Scilab Textbook Companion for Signals and Systems by P. R. Babu and R. Anandanatarajan[1]

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Book Description

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

Contents

List of Scilab Codes

Chapter 1

Signals an introduction

Scilab code Exa 1.7 Sketch the following signals

```
1  //Example 1_7_<i>
2  //Sketch the following signal.
3  clc;
4  clear all;
5  t=-5:1/1000:5;
6  for i=1:length(t)
7      if t(i)>1 then
8          x(i)=0;
9      else
10         x(i)=1;
11     end
12 end
13 f=scf(0);
14 plot2d(t,x);
15 plot(t,x,'red');
16 xtitle('Required figure','t','x(t)');
17 xgrid();
18 xs2jpg(0, 'problem1_7_i-plot.jpg');
19 //Example 1_7_<ii>
20 //Sketch the following signal.
21 clc;
```

```
t=-5:1/1000:5;
for i=1:length(t)
    if t(i)<1 then
        x(i)=0;
    else
        x(i)=1;
    end
end
for i=1:length(t)
    x1(i)=-2*x(i);
end
//figure
f=scf(0);
plot2d(t,x);
xtitle('required figure','t','x(t)');
xs2jpg(0, 'problem1.7.2-plot-a.jpg');
//figure
f=scf(1);
plot2d(t,x1);
plot(t,x1,'blue');
xtitle('Required figure','t','x1(t)');
xs2jpg(1, 'problem1.7.2-plot-b.jpg');
```

Scilab code Exa 1.8 Sketch the following signals

```
//Example 1.8.<i>
//Sketch the following signal
clc;
clear all;
t=-10:.001:10;
for i=1:length(t)
    if t(i)>=-2 & t(i)<3 then
        x(i)=1;
    else
        x(i)=0;
```

```
11      end
12  end
13  //figure
14  f=scf(0);
15  plot2d(t,x);
16  xtitle('Required figure','t','x(t)');
17  xs2jpg(0, 'EX1_8_1-plot.jpg');
18  //Example 1.8.<ii>
19  //Sketch the following signal.
20  clc;
21  clear all;
22  t=-10:.001:10;
23  for i=1:length(t)
24      if t(i)>=0 & t(i)<=2 then
25          x(i)=1;
26      else
27          x(i)=0;
28      end
29  end
30  //figure
31  f=scf(0);
32  plot2d(t,x,1);
33  xtitle('Required figure','t','x(t)');
34  xs2jpg(0, 'EX1_8_2-plot.jpg');
```

Scilab code Exa 1.12 Check whether the given signal is periodic or not

```
1  //Example 1.12<i>
2  //check whether the given signal is periodic or not
3  clc;
4  t=-5:.01:5;
5  x=%i*(exp(%i*5*t));
6  subplot(311)
7  plot(t,x);
8  disp('(a)This shows that the given signal is
```

```
    periodic with priod(.4*%pi)');
//Example 1.12<ii>
//Show whether the given signal is periodic or not
clc;
t=-1/5:0.001:1/5;
x=sin(50*%pi*t);
subplot(312)
plot(t,x);
disp('(b)the plotting shows that the given signal is
     periodic with period 1/25');
//Example 1.12.<iii>
//Check whether the given signal is periodic or not
clc;
t=-1:0.01:1;
x=20*cos((10*%pi*t)+(%pi/6));
subplot(313)
plot(t,x);
disp('(c)Plot shows that the given signal is
    periodic with period .2');

disp('In the figure we have the plots of part (a) -
    (c) in clockwise order strating from the top left
    ')
```

Scilab code Exa 1.13 Check whether the given signal is periodic or not

```
//Example 1.13<i>
//Check whether the given signal is periodic or not
clc;
t=-10:.01:10;
y=2*cos(10*t+1)-sin(4*t-1);
subplot(221)
plot(t,y);
disp('(a) The following signal is periodic with
    period %pi' );
```

```
9  //Example 1.13<ii>
10 //Show whether the given signal is periodic or not
11 clc;
12 t=-1:.01:1;
13 x=cos(60*%pi*t)+sin(50*%pi*t);
14 subplot(222)
15 plot(t,x);
16 disp('(b)Ther following figure shows that the given
      signal is periodic with the following period');
17 //Example1.13<iv>
18 //Check whether the given signal is periodic or not
19 clc;
20 t=-10:0.01:10;
21 x=3*cos(4*t)+2*sin(%pi*t);
22 subplot(223)
23 plot(t,x);
24 disp('(c)The signal is not periodic since ratio of
      two time periods is %pi/4 which is not rational
      number');
25 //Example 1.13<V>
26 //Check whether the given signal is periodic or not
27 clc;
28 t=0:10;
29 for i=1:length(t)
30     u(i)=1;
31 end
32 x=u(i)-(1/2);
33 subplot(224)
34 plot(t,x);
35 disp('(d)The signal is not periodic as seen from
      figure');
36
37 disp('In the figure we have the plots of part (a) -
      (d) in clockwise order strating from the top left
      ')
```

Scilab code Exa 1.14 Check whether the given signal is periodic or not

```
1 //Example 1.14<i>
2 //Find whether the following signal is periodic or
     not
3 clc;
4 n=-10:10;
5 x=cos(2*%pi*n);
6 subplot(321)
7 plot2d(n,x);
8 f=(2*%pi)/(2*%pi);//where f is the no of cycles/
     sample.
9 N=1/f;//where N is the no of samples per cycle.
10 disp('samples',N,'(a)The given signal is periodic');
11 //Example 1.14<ii>
12 //Find whether the following signal is periodic or
     not.
13 clc;
14 n=-20:20;
15 x=exp(%i*6*%pi*n);
16 subplot(322)
17 plot2d3(n,x);
18 f=(6*%pi)/(2*%pi);//where f is the no of cycles per
     sample.
19 N=1/f;//where N is the no of samples per cycle.
20 disp('samples',N,'(b)the given signal is periodic');
21 //example 1.14<1v>
22 //Find whether the given signal is periodic or not
23 clc;
24 n=-30:30;
25 x=exp(%i*(2*%pi/3)*n)+exp(%i*(3*%pi/4)*n);
26 subplot(323)
27 plot2d3(n,x);
28 disp('(c)The given signal is periodic');
```

```
29 //Example 1.14<v>
30 //Find whether the given signal is periodic or not;
31 clc;
32 n=-20:20;
33 x=exp(%i*(3*%pi/5)*(n+1/2));
34 subplot(324)
35 plot(n,x);
36 f=(3*%pi/5)/(2*%pi);//where f is the no of cycles
      per sample.
37 N=1/f;//where n is the no of samples per cycle.
38 disp('samples',N,'(d)the given signal is periodic');
39 //Example1.14<vi>
40 //whether the given signal is periodic or not
41 clc;
42 n=-40:40;
43 x=12*cos(20*n);
44 subplot(325)
45 plot(n,x);
46 f=20/(2*%pi);//where f is the no of cycles per
      sample
47 N=1/f;//where n is the no of sample per cycle
48 disp('samples',N,'(e)the given signal is not peridic
      ');
49
50 disp('In the figure we have the plots of part (a) -
      (d) in clockwise order strating from the top left
      ');
```

Scilab code Exa 1.15 Find the even and odd components of the signals

```
1 //Example 1.15<i>
2 //Find the even and odd components of the signal
3 clc;
4 clear;
5 t=-10:.1:10;
```

```
for j=1:length(t)
    i=t(j);
    x(j)=cos(i)+sin(i)+cos(i)*sin(i);
    y(j)=cos(-i)+sin(-i)+cos(-i)*sin(-i);
    e(j)=(1/2)*(x(j)+y(j));
    o(j)=(1/2)*(x(j)-y(j));
end
disp('In the plot even component is in red and odd
   component is in blue')
plot(t,e,'red')
plot(t,o,'blue')
//Example 1.15<ii>
//Find the even and odd components of the signal
clc;
clear;
n=-2:2;
c=3;
x=[-2 1 2 -1 3];
for j=1:length(n)
    i=n(j);
    xe(j)=(1/2)*(x(c+i)+x(c-i));
    xo(j)=(1/2)*(x(c+i)-x(c-i));
end
xe=[xe(c-2),xe(c-1),xe(c+0),xe(c+1),xe(c+2)];
xo=[xo(c-2),xo(c-1),xo(c+0),xo(c+1),xo(c+2)];

disp(xo,'odd component')
disp(xe,'even component')
```

Scilab code Exa 1.16 Determine power and rms value of the following signal

```
//Example 1.16
//Determine the power of the signal
clc;
```

```
A=2;
theta=0;
t=0:0.001:10;
y=A*cos(2*%pi*t+theta);
P=(integrate('A^2*(cos(2*%pi*t))^2','t',0,2*%pi))
   /(2*%pi);
disp(P,'power of the signal is:');
y=round(P);
disp(y,'The given signal is power signal as power is
    finite');
```

Scilab code Exa 1.17 Determine power and rms value of the signals

```
//Example 1.17<i>
//Determine the power and the rms value of the
   signal
clc;
t=0:0.001:10;
y=5*cos(50*t+%pi/3);
P=(integrate('5^2*(cos(50*t))^2','t',0,2*%pi))/(2*
   %pi);
rmsvalue=sqrt(P);
disp(P,'The power of the given signal is:');
disp(rmsvalue,'the rms value is:');
//Example 1.17<ii>
//Determine the power amd rms value of the signal
clc;
t=0:0.001:10;
x1=10*sin(50*t+%pi/4);
x2=16*cos(100*t+%pi/3);
P1=(integrate('10^2*(sin(50*t))^2','t',0,2*%pi))/(2*
   %pi);
P2=(integrate('16^2*(cos(100*t))^2','t',0,2*%pi))
   /(2*%pi);
P=P1+P2;
```

```
19 rmsvalue=sqrt(P);
20 disp(P,'The power of the given signal is:');
21 disp(rmsvalue,'the rms value is:');
22 //Example 1.17 <iii>
23 //Determine the power and rms value of the signal
24 clc;
25 t=0:0.001:10;
26 x1=5*cos(15*t);
27 x2=5*cos(5*t);
28 P1=(integrate('5^2*(cos(15*t))^2','t',0,2*%pi))/(2*
      %pi);
29 P2=(integrate('5^2*(cos(5*t))^2','t',0,2*%pi))/(2*
      %pi);
30 P=P1+P2;
31 rmsvalue=sqrt(P);
32 disp(P,'The power of the given signal is:');
33 disp(rmsvalue,'the rms value is:');
```

Scilab code Exa 1.19.a Sketch the followins signal and calculate the energy

```
1 //Example 1.19.1
2 //whether the signal is energy signal or power
     signal
3 clc ;
4  t =0:0.001:10;
5  y= exp (-10*t);
6  E= integrate ( ' ( exp(-10*t)) ^2 ' , ' t ' ,0 ,2*
     %pi );
7 disp (E, ' Energy o f the s i g n a l i s ' );
8  disp ( 'since the energy is finite hence it is
     energy signal');
9  figure
10 plot(t,y,'red');
11 xtitle('Required figure');
```

Scilab code Exa 1.21 Sketch the followins signal and calculate the energy

```
1  //Example 1.21<i>
2  //whether the signal is energy signal
3  clc ;
4   t =0:0.001:10;
5   y= exp (-3*t);
6   E= integrate ( ' ( exp(-3*t)) ^2 ' , ' t ' ,0 ,2*
       %pi );
7  disp (E, ' Energy o f the s i g n a l i s ' );
8   disp ( 'since the energy is finite , hence it is
       energy signal');
9   //example1.21<iii>
10 //show whethet x(t)=cost is a power or energy signal
11 clc;
12 t=0:0.01:100;
13 x=cos(t);
14 P=(integrate('cos(t)^2','t',0,2*%pi))/(2*%pi);
15 disp(P,'The power of the signal is:');
16 E=(integrate('cos(t)^2','t',0,2*%pi));
17 disp(E,'The energy is:');
18 disp('As t tends to infinity energy also tends to
      iinfinity but power remains finite.hence it is
      power signal');
19 //Example 1.21<iv>
20 //Find the energy of the signal
21 clc;
22 E=0;//initialize
23 for n=0:200
24     x(n+1)=(1/3)^n;
25 end
26 for n=0:200
27     E=E+x(n+1)^2;
28 end
```

```
29 if E<%inf then
30     disp(E,'The energy of the signal is;');
31 else disp('The given signal is not energy signal');
32 end
```

Scilab code Exa 1.22 Find which of the following signal is causal or non causal

```
1  //Example 1.22<i>
2  //Find whether the given signal is causal or not.
3  clear all;
4  clc;
5  t=-10:10;
6  a=.5;
7  for i=1:length(t)
8      if t(i)<0 then
9          x1(i)=0;
10     else
11         x1(i)=exp(a.*t(i));
12     end
13 end
14 causal=%t;
15 for i=1:length(t)
16     if t(i)<0 & x1(i)~=0 then
17         causal=%f;
18     end
19 end
20 disp(causal,"The statement that the system is causal
       is:");
21 //Example 1.22<ii>
22 //Find whether the given signal is causal or not.
23 clear all;
24 clc;
25 t=-10:10;
26 for i=1:length(t)
```

```
27      if t(i)>0 then
28          x2(i)=0;
29      else
30          x2(i)=exp(-2.*t(i));
31      end
32  end
33  causal=%t;
34  for i=1:length(t)
35      if t(i)<0 & x2(i)~=0 then
36          causal=%f;
37      end
38  end
39  disp(causal,"The statement that the system is causal
        is:");
40  //Example 1.22<iii>
41  //Find whether the given signal is causal or not.
42  clear all;
43  clc;
44  t=-10:10;
45  c=2;
46  for i=1:length(t)
47      x3(i)=sin(c.*t(i));
48      end
49  causal=%t;
50  for i=1:length(t)
51      if t(i)<0 & x3(i)~=0 then
52          causal=%f;
53      end
54  end
55  disp(causal,"The statement that the system is causal
        is:");
56  //Example 1.22<iv>
57  //Find whether the given signal is causal or not.
58  clear all;
59  clc;
60  n=-10:10;
61  for i=1:length(n)
62      if n(i)<-3 | n(i)>2 then
```

```
63          x1(i)=0;
64      else
65          x1(i)=1;
66      end
67      end
68  causal=%t;
69  for i=1:length(n)
70      if n(i)<0 & x1(i)~=0 then
71          causal=%f;
72      end
73  end
74  disp(causal,"The statement that the system is causal
        is:");
75  //Example 1.22<v>
76  //Find whether the given signal is causal or not.
77  clear all;
78  clc;
79  n=-10:10;
80  for i=1:length(n)
81      if  n(i)>-2 then
82          x2(i)=(1/2)^n(i);
83      else
84          x2(i)=0;
85      end
86      end
87  causal=%t;
88  for i=1:length(n)
89      if n(i)<0 & x2(i)~=0 then
90          causal=%f;
91      end
92  end
93  disp(causal,"The statement that the system is causal
        is:");
```

Chapter 2

Systems an introduction

Scilab code Exa 2.2 Find which of the following signal is causal or non causal

```
1  //Example 2.2<i>
2  //Find whether the given signal is causal or not.
3  clear all;
4  clc;
5  n=10;x1(1)=1;x2(1)=1;
6  for i=2:length(n)
7    x1(i)=i;
8     x2(i)=i-1;
9     y(i)=x1(i)+1 ./x2(i);
10     end
11 causal=%t;
12 for i=1:length(n)
13     if n(i)<0 &y(i)~=0 then
14         causal=%f;
15     end
16 end
17 disp(causal,"The statement that the system is causal
       is:");
18 //Example 2.2<ii>
19 //Find whether the given signal is causal or not.
```

```
clear all;
clc;
n=10;x1(1)=1;x2(1)=-1;
for i=2:length(n)
  x1(i)=i;
   x2(i)=i-2;
   y(i)=x1(i).*x1(i)+x2(i);
    end
causal=%t;
for i=1:length(n)
    if n(i)<0 &y(i)~=0 then
        causal=%f;
    end
end
disp(causal,"The statement that the system is causal
    is:");
//Example 2.2<vi>
//Find whether the given signal is causal or not.
clear all;
clc;
n=-10:10;
for i=1:length(n)
  x(i)=i;
   y(i)=(i.^2);
    end
causal=%t;
for i=1:length(n)
    if n(i)<0 &y(i)~=0 then
        causal=%f;
    end
end
disp(causal,"The statement that the system is causal
    is:");
```

Scilab code Exa 2.3 Check whether the following systems are linear or not

```
1  //Example 2.3<v>
2  //Check whether the following signal is linear or
       not.
3  clear;
4  close;
5  clc;
6  T=20;//length of the signal
7  A=5;
8  B=4;
9  for n=1:T
10     x(n)=n;
11     y(n)=A*x(n)+B;
12 end
13 x1=x;
14 y1=y;
15 for n=1:T
16     x2(n)=2;y2(n)=A*x2(n)+B;
17 end
18 z=y1+y2;
19 for n=1:T
20     y3(n)=A*(x1(n)+x2(n))+B;
21 end
22 if z==y3 then
23     disp('The following signal is linear');
24 else
25     disp('The following signal is non linear');
26 end
27 //Example 2.3<vi>
28 //Check whether the following signal is linear or
       not.
29 clear;
30 close;
31 clc;
32 T=20;//length of the signal
33 x1(1)=1;
34 x2(1)=2;
35 for n=2:T
36     x1(n)=n;
```

```
37      x2(n)=2*n;
38      y1(n)=(2*(x1(n)))+(1/x1(n-1));
39      y2(n)=(2*(x2(n)))+(1/x2(n-1));
40  end
41  z=y1+y2;
42  for n=2:T
43     y3(n)=(2*(x1(n)+x2(n)))+(1/(x1(n-1)+x2(n-1)));
44  end
45  if z==y3 then
46      disp('The following signal is linear');
47  else
48      disp('The following signal is non linear');
49  end
50  //Example 2.3<vii>
51  //Check whether the following signal is linear or
       not.
52  clear;
53  close;
54  clc;
55  T=20;//length of the signal
56  for n=1:T
57      x(n)=n;
58      y(n)=n*x(n);
59  end
60  x1=x;
61  y1=y;
62  for n=1:T
63      x2(n)=2;y2(n)=n*x2(n);
64  end
65  z=y1+y2;
66  for n=1:T
67      y3(n)=n*(x1(n)+x2(n));
68  end
69  if z==y3 then
70      disp('The following signal is linear');
71  else
72      disp('The following signal is non linear');
73  end
```

Scilab code Exa 2.4 Check whether the following systems are linear or not

```
1  //Example 2.4<i>
2  //Check whether the following signal is linear or
       not.
3  clear;
4  close;
5  clc;
6  T=20;//length of the signal
7  for n=1:T
8      x1(n)=n;x2(n)=2*n;
9      y1(n)=exp(x1(n));
10     y2(n)=exp(x2(n));
11 end
12 z=y1+y2;
13 for n=1:T
14     y3(n)=exp(x1(n)+x2(n));
15 end
16 if z==y3 then
17     disp('The following signal is linear');
18 else
19     disp('The following signal is non linear');
20 end
21 //Example 2.4<ii>
22 //Check whether the following signal is linear or
       not.
23 clear;
24 close;
25 clc;
26 T=20;//length of the signal
27 for n=1:T
28     x1(n)=n;x2(n)=2*n;
29     y1(n)=x1(n)*x1(n);
30     y2(n)=x2(n)*x2(n);
```

```
31 end
32 z=y1+y2;
33 for n=1:T
34     y3(n)=(x1(n)+x2(n))^2;
35 end
36 if z==y3 then
37     disp('The following signal is linear');
38 else
39     disp('The following signal is non linear');
40 end
41 //Example 2.4<iii>
42 //Check whether the following signal is linear or
     not.
43 clear;
44 close;
45 clc;
46 T=20;//length of the signal
47 for n=1:T
48     x1(n)=n;x2(n)=2*n;
49     y1(n)=n^2*(x1(n));
50     y2(n)=n^2*(x2(n));
51 end
52 z=y1+y2;
53 for n=1:T
54     y3(n)=n^2*(x1(n)+x2(n));
55 end
56 if z==y3 then
57     disp('The following signal is linear');
58 else
59     disp('The following signal is non linear');
60 end
```

Scilab code Exa 2.5 Determine whether the following systems are time invariant or not

```
1  //Example 2.5<i>
2  //Determine whether the following system is time
       invariant or not.
3  clc;
4  clear  all;
5  T=20;//length of the signal.
6  s=2;//shift
7  for n=1:T
8      x(n)=n;
9      y(n)=n*x(n);
10 end
11 IP=x(T-s);
12 OP=y(T-s);
13 if IP==OP then
14     disp('The given system is time invariant');
15 else
16     disp('The given system is  time variant');
17 end
18 //Example 2.5<ii>
19 //Determine whether the following system is time
       invariant or not.
20 clc;
21 clear  all;
22 T=-10:10;//length of the signal.
23 s=2;//shift
24 for n=1:length(T)
25     x(n)=2;
26     y(n)=x(n)*cos(50*%pi.*T(n));
27 end
28 IP=x(T(n)-s);
29 OP=y(T(n)-s);
30 if IP==OP then
31     disp('The given system is time invariant');
32 else
33     disp('The given system is  time variant');
34 end
35 //Example 2.5<vi>
36 //Determine whether the following signal is time
```

```
    invariant or not.
clc;
clear all;
N=10;
s=1//shift;
k=2;
for n=1:N
    x(n)=n;
end
for n=1:(N/k)
    y(n)=x(k*n);
end
ip=x(N-s);
op=y((N/k)-s);
if(ip==op) then
    disp('the following signal is time invariant');
else
    disp('The given signal is time variant');
//Example 2.5<vii>
//Determine whether the following signal is time
    invariant or not.
clc;
clear all;
T=20;
s=4;//shift
x(1)=1
for n=2:T
    x(n)=n;
    y(n)=x(n-1).*x(n-1);
end
inputshift=x(T-s);
outputshift=y(T-s);
if (inputshift==outputshift) then
    disp('The given signal is time invariant');
else
    disp('The given signal is  time variant');
end
```

Scilab code Exa 2.7 Check for the following systems

```
1  //Check for the following system.
2  //Example 2.7 <i>
3  clc;
4  clear ;//a>check whether static or dynamic
5  t=-10:.1:10;T=length(t)
6  s=2;
7  for i=1:length(t)
8      x(i)=i;
9      y(i)=abs(x(i));
10 end
11 if y(2)==x(2)& y(2)==x(1) then
12     disp('The given signal is dynamic' );
13 else
14     disp('the given signal is static');
15 end
16 //b>check whether linear or non linear
17 x1=x;
18 y1=y;
19 for i=1:length(t)
20     x2(i)=-2;
21     y2(i)=abs(x2(i));
22 end
23 for i=1:length(t)
24 z(i)=y1(i)+y2(i);
25 end
26 for i=1:length(t)
27     y3(i)=abs(x1(i)+x2(i));
28 end
29 if z==y3 then
30     disp('The given signal is linear');
31 else
32     disp('Not linear');
```

```
33 end
34 //c>check whether time invariant or not
35 IP=x(T-s);
36 OP=y(T-s);
37 if IP == OP then
38 disp('the given signal is time invariant');
39 else
40       disp('The given signal is not time invariant')
            ;
41     end
42 //Check for the following systems
43 //Example 2.7 <ii>
44 clc;
45 clear all;//a>check whether static or dynamic
46 t=0:5;T=length(t);w=1;
47 s=2;
48 for i=1:length(t)
49     x(i)=i;
50     y(i)=x(i)*cos(w*t(i));
51 end
52 if y(2)==x(2)& y(2)==x(1) then
53     disp('The given signal is dynamic' );
54 else
55     disp('the given signal is static');
56 end
57 //b>check whether linear or non linear
58 x1=x;
59 y1=y;
60 for i=1:length(t)
61     x2(i)=2*i;
62     y2(i)=x2(i)*cos(w*t(i));
63     y3(i)=cos(w*t(i))*(x1(i)+x2(i));
64 end
65 z=y1+y2;
66 if z~=y3 then
67     disp('The given signal is not linear');
68 else
69     disp('linear');
```

```
70 end
71 //c>check whether time invariant or not
72 IP=x(T-s);
73 OP=y(T-s);
74 if IP == OP then
75 disp('the given signal is time invariant');
76 else
77       disp('The given signal is not time invariant')
            ;
78     end
```

Chapter 3

Time domain analysis of discrete time systems

Scilab code Exa 6.0 Example 6 0f question and answer section

```
1  //Example 6 0f question and answer section
2  clc;
3  clear; close;
4  n=-5:.01:5;
5  for i=1:length(n)
6      if n(i)<0 then
7          x(i)=0;h1(i)=0;h2(i)=0;
8      else
9          x(i)=1;h1(i)=2;h2(i)=3;
10     end
11     h3(i)=h1(i)+h2(i)//when in parallel
12     h4(i)=h1(i).*h2(i)//when in series
13 end
14 y1=convol(x,h3);
15 y2=convol(x,h4);
16 subplot(4,2,1);
17 plot(n,x,'black');
18 xtitle('x[n]');
19 subplot(4,2,2);
```

```
20 plot(n,h1,'red');
21 xtitle('h1[n]');
22 subplot(4,2,3);
23 plot(n,h2,'red');
24 xtitle('h2[n]');
25 subplot(4,2,4);
26 plot(n,h3,'blue');
27 xtitle('h3[n]');
28 subplot(4,2,5);
29 plot(n,h4,'blue');
30 xtitle('h4[n]');
31 subplot(4,2,6);
32 n1=-10:.01:10;
33 plot(n1,y1,'green');
34 xtitle('y1[n]');
35 subplot(4,2,7);
36 n1=-10:.01:10;
37 plot(n1,y2,'green');
38 xtitle('y2[n]');
```

Scilab code Exa 3.13 Represent the sequence as sum of shifted unit impulse

```
1 //example 3.13
2 //Represent the sequence as sum of shifted unit
     impulse.
3 clear ;
4  close ;
5  clc ;
6  t= -1:1:4;T=3;
7  x=[3 2 -1 2 4 1];
8  for i =1: length (t)
9  if modulo(t(i),3)==0 then
10 h(i)=1;
11 else
```

```
12  h(i)=0;
13  end
14  end
15  y = convol(x,h);
16  //figure
17  f=scf(0);
18  plot2d (t,h)
19  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
        );
20   xs2jpg(0, 'problem38-plot-a.jpg');
21 // figure
22 f=scf(1);
23  plot2d (t,x)
24  xtitle ( ' Input Re spons e ' , ' t' , ' x ( t ) '
      );
25   xs2jpg(1, 'problem38-plot-b.jpg');
26  //figure
27  f=scf(2);
28  a= gca ();
29  t1 =-2:1:8;
30  plot2d (t1 ,y)
31  xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t) '
        );
32   xs2jpg(2, 'problem38-plot-c.jpg');
```

Scilab code Exa 3.15 Determine the convolution sum of two sequences

```
1 //Example 3.15
2 //Determine the convolution sum of two sequences.
3 clc;
4 x=[1 4 3 2];
5 h=[1 3 2 1];
6 y=convol(x,h);
7 disp(y,'Convolution sum of the above two sequences
     is:");
```

Scilab code Exa 3.16 Determine the output response

```
1 //Example 3.16
2 //Determine the output response.
3 clc;
4 x=[1 2 3 2];
5 h=[1 2 2];
6 y=convol(x,h);
7 disp(y,'convolution of the above two sequences is:')
    ;
```

Scilab code Exa 3.17 Find the convolution of the sequences

```
1 //Example 3.17
2 //Find the convolution of the sequences.
3 x1=[1 -1 2 3];
4 x2=[1 -2 3 -1];
5 y=convol(x1,x2);
6 disp(y,'The convolution of the above sequences is:')
    ;
```

Scilab code Exa 3.18 Find the convolution

```
1 //Example 3.18
2 //Find the convolution.
3 clc;
4 x1=[1 -2 3 1];
5 x2=[2 -3 -2];
6 y=convol(x1,x2);
```

```
7 disp(y,'The convolution of the above two sequences
    is:');
```

Scilab code Exa 3.19 Find the convolution of the following sequence

```
1 //Example 3.19
2 //Find the convolution of the following sequence.
3 x=[2 -1 1 3];
4 h=[3 4 2];
5 y=convol(x,h);
6 disp(y,'the convolution of the above sequence is:');
```

Scilab code Exa 3.20 Find the convolution

```
1 //Example 3.20
2 //Find the convolution of h(n)=a^n*u(n) and x(n)=b^n
    *u(n)
3 clear;
4 clc;
5 close;
6 n=-10:1/100:10;
7 a=5;
8 b=3;
9 for i =1:length(n)
10     if n(i)<0 then
11         h(i)=0;
12         x(i)=0;
13     else
14         h(i)=a^n(i);
15         x(i)=b^n(i);
16     end;
17     end;
18     y=convol(h,x);
```

```
19 //     figure
20     f=scf(0);
21     plot(n,h,'black');
22     xtitle('input response1','n','h(n)');
23     xs2jpg(0, 'problem29-plot-a.jpg');
24 //     figure
25     f=scf(1);
26     plot(n,x,'red');
27     xtitle('input response2','n','x(n)');
28     xs2jpg(1, 'problem29-plot-b.jpg');
29     n1=-20:1/100:20;
30 //     figure
31     f=scf(2);
32     plot(n1,y,'green');
33     xtitle('output response','n1','y(n)');
34     xs2jpg(2, 'problem29-plot-c.jpg');
```

Scilab code Exa 3.21 Determine the response of the below relaxed system

```
1 //Example 3.21
2 //Determine the response of the below relaxed system
    .
3 clc;
4 close;
5  n=-10:.01:10;
6  for i=1:length(n)
7      if n(i)<0 then
8          h(i)=0;x(i)=0;
9      else
10         h(i)=(1/3)^n(i);
11         x(i)=2^n(i);
12     end
13 end
14 y=convol(h,x);
15 //figure
```

```
16  f=scf(0);
17  plot(n,h,'black');
18  xtitle('input response1','n','h(n)');
19  xs2jpg(0, 'problem29-plot-a.jpg');
20 // figure
21 f=scf(1);
22  plot(n,x,'red');
23  xtitle('input response2','n','x(n)');
24  xs2jpg(1, 'problem29-plot-b.jpg');
25 // figure
26 f=scf(2);
27  n1=-20:.01:20;
28  plot(n1,y,'green');
29  xtitle('output response','n','y(n)');
30  xs2jpg(2, 'problem29-plot-c.jpg');
```

Scilab code Exa 3.22 Find the response

```
1  //Example 3.22
2  clear ;
3   close ;
4   clc ;
5   t = -5:1/100:5;
6   for i =1: length (t)
7   if t(i) <0 then
8   h(i)=0;
9   x(i)=0;
10  else
11  h(i)=1;
12  x(i)=1;
13  end
14  end
15  y = convol (x,h) ;
16  //figure
17  f=scf(0);
```

```
18  plot2d (t,h)
19  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
        );
20  xs2jpg(0, 'problem31-plot-a.jpg');
21  //figure
22  f=scf(1);
23  plot2d (t,x)
24  xtitle ( ' Input Re spons e ' , ' t ' , ' x ( t ) '
        );
25  xs2jpg(0, 'problem31-plot-b.jpg');
26  //figure
27  f=scf(2);
28  a= gca ();
29  t1 = -10:1/100:10;
30  plot2d (t1 ,y)
31  xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t )
       ' );
32  xs2jpg(0, 'problem31-plot-c.jpg');
```

Scilab code Exa 3.23 Find the convolution of the following sequences

```
1  //example 3.23<i>
2  //Find the convolution sum
3  clear ;
4   close ;
5   clc ;
6   t= -5:1/100:5;
7   for i =1: length (t)
8   if t(i) <0 then
9   h(i)=0;
10  x(i)=0;
11  else
12  h(i)=2^t(i);
13  x(i)=1;
14  end
```

```
15  end
16  y = convol (x,h) ;
17  //figure
18  f=scf(0);
19  plot2d (t,h)
20  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
        );
21  xs2jpg(0, 'problem32-plot-a.jpg');
22  //figure
23  f=scf(1);
24  plot2d (t,x)
25  xtitle ( ' Input Re spons e ' , ' t' , ' x ( t ) '
      );
26  xs2jpg(1, 'problem32-plot-b.jpg');
27  //figure
28  f=scf(2);
29  a= gca ();
30  t1 = -10:1/100:10;
31  plot2d (t1 ,y)
32  xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t) '
        );
33  xs2jpg(2, 'problem32-plot-c.jpg');
34  //example 3.23<ii>
35 //Find the response using convolution sum
36 clear ;
37 clc;
38  close ;
39  t = -5:1/100:5;
40  for i =1: length (t)
41  if t(i) <0 then
42  h(i)=0;
43  x(i)=0;
44  elseif t(i)<3 then
45  h(i)=0;
46  x(i)=1;
47  else h(i)=1;x(i)=1;
48  end
49  end
```

```
50  y = convol (x,h) ;
51  //figure
52  f=scf(0);
53  plot2d (t,h)
54  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
        );
55  xs2jpg(0, 'problem33-plot-a.jpg');
56  //figure
57 f=scf(1);
58  plot2d (t,x)
59  xtitle ( ' Input Re spons e ' , ' t ' , ' x ( t ) '
        );
60  xs2jpg(1, 'problem33-plot-b.jpg');
61  //figure
62  f=scf(2);
63  a= gca ();
64  t1 = -10:1/100:10;
65  plot2d (t1 ,y)
66  xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t )
       ' );
67  xs2jpg(2, 'problem33-plot-c.jpg');
68 //example 3.23<iii>
69 //Find the response using convolution sum
70 clear ;
71  close ;
72  clc ;
73  t = -5:1/100:5;
74  for i =1: length (t)
75  if t(i) <0 then
76  h(i)=0;
77  x(i)=0;
78  elseif t(i)<1 then
79  h(i)=0;
80  x(i)=1;
81 elseif t(i)<=4 then h(i)=1;x(i)=1;
82 elseif t(i)<=7 then
83      h(i)=0;
84      x(i)=1;
```

```
85  end
86  end
87  y = convol (x,h) ;
88  //figure
89   f=scf(0);
90  plot2d (t,h)
91  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
        );
92  xs2jpg(0, 'problem34-plot-a.jpg');
93 // figure
94  f=scf(1);
95  plot2d (t,x)
96  xtitle ( ' Input Re spons e ' , ' t ' , ' x ( t ) '
        );
97  xs2jpg(1, 'problem34-plot-b.jpg');
98  //figure
99   f=scf(2);
100 t1 = -10:1/100:10;
101 plot2d (t1 ,y)
102 xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t )
      ' );
103 xs2jpg(2, 'problem34-plot-c.jpg');
```

Scilab code Exa 3.25 Find whether the systems are causal and stable

```
1  //Example 3.25<i>
2  //Find whether the system is causal and stable.
3  clear all;
4   clc ;
5   n = -5:5;
6   for i =1: length (n)
7   if(n(i) <=0)
8   h(i)=  2^n(i);
9   else
10  h(i)=0;
```

```
11  end
12  end
13  causal =%t;
14  for i =1: length (n)
15  if n(i) <0 & h(i) ~=0 then
16  causal =%f;
17  end
18  end
19  disp (causal,'The statement that the system is
       causal is:');
20   n =0:100000;
21  for i =1: length (n)
22  if(n(i) <=0)
23  h(i)=  2^n(i);
24  else
25  h(i)=0;
26  end
27  end
28  bibo =sum(h);
29  if (bibo < %inf ) then
30  disp (" system is bibo stable ");
31  else
32  disp (" systes not stable ");
33 end
34 //Example 3.25<ii>
35 //Find whether the system is causal and stable.
36 clear all;
37  clc ;
38  n = -5:5;
39  for i =1: length (n)
40  if(n(i) >=1)
41  h(i)=  exp(2*n(i));
42  else
43  h(i)=0;
44  end
45  end
46  causal =%t;
47  for i =1: length (n)
```

```
48  if n(i) <0 & h(i) ~=0 then
49  causal =%f;
50  end
51  end
52  disp (causal,'The statement that the system is
       causal is:');
53   n =0:100000;
54  for i =1: length (n)
55  if(n(i) >=1)
56  h(i)=  exp(2*n(i));
57  else
58  h(i)=0;
59  end
60  end
61  bibo =sum(h);
62  if (bibo < %inf ) then
63  disp (" system is bibo stable ");
64  else
65  disp (" system not stable ");
66  end
67 //Example 3.25<iii>
68 //Find whether the system is causal and stable.
69 clear all;
70  clc ;
71  n = -5:5;
72  for i =1: length (n)
73  if(n(i) <=3)
74  h(i)=  (5*n(i));
75  else
76  h(i)=0;
77  end
78  end
79  causal =%t;
80  for i =1: length (n)
81  if n(i) <0 & h(i) ~=0 then
82  causal =%f;
83  end
84  end
```

```
85  disp (causal,'The statement that the system is
       causal is:');
86   n =0:100000;
87  for i =1: length (n)
88  if(n(i) <=1)
89  h(i)=  (5*n(i));
90  else
91  h(i)=0;
92  end
93  end
94  bibo =sum(h);
95  if (bibo < %inf ) then
96  disp (" system is bibo stable ");
97  else
98  disp (" system not stable ");
99  end
100 //Example 3.2<iv>
101 //Find whether the system is causal and stable.
102 clear all;
103  clc ;
104  n = -5:5;
105  for i =1: length (n)
106  h(i)=  exp(-6*abs(n(i)));
107  end
108  causal =%t;
109  for i =1: length (n)
110  if n(i) <0 & h(i) ~=0 then
111  causal =%f;
112  end
113  end
114  disp (causal,'The statement that the system is
       causal is:');
115   n =0:100000;
116  for i =1: length (n)
117  h(i)= exp(-6*abs(n(i)));
118  end
119  bibo =sum(h);
120  if (bibo < %inf ) then
```

```
121  disp (" system is bibo stable ");
122  else
123  disp (" system not stable ");
124  end
```

Scilab code Exa 3.26 Find the step response

```
1  //Find the step response.
2  //Example 3.26<i>
3  clear;
4  close;
5  clc;
6  n=-5:.01:5;
7  for i=1:length(n)
8      if n(i)==2 then
9          del1(i)=1;
10         del2(i)=0;
11     elseif n(i)==3 then
12         del1(i)=0;del2(i)=1;
13     else
14         del1(i)=0;del2(i)=0;
15     end
16     x1(i)=del1(i)+del2(i);
17     if n(i)<0 then
18         x2(i)=0;
19     else
20         x2(i)=1;
21     end
22 end
23 y=convol(x1,x2);
24 //figure
25 f=scf(0);
26 plot(n,x1,'black');
27 xtitle('Delta function as input');
28  xs2jpg(0, 'problem39-plot-a.jpg');
```

```
29 //figure
30 f=scf(1);
31 plot(n,x2,'red');
32 xtitle('Unit function as input');
33  xs2jpg(1, 'problem39-plot-b.jpg');
34 //figure
35 f=scf(2);
36 n1=-10:.01:10;
37 plot(n1,y,'green');
38 xtitle('Step function as output');
39  xs2jpg(2, 'problem39-plot-c.jpg');
40 //Example 3.26 <ii>
41 //Find the step response.
42 clc;
43 clear;
44 close;
45 n=-5:.01:5;
46 a=6;
47 for i=1:length(n)
48     if n(i)<0 then
49         h(i)=0;x(i)=0;
50     else
51         h(i)=(-a)^n(i);
52         x(i)=1;
53     end
54 end
55 s=convol(h,x);
56 //figure
57 f=scf(0);
58 plot(n,h,'red');
59 xtitle('h(n)');
60  xs2jpg(0, 'problem40-plot-a.jpg');
61 //figure
62 f=scf(1);
63 plot(n,x,'green');
64 xtitle('x(n)');
65  xs2jpg(1, 'problem40-plot-b.jpg');
66 //figure
```

```
f=scf(2);
n1=-10:.01:10;
plot(n1,s,'blue');
xtitle('s(n)');
 xs2jpg(2, 'problem40-plot-c.jpg');
//Example 3.26<iii>
//Find the step response of the system.
clc;
clear;
close;
n=-5:.01:5;
for i=1:length(n)
    if n(i)<0 then
        h(i)=0;x(i)=0;
    else
        h(i)=1;
        x(i)=1;
    end
end
s=convol(h,x);
//figure
f=scf(0);
plot(n,h,'black');
xtitle('h[n]');
xs2jpg(0, 'problem41-plot-a.jpg');
//figure
f=scf(1);
plot(n,x,'red');
xtitle('x[n]');
xs2jpg(1, 'problem41-plot-b.jpg');
//figure
f=scf(2);
n1=-10:.01:10;
plot(n1,s,'green');
xtitle('s[n]');
xs2jpg(2, 'problem41-plot-c.jpg');
//Example 3.26 <iv>
//Find the step response.
```

```
105 clc;
106 clear;
107 close;
108 n=-5:.01:5;
109 for i=1:length(n)
110     if n(i)<0 then
111         h(i)=0;x(i)=0;
112     else
113         h(i)=((1/2)^n(i))+((-(1/3))^n(i));
114         x(i)=1;
115     end
116 end
117 s=convol(h,x);
118 //figure
119 f=scf(0);
120 plot(n,h,'red');
121 xtitle('h(n)');
122 xs2jpg(0, 'problem42-plot-a.jpg');
123 //figure
124 f=scf(1);
125 plot(n,x,'green');
126 xtitle('x(n)');
127 xs2jpg(1, 'problem42-plot-b.jpg');
128 //figure
129 f=scf(2);
130 n1=-10:.01:10;
131 plot(n1,s,'blue');
132 xtitle('s(n)');
133 xs2jpg(2, 'problem42-plot-c.jpg');
```

Scilab code Exa 3.27 Find the convolution of the following sequences

```
1 //example 3.27<i>
2 //Find the convolution sum
3 clear ;
```

```
clc;
 close ;
 t= -10:1/100:10;
 for i =1: length (t)
 if t(i) <0 then
 h(i)=0;
 x(i)=0;
 else
 h(i)=(1/2)^t(i);
 x(i)=cos(%pi*t(i));
 end
 end
 y = convol (x,h) ;
// figure
  f=scf(0);
 plot2d (t,h)
 xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
     );
 xs2jpg(0, 'EX3_27_1-plot-a.jpg');
 //figure
   f=scf(1);
 plot2d (t,x)
 xtitle ( ' Input Re spons e ' , ' t' , ' x ( t ) '
    );
 xs2jpg(1, 'EX3_27_1-plot-b.jpg');
 //figure
   f=scf(2);
 t1 = -20:1/100:20;
 plot2d (t1 ,y)
 xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t) '
     );
 xs2jpg(2, 'EX3_27_1-plot-c.jpg');
//example 3.27<ii>
//Find the response using convolution sum
clear ;
 close ;
 clc ;
 t = -10:1/100:10;
```

```
39  for i =1: length (t)
40  if t(i) <0 then
41  h(i)=0;
42  x(i)=(1/3)^(-t(i));
43  elseif t(i)==0 then
44  h(i)=0;
45  x(i)=0;
46  else h(i)=1;x(i)=0;
47  end
48  end
49  y = convol (x,h) ;
50  //figure
51  f=scf(0);
52  plot2d (t,h)
53  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
        );
54   xs2jpg(0, 'EX3_27_2-plot-a.jpg');
55  //figure
56  f=scf(1);
57  plot2d (t,x)
58  xtitle ( ' Input Re spons e ' , ' t ' , ' x ( t ) '
        );
59   xs2jpg(1, 'EX3_27_2-plot-b.jpg');
60  //figure
61  f=scf(2);
62  a= gca ();
63  t1 = -20:1/100:20;
64  plot2d (t1 ,y)
65  xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t )
       ' );
66   xs2jpg(2, 'EX3_27_2-plot-c.jpg');
67 //example 3.27<iii>
68 //Find the response using convolution sum
69 clear ;
70  close ;
71  clc ;
72  t = -5:1/100:5;
73  for i =1: length (t)
```

```
 74  if t(i) <0 then
 75  h(i)=0;
 76  x(i)=0;
 77  elseif t(i)<=10 then
 78  x(i)=(1/2)^t(i);
 79  h(i)=1;
 80 else
 81     h(i)=0;
 82     x(i)=(1/2)^t(i);
 83  end
 84  end
 85  y = convol (x,h) ;
 86  //figure
 87  f=scf(0);
 88  plot2d (t,h)
 89  xtitle ( ' Input Re spons e ' , ' t ' , ' h ( t ) '
       );
 90  xs2jpg(0, 'EX3_27_3-plot-a.jpg');
 91 // figure
 92 f=scf(1);
 93  plot2d (t,x)
 94  xtitle ( ' Input Re spons e ' , ' t ' , ' x ( t ) '
       );
 95  xs2jpg(1, 'EX3_27_3-plot-b.jpg');
 96  //figure
 97  f=scf(2);
 98  a= gca ();
 99  t1 = -10:1/100:10;
100  plot2d (t1 ,y)
101  xtitle ( ' Output Re spons e ' , ' t ' , ' y ( t )
      ' );
102  xs2jpg(2, 'EX3_27_3-plot-c.jpg');
```

Scilab code Exa 3.28 Find the convolution

```
1  //Example 3.28
2  //Find the convolution.
3  clc;
4  clear;
5  close;
6  n=-5:.01:5;
7  for i=1:length(n)
8      if n(i)<0 then
9          x1(i)=0;
10     else
11         x1(i)=1;
12     end
13     if n(i)<3 then
14         x2(i)=0;
15     else
16         x2(i)=2;
17     end
18     if n(i)<6 then
19         x3(i)=0;
20     else
21         x3(i)=1;
22     end
23     x(i)=x1(i)-x2(i)+x3(i);
24     if n(i)<-2 | n(i)>9 then
25         h(i)=0;
26     else
27         h(i)=1;
28     end
29 end
30 y=convol(x,h);
31 //figure
32 f=scf(0);
33 plot(n,h,'red');
34 xtitle('h[n]');
35 xs2jpg(0, 'problem43-plot-a.jpg');
36 //figure
37 f=scf(1);
38 plot(n,x,'blue');
```

```
39 xtitle('x[n]');
40 xs2jpg(1, 'problem43-plot-b.jpg');
41 //figure
42 f=scf(2);
43 n1=-10:.01:10;
44 plot(n1,y,'green');
45 xtitle('y[n]');
46 xs2jpg(2, 'problem43-plot-c.jpg');
```

Scilab code Exa 3.31 Find the cross correlation of two finite length sequences

```
1 //Example 3.31
2 //Find the cross correlation of two finite length
     sequences.
3 clc;
4 x=[1 2 1 1];
5 y=[1 2 1 1];
6 z=convol(x,y);
7 disp(z);
```

Scilab code Exa 3.32 Find the input signal

```
1 //Example 3.32
2 //Find the input signal
3 clc;t=1:7;
4 y=[1 5 10 11 8 4 1];
5 h=[1 2 1 0 0 0 0];
6 Y=fft(y,-1);//-1 is taken to obtain the fourier
     transform of y.
7 H=fft(h,-1);
8
9 X=Y./H;
```

```
10 x=fft(X,1);//1 is taken to obtain the inverse
     fourier transform of X.
11 s=round(x);
12 disp(s,'The deconvolution of the above two sequences
     is :');
```

Chapter 4

Time domain analysis of continuous time systems

Scilab code Exa 4.4.2 Find the step response of the following impulse response

```
1  //Example 4.4 <ii>
2  //Find the step response of the following impulse
       response.
3  clc;
4  t=-1:.01:1;
5  for i=1:length(t)
6      if t(i)==0 then
7          del1(i)=1;del2(i)=0;
8      elseif t(i)==1 then
9          del1(i)=0;del2(i)=1;
10     else
11         del1(i)=0;del2(i)=0;
12 end
13 h(i)=del1(i)-del2(i);
14 if t(i)<0 then
15     u(i)=0;
16 else
17     u(i)=1;
```

```
18 end
19 end
20 s=convol(h,u);
21 t1=-10:.05:10;
22 f=scf(0);
23 plot(t1,s,'red');
24 xtitle('s[t]');
25 xs2jpg(0, 'EX4_4_2-plot-a.jpg');
```

Scilab code Exa 4.6 Find the convolution of the following signals

```
1 //Find the covolution Of the following signals.
2 //Example 4.6<i>
3 clc;
4 clear;
5 close;
6 a=.5;
7 b=.6;
8 t=-4:.01:4;
9 for i=1:length(t)
10     if t(i)<0 then
11         x1(i)=0;x2(i)=0;
12     else
13         x1(i)=exp(-a.*t(i));
14         x2(i)=exp(-b.*t(i));
15     end
16 end
17 y=convol(x1,x2);
18 f=scf(0);
19 subplot(3,1,1);
20 plot(x1,t,'red');
21 xtitle('x1[t]');
22 subplot(3,1,2);
23 plot(x2,t,'blue');
24 xtitle('x2[t]');
```

```
25 subplot(3,1,3);
26 t1=-8:.01:8;
27 plot(t1,y,'green');
28 xtitle('y[n]');
29 xs2jpg(0, 'EX4_6_1-plot-a.jpg');
30 //Find the covolution Of the following signals.
31 //Example 4.6<ii>
32 clc;
33 clear;
34 close;
35 t=-4:.01:4;
36 for i=1:length(t)
37     if t(i)<0 then
38         x1(i)=0;x2(i)=0;
39     else
40         x1(i)=1;
41         x2(i)=1;
42     end
43 end
44 y=convol(x1,x2);
45 f=scf(0);
46 subplot(3,1,1);
47 plot(x1,t,'red');
48 xtitle('x1[t]');
49 subplot(3,1,2);
50 plot(x2,t,'blue');
51 xtitle('x2[t]');
52 subplot(3,1,3);
53 t1=-8:.01:8;
54 plot(t1,y,'green');
55 xtitle('y[n]');
56 xs2jpg(0, 'EX4_6_2-plot-a.jpg');
57 //Find the covolution Of the following signals.
58 //Example 4.6<iii>
59 clc;
60 clear;
61 close;
62 t=-4:.01:4;
```

```
for i=1:length(t)
    if t(i)<0 then
        x1(i)=0;x2(i)=0;
    else
        x1(i)=t(i);
        x2(i)=1;
    end
end
y=convol(x1,x2);
f=scf(0);
subplot(3,1,1);
plot(x1,t,'red');
xtitle('x1[t]');
subplot(3,1,2);
plot(x2,t,'blue');
xtitle('x2[t]');
subplot(3,1,3);
t1=-8:.01:8;
plot(t1,y,'green');
xtitle('y[n]');
xs2jpg(0, 'EX4_6_3-plot-a.jpg');
//Find the covolution Of the following signals.
//Example 4.6<iv>
clc;
clear;
close;
t=-4:.01:4;
for i=1:length(t)
    if t(i)<0 then
        x1(i)=0;x2(i)=0;
    else
        x1(i)=sin(t(i));
        x2(i)=1;
    end
end
y=convol(x1,x2);
f=scf(0);
subplot(3,1,1);
```

```
plot(x1,t,'red');
xtitle('x1[t]');
subplot(3,1,2);
plot(x2,t,'blue');
xtitle('x2[t]');
subplot(3,1,3);
t1=-8:.01:8;
plot(t1,y,'green');
xtitle('y[n]');
xs2jpg(0, 'EX4_6_4-plot-a.jpg');
```

Scilab code Exa 4.7 Find the convolution of the following signals

```
//Find the covolution Of the following signals.
//Example 4.7<i>
clc;
clear;
close;
t=-4:.01:4;
//Define signal h(t)=u(t+2)
for i=1:length(t)
    if t(i)<-2 then
        h(i)=0;
    else
        h(i)=1;
    end
    //Define signal x(t)=exp^(-2*t)*u(t)
    if t(i)<0 then
    x(i)=0;
else
    x(i)=exp(-2.*t(i));
end
end
y=convol(h,x);//convolution is done
f=scf(0);
```

```
subplot(3,1,1);
plot(h,t,'red');
xtitle('h[t]');
subplot(3,1,2);
plot(x,t,'blue');
xtitle('x[t]');
subplot(3,1,3);
t1=-8:.01:8;
plot(t1,y,'green');
xtitle('y[n]');
xs2jpg(0, 'problem52-plot.jpg');
//Find the covolution Of the following signals.
//Example 4.7<iii>
clc;
clear;
close;
t=-4:.01:4;
//Define signal h(t)=u(t-2)
for i=1:length(t)
    if t(i)<-1 then
        h(i)=0;
    else
        h(i)=1;
    end
    //Define signal x(t)=u(t+1)
    if t(i)<2 then
    x(i)=0;
else
    x(i)=1;
end
end
y=convol(h,x);//The convolution is done here.
subplot(3,1,1);
plot(h,t,'red');
xtitle('input response 2','t','h[t]');
subplot(3,1,2);
plot(x,t,'blue');
xtitle('input response 2','t','x[t]');
```

```
61 subplot(3,1,3);
62 t1=-8:.01:8;
63 plot(t1,y,'green');
64 xtitle('output response','t','y[t1]');
65 //Find the covolution Of the following signals.
66 //Example 4.7<ii>
67 clc;
68 clear;
69 close;
70 t=-4:.01:4;
71 for i=1:length(t)
72          x(i)=exp(-abs(t(i)));
73          if t(i)<-1  then
74         h(i)=0;
75          else
76           h(i)=exp(-2.*(t(i)+1)) ;
77          end
78     end
79 y=convol(h,x);//Here convolution of the above two
     signals is done
80 subplot(3,1,1);
81 plot(h,t,'red');
82 xtitle('input response 2','t','h[t]');
83 subplot(3,1,2);
84 plot(x,t,'blue');
85 xtitle('input response 2','t','x[t]');
86 subplot(3,1,3);
87 t1=-8:.01:8;
88 plot(t1,y,'green');
89 xtitle('output response','t','y[t1]');
```

Scilab code Exa 4.8 Find the covolution Of the following signals

```
1 //Find the covolution Of the following signals.
2 //Example 4.8
```

```
clc;
clear;
close;
t=-4:.01:4;
for i=1:length(t)
    if t(i)>=0 & t(i)<=2 then
        x(i)=1;
    else
        x(i)=0;
    end
    if t(i)>=0 & t(i)<=3 then
    h(i)=1;
else
    h(i)=0;
end
end
y=convol(h,x);//Convolution of the above two signals
    is done.
subplot(3,1,1);
plot(t,h,'red');
xtitle('input response 2','t','h[t]');
subplot(3,1,2);
plot(t,x,'blue');
xtitle('input response 2','t','x[t]');
subplot(3,1,3);
t1=-8:.01:8;
plot(t1,y,'green');
xtitle('output response','t','y[t1]');
```

Scilab code Exa 4.9 Find the covolution Of the following signals

```
//Find the covolution Of the following signals.
//Example 4.9
clc;
clear;
```

```
close;
t=-10:.01:10;
//input signal:x(t)=u(t-3)-u(t-5)
for i=1:length(t)
    if t(i)<3 | t(i)>5 then
        x(i)=0;
    else
        x(i)=1;
    end
    //h(t)=exp(-3*t)*u(t)
    if t(i)>=0 then
    h(i)=exp(-3.*t(i));
else
    h(i)=0;
end
end
y=convol(h,x);//cconvolution of the above two
   signals
subplot(3,1,1);
plot(t,h,'red');
xtitle('input response 2','t','h[t]');
subplot(3,1,2);
plot(t,x,'blue');
xtitle('input response 2','t','x[t]');
subplot(3,1,3);
t1=-20:.01:20;
plot(t1,y,'green');
xtitle('output response','t','y[t1]');
```

Scilab code Exa 4.10 Find the covolution Of the following signal

```
//Find the covolution Of the following signals.
//Example 4.10
clc;
clear;
```

```
close;
t=-20:.01:20;
for i=1:length(t)
    if t(i)<0 | t(i)>2 then
        x(i)=0;
    else
        x(i)=1;
    end
    if t(i)>=10 then
    h(i)=1;
else
    h(i)=0;
end
end
y=convol(h,x);
subplot(3,1,1);
plot(t,h,'red');
xtitle('input response 2','t','h[t]');
subplot(3,1,2);
plot(t,x,'blue');
xtitle('input response 2','t','x[t]');
subplot(3,1,3);
t1=-40:.01:40;
plot(t1,y,'green');
xtitle('output response','t','y[t1]');
```

Scilab code Exa 4.11 Find the covolution Of the following signals

```
//Find the covolution Of the following signals.
//Example 4.11
clc;
clear;
close;
t=-5:.01:5;
for i=1:length(t)
```

```
8       if t(i)<0 | t(i)>2 then
9           x(i)=0;
10      else
11          x(i)=1;
12      end
13      if t(i)<-1 | t(i)>2 then
14      h(i)=0;
15  else
16      h(i)=2;
17  end
18  end
19  y=convol(h,x);
20  subplot(3,1,1);
21  plot(t,h,'red');
22  xtitle('input response 2','t','h[t]');
23  subplot(3,1,2);
24  plot(t,x,'blue');
25  xtitle('input response 2','t','x[t]');
26  subplot(3,1,3);
27  t1=-10:.01:10;
28  plot(t1,y,'green');
29  xtitle('output response','t','y[t1]');
```

Scilab code Exa 4.12 Find the convolution of the following signals

```
1  //Find the covolution Of the following signals.
2  //Example 4.12 <i>
3  clc;
4  clear;
5  close;
6  t=-5:.01:5;
7  for i=1:length(t)
8      if t(i)>=0 & t(i)<=2 then
9      x(i)=sin(%pi*t(i));
10 else
```

```
11      x(i)=0;
12      end
13  if t(i)<1 | t(i)>3 then
14      h(i)=0;
15  else
16      h(i)=1;
17  end
18  end
19  y=convol(h,x);//convolution of the above two signals
        is done here.
20  subplot(3,1,1);
21  plot(t,h,'red');
22  xtitle('input response 2','t','h[t]');
23  subplot(3,1,2);
24  plot(t,x,'blue');
25  xtitle('input response 2','t','x[t]');
26  subplot(3,1,3);
27  t1=-10:.01:10;
28  plot(t1,y,'green');
29  xtitle('output response','t','y[t1]');
30  //Find the covolution Of the following signals.
31  //Example 4.12 <ii>
32  clc;
33  clear;
34  close;
35  t=-5:.01:5;
36  for i=1:length(t)
37      if t(i)<0  then
38          x(i)=0;
39      elseif  t(i)<1 then
40          x(i)=1+t(i);
41      elseif t(i)<2 then
42      x(i)=1-t(i);
43  else
44      x(i)=0;
45  end
46  if t(i)<0 | t(i)>2 then
47      h(i)=0;
```

```
48 else
49     h(i)=1;
50 end
51 end
52 y=convol(h,x);
53 subplot(3,1,1);
54 plot(t,h,'red');
55 xtitle('input response 2','t','h[t]');
56 subplot(3,1,2);
57 plot(t,x,'blue');
58 xtitle('input response 2','t','x[t]');
59 subplot(3,1,3);
60 t1=-10:.01:10;
61 plot(t1,y,'green');
62 xtitle('output response','t','y[t1]');
```

Chapter 7

Laplace Transform Analysis of Signals and Systems

Scilab code Exa 7.1.1 Find the laplace transform and Roc of the following signal

```
1  //Example 7.1.1
2  //Find the laplace transform and Roc of the
       following signal
3  clc;
4  close;
5  syms t;
6  a=5;
7   x=exp(-a*t);
8  b=6;c=7;
9  s=b+c*%i;
10 X=integrate((exp(-(a+s)*t)),'t',0,%inf);
11 disp(X);
12 disp(real(s));
13 disp('Since real(s)>-a,so the integral converges');
```

Scilab code Exa 7.1.2 Find the laplace transform and Roc of the following signal

```
1  //Example 7_1_2
2  //Find the laplace transform and Roc of the
       following signal.
3  clc;
4  t=-10:.01:10;
5  a=4;
6  for i=1:length(t)
7      if t(i)>0 then
8          x(i)=0;
9      else
10         x(i)=-exp(-a*t(i));
11     end
12 end
13 s=%s;
14 numfs=1;
15 denfs=s+.04;
16 fs=syslin('c',numfs/denfs);
17 fs1=csim('impulse',t,fs);
18 f=scf(0);
19 subplot(2,1,1);
20 plot2d(t,x,2);
21 xtitle('Phrasing');
22 xgrid;
23 subplot(2,1,2);
24 plot2d(t,fs1,1);
25 xtitle('Solution');
26 xgrid;
27 disp(fs);
28 disp('As  real(s)<-a,so the integral converges for
       real(s)<-a');
29 xs2jpg(0, 'EX7_1_2-plot-a.jpg');
```

Scilab code Exa 7.2 Find the laplace transform and Roc of the following signal

```
1 //Example 7.2
2 //Find the laplace transform and Roc of the
     following signal
3 clc;
4 close;
5 syms t;
6  x=exp(-3*t)+exp(-2*t);
7 b=6;c=7;
8 s=b+c*%i;
9 X=integrate((exp(-(3+s)*t))+(exp(-(2+s)*t)),'t',0,
     %inf);
10 disp(X);
11 disp(real(s));
12 disp('Since real(s)>-2,so the integral converges');
```

Scilab code Exa 7.3 Find the laplace transform and Roc of the following signal

```
1 //Example 7.3
2 //Find the laplace transform and Roc of the
     following signal
3 clc;
4 close;
5 syms t;
6 a=3;b1=-8;
7  x1=exp(-a*t);
8 b=6;c=7;
9 s=b+c*%i;
10 X1=integrate((exp(-(a+s)*t)),'t',0,%inf);
11 x2=exp(-2*t);
12 X2=integrate((exp(-(b1+s)*t)),'t',-%inf,0);
13 disp(X1);
```

```
14  disp(X2);
15 X=X1+X2;disp(X);
16 disp(real(s));
17 disp('Since -a< real(s)>-b1,so the integral
      converges');
```

Scilab code Exa 7.4 Find the laplace transform

```
1  //Example 7.4
2  //Find the laplace transform
3  clc;
4  close;
5  syms t;
6  b=4;
7   a=2;c=1;
8  s=a+c*%i;
9  X1=integrate((exp(-(b+s)*t)),'t',0,%inf);
10 X2=integrate((exp(-(s-b)*t)),'t',-%inf,0);
11 disp(X1);
12  disp(X2);
13 X=X1+X2;disp(X)
14 disp(real(s));
15 disp('Since -b< real(s)<b,so the integral converges'
      );
```

Scilab code Exa 7.5 Find the laplace transform of the following signal

```
1  //Example 7.5.2
2  //Find the laplace transform of the following signal
      .
3  clc;
4  close;
5  t=-10:.01:10;
```

```
for i=1:length(t)
    if t(i)>=0 then
        x(i)=1;
    else
        x(i)=0;
    end
end
s=%s;
numfs=1;
denfs=s;
fs=syslin('c',numfs/denfs);
fs1=csim('impulse',t,fs);
disp(fs);
f=scf(0);
subplot(2,1,1);
plot2d(t,x,2);
xtitle('Phrasing');
xgrid;
subplot(2,1,2);
plot2d(t,fs1,1);
xtitle('solution');
xgrid;
xs2jpg(0, 'EX7_5-plot-a.jpg');
```

Scilab code Exa 7.6 Find the laplace transform

```
//Example 7.6
//Find the laplace transform
clc;
t=-5:.05:5;
w=2*%pi;
x=cos(w*t);
s=%s;
numfs=s;
denfs=s^2+w^2;
```

```
fs=syslin('c',numfs/denfs);
disp(fs);
fs1=csim('impulse',t,fs);
f=scf(0);
subplot(2,1,1);
plot2d(t,x,2);
xtitle('Phrasing');
xgrid;
subplot(2,1,2);
plot2d(t,fs1,1);
xtitle('Solution');
xgrid;
xs2jpg(0, 'EX7_6-plot-a.jpg');
```

Scilab code Exa 7.7 Find the laplace transform of the following signal

```
//Example 7.7.1
//Find the laplace transform of the following.
clc;
close;
syms t,;
 x=1;
 a=2;c=1;
 s=a+c*%i;
X=integrate((exp(-s*t)),'t',2,%inf);
 disp(X);
//Example 7.7.2
//Find the laplace transform .
clc;
t=-10:.01:10;
for i=1:length(t)
    if t(i)>=0 then
        x(i)=(t(i)^2)*exp(-2*t(i));
    else
        x(i)=0;
```

```
20      end
21  end
22  s=%s;
23  numfs=2;
24  denfs=(s+2)^3;
25  fs=syslin('c',numfs/denfs);
26  fs1=csim('impulse',t,fs);
27  disp(fs);
28  f=scf(0);
29  subplot(2,1,1);
30  plot2d(t,x,2);
31  xtitle('Phrasing');
32  xgrid;
33  subplot(2,1,2);
34  plot2d(t,fs1,1);
35  xtitle('Solution');
36  xgrid;
37  xs2jpg(0, 'EX7_7_2-plot-a.jpg');
```

Scilab code Exa 7.8 Find the laplace transform

```
1  //Example7.8
2  //Find the laplace transform .
3  clc;
4  s=%s;t=-10:10;
5  numfs=2*s;
6  denfs=s^2-8;
7  fs=syslin('c',numfs/denfs);
8  fs1=csim('impulse',t,fs);
9  f=scf(0);
10 plot2d(t,fs1,1);
11 xtitle('Solution');
12 xgrid;
13 xs2jpg(0, 'problem110-plot-a.jpg')
14 disp(fs,'fs=');
```

Scilab code Exa 7.11 find the laplace transform

```
1  //Example 7.11
2  //Find the laplace transform .
3  clc;
4  t=-10:.01:10;
5  for i=1:length(t)
6      if t(i)>=0 then
7          x(i)=exp(-2.*t(i))*sin(2*t(i));
8      else
9          x(i)=0;
10     end
11 end
12 s=%s;
13 numfs=2;
14 denfs=(s+2)^2+4;
15 fs=syslin('c',numfs/denfs);
16 fs1=csim('impulse',t,fs);
17 disp(fs);
18 f=scf(0);
19 subplot(2,1,1);
20 plot2d(t,x,2);
21 xtitle('Phrasing');
22 xgrid;
23 subplot(2,1,2);
24 plot2d(t,fs1,1);
25 xtitle('Solution');
26 xgrid;
27 xs2jpg(0, 'problem109-plot-a.jpg');
```

Scilab code Exa 7.16 Find the laplace transform of the following signals

```
1  //Example7.16.1
2  //Find the laplace transform .
3  clc;
4  s=%s;t=-5:5;
5  numfs=s^2+4*s+3;
6  denfs=(s^2+4*s+5)^2;
7  fs=syslin('c',numfs/denfs);
8  fs1=csim('impulse',t,fs);
9  plot2d(t,fs1,1);
10 xtitle('Solution');
11 xgrid;
12 disp(fs);
13 //Example7.16.2
14 //Find the laplace transform .
15 clc;
16 s=%s;t=-5:5;
17 numfs=s+3;
18 denfs=(s^2+6*s+10);
19 fs=syslin('c',numfs/denfs);
20 fs1=csim('impulse',t,fs);
21 f=scf(0);
22 plot2d(t,fs1,1);
23 xtitle('Solution');
24 xgrid;
25 xs2jpg(0, 'EX7_16_2-plot-a.jpg');
26 disp(fs);
27 //Example7.16.3
28 //Find the laplace transform .
29 clc;
30 s=%s;t=-5:5;
31 numfs=(s+2)^2;
32 denfs=(s^2+4*s+5)^2;
33 fs=syslin('c',numfs/denfs);
34 fs1=csim('impulse',t,fs);
35 plot2d(t,fs1,1);
36 xtitle('Solution');
37 xgrid;
38 disp(fs);
```

Scilab code Exa 7.22 Find the laplace transform

```
1  //Example 7.22
2  //Find the laplace transform .
3  clc;
4  t=-10:.01:10;
5  for i=1:length(t)
6      y(i)=exp(-t(i))-2*exp(-2*t(i))+exp(-3*t(i));
7      x(i)=exp(-0.5*t(i));
8  end
9  s=%s;
10 numfs1=1;
11 denfs1=s+0.5;
12 fs=syslin('c',numfs1/denfs1);
13 numfs2=2;
14 denfs2=(s+1)*(s+2)*(s+3);
15 fs1=syslin('c',numfs2/denfs2);
16 hs=fs1/fs;
17 hs1=csim('impulse',t,hs);
18 subplot(3,1,1);
19 plot2d(t,x,2);
20 xtitle('Phrasing');
21 xgrid;
22 subplot(3,1,2);
23 plot2d(t,y,3);
24 xtitle('Phrasing');
25 xgrid;
26 subplot(3,1,3);
27 plot2d(t,hs1,1);
28 xtitle('Solution');
29 xgrid;
30 disp(fs,'fs=:');
31 disp(fs1,'fs1=:');
32 disp(hs,'hs=:');
```

Chapter 8

Fourier analysis of discrete time signals

Scilab code Exa 8.14 Find the convolution of the signals given below using fourier transform

```
1
2 //Example 8.14
3 //Find the convolution of the signals given below
     using fourier transform
4 clc;
5 clear all;
6 n=-10:10;
7 for i=1:length(n)
8     if n(i)>=0 then
9         x1(i)=(1/2)^n(i);
10        x2(i)=(1/3)^n(i);
11    else
12        x1(i)=0;
13        x2(i)=0;
14    end
15 end
16 subplot(3,2,1)
17 plot(x1,n);
```

```
18 xtitle('(a) x1(n)');
19 subplot(3,2,2)
20 plot(x2,n);
21 xtitle('(b) x2(n)');
22 X1=fft(x1,-1);
23 X2=fft(x2,-1);
24 subplot(3,2,3)
25 plot(X1,n);
26 xtitle('(c) X1(n)');
27 subplot(3,2,4)
28 plot(X2,n);
29 xtitle('(d) X2(n)');
30 X3=X2.*X1;
31 subplot(3,2,5)
32 plot(X3,n);
33 xtitle('(e) X3(n)');
34 x3=fft(X3,1);
35 disp(x3,'The result of convolution is:');
36 subplot(3,2,6)
37 plot(x3,n);
38 xtitle('(f) x3(n)');
```

Scilab code Exa 8.19 Use fourier transform to determine the response of the following signal

```
1
2 //Example 8.19.1
3 //Use fourier transform to determine the response of
      the following signal
4 clc;
5 clear all;
6 n=-10:10
7 for i=1:length(n)
8     if n(i)>=1 then
9         x(i)=(3/4)^n(i);
```

```
10          h(i)=(1/2)^n(i);
11      else
12          x(i)=0;
13          h(i)=0;
14      end
15  end
16  subplot(3,2,1)
17  plot(x,n);
18  xtitle('(a)x(n)');
19  subplot(3,2,2)
20  plot(h,n);
21  xtitle('(b)h(n)');
22  X=fft(x,-1);
23  H=fft(h,-1);
24  subplot(3,2,3)
25  plot(X,n);
26  xtitle('(c)X(n)');
27  subplot(3,2,4)
28  plot(H,n);
29  xtitle('(d)H(n)');
30  Y=H.*X;
31  subplot(3,2,5)
32  plot(Y,n);
33  xtitle('(e)Y(n)');
34  y=fft(Y,1);
35  disp(y,'The output response is:');
36  subplot(3,2,6)
37  plot(y,n);
38  xtitle('(f)y(n)');
39
40
41  clf()
42
43  //Example 8.19.2
44  //Use fourier transform to determine the response of
        the following signal
45  clc;
46  clear;
```

```
47 n=-10:10
48 for i=1:length(n)
49     if n(i)>=1 then
50         x(i)=(-1)^n(i);
51         h(i)=(1/2)^n(i);
52     else
53         x(i)=0;
54         h(i)=0;
55     end
56 end
57 subplot(3,2,1)
58 plot(x,n);
59 xtitle('x(n)');
60 subplot(3,2,2)
61 plot(h,n);
62 xtitle('h(n)');
63 X=fft(x,-1);
64 H=fft(h,-1);
65 subplot(3,2,3)
66 plot(X,n);
67 xtitle('X(n)');
68 subplot(3,2,4)
69 plot(H,n);
70 xtitle('H(n)');
71 Y=H.*X;
72 subplot(3,2,5)
73 plot(Y,n);
74 xtitle('Y(n)');
75 y=fft(Y,1);
76 disp(y,'The output response is:');
77 subplot(3,2,6)
78 plot(y,n);
79 xtitle('y(n)');
```

Scilab code Exa 8.25 Find IDFT of the following signals

```
1 //Example 8.25.1
2 //Find idft of the following
3 clc;
4 X=[1 1-%i*2 -1 1+%i*2];
5 x=fft(X,1);
6 disp(x);
7 //Example 8.25.2
8 //Find idft of the following
9 clc;
10 X=[1 0 1 0];
11 x=fft(X,1);
12 disp(x);
```

Scilab code Exa 8.26 Find the circular convolution of two sequences

```
1
2 //Example 8.26
3 //Find the circular convolution of two sequences
4 clc;
5 clear all;
6 x1=[1 2 3 4];
7 x2=[1 -1 2 1];
8 X1=fft(x1,-1);
9 X2=fft(x2,-1);
10 X3=X1.*X2;
11 x3=fft(X3,1);
12 disp(x3,'The circular convolution is:');
```

Scilab code Exa 8.27 Find the circular convolution of the following sequences

```
1
2 //Example 8.27
```

```
3 //Find the circular convolution of the following
     sequences
4 clc;
5 clear all;
6 x1=[1 -1 2 3];
7 x2=[0 1 2 3];
8 X1=fft(x1,-1);//To obtain fourier transform of x1,
     -1 is taken.
9 X2=fft(x2,-1);
10 X3=X1.*X2;
11 x3=fft(X3,1);//+1 to obtain inverse fourier
     transform.
12 disp(x3,'Circular convolution of the above two
     sequences is:');
```

Scilab code Exa 8.28 Find the linear and circular convolution

```
1
2 //Example 8.28
3 //Find the linear and circular convolution
4 clc;
5 clear all;
6 x1=[1 2 3 4];
7 x2=[2 3 4 1];
8 //Linear convolution
9 z=convol(x1,x2);
10 disp(z,'The linear convolution is:');
11 //To obtain circular convolution
12 X1=fft(x1,-1);
13 X2=fft(x2,-1);
14 X3=X1.*X2;
15 x3=fft(X3,1);
16 disp(x3,'The circular convolution is:');
```

Scilab code Exa 8.29 Find DFT of the following sequences

```
1  //Find dft of the following sequence
2  //Example 8.29.1
3  clc;
4  n=-10:10;
5  for i=1:length(n)
6      if n(i)==0 then
7          x(i)=1;
8      else
9          x(i)=0;
10     end
11 end
12 y=fft(x,-1);
13 disp(y,'The dft of the sequence is:');
14 //Find dft of the following sequence
15 //Example 8.29.2
16 clc;
17 n=-10:10;n0=2;
18 for i=1:length(n)
19     if n(i)==n0 then
20         x(i)=1;
21     else
22         x(i)=0;
23     end
24 end
25 y=fft(x,-1);
26 disp(y,'The dft of the sequence is:');
27 //Find dft of the following sequence
28 //Example 8.29.3
29 clc;
30 n=-10:10;a=2;
31 for i=1:length(n)
32    x(i)=a^n(i);
```

```
33 end
34 y=fft(x,-1);
35 disp(y,'The dft of the sequence is:');
```

Chapter 12

Random processes

Scilab code Exa 12.1 Show whether independent or not

```
1 //Example 12.1
2 //Show whether independent or not
3 disp('Two events are independent if P(A and B)=P(A)P
    (B)')
4 disp(0.28,'P(A and B)=')
5 disp(0.8*0.35,'P(A)*P(B)=')
6 disp('Hence A and B are independent')
```

Scilab code Exa 12.2 Find the probability of the problem

```
1 //Example 12.2
2 //Find the probability of the problem.
3 disp('The sample space in this case is:-');
4 disp('(1,1) (1,2) (1,3) (1,4) (1,5) (1,6)');
5 disp('(2,1) (2,2) (3,3) (4,4) (5,5) (6,6)');
6 disp('(3,1) (2,2) (3,3) (4,4) (5,5) (6,6)');
7 disp('(4,1) (2,2) (3,3) (4,4) (5,5) (6,6)');
8 disp('(5,1) (2,2) (3,3) (4,4) (5,5) (6,6)');
```

```
disp('(6,1) (2,2) (3,3) (4,4) (5,5) (6,6)');
disp('Implies that N=36');
disp('Let A be the event of sum 7' );
disp('A={1,6} (2,5) (3,4) (4,3) (5,2) (6,1)} i.e n(A)=6' );
p_a=6/36;
disp(p_a,'Hence the probability of getting a sum 7 is p(A)=6/36=' );
disp('Let B be the event of sum 11' );
disp('A={5,6} (6,5) } i.e n(B)=2' );
p_b=2/36;
disp(p_b,'Hence the probability of getting a sum 2 is P(B)=2/36=' );
disp('Let C be the event of sum 7 or 11' );
disp('Probabilty of getting a sum of 7 or 11 ,P(C)=P(A)+P(B)' );
p_c=p_a+p_b;
disp(p_c,'Hence the probability of getting a sum 7 or 11 is P(C)=' );
disp('Let D be the event of sum 3' );
disp('A={1,2} (2,1)} i.e n(A)=2' );
p_d=2/36;
disp(p_d,'Hence the probability of getting a sum 3 is P(D)=2/36=' );
disp('Let E be the event of sum 2 or 12' );
disp('Probabilty of getting a sum of 2 or 12 ,P(E)=P(sum of 2)+P(sum of 12)' );
disp('P(sum of 2)=1/36  P(sum of 12)=1/36')
p_e=2/36;
disp(p_e,'Hence the probability of getting a sum of 2 or 12 is P(E)=' );
disp('Let F be the event of sum 2 or 3 0r 12' );
disp('Probabilty of getting a sum of 2 or 3 or 12 ,P(F)=P(D)+P(E)' );
p_f=p_d+p_e;
disp(p_f,'Hence the probability of getting a sum 2 or 3 or 12 is P(F)=' );
```

Scilab code Exa 12.3 Find the probability that tails shows up at least once

```
1 //Example12.3
2 //Find the probability that tails shows up at least
     once.
3 disp('Let A be the event that tail shows atleast
     once');
4 disp('Eac toss has two possible outcmes H ,T');
5 disp(2^3,'Hence the total no of outcomes is 2^3=');
6 disp(1-(1/2^3),'P(A)=1-Probability of getting all
     head i.e 1/8=');
```

Scilab code Exa 12.4 Probability to find the required sample size

```
1 //Example 12.4
2 //Probability to find the required sample size.
3 disp('Let A be the event of choosing a sample size
     of 6 containing two red, one green , two blue and
      one white blue ball.');
4 funcprot(0)
5 function c = combination ( n , r )
6 c = prod ( n : -1 : n-r+1 )/ prod (1:r)
7 endfunction
8 disp('The number of combination of choosing 6 balls
     from 14 balls is 14 C 6 ways')
9 disp('The number of combination of choosing 2 red
     balls from 4 balls is 4 C 2 ways')
10 disp('The number of combination of choosing 1 from 3
      green balls is 3 C 1 ways')
11 disp('The number of combination of choosing 2 from 5
      green balls is 5 C 2 ways')
```

```
12 disp('The number of combination of choosing 1 from 2
       white balls is 2 C 1 ways')
13 disp('P(A)={(4 C 2)*(3 C 1)*(5 C 2)*(2 C 1)}/(14 C
   6)=')
14 p=(combination(4,2)*combination(3,1)*combination
   (5,2)*combination(2,1))/combination(14,6);
15 disp(p);
```

Scilab code Exa 12.5 Probability to find the first white ball on the 3rd draw

```
1  //Example 12.5
2  //Probability to find the first white ball on the 3
   rd draw.
3  disp('Let A be the event of drawing the first white
   ball at the third draw from 15 balls ')
4  disp('Let W be the event of drawing a 10 white balls
   ')
5  disp('Let B be the event of drawing a 5 black balls'
   )
6  disp('Hence we have 1st draw :B  2nd Draw :B  3rd
   Draw :W');
7  funcprot(0)
8  function c = combination ( n , r )
9  c = prod ( n : -1 : n-r+1 )/ prod (1:r)
10 endfunction
11 disp('P(A)={(5 C 1)*(5 C 1)*(10 C 1)}/{(15 C 1)*(15
   C 1)*(15 C 1)}=')
12 p=(combination(5,1)*combination(5,1)*combination
   (10,1))/(combination(15,1)*combination(15,1)*
   combination(15,1))
13 disp(p)
```

Scilab code Exa 12.6 To find the required probabilities

```
1 //Example 12.6
2 //To find the required probabilities.
3 disp(100/500,'P(1 kilo-ohms)=100/500=');
4 disp(140/500,'P(20%)=140/500=');
5 disp((125/500)/(260/500),'P(10%/10 kilo-ohms)={P(10%
    )&P(10 kilo-ohms)}/{P(10 kilo-ohms)}=(125/500)
    /(260/500)');
```

Scilab code Exa 12.7 find the required probabilities

```
1 //Example 12.7
2 //find the required probabilities.
3 disp(((1/2)*(1/2))+((2/3)*(1/2)),'P(PMOS is chosen)
    =(P{PMOS/4}/P{4})+(P{PMOS/3}/P{3})=((1/2)*(1/2))
    +((2/3)*(1/2))=');
4 disp('Using Bayes Rule:')
5 disp('P{4/NMOS}=P(NMOS/4)*P(4)/P(NMOS)=')
6 disp('(1/2)*(1/2)/(1-(7/12))=')
7 disp((1/2)*(1/2)/(1-(7/12)))
```

Scilab code Exa 12.8 Find the given probabillities

```
1 //Example 12.8
2 //Find the given probabillities.
3 disp('P{R1/So}=0.15 and P{Ro/S}=0.75');
4 disp((1-0.15),'P{Ro/So}1-P{R1/So}');
5 disp((1-0.075),'P{R1/S1}1-P{Ro/S1}');
6 disp('P{R1}=P{R1/So}P(So)+P{R1/S1}P{S1}=');
7 disp(((0.15)*(0.85)+(0.925)*(1-0.85)),'(0.15)(0.85)
    +(0.925)(1-0.85)=');
8 disp('Using Bayes Rule:')
```

```
9  disp('P{S1/R1}=(P{R1/S1}P{S0})/P{R0}=');
10 p=(0.925*0.15/0.266)
11 disp(p,'(0.925)(1-0.85)/0.266=');
12 disp('P{Ro/So}P{So}/P{Ro}');
13 disp('P{Ro/So}P{So}/(P{Ro/So}P{So}+P{Ro/S1}P{S1}=');
14 p=(0.85)*(0.85)/((0.85)*(0.85)+(0.075)*(0.15))
15 disp(p,'(0.85)(0.85)/((0.85)(0.85)+(0.075)(0.15))=')
   ;
```

Scilab code Exa 12.9 Find the required probabilities

```
1  //Example 12.9
2  //Find the required probabilities.
3  disp('Let H be the event that Husband is alive')
4  disp('Let W be the event that wife is alive')
5  disp('P(H)=0.85   P(W)=0.9')
6  disp(0.85*0.9,'P(both alive)=P(H)P(W)=')
7  disp(0.15*0.1,'P(neither alive)=(1-P(H))(1-P(W))=')
8  disp(0.85+0.9-0.765,'P(Atleast one is alive)=P(H)+P(
   W)-P(both are alive)=')
9  disp('P(only one is alive)=P(Husband is alive and
   wife is dead)OR P(Husband is dead and wife is
   alive)')
10 disp('P(H)(1-P(W))+(1-P(H))P(W)=')
11 disp((0.85)*(1-0.9)+(1-0.85)*(0.9),'(0.85)(1-0.9)
   +(1-0.85)(0.9)=')
```

Scilab code Exa 12.10 find the required probabilities

```
1  //Example 12.10
2  //find the required probabilities.
3  disp('P(Plant shut down)=P(S1&S2&S3 is offline)or P(
   S1&S2 is offline)or P(S1&S3 are offline)=')
```

```
4 p=(0.01)*(0.03)*(0.05)+(0.01)*(0.03)*(1-0.05)+(0.01)
    *(1-0.03)*(0.05)
5 disp('(0.01)*(0.03)*(0.05)+(0.01)*(0.03)*(1-0.05)
    +(0.01)*(1-0.03)*(0.05)=')
6 disp(p)
7 disp(1-p,'P(Plant on line)=1-P(Plant shut down)=')
8 disp('P(plant is online/S1 failed)=')
9 disp((0.01)*(1-0.03)*(1-0.05)/0.01,'P(plant is
    online and S1 failed)/P(S1 failed)=(0.01)
    *(1-0.03)*(1-0.05)/0.01')
```

Scilab code Exa 12.11 Find the required probabilities

```
1 //Exampple 12.11
2 //Find the required probabilities.
3 disp(0.45,'Let SS be the event that Ramesh pass in
    Signal and systems, P(SS)=')
4 disp(0.32,'Let RP be the event that Ramesh pass in
    Random process P(RP)=')
5 disp(0.15,'P(passed in both)=')
6 disp('P(passed in either one subject)=P(SS U RP)')
7 disp(0.45+0.32-0.15,'P(SS)+P(RP)-P(passed in both)
    =0.45+0.32-0.15=')
8 disp(1-0.62,'P(passed in neither of the subjects)=1*
    P(passed in either subjects)=1-0.62=')
9 disp('P( passed in one subject)=');
10 disp(0.45*0.68+0.55*0.32,'P(SS)*P(failed in RP)+P(
    failed in SS)*P(RP)=(0.45)*(1-0.32)+(1-0.45)
    *(0.32)=')
11 disp(1-0.45,'P(failed in SS)=1-P(SS)=1-0.45')
```

Scilab code Exa 12.12 Find the required probabilities

```
1  //Example 12.12
2  //Find the required probabilities.
3  disp('P(A occurs exactly k times in N trials)=(n C K
       )[P(A)]^k[1-P(A)]^(N-k)')
4  disp('P(A)=1/6  P(~A)=5/6')
5  funcprot(0)
6  function c = combination ( n , r )
7  c = prod ( n : -1 : n-r+1 )/ prod (1:r)
8  endfunction
9  disp('P( 3 shows up exactly twice in 6 trials)=(6 c
       2)*(1/6)^2*(5/6)^4=')
10 p=combination(6,2)*(1/6)^2*(5/6)^4;
11 disp(p);
12 disp('P(4 shows up atleast twice)=1-P(4 does not
       shows up)-P(4 shows up once)')
13 disp('P(4 does not show up)=(6 c 0)*(1/6)^0*(5/6)^6=
       ')
14 p=combination(6,0)*(1/6)^0*(5/6)^6;
15 disp(p);
16 disp('P(4 shows up once)=(6 c 1)*(1/6)^1*(5/6)^5=')
17 p=combination(6,1)*(1/6)^1*(5/6)^5;
18 disp(p);
19 disp('P(4 shows up atleast twice)=1-(5/6)^6-(5/6)^5=
       ')
20 p=1-(5/6)^6-(5/6)^5;
21 disp(p);
```

Scilab code Exa 12.13 Find the required probabilities

```
1  //Example 12.13
2  //Find the required probabilities.
3  disp('P(X>0.6)=1-F(0.6)=')
4  disp(%e^(-1.2),'1-(1-e^(-1.2))=e^(-1.2)=')
5  disp(1-%e^(-0.5),'P(X<=0.25)=(1-e^(2*(-1.2)))=1-e
       ^(-0.5)=')
```

```
disp('P(0.4<X<=0.8)=F(0.8)-F(0.4)=')
disp((1-%e^(-1.6))-(1-%e^(-0.8)),'(1-e^(-1.6))-(1-e
    ^(-0.8))=')
```

Scilab code Exa 12.14 Find the mean value of the current under following conditions

```
//Example 12.14
//Find the mean value of the current under following
    conditions.
disp('I=Io[e^(nV)-1]')
disp('E[I]=E[Io[e^(nV)-1]]:')
Xo=0; X1=2;
X=integrate('%e^(10*X)-1','X',Xo,X1);
disp(10^(-9)*X/2,'Hence E[I]=')
```

Scilab code Exa 12.16 Find the following

```
//Example 12.16
//Find the following.
Xo=0;X1=1
X=integrate('2*X*((1-X)^2)','X',Xo,X1)
disp(X,'E[X]=')
Xo=0;X1=1
X2=integrate('2*X^2*((1-X)^2)','X',Xo,X1)
disp(X2,'E[X^2]=')
disp(6*X+3*(X2),'E[6X+3X^2]=6E[X]+3E[X^2]=')
disp(2*X+3,'E[2*X+3]=2E[X]+3=')
x1=2*X+3
disp(4*X2+9+12*X,'E[(2*X+3)^2]=E[4*X^2+9+12*X]=')
x2=4*X2+9+12*X
disp(x2-x1^2,'Variance of (2*X+3)=E[(2*x+3)^2]-{E[2*
    X+3]}^2=')
```

Scilab code Exa 12.17 Probablity that R lies between 110 and 120 ohm

```
1 //Example 12.17
2 //Probablity that R lies between 110 and 120 ohm
3 clc;
4 X0=110;
5 X1=120;
6 X=integrate('1/(130-100)','X',X0,X1);
7 disp(X,'The probability that R lies between 110 and
    120 is :');
```

Scilab code Exa 12.18 Find the mean and variance if they exist

```
1 //Example 12.18
2 //Find the mean and variance,if they exist.
3 Xo=0;X1=1
4 X=integrate('X*(X^3/12)','X',Xo,X1)
5 disp(X,'E[X]=')
6 Xo=0;X1=1
7 X2=integrate('X^2*(X^3/12)','X',Xo,X1)
8 disp(X2,'E[X^2]=')
9 disp(X2-X^2,'Variance =E[X^2]-E[X]^2=')
10 x=1:1:5;
11 y=sum(x^2)/15;
12 disp(y,'E[X]=sum(x*f(x))=sum(x^2)/15')
13 y1=sum(x^3)/15;
14 disp(y1,'E[X]=sum(x^2*f(x))=sum(x^3)/15')
15 disp(y1-y^2,'Variance =E[X^2]-E[X]^2=')
```

Scilab code Exa 12.19 Find the required values

```
1  //Example 12.19
2  //Find the required values.
3  x=[0,0;8,8;8,0]
4  y=[0,0;3,3;0,3]
5  deff('z=f(x,y)','z=x/6')
6  I=int2d(x,y,f)
7  disp(I,'E[X]=')
8  deff('z=f(x,y)','z=y/6')
9  I=int2d(x,y,f)
10 disp(I,'E[Y]=')
11 deff('z=f(x,y)','z=x*y/6')
12 I=int2d(x,y,f)
13 disp(I,'E[XY]=')
```

Scilab code Exa 12.20 Find the correlation

```
1  Xo=0;X1=1
2  X=integrate('X*(X+0.5)','X',Xo,X1)
3  disp(X,'E[X]=')
4  Yo=0;Y1=1
5  Y=integrate('Y*(Y+0.5)','Y',Yo,Y1)
6  disp(Y,'E[Y]=')
7  x=[0,0;1,1;1,0]
8  y=[0,0;1,1;0,1]
9  deff('z=f(x,y)','z=x*y*(x+y)')
10 I=int2d(x,y,f)
11 disp(I,'E[XY]=')
12 disp(I-X*Y,'cov(X,Y)=E[XY]-E[X]E[Y]=');
13 cov=I-X*Y
14 Xo=0;X1=1
15 X2=integrate('X^2*(X+0.5)','X',Xo,X1)
16 disp(X2,'E[X^2]=')
17 Yo=0;Y1=1
```

```
18 Y2=integrate('Y^2*(Y+0.5)','Y',Yo,Y1)
19 disp(Y2,'E[Y^2]=')
20 disp(X2-X^2,'Variance of X=E[X^2]-E[X]^2)=')
21 v1=X2-X^2
22 disp(Y2-Y^2,'Variance of Y=E[Y^2]-E[Y]^2)=')
23 v2=Y2-Y^2
24 disp(cov/sqrt(v1*v2),'Correlation coefficient of X
     and Y=cov(X,Y)/(s.d of X*s.d of Y)=')
```

Scilab code Exa 12.52 Find the average power

```
1 //Example 12.52
2 //Find the average power.
3 Xo=-(4*%pi);X1=4*%pi
4 X=integrate('(1-(X/(4*%pi)))','X',Xo,X1)
5 disp(X/(4*%pi),'Average Power=')
```