.y_location = "origin";
xlabel("Time in (sec.)","fontsize",4)
ylabel("Amplitude","fontsize",4)
title("Real Part","fontsize",4);
subplot(2,1,2);
plot2d3('gnn',n,imag(x));
a = gca();                                          //
   get the current axes
a.x_location = "origin";                            //
   To Change reference axis
a.y_location = "origin";
xlabel("Time in (sec.)","fontsize",4)
ylabel("Amplitude","fontsize",4)
title("Imaginary Part","fontsize",4)


// Generation of comlex exponential sequence

clear; clc;
a=input("Type in real exponent = ");
b=input("Type in imaginary exponent = ");
c= a+b*%i;                                          //a+j*b
   for imaginary value
K=input("Type in the gain constant = ");
N=input("Type in length of sequence = ");
n=1:N;
```

```
83  x=K*exp(c*n); //generate the sequence
84  f4=scf(3);
85  figure(3)
86  subplot(2,1,1);
87  plot2d3('gnn',n,real(x));                          //
       real(x) = gives real component
88  a = gca();                                         //
       get the current axes
89  a.x_location = "origin";                           //
       To Change reference axis
90  a.y_location = "origin";
91  xlabel("Time in (sec.)","fontsize",4)
92  ylabel("Amplitude","fontsize",4)
93  title("Real Part","fontsize",4);
94  subplot(2,1,2)
95  plot2d3('gnn',n,imag(x));                          //
       imag(x) = gives imaginary component
96  a = gca();                                         //
       get the current axes
97  a.x_location = "origin";                           //
       To Change reference axis
98  a.y_location = "origin";
99  xlabel("Time in (sec.)","fontsize",4)
100 ylabel("Amplitude","fontsize",4)
101 title("Imaginary Part","fontsize",4)
102
103 //For Example
104
105 // Type in real exponent = -0.0833
106 // Type in imaginary exponent = 0.5236
107 // Type in the gain constant = 1.5
108 // Type in length of sequence = 40
```

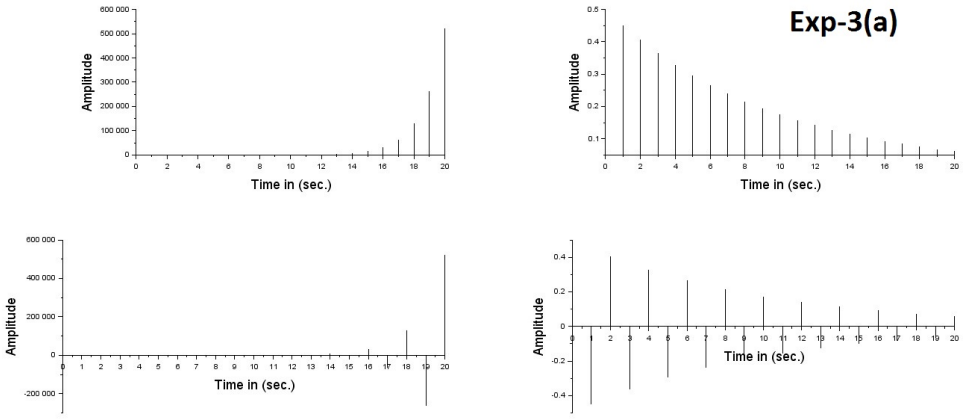

Figure 3.1: Exp3

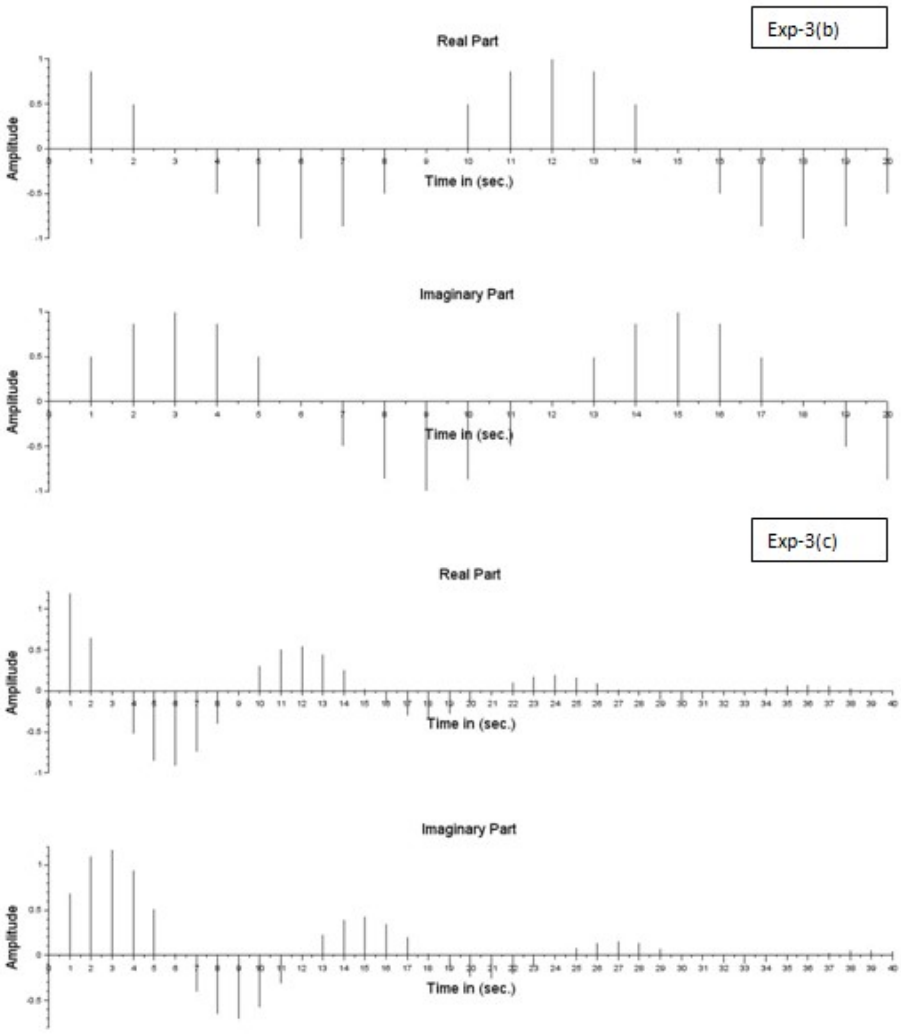

Figure 3.2: Exp3

Experiment: 4

Performing cross correlation operation using SCILAB code

Scilab code Solution 4.4 Exp4

```
1  //Experiment-4
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5
6  // AIM : Performing Cross Correlation Operation
       using SCILAB code
7
8  clear; clc;
9
10 n1=[-1,0,1]
11 x1=[1,2,3]
12 f4=scf(1);
13 figure(1)
14 subplot(2,2,1)
15 plot2d3('gnn',n1,x1);
16 a = gca();                                        //
       get the current axes
17 a.x_location = "origin";                          //
```

```
    To Change reference axis
a.y_location = "origin";
xlabel("Reference Axis","fontsize",3);
ylabel("Amplitude","fontsize",3);
title("Sequence-1","fontsize",3);
n2=[-1,0,1]
x2=[4,5,6]
subplot(2,2,2)
plot2d3('gnn',n2,x2);
a = gca();                                          //
    get the current axes
a.x_location = "origin";                            //
    To Change reference axis
a.y_location = "origin";
xlabel("Reference Axis","fontsize",3);
ylabel("Amplitude","fontsize",3);
title("Sequence-2","fontsize",3);
[c, ind]=xcorr(x1,x2)                 // function of cross
    correlation
[ind',c']
subplot(2,2,3)
plot2d3('gnn',c)
a = gca();                                          //
    get the current axes
a.x_location = "origin";                            //
    To Change reference axis
a.y_location = "origin";
xlabel("Reference Axis","fontsize",3);
ylabel("Amplitude","fontsize",3);
title("Cross- Correlation Sequence","fontsize",3);


clear; clc;

x=input ("Type in the refrence sequence = ");
y=input ("Type in the second sequence = ");

//compute the correlation sequence
```

```
50
51 n1=length(y)-1;
52 n2=length(x)-1;
53 r=conv(x,y);
54 k=(-n1):n2;
55 f4=scf(2);
56 figure(2)
57 plot2d3('gnn',k,r);
58 a = gca();                                          //
      get the current axes
59 a.x_location = "origin";                           //
      To Change reference axis
60 a.y_location = "origin";
61 xlabel("Lag index","fontsize",4);
62 ylabel("Amplitude","fontsize",4);
63
64
65
66 //For Example
67
68 //Type in the refrence sequence =
      [2,-1,3,7,1,2,-3,0]
69 //Type in the second sequence = [1,-1,2,-2,4,1,-2,5]
```

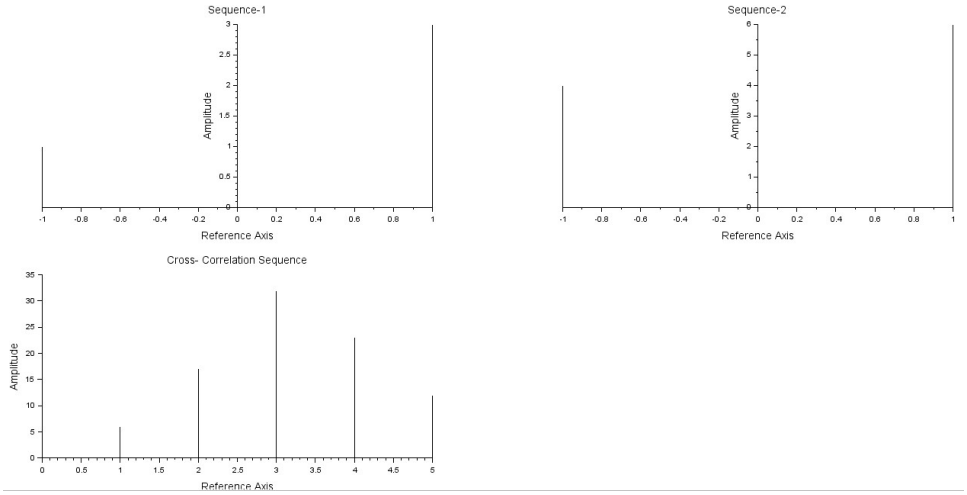

Figure 4.1: Exp4

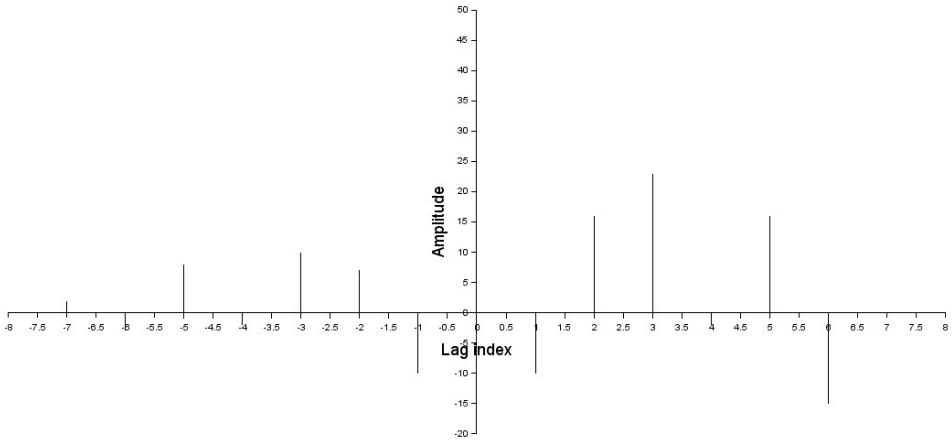

Figure 4.2: Exp4

Experiment: 5

Performing auto correlation operation using Scilab code

Scilab code Solution 5.3 Exp5

```
1  //Experiment-5
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5  //5
6
7  //AIM: Performing Auto Correlation Operation using
       SCILAB code
8
9  clear; clc;
10 x=[2,-1,3,7,1,2,-3,0]
11 [c,ind]=xcorr(x)
12 [ind' c']
13 plot2d3("gnn",c)
14 a = gca();                                          //
       get the current axes
15 a.x_location = "origin";                            //
       To Change reference axis
16 a.y_location = "origin";
```

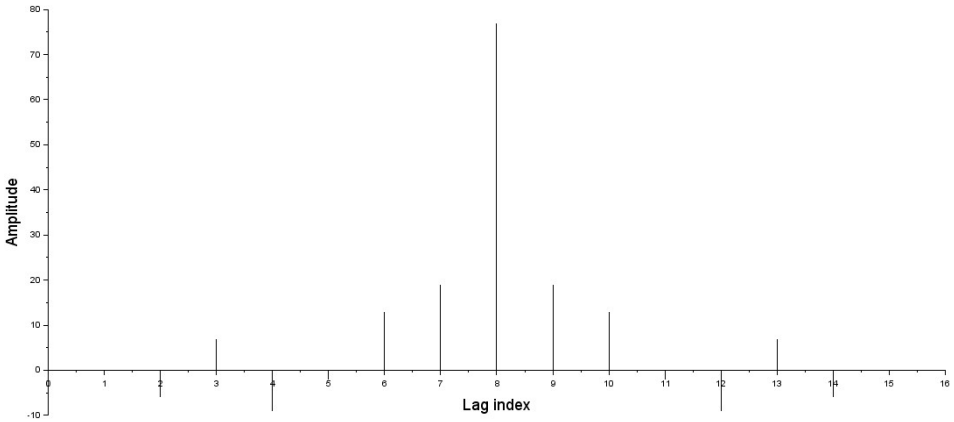

Figure 5.1: Exp5

```
17 xlabel("Lag index","fontsize",4);
18 ylabel("Amplitude","fontsize",4);
```

Experiment: 6

A Scilab program to perform addition of sequences

Scilab code Solution 6.6 Exp6

```
1  //Experiment-6
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5  //A SCILAB program to perform Addition of sequences
6  clc;
7  clear;
8  i=1:20;
9  n1=[ones(1,10),zeros(1,10)];              //Discrete
       Signal
10 n2=[zeros(1,6),ones(1,6),zeros(1,8)];     //Discrete
       Signal
11 n3=n1+n2;                                 //Addition
       of two discrete Signals
12 //n4=n1-n2;                                 //
       Subtraction of two discrete Signals
13 subplot(2,2,1);
14 plot2d3 (i,n1);
15 xlabel('Reference Axis',"fontsize",4);
```

```
16 ylabel('Amplitude',"fontsize",4);
17 title('1st Signal',"fontsize",4);
18 subplot(2,2,2);
19 plot2d3 (i,n2);                          //plot2d3('
     gnn',n,x1) in discrete form
20 xlabel('Reference Axis',"fontsize",4);
21 ylabel('Amplitude',"fontsize",4);
22 title('2nd Signal',"fontsize",4);
23 subplot(2,2,3);
24 plot2d3(i,n3);
25 xlabel('Reference Axis',"fontsize",4);
26 ylabel('Amplitude',"fontsize",4);
27 title('Addition of two discrete Signals',"fontsize"
     ,4);
28 subplot(2,2,4);
29 plot(i,n3);                              // Plot
     Continuous Signal
30 xlabel('Reference Axis',"fontsize",4);
31 ylabel('Amplitude',"fontsize",4);
32 title('Addition of two continuous Signals',"fontsize
     ",4);
33 set(gca(),"data_bounds",matrix([0,20,0,2.5],2,-1));
      // Range of axis
34 //subplot(2,3,5);
35 //plot2d3(i,n4);
36 //a = gca();                                    //
     get the current axes
37 //a.x_location = "origin";                      //
     To Change reference axis
38 //a.y_location = "origin";
39 //xlabel('time');
40 //ylabel('amplitude');
41 //title('Subtraction of two discrete Signals');
42 //subplot(2,3,6);
43 //plot(i,n4);
44 //xlabel('time');
45 //ylabel('amplitude');
46 //title('Subtraction of two continuous Signals');
```

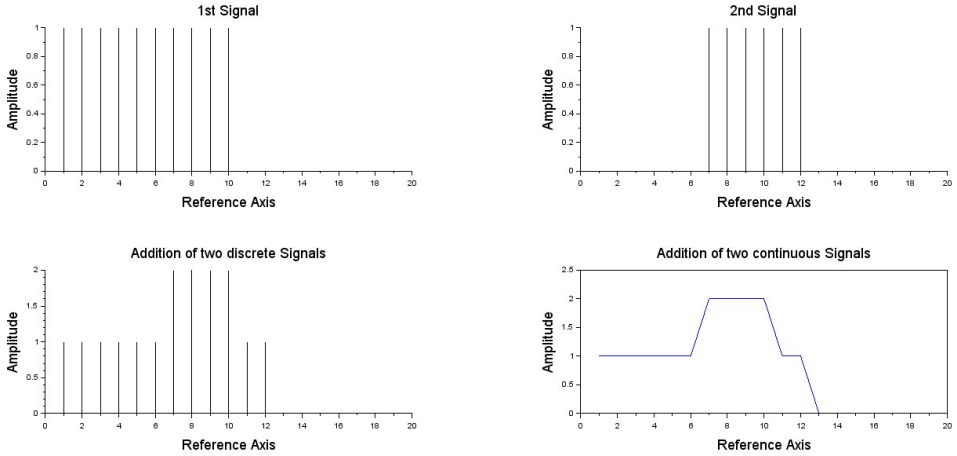

Figure 6.1: Exp6

47 //

Experiment: 7

A Scilab program to perform multiplication and folding of sequences

Scilab code Solution 7.7 Exp7

```
1  //Experiment-7
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5  //A SCILAB program to perform Multiplication and
       Folding of sequences
6
7  clc;
8  clear;
9  i=0:6;
10 n1=[zeros(1,3),ones(1,4)];
11 n2=i-2;                          //Advancing Shifting
       Signal
12 n3=i+2;                          //Delay Shifting
       Signal
13 n4=i;                            //Folded Signal
14 //n5=n1+n2;                       //Addition of
```

```
    Signals
15 n6=n3.*n4;                          //Multiplication of
    Signals
16 subplot(3,1,1);
17 plot2d3(i,n1);
18 xlabel('Reference Axis',"fontsize",4);
19 ylabel('Amplitude',"fontsize",4);
20 title('Sample Signal',"fontsize",4);
21 //subplot(3,2,2);
22 //plot2d3(i,n2);
23 //a = gca();                                          //
    get the current axes
24 //a.x_location = "origin";                            //
    To Change reference axis
25 //a.y_location = "origin";
26 //xlabel('time');
27 //ylabel('amplitude');
28 //title('Advancing Shifting Signal');
29 //subplot(3,2,3);
30 //plot2d3(i,n3);
31 //a = gca();                                          //
    get the current axes
32 //a.x_location = "origin";                            //
    To Change reference axis
33 //a.y_location = "origin";
34 //xlabel('time');
35 //ylabel('amplitude');
36 //title('Delay Shifting Signal');
37 subplot(3,1,2);
38 plot2d3(i,n4);
39 xlabel('Reference Axis',"fontsize",4);
40 ylabel('Amplitude',"fontsize",4);
41 title('Folded Signal',"fontsize",4);
42 //subplot(3,2,5);
43 //plot2d3(i,n5);
44 //a = gca();                                          //
    get the current axes
45 //a.x_location = "origin";                            //
```

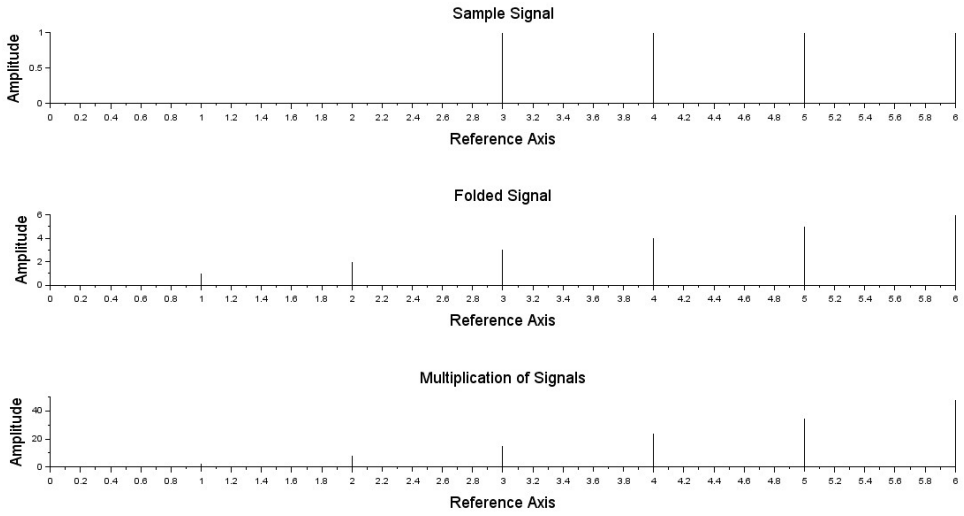

Figure 7.1: Exp7

```
    To Change reference axis
//a.y_location = "origin";
//xlabel('time');
//ylabel('amplitude');
//title('Addition of Signals');
subplot(3,1,3);
plot2d3(i,n6);
xlabel('Reference Axis',"fontsize",4);
ylabel('Amplitude',"fontsize",4);
title('Multiplication of Signals',"fontsize",4);
```

Experiment: 8

Scilab code to demonstrate amplitude Modulation concept

Scilab code Solution 8.8 Exp8

```
1 //Experiment-8
2 // windows - 10 - 64-Bit
3 //Scilab - 5.4.1
4
5
6 //SCILAB code to demonstrate Amplitude Modulation
     concept
7
8 clear; clc;
9 t=0:0.001:1;
10 Am=5;//Amplitude of signal
11 Ac=5;
12 fm=input("Message frequency=");//Accepting input
     value
13 fc=input("Carrier frequency=");//Accepting input
     value (fc>fa)
14 mi=input("Modulation Index=");//Modulation Index
15 Sm=Am*sin(2*%pi*fm*t);//Message Signal
16 subplot(3,1,1);
```

```
17 plot(t,Sm);
18 xlabel("Time in (sec.)","fontsize",4);
19 ylabel("Amplitude","fontsize",4);
20 title("Message Signal","fontsize",4);
21 Sc=Ac*sin(2*%pi*fc*t);//Carrier Signal
22 subplot(3,1,2);
23 plot(t,Sc);
24 xlabel("Time in (sec.)","fontsize",4);
25 ylabel("Amplitude","fontsize",4);
26 title("Carrier Signal","fontsize",4);
27 Sam=(Ac+mi*Sm).*sin(2*%pi*fc*t);//AM Signal
28 subplot(3,1,3);
29 plot(t,Sam);
30 xlabel("Time in (sec.)","fontsize",4);
31 ylabel("Amplitude","fontsize",4);
32 title("AM Signal","fontsize",4);
33
34
35 //For Example
36 //fm = 3
37 //fc = 50
38 //mi = 1
```

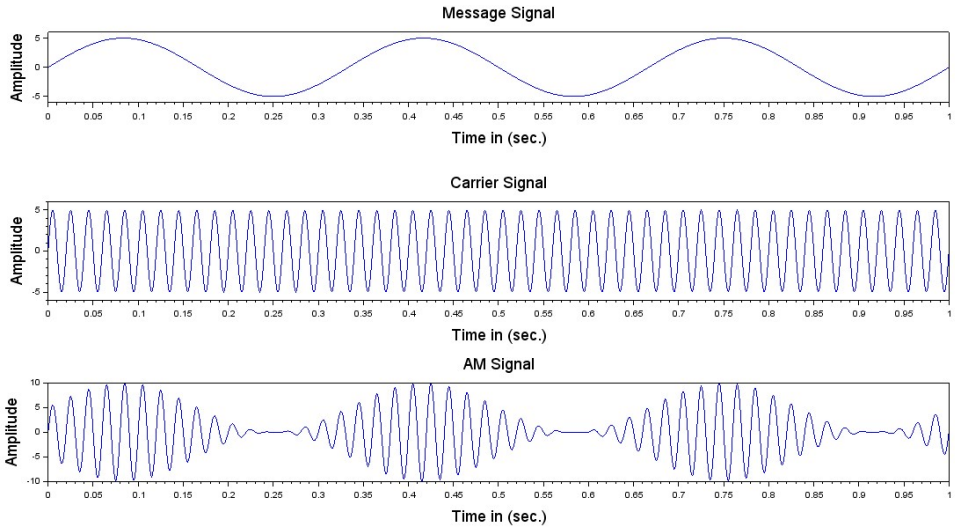

Figure 8.1: Exp8

Experiment: 9

Scilab code to demonstrate frequency Modulation concept

Scilab code Solution 9.9 Exp9

```
1  //Experiment-9
2  // windows - 10 - 64-Bit
3  //Scilab - 5.4.1
4
5
6  //SCILAB code to demonstrate Frequency Modulation
       concept
7
8  clear; clc;
9  fm=input("Message frequency=");//Accepting input
       value
10 fc=input("Carrier frequency=");//Accepting input
       value (fc>fa)
11 mi=input("Modulation Index=");//Modulation Index
12 t=0:0.0001:0.1;
13 Sm=sin(2*%pi*fm*t);
14 subplot(3,1,1);
15 plot(t,Sm);
16 xlabel("Time in (sec.)","fontsize",4);
```

```
17 ylabel("Amplitude","fontsize",4);
18 title("Message Signal","fontsize",4);
19 Sc=sin(2*%pi*fc*t);
20 subplot(3,1,2);
21 plot(t,Sc);
22 xlabel("Time in (sec.)","fontsize",4);
23 ylabel("Amplitude","fontsize",4);
24 title("Carrier Signal","fontsize",4);
25 Sfm=sin(2*%pi*fc*t+(mi.*sin(2*%pi*fm*t))); //
     Frequency changing w.r.t Message
26 subplot(3,1,3);
27 plot(t,Sfm);
28 xlabel("Time in (sec.)","fontsize",4);
29 ylabel("Amplitude","fontsize",4);
30 title("FM Signal","fontsize",4);
31
32
33 //For Example
34
35 //Message frequency=25
36 //Carrier frequency=400
37 //Modulation Index=5
```

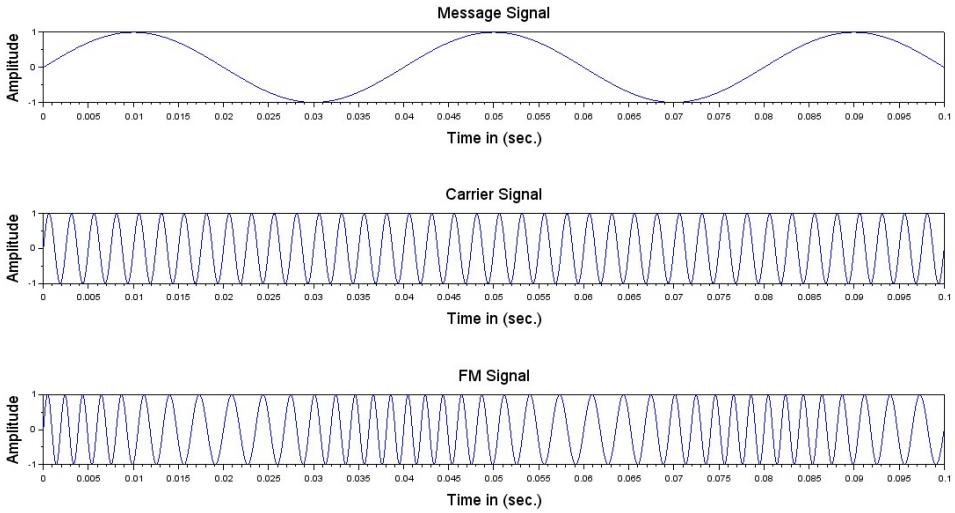

Figure 9.1: Exp9