Scilab Textbook Companion for Higher Engineering Mathematics by B. S. Grewal[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.

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Chapter 1

Solution of equation and curve fitting

Scilab code Exa 1.1 finding the roots of quadratic equations

```
clear
clc
x=poly([0],'x');
p=2*(x^3)+x^2-13*x+6
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.2 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=3*(x^3)-4*(x^2)+x+88
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.3 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],’x’);
p=x^3-7*(x^2)+36
disp(”the roots of above equation are ”)
roots(p)
```

Scilab code Exa 1.6 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],’x’);
p=x^4-2*(x^3)-21*(x^2)+22*x+40
disp(”the roots of above equation are ”)
roots(p)
```

Scilab code Exa 1.7 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],’x’);
p=2*(x^4)-15*(x^3)+35*(x^2)-30*x+8
disp(”the roots of above equation are ”)
roots(p)
```

Scilab code Exa 1.11 forming an equation with known roots

```
clear
clc
x=poly([0],'x');
x1=poly([0],'x1');
x2=poly([0],'x2');
x3=poly([0],'x3');
p=x^3-3*(x^2)+1
disp("the roots of above equation are ")
roots(p)
disp("let ")
x1=0.6527036
x2=-0.5320889
x3=2.8793852
disp("so the equation whose roots are cube of the roots of above equation is (x-x1^3)*(x-x2^3)*(x-x3^3)=0 => ")
p1=(x-x1^3)*(x-x2^3)*(x-x3^3)
```

Scilab code Exa 1.12 forming an equation under restricted conditions

```
clear
clc
x=poly([0],'x');
x1=poly([0],'x1');
x2=poly([0],'x2');
x3=poly([0],'x3');
x4=poly([0],'x4');
x5=poly([0],'x5');
x6=poly([0],'x6');
p=x^3-6*(x^2)+5*x+8
disp("the roots of above equation are ")
roots(p)
disp("let ")
```

```
x1=-0.7784571
x2=2.2891685
x3=4.4892886
disp(" now, since we want equation whose sum of roots is 0.sum of roots of above equation is 6,so we will decrease")
disp("value of each root by 2 i.e. x4=x1-2 ")
x4=x1-2
disp("x5=x2-2")
x5=x2-2
disp("x6=x3-2")
x6=x3-2
disp("hence,the required equation is (x-x4)*(x-x5)*(x-x6)=0 -->")
p1=(x-x4)*(x-x5)*(x-x6)
```

Scilab code Exa 1.13 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=6*(x^5)-41*(x^4)+97*(x^3)-97*(x^2)+41*x-6
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.14 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=6*(x^6)-25*(x^5)+31*(x^4)-31*(x^2)+25*x-6
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.15 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^3-3*(x^2)+12*x+16
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.16 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=28*(x^3)-9*(x^2)+1
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.17 finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^3+x^2-16*x+20
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.18 Finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^3-3*(x^2)+3
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.19 Finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^4-12*(x^3)+41*(x^2)-18*x-72
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.20 Finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^4-2*(x^3)-5*(x^2)+10*x-3
disp("the roots of above equation are ")
roots(p)
```

Scilab code Exa 1.21 Finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^4-8*(x^2)-24*x+7
disp(”the roots of above equation are ”)
roots(p)
```

Scilab code Exa 1.22 Finding the roots of equation containing one variable

```
clear
clc
x=poly([0],'x');
p=x^4-6*(x^3)-3*(x^2)+22*x-6
disp(”the roots of above equation are ”)
roots(p)
```

Scilab code Exa 1.23 Finding the solution of equation by drawing graphs

```
clear
clc
xset('window',1)
xtitle(”My Graph”,”X axis”,”Y axis”)
x=linspace(1,3,30)
y1=3-x
y2=%e^(x-1)
plot(x,y1,”o–”)
plot(x,y2,”+–”)
legend(”3–x”,”%e^(x–1)”)
```

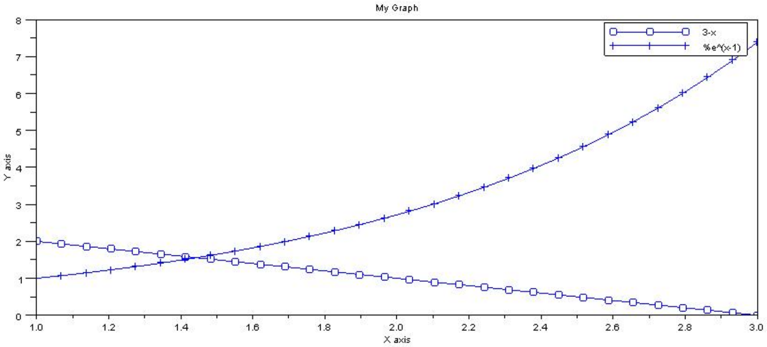

Figure 1.1: Finding the solution of equation by drawing graphs

```
disp("from the graph,it is clear that the point of
   intersection is nearly x=1.43 ")
```

Scilab code Exa 1.24 Finding the solution of equation by drawing graphs

```
clear
clc
xset('window',2)
xtitle("My Graph","X axis","Y axis")
x=linspace(1,3,30)
y1=x
y2=sin(x)+%pi/2
plot(x,y1,"o-")
plot(x,y2,"+-")
legend("x","sin(x)+%pi/2")
disp("from the graph,it is clear that the point of
   intersection is nearly x=2.3 ")
```

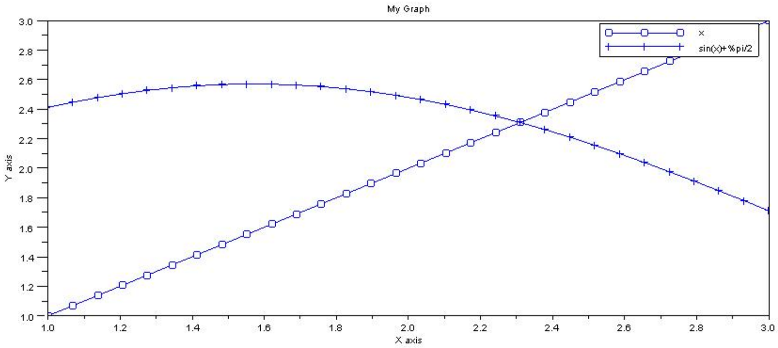

Figure 1.2: Finding the solution of equation by drawing graphs

Scilab code Exa 1.25 Finding the solution of equation by drawing graphs

```
clear
clc
xset('window',3)
xtitle("My Graph","X axis","Y axis")
x=linspace(0,3,30)
y1=-sec(x)
y2=cosh(x)
plot(x,y1,"o-")
plot(x,y2,"+-")
legend("-sec(x)","cosh(x)")
disp("from the graph,it is clear that the point of
   intersection is nearly x=2.3 ")
```

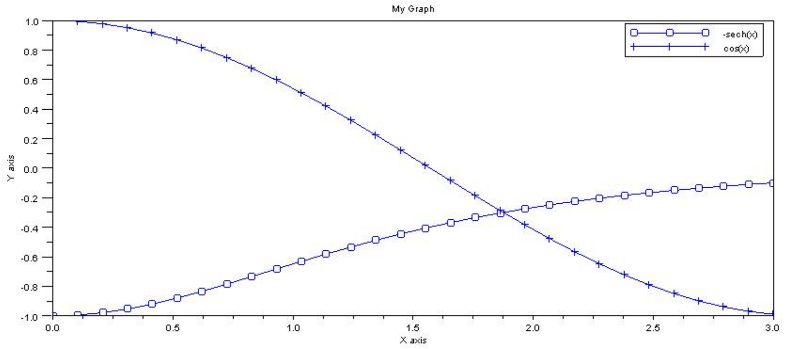

Figure 1.3: Finding the solution of equation by drawing graphs

Chapter 2

Determinants and Matrices

Scilab code Exa 2.1 Calculating Determinant

```
clc
syms a;
syms h;
syms g;
syms b;
syms f;
syms c;
A=[a h g;h b f;g f c]
det(A)
```

Scilab code Exa 2.2 Calculating Determinant

```
clear
clc
a=[0 1 2 3;1 0 3 0;2 3 0 1;3 0 1 2]
disp(”determinant of a is ”)
det(a)
```

Scilab code Exa 2.3 Calculating Determinant

```
clc
syms a;
syms b;
syms c;
A=[a a^2 a^3-1;b b^2 b^3-1;c c^2 c^3-1]
det(A)
```

Scilab code Exa 2.4 Calculating Determinant

```
clear
clc
a=[21 17 7 10;24 22 6 10;6 8 2 3;6 7 1 2]
disp(”determinant of a is ”)
det(a)
```

Scilab code Exa 5.8 Partial derivative of given function

```
clc
syms x y
u=x^y
a=diff(u,y)
b=diff(a,x)
c=diff(b,x)
d=diff(u,x)
e=diff(d,y)
f=diff(e,x)
disp(’clearly ,c=f’)
```

Scilab code Exa 2.16 product of two matrices

```
clear
clc
A=[0 1 2;1 2 3;2 3 4]
B=[1 -2;-1 0;2 -1]
disp("AB= ")
A*B
disp("BA= ")
B*A
```

Scilab code Exa 2.17 Product of two matrices

```
clear
clc
A=[1 3 0;-1 2 1;0 0 2]
B=[2 3 4;1 2 3;-1 1 2]
disp("AB= ")
A*B
disp("BA= ")
B*A
disp("clearly AB is not equal to BA")
```

Scilab code Exa 2.18 Product and inverse of matrices

```
clear
clc
A=[3 2 2;1 3 1;5 3 4]
C=[3 4 2;1 6 1;5 6 4]
```

```
disp("AB=C -->B=inv(A)*C")
B=inv(A)*C
```

Scilab code Exa 2.19 Solving equation of matrices

```
clear
clc
A=[1 3 2;2 0 -1;1 2 3]
I=eye(3,3)
disp("A^3-4*A^2-3A+11I=")
A^3-4*A*A-3*A+11*I
```

Scilab code Exa 2.20 Nth power of a given matrix

```
clc
A=[11 -25;4 -9]
n=input('Enter the value of n ");
disp('calculating A^n ');
A^n
```

Scilab code Exa 2.23 Inverse of matrix

```
clear
clc
A=[1 1 3;1 3 -3;-2 -4 -4]
disp("inverse of A is ")
inv(A)
```

Scilab code Exa 2.24.1 Rank of a matrix

```
clear
clc
A=[1 2 3;1 4 2;2 6 5]
disp("Rank of A is ")
rank(A)
```

Scilab code Exa 2.24.2 Rank of a matrix

```
clear
clc
A=[0 1 -3 -1;1 0 1 1;3 1 0 2;1 1 -2 0]
disp("Rank of A is ")
rank(A)
```

Scilab code Exa 2.25 Inverse of matrix

```
clear
clc
A=[1 1 3;1 3 -3;-2 -4 -4]
disp("inverse of A is ")
inv(A)
```

Scilab code Exa 2.26 eigen values vectors rank of matrix

```
clear
clc
A=[2 3 -1 -1;1 -1 -2 -4;3 1 3 -2;6 3 0 -7]
[R P]=spec(A)
```

```
disp(”rank of A”)
rank(A)
```

Scilab code Exa 2.28 Inverse of a matrix

```
clear
clc
A=[1 1 1;4 3 -1;3 5 3]
disp(”inverse of A =”)
inv(A)
```

Scilab code Exa 2.31 Solving equation using matrices

```
clear
clc
disp(”the equations can be re written as AX=B where X=[x1;x2;x3;x4] and ”)
A=[1 -1 1 1;1 1 -1 1;1 1 1 -1;1 1 1 1]
B=[2;-4;4;0]
disp(”determinant of A=”)
det(A)
disp(”inverse of A =”)
inv(A)
disp(”X=”)
inv(A)*B
```

Scilab code Exa 2.32 Solving equation using matrices

```
clear
clc
```

```
disp("the equations can be re written as AX=B where X=[x;y;z] and ")
A=[5 3 7;3 26 2;7 2 10]
B=[4;9;5]
disp("determinant of A=")
det(A)
disp("Since det(A)=0,hence,this system of equation will have infinite solutions..hence,the system is consistent")
```

Scilab code Exa 2.34.1 predicting nature of equation using rank of matrix

```
clc
A=[1 2 3;3 4 4;7 10 12]
disp('rank of A is')
p=rank(A)
if p==3 then
  disp('equations have only a trivial solution:x=y=z=0')
else
  disp('equations have infinite no. of solutions.')
  end
```

Scilab code Exa 2.34.2 predicting nature of equation using rank of matrix

```
clc
A=[4 2 1 3;6 3 4 7;2 1 0 1]
disp('rank of A is')
p=rank(A)
if p==4 then
  disp('equations have only a trivial solution:x=y=z=0')
else
```

```
  disp('equations have infinite no. of solutions.')
  end
```

Scilab code Exa 2.38 Inverse of a matrix

```
clear;
clc;
disp("the given equations can be written as Y=AX where ")
A=[2 1 1;1 1 2;1 0 -2]
disp("determinant of A is")
det(A)
disp("since,its non-singular,hence transformation is regular ")
disp("inverse of A is ")
inv(A)
```

Scilab code Exa 2.39 Transpose and product of matrices

```
clear
clc
A=[-2/3 1/3 2/3;2/3 2/3 1/3;1/3 -2/3 2/3]
disp("A transpose is equal to ")
A'
disp("A*(transpose of A)=")
A*A'
disp("hence,A is orthogonal ")
```

Scilab code Exa 2.42 eigen values and vectors of given matrix

```
clear
clc
A=[5 4;1 2]
disp(”let R represents the matrix of transformation and P represents a diagonal matrix whose values are the eigen values of A.then ”)
[R P]=spec(A)
disp(”R is normalised.let U represents unnormalised version of r ”)
U(:,1)=R(:,1)*sqrt(17);
U(:,2)=R(:,2)*sqrt(2)
disp(”two eigen vectors are the two columns of U”)
```

Scilab code Exa 2.43 eigen values and vectors of given matrix

```
clear
clc
A=[1 1 3;1 5 1;3 1 1]
disp(”let R represents the matrix of transformation and P represents a diagonal matrix whose values are the eigen values of A.then ”)
[R P]=spec(A)
disp(”R is normalised.let U represents unnormalised version of r ”)
U(:,1)=R(:,1)*sqrt(2);
U(:,2)=R(:,2)*sqrt(3);
U(:,3)=R(:,3)*sqrt(6)
disp(”three eigen vectors are the three columns of U”)
```

Scilab code Exa 2.44 eigen values and vectors of given matrix

```
clear
```

```
clc
A=[3 1 4;0 2 6;0 0 5]
disp("let R represents the matrix of transformation and P represents a diagonal matrix whose values are the eigen values of A.then ")
[R P]=spec(A)
disp("R is normalised.let U represents unnormalised version of r ")
U(:,1)=R(:,1)*sqrt(1);
U(:,2)=R(:,2)*sqrt(2);
U(:,3)=R(:,3)*sqrt(14)
disp("three eigen vectors are the three columns of U ")
```

Scilab code Exa 2.45 eigen values and characteristic equation

```
clear
clc
x=poly([0],'x')
A=[1 4;2 3]
I=eye(2,2)
disp("eigen values of A are ")
spec(A)
disp("let ")
a=-1;
b=5;
disp("hence,the characteristic equation is (x-a)(x-b) ")
p=(x-a)*(x-b)
disp("A^2-4*A-5*I=")
A^2-4*A-5*I
disp("inverse of A= ")
inv(A)
```

Scilab code Exa 2.46 eigen values and characteristic equation

```
clear
clc
x=poly([0],'x')
A=[1 1 3;1 3 -3;-2 -4 -4]
disp("eigen values of A are ")
spec(A)
disp("let ")
a=4.2568381;
b=0.4032794;
c=-4.6601175;
disp("hence,the characteristic equation is (x-a)(x-b)(x-c) ")
p=(x-a)*(x-b)*(x-c)
disp("inverse of A= ")
inv(A)
```

Scilab code Exa 2.47 eigen values and characteristic equation

```
clear
clc
x=poly([0],'x')
A=[2 1 1;0 1 0;1 1 2]
I=eye(3,3)
disp("eigen values of A are ")
spec(A)
disp("let ")
a=1;
b=1;
c=3;
```

```
disp(”hence,the characteristic equation is (x−a)(x−b)(x−c) ”)
p=(x-a)*(x-b)*(x-c)
disp(”A^8−5∗A^7+7∗A^6−3∗A^5+A^4−5∗A^3+8∗A^2−2∗A+I =”)
A^8-5*A^7+7*A^6-3*A^5+A^4-5*A^3+8*A^2-2*A+I
```

Scilab code Exa 2.48 eigen values and vectors of given matrix

```
clear
clc
A=[-1 2 -2;1 2 1;-1 -1 0]
disp(”R is matrix of transformation and D is a diagonal matrix ”)
[R D]=spec(A)
```

Scilab code Exa 2.49 eigen values and vectors of given matrix

```
clear
clc
A=[1 1 3;1 5 1;3 1 1]
disp(”R is matrix of transformation and D is a diagonal matrix ”)
[R D]=spec(A)
disp(”R is normalised,let P denotes unnormalised version of R.Then ”)
P(:,1)=R(:,1)*sqrt(2);
P(:,2)=R(:,2)*sqrt(3);
P(:,3)=R(:,3)*sqrt(6)
disp(”A^4=”)
A^4
```

Scilab code Exa 2.50 eigen values and vectors of given matrix

```
clear
clc
disp("3*x^2+5*y^2+3*z^2-2*y*z+2*z*x-2*x*y")
disp("The matrix of the given quadratic form is ")
A=[3 -1 1;-1 5 -1;1 -1 3]
disp("let R represents the matrix of transformation and P represents a diagonal matrix whose values are the eigen values of A.then ")
[R P]=spec(A)
disp("so,canonical form is 2*x^2+3*y^2+6*z^2")
```

Scilab code Exa 2.51 eigen values and vectors of given matrix

```
clear
clc
disp("2*x1*x2+2*x1*x3-2*x2*x3 ")
disp("The matrix of the given quadratic form is ")
A=[0 1 1;1 0 -1;1 -1 0]
disp("let R represents the matrix of transformation and P represents a diagonal matrix whose values are the eigen values of A.then ")
[R P]=spec(A)
disp("so,canonical form is -2*x^2+y^2+z^2")
```

Scilab code Exa 2.52 Hermitian matrix

```
clear
```

```
clc
A=[2+%i 3 -1+3*%i;-5 %i 4-2*%i]
disp("A*=")
A'
disp("AA*=")
A*A'
disp("clearly ,AA* is hermitian matrix ")
```

Scilab code Exa 2.53 tranpose and inverse of complex matrix

```
clear
clc
A=[(1/2)*(1+%i) (1/2)*(-1+%i);(1/2)*(1+%i) (1/2)*(1-
   %i)]
disp("A*=")
A'
disp("AA*=")
A*A'
disp("A*A=")
A'*A
disp("inverse of A is ")
inv(A)
```

Scilab code Exa 2.54 Unitary matrix

```
clear
clc
A=[0 1+2*%i;-1+2*%i 0]
I=eye(2,2)
disp("I-A= ")
I-A
disp("inverse of (I+A)= ")
inv(I+A)
```

```
disp("((I-A)(inverse(I+A)))*((I-A)(inverse(I+A)))=")
(((I-A)*(inv(I+A)))')*((I-A)*(inv(I+A)))
disp("((I-A)(inverse(I+A)))((I-A)(inverse(I+A)))*=")
((I-A)*(inv(I+A)))*(((I-A)*(inv(I+A)))')
disp("clearly,the product is an identity matrix. hence,it is a unitary matrix")
```

Chapter 4

Differentiation and Applications

Scilab code Exa 4.4.1 finding nth derivative

```
//ques4.1
//clear
//cd SCI
//cd ("..")
//cd ("..")
//exec symbolic.sce
clc
disp(' we have to find yn for F=cosxcos2xcos3x ');
syms x
F=cos(x)*cos(2*x)*cos(3*x);
n=input('Enter the order of differentiation ");
disp('calculating  yn ');
yn=diff(F,x,n)
disp('the expression for yn is ');
disp(yn);
```

Scilab code Exa 4.5 finding nth derivative

```
//ques4.1
//clear
//cd SCI
//cd ("..")
//cd ("..")
//exec symbolic.sce
clc
disp(' we have to find yn for F=cosxcos2xcos3x ');
syms x
F=x/((x-1)*(2*x+3));
n=input('Enter the order of differentiation :  ");
disp('calculating  yn ');
yn=diff(F,x,n)
disp('the expression for yn is ');
disp(yn);
```

Scilab code Exa 4.6 finding nth derivative

```
//ques4.1
//clear
//cd SCI
//cd ("..")
//cd ("..")
//exec symbolic.sce
clc
disp(' we have to find yn for F=cosxcos2xcos3x ');
syms x a
F=x/(x^2+a^2);
n=input('Enter the order of differentiation :  ");
disp('calculating  yn ');
yn=diff(F,x,n)
disp('the expression for yn is ');
disp(yn);
```

Scilab code Exa 4.7 finding nth derivative

```
//ques4.1
//clear
//cd SCI
//cd ("..")
//cd ("..")
//exec symbolic.sce
clc
disp(' we have to find yn for F=cosxcos2xcos3x ');
syms x a
F=%e^(x)*(2*x+3)^3;
//n=input('Enter the order of differentiation : ");
disp('calculating yn ');
yn=diff(F,x,n)
disp('the expression for yn is ');
disp(yn);
```

Scilab code Exa 4.8 proving the given differential equation

```
//ques4.1
//clear
//cd SCI
//cd ("..")
//cd ("..")
//exec symbolic.sce
clc
disp(' y=(sin^-1)x) --sign inverse x ');
syms x
y=(asin(x))^2;
disp('we have to prove (1-x^2)y(n+2)-(2n+1)xy(n+1)-n
   ^2yn ') ;
```

```
//n=input('Enter the order of differentiation ");
disp('calculating  yn for various values of n');
for n=1:4

  F=(1-x^2)*diff(y,x,n+2)-(2*n+1)*x*diff(y,x,n+1)-(n
     ^2+a^2)*diff(y,x,n);
  disp(n);
  disp('the expression for yn is ');
  disp(F);
  disp('Which is equal to 0 ');

end
disp('Hence proved');
```

Scilab code Exa 4.9 proving the given differential equation

```
//ques4.1
//clear
//cd SCI
//cd ("..")
//cd ("..")
//exec symbolic.sce
clc
disp(' y=e^(a(sin^-1)x)) --sign inverse x ');
syms x a
y=%e^(a*(asin(x)));
disp('we have to prove (1-x^2)y(n+2)-(2n+1)xy(n+1)-(
   n^2+a^2)yn ') ;
//n=input('Enter the order of differentiation ");
disp('calculating  yn for various values of n');
for n=1:4

  //yn=diff(F,x,n)
  F=(1-x^2)*diff(y,x,n+2)-(2*n+1)*x*diff(y,x,n+1)-(n
     ^2+a^2)*diff(y,x,n);
  disp(n);
  disp('the expression for yn is ');
  disp(F);
  disp('Which is equal to 0 ');

end
disp('Hence proved');
```

Scilab code Exa 4.10 proving the given differential equation

```
clc
disp(' y^(1/m)+y^-(1/m)=2x   ');
disp(' OR y^(2/m)-2xy^(1/m)+1');
disp('OR y=[x+(x^2-1)]^m and y=[x-(x^2-1)]^m ');

syms x m
disp('For y=[x+(x^2-1)]^m ');
 y=(x+(x^2-1))^m
disp('we have to prove (x^2-1)y(n+2)+(2n+1)xy(n+1)+(n^2-m^2)yn ') ;
//n=input('Enter the order of differentiation ");
disp('calculating  yn for various values of n');
for n=1:4

  //yn=diff(F,x,n)
  F=(x^2-1)*diff(y,x,n+2)+(2*n+1)*x*diff(y,x,n+1)+(n^2-m^2)*diff(y,x,n);
  disp(n);
  disp('the expression for yn is ');
  disp(F);
  disp('Which is equal to 0 ');

end
disp('For y=[x-(x^2-1)]^m ');
 y=(x-(x^2-1))^m
```

```
disp('we have to prove (x^2-1)y(n+2)+(2n+1)xy(n+1)+(n^2-m^2)yn ') ;
//n=input('Enter the order of differentiation ");
disp('calculating  yn for various values of n');
for n=1:4

  //yn=diff(F,x,n)
  F=(x^2-1)*diff(y,x,n+2)+(2*n+1)*x*diff(y,x,n+1)+(n^2-m^2)*diff(y,x,n);
  disp(n);
  disp('the expression for yn is ');
  disp(F);
  disp('Which is equal to 0 ');

end
disp('Hence proved');
```

Scilab code Exa 4.11 verify roles theorem

```
clc
disp('for roles theorem F9x) should be differentiable in (a,b) and f(a)=f(b)');
disp(' Here f(x)=sin(x)/e^x');
disp('');
syms x
y=sin(x)/%e^x;

y1=diff(y,x);
disp(y1);
disp('putting this to zero we get tan(x)=1 ie x=pi/4 ');
disp('value pi/2 lies b/w 0 and pi. Hence roles theorem is verified');
```

Scilab code Exa 4.16 expansion using maclaurins series

```
//ques16
disp('Maclaurins series');
disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)+......');
syms x a
//function y=f(a)
  y=tan(a);
//endfunction
n=input('enter the number of expression in series : ');
a=1;
t=eval(y);
a=0;
for i=2:n
  y1=diff(y,'a',i-1);
  t=t+x^(i-1)*eval(y1)/factorial(i-1);
end
disp(t)
```

Scilab code Exa 4.17 expanding function as fourier series of sine term

```
//ques16
disp('Maclaurins series');
disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)+......');
syms x a

  y=%e^(sin(a));
  n=input('enter the number of expression in seris : ');
  a=0;
t=eval(y);
a=0;
for i=2:n
  y1=diff(y,'a',i-1);
   t=t+x^(i-1)*eval(y1)/factorial(i-1);
end
disp(t)
```

Scilab code Exa 4.18 expansion using maclaurins series

```
//ques18
disp('Maclaurins series');
disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)+......');
syms x a

  y=log(1+(sin(a))^2);
  n=input('enter the number of differentiation involved in  maclaurins series : ');
  a=0;
t=eval(y);
a=0;
for i=2:n
  y1=diff(y,'a',i-1);
   t=t+x^(i-1)*eval(y1)/factorial(i-1);
end
disp(t)
```

Scilab code Exa 4.19 expansion using maclaurins series

```
//ques19
disp('Maclaurins series');
disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)+......');
syms x a b

  y=%e^(a*asin(b));
  n=input('enter the number of expression in seris :');
  b=0;
t=eval(y);

for i=2:n
  y1=diff(y,'b',i-1);
   t=t+x^(i-1)*eval(y1)/factorial(i-1);
end
disp(t)
```

Scilab code Exa 4.20 expansion using taylors series

```
//ques20
disp('Advantage of scilab is that we can calculate log1.1 directly without using Taylor series');
disp(' Use of taylor series are given in subsequent examples');
y=log(1.1);
disp('log(1.1)= ');
disp(log(1.1));
```

Scilab code Exa 4.21 taylor series

```
//ques21
disp('Taylor series');
disp('f(x+h)=f(x)+hf1(x)+h^2/2!*f2(x)+h^3/3!*f3(x)+......');
disp('To finf the taylor expansion of tan-1(x+h)')
syms x h

  y=atan(x);
  n=input('enter the number of expression in seris : ');

t=y;

for i=2:n
  y1=diff(y,'x',i-1);
   t=t+h^(i-1)*(y1)/factorial(i-1);
end
disp(t)
```

Scilab code Exa 4.22 evaluating limit

```
//ques22
disp('Here we need to find find the limit of f(x) at x=0')
syms x
y=(x*%e^x-log(1+x))/x^2;
//disp('The limit at x=0 is : ');
//l=limit(y,x,0);
//disp(l)
f=1;
while f==1
yn=x*%e^x-log(1+x);
yd=x^2;
yn1=diff(yn,'x',1);
yd1=diff(yd,'x',1);
x=0;
a=eval(yn1);
b=eval(yd1);
if a==b then
```

```
  yn=yn1;
  yd=yd1;
else
  f=0;

end
end
h=a/b;
disp(h);
```

Scilab code Exa 4.32 tangent to curve

```
//ques 32
disp('Equation of tangent');
syms x a y;
f=(a^(2/3)-x^(2/3))^(3/2);
s=diff(f,x);

Y1=s*(-x)+y;
X1=-y/s*x;
g=x-(Y1-s*(X1-x));
disp('Equation is g=0 where g is');
disp(g);
```

Scilab code Exa 4.34 finding equation of normal

```
//ques34
disp('Equation of tangent');
syms x a t y
xo=a*(cos(t)+t*sin(t));
yo=a*(sin(t)-t*cos(t));
s=diff(xo,t)/diff(yo,t);
y=yo+s*(x-xo);
```

```
disp('y=');
disp(y);
```

Scilab code Exa 4.35 finding angle of intersection of curve

```
//ques35
disp("The two given curves are x^=4y and y^2=4x which intersects at (0,0) and (4,4)');
disp('for (4,4)');
x=4;
syms x
y1=x^2/4;
y2=2*x^(1/2);
m1=diff(y1,x,1);
m2=diff(y2,x,1);
x=4;
m1=eval(m1);
m2=eval(m2);

disp('Angle between them is(radians) :-');
t=atan((m1-m2)/(1+m1*m2));
disp(t);
```

Scilab code Exa 4.37 prove given tangent statement

```
//ques37
syms a t
x=a*(cos(t)+log(tan(t/2)));
y=a*sin(t);
s=diff(x,t,1)/diff(y,t,1);
disp('length of tangent ');
l=y*(1+s)^(0.5);
disp(l);
disp('checking for its dependency on t')

f=1
t=0;
k=eval(l);
for i=1:10
  t=i;
  if(eval(l)~=k)
    f=0;
  end
end
if(f==1)
  disp("verified and equal to a");
  disp('subtangent');
  m=y/s;
  disp(m);
```

Scilab code Exa 4.39 finding angle of intersection of curve

```
//ques39
clc
disp('Angle of intersection');
disp('point of intersection of r=sint+cost and r=2 sint is t=pi/4 ');
disp('tanu=dQ/dr*r');
syms Q ;

r1=2*sin(Q);
r2=sin(Q)+cos(Q);
u=atan(r1*diff(r2,Q,1));
Q=%pi/4;
u=eval(u);
disp('The angle at point of intersection in radians is : ');
disp(u);
```

Scilab code Exa 4.41 finding pedal equation of parabola

```
//ques41
clc
disp('tanu=dQ/dr*r');
syms Q a;

r=2*a/(1-cos(Q));

u=atan(r/diff(r2,Q,1));
u=eval(u);
p=r*sin(u);
syms r;
Q=acos(1-2*a/r);

//cos(Q)=1-2*a/r;
p=eval(p);
disp(p);
```

Scilab code Exa 4.43 finding radius of curvature of cycloid

```
//ques43
syms a t
x=a*(t+sin(t));
y=a*(1-cos(t));
s2=diff(y,t,2)/diff(x,t,2);
s1=diff(y,t,1)/diff(x,t,1);

r=(1+s1^2)^(3/2)/s2;
disp('The radius of curvature is : ');
disp(r);
```

Scilab code Exa 4.46 radius of curvature of cardoid

```
//ques46
disp('radius of curvature');
syms a t
r=a*(1-cos(t));
r1=diff(r,t,1);
l=(r^2+r1^2)^(3/2)/(r^2+2*r1^2-r*r1);
syms r;
t=acos(1-r/a);
l=eval(l);
disp(l);
disp('Which is proportional to r^0.5');
```

Scilab code Exa 4.47 cordinates of centre of curvature

```
//qus47
disp('The centre of curvature');
syms x a y
y=2*(a*x)^0.5;
y1=diff(y,x,1);
y2=diff(y,x,2);
xx=x-y1*(1+y1)^2/y2;
yy=y+(1+y1^2)/y2;
disp('the coordinates x,y are resp :');

disp(xx);
disp(yy);
```

Scilab code Exa 4.48 proof statement cycloid

```
//ques48
disp('centre of curvature of given cycloid ');
syms a t
x=a*(t-sin(t));
y=a*(1-cos(t));
y1=diff(y,t,1);
y2=diff(y,t,2);
xx=x-y1*(1+y1)^2/y2;
yy=y+(1+y1^2)/y2;

disp('the coordinates x,y are resp :');
disp(xx);
disp(yy);
disp('which another parametric equation of cycloid ');
```

Scilab code Exa 4.52 maxima and minima

```
//error
//ques52
disp('To find the maxima and minima of given function put f1(x)=0');
syms x
//x=poly(0,'x');
f=3*x^4-2*x^3-6*x^2+6*x+1;
k=diff(f,x);
x=poly(0,'x');
k=eval(k);
```

Scilab code Exa 4.61 finding the asymptotes of curve

```
//ques 61
clc
disp('to find the assymptote of given curve ');
syms x y
f=x^2*y^2-x^2*y-x*y^2+x+y+1;
//a=degrees(f,x);
f1=coeffs(f,x,2);
disp('assymptotes parallel to x-xis is given by f1=0 where f1 is :');
disp(factor(f1));
f2=coeffs(f,y,2);
disp('assymptotes parallel to y-axis is given by f2=0 and f2 is :');
disp(factor(f2));
```

Chapter 5

Partial Differentiation And Its Applications

Scilab code Exa 5.5 Partial derivative of given function

```
clc
syms x y z
v=(x^2+y^2+z^2)^(-1/2)
a=diff(v,x,2)
b=diff(v,y,2)
c=diff(v,z,2)
a+b+c
```

Scilab code Exa 5.14 Partial derivative of given function

```
clc
syms x y
u=asin((x+y)/(x^0.5+y^0.5))
a=diff(u,x)
b=diff(u,y)
c=diff(a,x)
```

```
d=diff(b,y)
e=diff(b,x)
x*a+y*b
(1/2)*tan(u)
(x^2)*c+2*x*y*e+(y^2)*d
(-sin(u)*cos(2*u))/(4*(cos(u))^3)
```

Scilab code Exa 5.25.1 Partial derivative of given function

```
clc
syms r l
x=r*cos(l)
y=r*sin(l)
a=diff(x,r)
b=diff(x,l)
c=diff(y,r)
d=diff(y,l)
A=[a b;c d]
det(A)
```

Scilab code Exa 5.25.2 Partial derivative of given function

```
clc
syms r l z
x=r*cos(l)
y=r*sin(l)
m=z
a=diff(x,r)
b=diff(x,l)
c=diff(x,z)
d=diff(y,r)
e=diff(y,l)
f=diff(y,z)
```

```
g=diff(m,r)
h=diff(m,l)
i=diff(m,z)
A=[a b c;d e f;g h i]
det(A)
```

Scilab code Exa 5.25.3 Partial derivative of given function

```
clc
syms r l m
x=r*cos(l)*sin(m)
y=r*sin(l)*sin(m)
z=r*cos(m)
a=diff(x,r)
b=diff(x,m)
c=diff(x,l)
d=diff(y,r)
e=diff(y,m)
f=diff(y,l)
g=diff(z,r)
h=diff(z,m)
i=diff(z,l)
A=[a b c;d e f;g h i]
det(A)
```

Scilab code Exa 5.26 Partial derivative of given function

```
clc
syms x1 x2 x3
y1=(x2*x3)/x1
y2=(x3*x1)/x2
y3=(x1*x2)/x3
a=diff(y1,x1)
```

```
b=diff(y1,x2)
c=diff(y1,x3)
d=diff(y2,x1)
e=diff(y2,x2)
f=diff(y2,x3)
g=diff(y3,x1)
h=diff(y3,x2)
i=diff(y3,x3)
A=[a b c;d e f;g h i]
det(A)
```

Scilab code Exa 5.30 Partial derivative of given function

```
clc
syms x y
u=x*(1-y^2)^0.5+y*(1-x^2)^0.5
v=asin(x)+asin(y)
a=diff(u,x)
b=diff(u,y)
c=diff(v,x)
d=diff(v,y)
A=[a b; c d ]
det(A)
```

Chapter 6

Integration and its Applications

Scilab code Exa 6.1.1 indefinite integral

```
//ques1
disp('Indefinite integral');
syms x
f=integ((sin(x))^4,x);
disp(f);
```

Scilab code Exa 6.1.2 indefinite integral

```
//ques1
disp('Indefinite integral');
syms x
f=integ((cos(x))^7,x);
disp(f);
```

Scilab code Exa 6.2.1 definite integral

```
//ques1
disp('definite integral');
syms x
f=integ((cos(x))^6,x,0,%pi/2);
disp(float(f));
```

Scilab code Exa 6.2.2 Definite Integration of a function

```
//no output
//ques1
clc
disp('definite integral');
syms x a
g=x^7/(a^2-x^2)^1/2
f=integ(g,x,0,a);
disp(float(f));
```

Scilab code Exa 4.2.3 definite integral

```
//error no output
//ques4
clc
disp('definite integral');
syms x a
g=x^3*(2*a*x-x^2)^(1/2);
f=integ(g,x,0,2*a);
disp(f);
```

Scilab code Exa 6.2.3 definite integral

```
//no output
//ques1
clc
disp('definite integral');
syms x a n
g=1/(a^2+x^2)^n;
f=integ(g,x,0,%inf);
disp(f);
```

Scilab code Exa 6.4.1 definite integral

```
//ques4
clc
disp('definite integral');
syms x
g=(sin(6*x))^3*(cos(3*x))^7;
f=integ(g,x,0,%pi/6);
disp(float(f));
```

Scilab code Exa 4.4.2 definite integral

```
//ques4
clc
disp('definite integral');
syms x
g=x^4*(1-x^2)^(3/2);
f=integ(g,x,0,1);
disp(float(f));
```

Scilab code Exa 6.5 definite integral

```
//error no internal error
//ques5
clc
disp('definite integral');
syms x m n
n=input('Enter n :');
m=input('Enter m : ');
g=(cos(x))^m*cos(n*x);
f=integ(g,x,0,%pi/2);
disp(float(f));
g2=(cos(x))^(m-1)*cos((n-1)*x);
f2=m/(m+n)*integ(g2,x,0,%pi/2);
disp(float(f2));
disp('Equal');
```

Scilab code Exa 6.6.1 reducing indefinite integral to simpler form

```
//ques6
clc
disp('definite integral');
syms x a
n=input('Enter n :');
g=exp(a*x)*(sin(x))^n;

f=integ(g,x);
disp(f);
```

Scilab code Exa 6.7.1 Indefinite Integration of a function

```
clc
syms x
disp(integ(tan(x)^5,x))
```

Scilab code Exa 6.8 Getting the manual input of a variable and integration

```
clc
n=input('Enter the value of n ”);
p=integrate('(tan(x))^(n-1)','x',0,%pi/4)
q=integrate('(tan(x))^(n+1)','x',0,%pi/4)
disp('n(p+q)=')
disp(n*(p+q))
```

Scilab code Exa 6.9.1 Definite Integration of a function

```
clear
clc
integrate('sec(x)^4','x',0,%pi/4)
```

Scilab code Exa 6.9.2 Definite Integration of a function

```
clear
clc
integrate('1/sin(x)^3','x',%pi/3,%pi/2)
```

Scilab code Exa 6.10 definite integral

```

//ques8
clc
```

```
syms x
g=x*sin(x)^6*cos(x)^4;
f=integ(g,x,0,%pi);
disp(float(f));
```

Scilab code Exa 6.12 Definite Integration of a function

```
clear
clc
integrate('sin(x)^0.5/(sin(x)^0.5+cos(x)^0.5)','x',0,%pi/2)
```

Scilab code Exa 6.13 sum of infinite series

```

//ques13
clc
syms x
disp('The summation is equivalent to integration of 1/(1+x^2) from 0 to 1 ');
g=1/(1+x^2);
f=integ(g,x,0,1);
disp(float(f));
```

Scilab code Exa 6.14 finding the limit of the function

```
//ques14
clc
syms x
```

```
disp('The summation is equivalent to integration of log(1+x) from 0 to 1 ');
g=log(1+x);
f=integ(g,x,0,1);
disp(float(f));
```

Scilab code Exa 6.15 Definite Integration of a function

```
clear
clc
integrate('x*sin(x)^8*cos(x)^4','x',0,%pi)
```

Scilab code Exa 6.16 Definite Integration of a function

```
clear
clc
integrate('log(sin(x))','x',0,%pi/2)
```

Scilab code Exa 6.24 Calculating the area under two curves

```
clear
clc
xset('window',1)
xtitle("My Graph","X axis","Y axis")
x=linspace(-5,10,70)
y1=(x+8)/2
y2=x^2/8
plot(x,y1,"o-")
plot(x,y2,"+-")
legend("(x+8)/2","x^2/8")
```

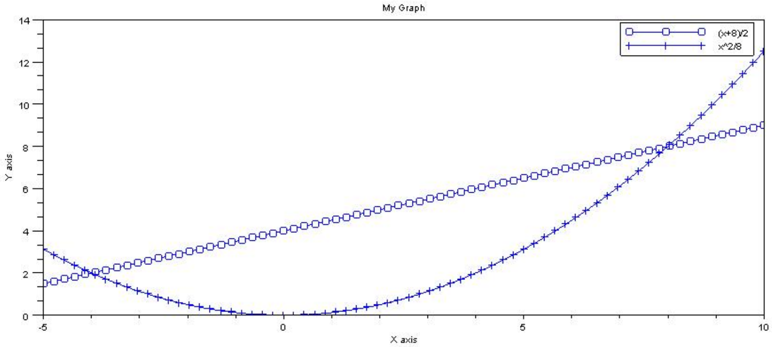

Figure 6.1: Calculating the area under two curves

```
disp("from the graph,it is clear that the points of intersection are x=-4 and x=8.")
disp("So,our region of integration is from x=-4 to x=8")
integrate('(x+8)/2-x^2/8','x',-4,8)
```

Chapter 9

Infinite Series

Scilab code Exa 9.1 to find the limit at infinity

```
clc
syms n;
f=((1/n)^2-2*(1/n))/(3*(1/n)^2+(1/n))
disp(limit(f,n,0));
```

Scilab code Exa 9.1.3 to find the limit at infinity

```
clc
syms n;
f=3+(-1)^n
limit(f,n,%inf)
```

Scilab code Exa 9.2.1 to find the sum of series upto infinity

```
clc
syms n
```

```
disp('1+2+3+4+5+6+7+....+n+.....=')
p=1/n*(1/n+1)/2
disp(limit(p,n,0));
```

Scilab code Exa 9.2.2 to check for the type of series

```
clc
disp('5-4-1+5-4-1+5-4-1+5-4-1+........=0,5,1
   according to the no. of terms.')
disp('clearly,in this case sum doesnt tend to a
   unique limit.hence,series is oscillatory.')
```

Scilab code Exa 9.5.1 to check the type of infinite series

```
clc
syms n;
v=1/((1/n)^2)
u=(2/n-1)/(1/n*(1/n+1)*(1/n+2))
disp(limit(u/v,n,0));
disp('both u and v converge and diverge together,
   hence u is convergent')
```

Scilab code Exa 9.5.2 to check the type of infinite series

```
clc
syms n;
v=n
u=((1/n)^2)/((3/n+1)*(3/n+4)*(3/n+7))
disp(limit(u/v,n,0));
disp('both u and v converge and diverge together,
   hence u is divergent')
```

Scilab code Exa 9.7.1 to check the type of infinite series

```
clc
syms n
disp('u=((n+1)^0.5-1)/((n+2)^3-1)=>')
//put n=1/n
u=((1+1/(1/n))-(1/n)^(-0.5))/(((1/n)^5/2)*((1+2/(1/n))^3-(1/n)^(-3)))
v=(1/n)^(-5/2)
disp(limit(u/v,n,0));
//disp('=1')
disp('since , v is convergent,so u is also conzavergent.')
```

Scilab code Exa 9.7.3 to check the type of infinite series

```
clc
syms n
disp(integ(1/(n*log(n)),n,2,%inf));
```

Scilab code Exa 9.8.1 to find the sum of series upto infinity

```
clc
syms x n;
//put n=1/n
u=(x^(2*(1/n)-2))/(((1/n)+1)*(1/n)^0.5)
v=(x^(2*(1/n)))/((1/n+2)*(1/n+1)^0.5)
disp(limit(u/v,n,0));
```

Scilab code Exa 9.8.2 to find the limit at infinity

```
clc
syms x n;
//put n=1/n
u=((2^(1/n)-2)*(x^(1/n-1)))/(2^(1/n)+1)
v=((2^((1/n)+1)-2)*(x^(1/n)))/(2^(1/n+1)+1)
disp(limit(u/v,n,0));
```

Scilab code Exa 9.10.1 to find the limit at infinity

```
clc
syms x n;
u=1/(1+x^(-n));
v=1/(1+x^(-n-1));
disp(limit(u/v,n,0));
```

Scilab code Exa 9.10.2 to find the limit at infinity

```
clc
syms a b n;
l=(b+1/n)/(a+1/n)
disp(limit(l,n,0));
```

Scilab code Exa 9.11.1 to find the limit at infinity

```
clc
syms x n;
disp('u=((4.7....(3n+1))*x^n)/(1.2.....n)')
disp('v=((4.7....(3n+4)*x^(n+1))/(1.2.....(n+1))')
disp('l=u/v=>')
l=(1+n)/((3+4*n)*x)
disp(limit(l,n,0))
```

Scilab code Exa 9.11.2 to find the limit at infinity

```
clc
syms x n;
u=(((factorial(n))^2)*x^(2*n))/factorial(2*n)
v=(((factorial(n+1))^2)*x^(2*(n+1)))/factorial(2*(n
   +1))
limit(u/v,n,%inf)
```

Chapter 10

Fourier Series

Scilab code Exa 10.1 finding fourier series of given function

```
//ques1
clc
disp('finding the fourier series of given function')
   ;
syms  x
ao=1/%pi*integ(exp(-1*x),x,0,2*%pi);
s=ao/2;
n=input('enter the no of terms upto each of sin or
   cos terms in the expansion : ');
for i=1:n
  ai=1/%pi*integ(exp(-x)*cos(i*x),x,0,2*%pi);
  bi=1/%pi*integ(exp(-x)*sin(i*x),x,0,2*%pi);
  s=s+float(ai)*cos(i*x)+float(bi)*sin(i*x);
end
disp(float(s));
```

Scilab code Exa 10.2 finding fourier series of given function

```
//error
//ques2
disp('To find the fourier transform of given function ');
syms x s
F=integ(exp(%i*s*x),x,-1,1);
disp(F);
//produces error->
F1=integ(sin(x)/x,x,0,%inf);
```

Scilab code Exa 10.3 finding fourier series of given function

```
//ques3
clc
disp('finding the fourier series of given function');
syms x
ao=1/%pi*(integ(-1*%pi*x^0,x,-%pi,0)+integ(x,x,0,%pi));
s=ao/2;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=1/%pi*(integ(-1*%pi*cos(i*x),x,-1*%pi,0)+integ(x*cos(i*x),x,0,%pi));
  bi=1/%pi*(integ(-1*%pi*x^0*sin(i*x),x,-1*%pi,0)+integ(x*sin(i*x),x,0,%pi));
  s=s+float(ai)*cos(i*x)+float(bi)*sin(i*x);
end
disp(float(s));
```

Scilab code Exa 10.4 finding fourier series of given function

```
//ques4
clc
disp('finding the fourier series of given function');
syms  x l
ao=1/l*integ(exp(-1*x),x,-l,l);
s=ao/2
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=1/l*integ(exp(-x)*cos(i*%pi*x/l),x,-l,l);
  bi=1/l*integ(exp(-x)*sin(i*%pi*x/l),x,-l,l);
  s=s+float(ai)*cos(i*%pi*x/l)+float(bi)*sin(i*%pi*x/l);
end
disp(float(s));
```

Scilab code Exa 10.5 finding fourier series of given function in interval minus pi to pi

```
//ques5
clc
disp('finding the fourier series of given function');
syms  x l
s=0;
n=input('enter the no of terms upto each of sin terms in the expansion : ');
for i=1:n

   bi=2/%pi*integ(x*sin(i*x),x,0,%pi);
  s=s+float(bi)*sin(i*x);
end
disp(float(s));
```

Scilab code Exa 10.6 finding fourier series of given function in interval minus l to l

```
//error no output
//ques6
clc
disp('finding the fourier series of given function');
syms  x l
ao=2/l*integ(x^2,x,0,l);
s=float(ao)/2;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=2/l*integ(x^2*cos(i*%pi*x/l),x,0,l);
  //bi=1/l*integ(exp(-x)*sin(i*x),x,-l,l);
  s=s+float(ai)*cos(i*%pi*x/l);
  end
disp(float(s));
```

Scilab code Exa 10.7 finding fourier series of given function in interval minus pi to pi

```
//ques1
clc
disp('finding the fourier series of given function');
syms  x
ao=2/%pi*(integ(cos(x),x,0,%pi/2)+integ(-cos(x),x,%pi/2,%pi));
s=ao/2;
```

```
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=2/%pi*(integ(cos(x)*cos(i*x),x,0,%pi/2)+integ(-cos(x)*cos(i*x),x,%pi/2,%pi));
  //bi=1/%pi*(integ(-1*%pi*x^0*sin(i*x),x,-1*%pi,0)+integ(x*sin(i*x),x,0,%pi));
  s=s+float(ai)*cos(i*x);
end
disp(float(s));
```

Scilab code Exa 10.8 finding fourier series of given function in interval minus pi to pi

```
//ques8
clc
disp('finding the fourier series of given function');
syms x
ao=2/%pi*(integ((1-2*x/%pi),x,0,%pi));
s=ao/2;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=2/%pi*(integ((1-2*x/%pi)*cos(i*x),x,0,%pi));
  //bi=1/%pi*(integ(-1*%pi*x^0*sin(i*x),x,-1*%pi,0)+integ(x*sin(i*x),x,0,%pi));
  s=s+float(ai)*cos(i*x);
end
disp(float(s));
```

Scilab code Exa 10.9 finding half range sine series of given function

```
//ques9
clc
disp('finding the fourier series of given function');
syms  x l

s=0;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
//   ai=1/l*integ(exp(-x)*cos(i*%pi*x/l),x,-l,l);
  bi=integ(x*sin(i*%pi*x/2),x,0,2);
  s=s+float(bi)*sin(i*%pi*x/2);
end
disp(float(s));
```

Scilab code Exa 10.10 finding half range cosine series of given function

```
//ques10
clc
disp('finding the fourier series of given function');
syms  x
ao=2/2*(integ(x,x,0,2));
s=ao/2;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=2/2*(integ(x*cos(i*%pi*x/2),x,0,2));
  //bi=1/%pi*(integ(-1*%pi*x^0*sin(i*x),x,-1*%pi,0)+integ(x*sin(i*x),x,0,%pi));
  s=s+float(ai)*cos(i*%pi*x/2);
end
disp(float(s));
```

Scilab code Exa 10.11 expanding function as fourier series of sine term

```
//ques3
clc
disp('finding the fourier series of given function');
syms x
ao=0;
s=ao;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
    bi=2/1*(integ((1/4-x)*sin(i*%pi*x),x,0,1/2)+integ((x-3/4)*sin(i*%pi*x),x,1/2,1));
  s=s+float(bi)*sin(i*%pi*x);
end
disp(float(s));
```

Scilab code Exa 10.12 finding fourier series of given function

```
//ques1
clc
disp('finding the fourier series of given function');
syms x
ao=1/%pi*integ(x^2,x,-%pi,%pi);
s=ao/2;
n=input('enter the no of terms upto each of sin or cos terms in the expansion : ');
for i=1:n
  ai=1/%pi*integ((x^2)*cos(i*x),x,-%pi,%pi);
  bi=1/%pi*integ((x^2)*sin(i*x),x,-%pi,%pi);
  s=s+float(ai)*cos(i*x)+float(bi)*sin(i*x);
end
disp(float(s));
```

Scilab code Exa 10.13 finding complex form of fourier series

```
//ques13
clc
disp('The complex form of series is summation of f(n,x) where n varies from -%inf to %inf and f(n,x) is given by :');
syms n x
cn=1/2*integ(exp(-x)*exp(-%i*%pi*n*x),x,-1,1);
fnx=float(cn)*exp(%i*n*%pi*x);

disp(float(fnx));
```

Scilab code Exa 10.14 practical harmonic analysis

```
//ques15
//yo=[1.80 1.10 0.30 0.16 1.50 1.30 2.16 1.25 1.30 1.52 1.76 2.00]
//x0=[0 %pi/6 %pi/3 %pi/2 2*%pi/3 5*%pi/6 %pi 7*%pi/6 4*%pi/3 3*%pi/2 5*%pi/3 11*%pi/6]
disp('Practical harmonic analysis');
syms x
xo=input('Input xo matrix : ');
yo=input('Input yo matrix : ');
ao=2*sum(yo)/length(xo);
s=ao/2;
n=input('No of sin or cos term in expansion : ');
for i=1:n
  an=2*sum(yo.*cos(i*xo))/length(yo);
  bn=2*sum(yo.*sin(i*xo))/length(yo);
  s=s+float(an)*cos(i*x)+float(bn)*sin(i*x);

  end
  disp(s);
```

Scilab code Exa 10.15 practical harmonic analysis

```
//error
//ques15,16,17
//yo=[1.98 1.30 1.05 1.30 -0.88 -.25 1.98]
//x0=[0 1/6 1/3 1/2 2/3 5/6 1]
disp('Practical harmonic analysis');
syms x T
xo=input('Input xo matrix (in factor of T) : ');
yo=input('Input yo matrix : ');
ao=2*sum(yo)/length(xo);
s=ao/2;
n=input('No of sin or cos term in expansion : ');
 i=1
  an=2*(yo.*cos(i*xo*2*%pi))/length(yo);
  bn=2*(yo.*sin(i*xo*2*%pi))/length(yo);
  s=s+float(an)*cos(i*x*2*%pi/T)+float(bn)*sin(i*x*2*%pi/T);

  disp(s);
  disp('Direct current :');
 i=sqrt(an^2+bn^2);
```

Scilab code Exa 10.16 practical harmonic analysis

```
//error
//ques15,16,17
```

```
//yo=[1.98 1.30 1.05 1.30 -0.88 -.25 1.98]
//x0=[0 1/6 1/3 1/2 2/3 5/6 1]
disp('Practical harmonic analysis');
syms x T
xo=input('Input xo matrix (in factor of T) : ');
yo=input('Input yo matrix : ');
ao=2*sum(yo)/length(xo);
s=ao/2;
n=input('No of sin or cos term in expansion : ');
 i=1
  an=2*(yo.*cos(i*xo*2*%pi))/length(yo);
  bn=2*(yo.*sin(i*xo*2*%pi))/length(yo);
  s=s+float(an)*cos(i*x*2*%pi/T)+float(bn)*sin(i*x*2*%pi/T);

  disp(s);
  disp('Direct current :');
 i=sqrt(an^2+bn^2);
```

Scilab code Exa 10.17 practical harmonic analysis

```
//error
//ques15,16,17
//yo=[1.98 1.30 1.05 1.30 -0.88 -.25 1.98]
//x0=[0 1/6 1/3 1/2 2/3 5/6 1]
disp('Practical harmonic analysis');
syms x T
xo=input('Input xo matrix (in factor of T) : ');
yo=input('Input yo matrix : ');
ao=2*sum(yo)/length(xo);
s=ao/2;
n=input('No of sin or cos term in expansion : ');
 i=1
  an=2*(yo.*cos(i*xo*2*%pi))/length(yo);
  bn=2*(yo.*sin(i*xo*2*%pi))/length(yo);
  s=s+float(an)*cos(i*x*2*%pi/T)+float(bn)*sin(i*x
     *2*%pi/T);

  disp(s);
  disp('Direct current :');
 i=sqrt(an^2+bn^2);
```

Chapter 13

Linear Differential Equations

Scilab code Exa 13.1 solvinf linear differential equation

```
//ques1
clc
disp('solution of the given linear differential equation is given by : ');
syms c1 c2 x
m=poly(0,'m');
f=m^2+m-2;
r=roots(f);
disp(r);
y=0;
//for i=1:length(r)
  //syms c(i)
  //y=y+c(i)*exp(r(i)*x);
  //end
  y=c1*exp(r(1)*x)+c2*exp(r(2)*x);
  disp('y=');
  disp(y);
```

Scilab code Exa 13.2 solving linear differential equation

```
//ques2
clc
disp('solution of the given linear differential
   equation is given by : ');
syms c1 c2 x;
m=poly(0,'m');
f=m^2+6*m+9;
r=roots(f);
disp(r);
disp('roots are equal so solution is given by :');
disp('y=');
y=(c1+x*c2)*exp(r(1)*x);
disp(y);
```

Scilab code Exa 13.3 solving linear differential equation

```
//ques4
clc
disp('solution of the given linear differential
   equation is given by : ');
syms c1 c2 c3 x
m=poly(0,'m');
f=m^3+m^2+4*m+4;
r=roots(f);
disp(r);
y=c1*exp(r(1)*x)+c2*exp(r(2)*x)+c3*exp(r(3)*x);
disp('y=');
disp(real(y));
```

Scilab code Exa 13.4 solving linear differential equation

```
//ques4
clc
```

```
disp('solution of the given linear differential
   equation is given by : ');
m=poly(0,'m');
syms c1 c2 c3 c4 x
f=m^4+4;
r=roots(f);
disp(r);
y=c1*exp(r(1)*x)+c2*exp(r(2)*x)+c3*exp(r(3)*x)+c4*
   exp(r(4)*x);
disp('y=');
disp(real(y));
```

Scilab code Exa 13.5 finding particular integral

```
//ques5
clc
disp('solution of the given linear differential
   equation is given by : ');
m=poly(0,'m');
f=m^2+5*m+6;
//for particular solution a=1
y=exp(x)/horner(f,1);
disp('y-');
disp(y);
```

Scilab code Exa 13.6 finding particular integral

```
//ques6
clc
disp('solution of the given linear differential
   equation is given by : ');
m=poly(0,'m');
f=(m+2)*(m-1)^2;
```

```
r=roots(f);
disp(r);
disp('y=1/f(D)*[exp(-2x)+exp(x)-exp(-x)');
disp('using 1/f(D)exp(ax)=x/f1(D)*exp(ax) if f(m)=0');
y1=x*exp(-2*x)/9;
y2=exp(-x)/4;
y3=x^2*exp(x)/6;
y=y1+y2+y3;
disp('y=');
disp(y);
```

Scilab code Exa 13.7 finding particular integral

```
//ques7
clc
disp('solution of the given linear differential equation is given by : ');
m=poly(0,'m');
f=m^3+1;
disp('Using the identity 1/f(D^2)*sin(ax+b)[or cos(ax+b)]=1/f(-a^2)*sin(ax+b)[or cos(ax+b)] this equation can be reduced to ');
disp('y=(4D+1)/65*cos(2x-1)');
y=(cos(2*x-1)+4*diff(cos(2*x-1),x))/65;
disp('y=');
disp(y);
```

Scilab code Exa 13.8 finding particular integral

```
//ques8
clc
```

```
disp('solution of the given linear differential equation is given by : ');
m=poly(0,'m');
f=m^3+4*m;
disp('using 1/f(D)exp(ax)=x/f1(D)*exp(ax) if f(m)=0');
disp('y=x*1/(3D^2+4)*sin2x');
disp('Using the identity 1/f(D^2)*sin(ax+b)[or cos(ax+b)]=1/f(-a^2)*sin(ax+b)[or cos(ax+b)] this equation can be reduced to ');
disp('y=-x/8*sin2x');
disp('y=');
y=-x*sin(2*x)/8;
disp(y);
```

Scilab code Exa 13.9 finding particular integral

```
//ques9
clc
disp('solution of the given linear differential equation is given by : ');
m=poly(0,'m');

disp('y=1/(D(D+1))[x^2+2x+4] can be written as (1-D+D^2)/D[x^2+2x+4] which is combination of differentiation and integration ');
g=x^2+2*x+4;
f=g-diff(g,x)+diff(g,x,2);
y=integ(f,x);
disp('y=');
disp(y);
```

Scilab code Exa 13.10 finding particular integral

```
//error
clc
disp('solution of the given linear differential equation is given by : ');
```

Scilab code Exa 13.11 solving the given linear equation

```
//ques11
clc
disp('solution of the given linear differential equation is given by : ');
disp('CF + PI');
syms c1 c2 x
m=poly(0,'m');
f=(m-2)^2;
r=roots(f);
disp(r);
disp('CF is given by ');
cf=(c1+c2*x)*exp(r(1)*x);
disp(cf);
disp('----------------------------------------');
disp('PI =8*{1/(D-2)^2[exp(2x)]+{1/(D-2)^2[sin(2x)]+{1/(D-2)^2[x^2]}');
disp('using identities it reduces to : ');
pi=4*x^2*exp(2*x)+cos(2*x)+4*x+3;
disp(pi);
y=cf+pi;
disp('The solution is : y=');
disp(y);
```

Scilab code Exa 13.12 solving the given linear equation

```
//ques12
```

```
clc

disp('solution of the given linear differential equation is given by : ');
disp('CF + PI');
syms c1 c2 x
m=poly(0,'m');
f=(m^2-4);
r=roots(f);
disp(r);
disp('CF is given by ');
cf=c1*exp(r(1)*x)+c2*exp(r(2)*x);
disp(cf);
disp('----------------------------------------');
disp('PI =8*{1/(D^2-4)[x*sinh(x)]');
disp('using identities it reduces to : ');
pi=-x/6*(exp(x)-exp(-x))-2/18*(exp(x)+exp(-x));
disp(pi);
y=cf+pi;
disp('The solution is : y=');
disp(y);
```

Scilab code Exa 13.13 solving the given linear equation

```
//ques12
clc

disp('solution of the given linear differential equation is given by : ');
disp('CF + PI');
syms c1 c2 x
m=poly(0,'m');
f=(m^2-1);
r=roots(f);
disp(r);
disp('CF is given by ');
cf=c1*exp(r(1)*x)+c2*exp(r(2)*x);
disp(cf);
disp('-----------------------------------------');
disp('PI =*{1/(D^2-1)[x*sin(3x)+cos(x)]');
disp('using identities it reduces to : ');
pi=-1/10*(x*sin(3*x)+3/5*cos(3*x))-cos(x)/2;
disp(pi);
y=cf+pi;
disp('The solution is : y=');
disp(y);
```

Scilab code Exa 13.14 solving the given linear equation

```
//ques14
clc

disp('solution of the given linear differential equation is given by : ');
disp('CF + PI');
syms c1 c2 c3 c4 x
m=poly(0,'m');
f=(m^4+2*m^2+1);
r=roots(f);
disp(r);
disp('CF is given by ');
cf=real((c1+c2*x)*exp(r(1)*x)+(c3+c4*x)*exp(r(3)*x));
disp(cf);
disp('-----------------------------------------');
disp('PI =*{1/(D^4+2*D+1)[x^2*cos(x)]');
disp('using identities it reduces to : ');
pi=-1/48*((x^4-9*x^2)*cos(x)-4*x^3*sin(x));
disp(pi);
y=cf+pi;
```

```
disp('The solution is : y=');
disp(y);
```

Chapter 21

Laplace Transform

Scilab code Exa 21.1.1 finding laplace transform

```
//ques1(i)
disp('To find the laplace of given function in t ');
syms t s
disp(laplace(sin(2*t)*sin(3*t),t,s));
```

Scilab code Exa 21.1.2 finding laplace transform

```
//ques1(ii)
disp('To find the laplace of given function in t ');
syms t s
disp(laplace((cos(t))^2,t,s));
```

Scilab code Exa 21.1.3 finding laplace transform

```
//ques1(ii)
disp('To find the laplace of given function in t ');
```

```
syms t s
disp(laplace((sin(t))^3,t,s));
```

Scilab code Exa 21.2.1 finding laplace transform

```
//ques1(ii)
disp('To find the laplace of given function in t ');
syms t s
f=exp(-3*t)*(2*cos(5*t)-3*sin(5*t));
disp(laplace(f,t,s));
```

Scilab code Exa 21.2.2 finding laplace transform

```
//ques1(ii)
clc
disp('To find the laplace of given function in t ');
syms t s
f=exp(3*t)*(sin(t))^2;
disp(laplace(f,t,s));
```

Scilab code Exa 21.2.3 finding laplace transform

```
//ques1(ii)
clc
disp('To find the laplace of given function in t ');
syms t s
f=exp(4*t)*(cos(t)*sin(2*t));
disp(laplace(f,t,s));
```

Scilab code Exa 21.4.1 finding laplace transform

```
//ques1(ii)
clc
disp('To find the laplace of given function in t');
syms t s a
f=t*sin(a*t);
disp(laplace(f,t,s));
```

Scilab code Exa 21.4.2 finding laplace transform

```
//ques4(ii)
clc
disp('To find the laplace of given function in t');
syms t s a
f=t*cos(a*t);
l=laplace(f,t,s);
disp(l);
```

Scilab code Exa 21.5 finding laplace transform

```
//error
//ques5
clc
syms t  s u
f=integ(exp(-s*t)*t/u,t,0,u)+integ(exp(-s*t),t,u,%inf);
disp(f);
```

Scilab code Exa 21.7 finding laplace transform

```
//ques7
clc
disp('To find the laplace of given function in t ');
syms t s a
f=sin(a*t)/t;
disp(laplace(f,t,s));
```

Scilab code Exa 21.8.1 finding laplace transform

```
//ques7
clc
disp('To find the laplace of given function in t ');
syms t s a
f=t*cos(a*t);
disp(laplace(f,t,s));
```

Scilab code Exa 21.8.2 finding laplace transform

```
//ques7
clc
disp('To find the laplace of given function in t ');
syms t s a
f=t^2*sin(a*t);
disp(laplace(f,t,s));
```

Scilab code Exa 21.8.3 finding laplace transform

```
//ques7
clc
disp('To find the laplace of given function in t ');
syms t s a
f=exp(-3*t)*t^3;
l=laplace(f,t,s)
disp(l);
```

Scilab code Exa 21.8.4 finding laplace transform

```
//ques7
clc
disp('To find the laplace of given function in t ');
syms t s a
f=exp(-t)*t*sin(3*t);
l=laplace(f,t,s)
disp(l);
```

Scilab code Exa 21.9.1 finding laplace transform

```
//error
//ques7
clc
disp('To find the laplace of given function in t ');
syms t s a
f=(1-exp(t))/t;

l=laplace(f,t,s)
disp(l);
```

Scilab code Exa 21.9.2 finding laplace transform

```
//ques9
clc
disp('To find the laplace of given function in t ');
syms t s a b
f=(cos(a*t)-cos(b*t))/t;

l=laplace(f,t,s)
disp(l);
```

Scilab code Exa 21.10.1 finding laplace transform

```
//ques10(i)
clc
disp('To find the the given integral find the laplace of tsin(t) and put s=2 ');
syms t s m
f=sin(t)*t;

l=laplace(f,t,s)
s=2

disp(eval(l));
```

Scilab code Exa 21.10.3 finding laplace transform

```
//error
//ques10
```

```
clc
disp('To find the laplace of given function in t ');
syms t s a b
f=integ(exp(t)*sin(t)/t,t,0,t);

l=laplace(f,t,s)
disp(l);
```

Scilab code Exa 21.11.1 finding inverse laplace transform

```
//ques11
disp('To find the inverse laplace transform of the
   function');
syms s t
f=(s^2-3*s+4)/s^3;
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.11.2 finding inverse laplace transform

```
//ques11
disp('To find the inverse laplace transform of the
   function');
syms s t
f=(s+2)/(2*s^2-4*s+13));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.12.1 finding inverse laplace transform

```
//ques11
disp('To find the inverse laplace transform of the function');
syms s t
f=((2*s^2-6*s+5)/(s^3-6*s^2+11*s-6);
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.12.3 finding inverse laplace transform

```
//ques11
disp('To find the inverse laplace transform of the function');
syms s t
f=(4*s+5)/((s-1)^2*(s+2));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.13.1 finding inverse laplace transform

```
//ques11
disp('To find the inverse laplace transform of the function');
syms s t
f=(5*s+3)/((s-1)*(s^2+2*s+5));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.13.2 finding inverse laplace transform

```
//error no output
//ques11

disp('To find the inverse laplace transform of the function');
syms s t a
f=s/(s^4+4*a^4);
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.14.1 finding inverse laplace transform

```

//ques14
disp('To find the inverse laplace transform of the function');
syms s t a
f=s^2/(s-2)^3;
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.14.2 finding inverse laplace transform

```

//ques14
disp('To find the inverse laplace transform of the function');
syms s t a
f=(s+3)/((s^2-4*s+13));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.15.1 finding inverse laplace transform

```
//no outp
//ques15
disp('To find the inverse laplace transform of the function');
syms s t a
f=1/(s*(s^2+a^2));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.15.2 finding inverse laplace transform

```

//ques15
disp('To find the inverse laplace transform of the function');
syms s t a
f=1/(s*(s+a)^3);
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.16.1 finding inverse laplace transform

```
//no outp
//ques15
disp('To find the inverse laplace transform of the function');
syms s t a
```

```
f=s/((s^2+a^2)^2);
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.16.2 finding inverse laplace transform

```
//no output
//ques15
disp('To find the inverse laplace transform of the function');
syms s t a
f=s^2/((s^2+a^2)^2);
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.16.3 finding inverse laplace transform

```
//no output
//ques15
disp('To find the inverse laplace transform of the function');
syms s t a

f=1/((s^2+a^2)^2);
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.17.1 finding inverse laplace transform

```
//no output
```

```
//ques15
disp('To find the inverse laplace transform of the function');
syms s t a

f=(s+2)/(s^2*(s+1)*(s-2));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.17.2 finding inverse laplace transform

```
//no output
//ques15
disp('To find the inverse laplace transform of the function');
syms s t a

f=(s+2)/(s^2+4*s+5)^2;
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.19.1 finding inverse laplace transform

```
//error no output
//ques18
disp('To find the inverse laplace transform of the function');
syms s t a

f=s/(s^2+a^2)^2;
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.19.2 finding inverse laplace transform

```
//error no output
//ques18
disp('To find the inverse laplace transform of the function');
syms s t a b

f=s^2/((s^2+a^2)*(s^2+b^2));
il=ilaplace(f,s,t);
disp(il);
```

Scilab code Exa 21.28.1 finding laplace transform

```
//ques28
syms s t
f=integ(exp(-s*t)*(t-1),t,1,2)+integ(exp(-s*t)*(3-t),t,2,3);
disp('Laplace of given function is');
disp(f);
```

Scilab code Exa 21.28.2 finding laplace transform

```
//ques28
syms s t
f=integ(exp(-s*t)*exp(-t),t,0,2);
disp('Laplace of given function is');
disp(f);
```

Scilab code Exa 21.34 finding laplace transform

```
//error no output
//ques34
disp('to find the laplace transform of periodic function ');
syms w t s
f=1/(1-exp(-2*%pi*s/w))*integ(exp(-1*s*t)*sin(w*t),t,0,%pi/w);
disp(f)
```

Chapter 22

Integral Transform

Scilab code Exa 22.1 finding fourier sine integral

```
//error
//ques1
disp('To find the fourier sine integral');
syms x t u
fs=2/%pi*integ(sin(u*x),u,0,%inf)*(integ(x^0*sin(u*t
    ),t,0,%inf));
disp(fs);
```

Scilab code Exa 22.2 finding fourier transform

```
//error
//ques2
disp('To find the fourier transform of given
    function ');
syms x  s
F=integ(exp(%i*s*x),x,-1,1);
disp(F);
//produces error->
F1=integ(sin(x)/x,x,0,%inf);
```

Scilab code Exa 22.3 finding fourier transform

```
//error
//ques3
disp('To find the fourier transform of given function ');
syms x  s
F=integ(exp(%i*s*x)*(1-x^2),x,-1,1);
disp(F);
//produces error->
F1=integ((x*cos(x)-sin(x))/x^3*cos(x/2),x,0,%inf);
```

Scilab code Exa 22.4 finding fourier sine transform

```
//error
//ques1
disp('To find the fourier sine transform');
syms x s m
//functtion fs=f(x)
fs=integ(sin(s*x)*exp(-x),x,0,%inf);
disp(fs);
//integ produces error
f=integ(x*sin(m*x)/(1+x^2),x,0,%inf);
disp(f);
```

Scilab code Exa 22.5 finding fourier cosine transform

```
//ques5
syms x s
```

```
disp('Fourier cosine transform');
f=integ(x*cos(s*x),x,0,1)+integ((2-x)*cos(s*x),x
    ,1,2);
disp(f)
```

Scilab code Exa 22.6 finding fourier sine transform

```
//ques6
syms x s a
disp('Fourier cosine transform');
f=integ(exp(-a*x)/x*sin(s*x),x,0,%inf);
disp(f)
```

Chapter 23

Statistical Methods

Scilab code Exa 23.1 Calculating cumulative frequencies of given using iterations on matrices

```
clear
clc
disp('the first row of A denotes the no. of students falling in the marks group starting from (5-10)...till (40-45)')
A(1,:)=[5 6 15 10 5 4 2 2];
disp('the second row denotes cumulative frequency (less than)')
A(2,1)=5;
for i=2:8
  A(2,i)=A(2,i-1)+A(1,i);
end
disp('the third row denotes cumulative frequency (more than)')
A(3,1)=49;
for i=2:8
  A(3,i)=A(3,i-1)-A(1,i-1);
end
disp(A)
```

Scilab code Exa 23.2 Calculating mean of of statistical data performing iterations matrices

```
clc
disp('the first row of A represents the mid values of weekly earnings having interval of 2 in each class=x')
A(1,:)=[11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41]
disp('the second row denotes the no. of employees or in other words frequency=f')
A(2,:)=[3 6 10 15 24 42 75 90 79 55 36 26 19 13 9 7]
disp('third row denotes f*x')
for i=1:16
  A(3,i)=A(1,i)*A(2,i);
end
disp('fourth row denotes u=(x-25)/2')
for i=1:16
  A(4,i)=(A(1,i)-25)/2
end
disp('fifth row denotes f*x')
for i=1:16
  A(5,i)=A(4,i)*A(2,i);
end
A
b=0;
disp('sum of all elements of third row=')
for i=1:16
  b+=A(3,i)
end
disp(b)
f=0;
disp('sum of all elements of second row=')
for i=1:16
```

```
  f+=A(2,i)
end
disp(f)
disp('mean=')
b/f
d=0;
disp('sum of all elements of fifth row=')
for i=1:16
  d+=A(5,i)
end
disp('mean  by step deviation method=')
25+(2*d/f)
```

Scilab code Exa 23.3 Analysis of statistical data performing iterations on matrices

```
clear
clc
disp('the first row of A denotes the no. of students falling in the marks group starting from (5-10)...till (40-45)')
A(1,:)=[5 6 15 10 5 4 2 2];
disp('the second row denotes cumulative frequency (less than)')
A(2,:)=[5 11 26 36 41 45 47 49]
disp('the third row denotes cumulative frequency (more than)')
A(3,:)=[49 44 38 23 13 8 4 2]
disp('median falls in the class (15-20) = l+((n/2-c)*h)/f=')
15+((49/2-11)*5)/15
disp('lower quartile also falls in the class (15-20)=')
Q1=15+((49/4-11)*5)/15
disp('upper quartile also falls in the class (25-30)
=')
Q3=25+((3*49/4-36)*5)/5
disp('semi interquartile range=')
(Q3-Q1)/2
```

Scilab code Exa 23.4 Analysis of statistical data

```
clear
clc
disp('the first row of A denotes the roll no. of students form 1 to 10 and that of B denotes form 11 to 20')
A(1,:)=[1 2 3 4 5 6 7 8 9 10];
B(1,:)=[11 12 13 14 15 16 17 18 19 20];
disp('the second row of A annd B denotes the corresponding marks in physics ')
A(2,:)=[53 54 52 32 30 60 47 46 35 28];
B(2,:)=[25 42 33 48 72 51 45 33 65 29];
disp('the third row denotes the corresponding marks in chemistry ')
A(3,:)=[58 55 25 32 26 85 44 80 33 72];
B(3,:)=[10 42 15 46 50 64 39 38 30 36];
disp('median marks in physics =arithmetic mean of 10 thand 11 th student =')
(28+25)/2
disp('median marks in chemistry =arithmetic mean of 10 thand 11 th student =')
(72+10)/2
```

Scilab code Exa 23.5 Finding the missing frequency of given statistical data using given constants

```
clear
```

```
clc
disp('let the misssing frequencies be f1and f2')
disp('sum of given frequencies=12+30+65+25+18=')
c=12+30+65+25+18
disp('so, f1+f2=229-c=')
229-c
disp('median=46=40+(114.5-(12+30+f1))*10/65)')
disp('f1=33.5=34')
f1=34
f2=45
```

Scilab code Exa 23.6 Calculating average speed

```
clear
clc
syms s;
disp('let the eqidistance be s,then')
t1=s/30
t2=s/40
t3=s/50
disp('average speed=total distance/total time taken')
3*s/(t1+t2+t3)
```

Scilab code Exa 23.7 Calculating mean and standard deviation performing iterations on matrices

```
clear
clc
disp('the first row denotes the size of item')
A(1,:)=[6 7 8 9 10 11 12];
disp('the second row denotes the corresponding frequency (f)')
```

```
A(2,:)=[3 6 9 13 8 5 4];
disp('the third row denotesthe corresponding deviation (d)')
A(3,:)=[-3 -2 -1 0 1 2 3];
disp('the fourth row denotes the corresponding f*d ')
for i=1:7
  A(4,i)=A(2,i)*A(3,i);
end
disp('the fifth row denotes the corresponding f*d^2')
for i=1:7
  A(5,i)=A(2,i)*(A(3,i)^2);
end
A
b=0;
disp('sum of fourth row elements=')
for i=1:7
  b=b+A(4,i);
end
disp(b)
c=0
disp('sum of fifth row elements=')
for i=1:7
  c=c+A(5,i);
end
disp(c)
d=0;
disp('sum of all frequencies=')
for i=1:7
  d=d+A(2,i);
end
disp(d)
disp('mean=9+b/d=')
9+b/d
disp('standard deviation=(c/d)^0.5')
(c/d)^0.5
```

Scilab code Exa 23.8 Calculating mean and standard deviation performing iterations on matrices

```
clc
disp('the first row of A represents the mid values of wage classes having interval of 8 in each class=x')
A(1,:)=[8.5 16.5 24.5 32.5 40.5 48.5 56.5 64.5 72.5]
disp('the second row denotes the no. of men or in other words frequency=f')
A(2,:)=[2 24 21 18 5 3 5 8 2]
disp('third row denotes f*x')
for i=1:9
  A(3,i)=A(1,i)*A(2,i);
end
disp('fourth row denotes d=(x-32.5)/8')
for i=1:9
  A(4,i)=(A(1,i)-32.5)/8
end
disp('fifth row denotes f*d')
for i=1:9
  A(5,i)=A(4,i)*A(2,i);
end
disp('sixth row denotes f*(d^2)  ')
for i=1:9
  A(6,i)=A(4,i)^2*A(2,i);
end
A
b=0;
disp('sum of all elements of sixth row=')
for i=1:9
  b+=A(6,i)
end
disp(b)
```

```
f=0;
disp('sum of all elements of second row=')
for i=1:9
  f+=A(2,i)
end
disp(f)
disp('mean=')
b/f
d=0;
disp('sum of all elements of fifth row=')
for i=1:9
  d+=A(5,i)
end
disp('mean wage=')
32.5+(8*d/f)
disp('standard deviation=')
8*(b/f-(d/f)^2)
```

Scilab code Exa 23.9 Analysis of statistical data performing iterations on matrices

```
clear
clc
disp('the first row of A denotes the scores of A and that of B denotes that of B')
A(1,:)=[12 115 6 73 7 19 119 36 84 29];
B(1,:)=[47 12 16 42 4  51 37 48 13 0];
disp('the second row of A annd B denotes the corresponding deviation ')
for i=1:10
  A(2,i)= A(1,i)-51;
  B(2,i)=B(1,i)-51;
    end
disp('the third row of A and B denotes the corresponding deviation square')
```

```
for i=1:10
  A(3,i)= A(2,i)^2;
  B(3,i)=B(2,i)^2;
end
A
B
b=0;
disp('sum of second row elements of A=b=')
for i=1:10
  b=b+A(2,i);
  end
  disp(b)
  c=0;
disp('sum of second row elements of B=c=')
for i=1:10
  c=c+B(2,i);
  end
  disp(c)
  d=0;
disp('sum of third  row elements of A=d=')
for i=1:10
  d=d+A(3,i);
  end
  disp(d)
  e=0;
disp('sum of second row elements of B=e=')
for i=1:10
  e=e+B(3,i);
  end
  disp(e)
  disp('arithmetic mean of A=')
  f=51+b/10
  disp('standard deviation of A=')
  g=(d/10-(b/10)^2)^0.5
  disp('arithmetic mean of B=')
  h=51+c/10
  disp('standard deviation of A=')
  i=(e/10-(c/10)^2)^0.5
  disp('coefficient of variation of A=')
  (g/f)*100
  disp('coefficient of variation of B=')
  (i/h)*100
```

Scilab code Exa 23.10 Calculating mean and standard deviation of different statistical data when put together

```
clear
clc
disp('if m is the mean of entire data,then ')
m=(50*113+60*120+90*115)/(50+60+90)
disp('if s is the standard deviation of entire data, then ')
s=(((50*6^2)+(60*7^2)+(90*8^2)+(50*3^2)+(60*4^2)+(90*1^2))/200)^0.5
```

Scilab code Exa 23.12 Calculating median and quartiles of given statistical data performing iterations on matrices

```
clear
clc
disp('the first row of A denotes the no. of persons falling in the weight  group starting from (70-80)...till (140-150)')
A(1,:)=[12 18 35 42 50 45 20 8];
disp('the second row denotes cumulative frequency')
A(2,1)=12;
for i=2:8
  A(2,i)=A(2,i-1)+A(1,i);
  end
disp('median falls in the class (110-120) = l+((n/2-c)*h)/f=')
```

```
Q2=110+(8*10)/50
disp('lower quartile also falls in the class (90-100)=')
Q1=90+(57.5-30)*10/35
disp('upper quartile also falls in the class (120-130)=')
Q3=120+(172.5-157)*10/45
disp('quartile coefficient of skewness=')
(Q1 +Q3-2*Q2)/(Q3-Q1)
```

Scilab code Exa 23.13 Calculating coefficient of correlation

```
clear
clc
disp('the first row of A denotes the corresponding I.R. of students ')
A(1,:)=[105 104 102 101 100 99 98 96 93 92];
disp('the second row denotes the corresponding deviation of I.R.')
for i=1:10
  A(2,i)=A(1,i)-99;
end
disp('the third row denotes the square of corresponding deviation of I.R. ')
for i=1:10
  A(3,i)=A(2,i)^2;
end
disp('the fourth row denotes the corresponding  E.R. of students ')
  A(4,:)=[101 103 100 98 95 96 104 92 97 94];
disp('the fifth row denotes the corresponding deviation of E.R. ')
for i=1:10
  A(5,i)=A(4,i)-98;
end
```

```
disp('the sixth row denotes the square of
    corresponding deviation of E.R. ')
for i=1:10
  A(6,i)=A(5,i)^2;
end
disp('the seventh row denotes the product of the two
    corresponding deviations ')
for i=1:10
  A(7,i)=A(2,i)*A(5,i);
end
A
a=0;
disp('the sum of elements of  first row=a')
for i=1:10
  a=a+A(1,i);
end
a
b=0;
disp('the sum of elements of  second row=b')
for i=1:10
  b=b+A(2,i);
end
b
c=0;
disp('the sum of elements of  third  row=c')
for i=1:10
  c=c+A(3,i);
end
c
d=0;
disp('the sum of elements of  fourth row=d')
for i=1:10
  d=d+A(4,i);
end
d
e=0;
disp('the sum of elements of  fifth row=e')
for i=1:10
```

```
  e=e+A(5,i);
end
e
f=0;
disp('the sum of elements of  sixth row=d')
for i=1:10
  f=f+A(6,i);
end
f
g=0;
disp('the sum of elements of  seventh row=d')
for i=1:10
  g=g+A(7,i);
end
g
disp('coefficient of correlation=')
g/(c*f)^0.5
```

Chapter 24

Numerical Methods

Scilab code Exa 24.1 finding the roots of equation

```
clc
clear
x=poly(0,'x');
p=x^3-4*x-9
disp("Finding roots of this equation by bisection method");
disp('f(2) is -ve and f(3) is +ve so a root lies between 2 and 3');
l=2;
m=3;
function y=f(x)
  y=x^3-4*x-9;
endfunction
for i=1:4
    k=1/2*(l+m);
if(f(k)<0)
    l=k;
else
  m=k;
  end
end
```

```
disp(k)
```

Scilab code Exa 24.3 finding the roots of equation by the method of false statement

```
//ques 2
disp('f(x)=xe^x-cos(x)');
function y=f(x)
  y=x*%e^(x)-cos(x);
endfunction

disp('we are required to find the roots of f(x) by the method of false position');
disp('f(0)=-ve and f(1)=+ve so s root lie between 0 and 1');
disp('finding the roots by false position method');

l=0;
m=1;
for i=1:10
   k=l-(m-l)*f(l)/(f(m)-f(l));
  if(f(k)<0)
    l=k;
  else
    m=k;
  end
end
//fprintf('The roots of the equation is %g',k)
disp('The root of the equation is :');
disp(k);
```

Scilab code Exa 24.4 finding rea roots of equation by regula falsi method

```
//ques 2
disp('f(x)=x*log(x)-1.2');
function y=f(x)
  y=x*log10(x)-1.2;
endfunction

disp('we are required to find the roots of f(x) by the method of false position');
disp('f(2)=-ve and f(3)=+ve so s root lie between 2 and 3');
disp('finding the roots by false position method');

l=2;
m=3;
for i=1:3
   k=l-(m-l)*f(l)/(f(m)-f(l));
  if(f(k)<0)
    l=k;
  else
    m=k;
  end
end
//fprintf('The roots of the equation is %g',k)
disp('The root of the equation is :');
disp(k);
```

Scilab code Exa 24.5 real roots of equation by newtons method

```
//ques 5
disp(' To find the roots of f(x)=3x-cos(x)-1 by newtons method ');
disp('f(0)=-ve and f(1) is +ve so a root lies between 0 and 1');
l=0;
m=1;
```

```
function y=f(x)
  y=3*x-cos(x)-1;
endfunction
x0=0.6;
disp('let us take x0=0.6 as the root is closer to 1');
disp("Root is given by r=x0-f(xn)/der(f(xn)) ");
disp('approximated root in each steps are');
for i=1:3
  k=x0-f(x0)/derivative(f,x0);
  disp(k);
  x0=k;
end
```

Scilab code Exa 24.6 real roots of equation by newtons method

```
//ques 7
clear
clc
disp('To find squareroot of 28 by newtons method let x=sqrt(28) ie x^2-28=0');
function y=f(x)
  y=x^2-28;
endfunction
disp(' To find the roots by newtons method ');
disp('f(5)=-ve and f(6) is +ve so a root lies between 5 and 6');
l=5;
m=6;
disp('let us take x0=5.5');
disp("Root is given by rn=xn-f(xn)/der(f(xn)) ");
disp('approximated root in each steps are');
x0=5.5;
for i=1:4
  k=x0-f(x0)/derivative(f,x0);
  disp(k);
  x0=k;
end
```

Scilab code Exa 24.7 evaluating square root by newtons iterative method

```
//ques 7
clear
clc
disp('To find squareroot of 28 by newtons method let x=sqrt(28) ie x^2-28=0');
function y=f(x)
  y=x^2-28;
endfunction
disp(' To find the roots by newtons method ');
disp('f(5)=-ve and f(6) is +ve so a root lies between 5 and 6');
l=5;
m=6;
disp('let us take x0=5.5');
disp("Root is given by rn=xn-f(xn)/der(f(xn)) ");
disp('approximated root in each steps are');
x0=5.5;
for i=1:4
  k=x0-f(x0)/derivative(f,x0);
  disp(k);
  x0=k;
end
```

Scilab code Exa 24.10 solving equations by guass elimination method

```
//ques 10 , ques 11
```

```
//Linear equation system 'Ax=r' by Gauss elimination method.
clc
clear

disp('Solution of N—equation [A][X]=[r]')
n=input ('Enter number of Equations :');
A=input ('Enter Matrix [A]:');
r=input ('Enter Matrix [r]:');
D=A;d=r;

//create upper triangular matrix
s=0;
for j=1:n-1
    if A(j,j)==0
        k=j;
        for k=k+1:n
            if A(k,j)==0
                continue
            end
            break
        end
        B=A(j,:); C=r(j);
        A(j,:)=A(k,:); r(j)=r(k);
        A(k,:)=B; r(k)=C;
    end
    for i=1+s:n-1
        L=A(i+1,j)/A(j,j);
        A(i+1,:)=A(i+1,:)-L*A(j,:);
        r(i+1)=r(i+1)-L*r(j);
    end
    s=s+1;
end
//Solution of equations
x(n)=r(n)/A(n,n);
for i=n-1:-1:1
    sum=0;
    for j=i+1:n
```

```
        sum=sum+A(i,j)*x(j);
    end
    x(i)=(1/A(i,i))*(r(i)-sum);
end

//hecking with scilab functions
p=inv(D)*d;
//Output
disp('@------------------------------------------------------------------------@')
disp('Output [B][x]=[b]')
disp('Upper riangular Matrix [B] =');disp(A)
disp('Matrix [b] =');disp(r)
disp('solution of linear equations :');disp(x')
disp('solve with matlab functions(for checking):');disp(p)
```

Scilab code Exa 24.12 solving equations by guass elimination method

```
//ques 10 , ques 11
//Linear equation system 'Ax=r' by Gauss elimination method.
clc
clear

disp('Solution of N-equation [A][X]=[r]')
n=input ('Enter number of Equations :');
A=input ('Enter Matrix [A]:');
r=input ('Enter Matrix [r]:');
D=A;d=r;

//create upper triangular matrix
s=0;
for j=1:n-1
```

```
    if A(j,j)==0
        k=j;
        for k=k+1:n
            if A(k,j)==0
                continue
            end
            break
        end
        B=A(j,:); C=r(j);
        A(j,:)=A(k,:); r(j)=r(k);
        A(k,:)=B; r(k)=C;
    end
    for i=1+s:n-1
        L=A(i+1,j)/A(j,j);
        A(i+1,:)=A(i+1,:)-L*A(j,:);
        r(i+1)=r(i+1)-L*r(j);
    end
    s=s+1;
end
//Solution of equations
x(n)=r(n)/A(n,n);
for i=n-1:-1:1
    sum=0;
    for j=i+1:n
        sum=sum+A(i,j)*x(j);
    end
    x(i)=(1/A(i,i))*(r(i)-sum);
end

//hecking with scilab functions
p=inv(D)*d;
//Output
disp('@
   ------------------------------------------------------------
   @')
disp('Output [B][x]=[b]')
disp('Upper riangular Matrix [B] =');disp(A)
disp('Matrix [b] =');disp(r)
disp('solution of linear equations :');disp(x')
disp('solve with matlab functions(for checking):');disp(p)
```

Scilab code Exa 24.13 solving equations by guass elimination method

```
//ques 10 , ques 11
//Linear equation system 'Ax=r' by Gauss elimination method.
clc
clear

disp('Solution of N-equation [A][X]=[r]')
n=input ('Enter number of Equations :');
A=input ('Enter Matrix [A]:');
r=input ('Enter Matrix [r]:');
D=A;d=r;

//create upper triangular matrix
s=0;
for j=1:n-1
    if A(j,j)==0
        k=j;
        for k=k+1:n
            if A(k,j)==0
                continue
            end
            break
        end
        B=A(j,:); C=r(j);
        A(j,:)=A(k,:); r(j)=r(k);
        A(k,:)=B; r(k)=C;
    end
    for i=1+s:n-1
        L=A(i+1,j)/A(j,j);
        A(i+1,:)=A(i+1,:)-L*A(j,:);
        r(i+1)=r(i+1)-L*r(j);
    end
    s=s+1;
end
//Solution of equations
x(n)=r(n)/A(n,n);
for i=n-1:-1:1
    sum=0;
    for j=i+1:n
        sum=sum+A(i,j)*x(j);
    end
    x(i)=(1/A(i,i))*(r(i)-sum);
end

//hecking with scilab functions
p=inv(D)*d;
//Output
disp('@----------------------------------------------------------------@')
disp('Output [B][x]=[b]')
disp('Upper riangular Matrix [B] =');disp(A)
disp('Matrix [b] =');disp(r)
disp('solution of linear equations :');disp(x')
disp('solve with matlab functions(for checking):');
   disp(p)
```

Chapter 26

Difference Equations and Z Transform

Scilab code Exa 26.2 finding difference equation

```
//ques2
syms n a b yn0 yn1 yn2
yn=a*2^n+b*(-2)^n;
disp('yn=');
disp(yn);
n=n+1;
yn=eval(yn);
disp('y(n+1)=yn1=');
disp(yn);
n=n+1;
yn=eval(yn);
disp('y(n+2)=yn2=');
disp(yn);
disp('Eliminating a b fropm these equations we get : ');
A=[yn0 1 1;yn1 2 -2;yn2 4 4]
y=det(A);
disp('The required difference equation :');
disp(y);
disp('=0');
```

Scilab code Exa 26.3 solving difference equation

```
//ques3
syms  c1 c2 c3
disp('Cumulative function is given by E^3-2*E^2-5*E+6     =0 ');
E=poly(0,'E');
f=E^3-2*E^2-5*E+6;
r=roots(f);
disp(r);
disp('There for the complete solution is :');
un=c1*(r(1))^n+c2*(r(2))^n+c3*(r(3))^n;
disp('un=');
disp(un);
```

Scilab code Exa 26.4 solving difference equation

```
//ques4
syms  c1 c2 c3 n
disp('Cumulative function is given by E^2-2*E+1=0 ');
E=poly(0,'E');
f=E^2-2*E+1;
r=roots(f);
disp(r);
disp('There for the complete solution is :');
un=(c1+c2*n)*(r(1))^n;
disp('un=');
disp(un);
```

Scilab code Exa 26.6 firming fibonacci difference equation

```
//ques6
syms  c1 c2 c3 n
disp('For Fibonacci Series yn2=yn1+yn0');
disp('so Cumulative function is given by E^2-E-1 =0 ');
E=poly(0,'E');
f=E^2-E-1;
r=roots(f);
disp(r);
disp('There for the complete solution is :');
un=(c1)*(r(1))^n+c2*(r(2))^n;
disp('un=');
disp(un);
disp('Now puttting n=1, y=0 and n=2 , y=1 we get');
disp('c1=(5-sqrt(5))/10  c2=(5+sqrt(5))/10 ');
c1=(5-sqrt(5))/10;
c2=(5+sqrt(5))/10;
un=eval(un);
disp(un);
```

Scilab code Exa 26.7 solving difference equation

```
//ques4
syms  c1 c2 c3 n
disp('Cumulative function is given by E^2-4*E+3 =0 ');
E=poly(0,'E');
f=E^2-4*E+3;
r=roots(f);
disp(r);
disp('There for the complete solution is = cf + pi');
cf=c1*(r(1))^n+c2*r(2)^n;
disp('CF=');
disp(cf);
disp('PI = 1/(E^2-4E+3)[5^n]');
disp('put E=5');
disp('We get PI=5^n/8');
pi=5^n/8;
un=cf+pi;
disp('un=');
disp(un);
```

Scilab code Exa 26.8 solving difference equation

```
//ques4
syms  c1 c2 c3 n
disp('Cumulative function is given by E^2-4*E+4 =0 ');
E=poly(0,'E');
f=E^2-4*E+4;
r=roots(f);
disp(r);
disp('There for the complete solution is = cf + pi');
cf=(c1+c2*n)*r(1)^n;
disp('CF=');
disp(cf);
disp('PI = 1/(E^2-4E+4)[2^n]');
disp('We get PI=n*(n-1)/2*2^(n-2)');
pi=n*(n-1)/factorial(2)*2^(n-2);
un=cf+pi;
disp('un=');
disp(un);
```

Scilab code Exa 26.10 solving difference equation

```
//ques10
clc
syms  c1 c2 c3 n
disp('Cumulative function is given by E^2-4     =0 ');
E=poly(0,'E');
f=E^2-4;
r=roots(f);
disp(r);
disp('There for the complete solution is = cf + pi');
cf=(c1+c2*n)*r(1)^n;
disp('CF=');
disp(cf);
//particular integral calulation manually
disp('PI = 1/(E^2-4)[n^2+n-1]');
disp('We get PI=-n^2/3-7/9*n-17/27');
pi=-n^2/3-7/9*n-17/27;
un=cf+pi;
disp('un=');
disp(un);
```

Scilab code Exa 26.11 solving difference equation

```
//ques11
clc
syms  c1 c2 c3 n
disp('Cumulative function is given by E^2-2*E+1 =0 ');
E=poly(0,'E');
```

```
f=E^2+2*E-1;
r=roots(f);
disp(r);
disp('There for the complete solution is = cf + pi');
cf=(c1+c2*n)*r(1)^n;
disp('CF=');
disp(cf);
//particular integral calulation manually
disp('PI = 1/(E-1)^2[n^2*2^n]');
disp('We get PI=2^n*(n^2-8*n+20');
pi=2^n*(n^2-8*n+20);
un=cf+pi;
disp('un=');
disp(un);
```

Scilab code Exa 26.12 solving simultanious difference equation

```
//ques12
clc
disp('simplified equations are :');
disp('(E-3)ux+vx=x.....(i) 3ux+(E-5)*vx=4^x......(ii) ');
disp('Simplifying we get (E^2-8E+12)ux=1-4x-4^x ');
syms  c1 c2 c3 x
disp('Cumulative function is given by E^2-8*E+12 =0 ');
E=poly(0,'E');
f=E^2-8*E+12;
r=roots(f);
disp(r);
disp('There for the complete solution is = cf + pi');
cf=c1*r(1)^x+c2*r(2)^x;
disp('CF=');
disp(cf);
//particular integral calulation manually
disp('solving for PI ');
disp('We get PI=');
pi=-4/5*x-19/25+4^x/4;
ux=cf+pi;
disp('ux=');
disp(ux);
disp('Putting in (i) we get vx=');
vx=c1*2^x-3*c2*6^x-3/5*x-34/25-4^x/4;
disp(vx);
```

Scilab code Exa 26.15.2 Z transform

```
//ques15(ii)
syms n z
y=z^(-n);
f=symsum(y,n,0,%inf);
disp(f);
```

Scilab code Exa 26.16 evaluating u2 and u3

```
//ques16
syms z
//f=(2/z^2+5/z^3+14/z^4)/(1-1/z)^4
f=(2/z^2+5/z+14)/(1/z-1)^4
u0=limit(f,z,0);
u1=limit(1/z*(f-u0),z,0);
u2=limit(1/z^2*(f-u0-u1*z),z,0);
disp('u2=');
disp(u2);
u3=limit(1/z^3*(f-u0-u1*z-u2*z^2),z,0);
disp('u3=');
disp(u3);
```

Chapter 27

Numerical Solution of Ordinary Differential Equations

Scilab code Exa 27.1 solving ODE with picards method

```
//ques1
syms x
disp('solution through picards method');
n=input('The no of iterations required');
disp('y(0)=1 and y(x)=x+y');
yo=1;
yn=1;
for i = 1:n
  yn=yo+integ(yn+x,x,0,x);
end
disp('y=');
disp(yn);
```

Scilab code Exa 27.2 solving ODE with picards method

```
//error
```

```
//ques2
syms x
disp('solution through picards method');
n=input('The no of iterations required');
disp('y(0)=1 and y(x)=x+y');
yo=1;
y=1;
for i = 1:n

  f=(y-x)/(y+x);
  y=yo+integ(f,x,0,x);
end
disp('y=');
x=0.1;
disp(eval(y));
```

Scilab code Exa 27.5 solving ODE using Eulers method

```
//ques5
clc
disp('Solution using Eulers Method ');
disp x y;
n=input('Input the number of iteration :-');
x=0;
y=1;
for i=1:n

y1=x+y;
y=y+0.1*y1;
x=x+0.1;
end
disp('The value of y is :-');
disp(y);
```

Scilab code Exa 27.6 solving ODE using Eulers method

```
//ques5
clc
disp('Solution using Eulers Method ');
disp x y;
n=input('Input the number of iteration :-');
x=0;
y=1;
for i=1:n

y1=(y-x)/(y+x);
y=y+0.02*y1;
x=x+0.1;
disp(y);
end
disp('The value of y is :-');
disp(y);
```

Scilab code Exa 27.7 solving ODE using Modified Eulers method

```
//ques7
clc
disp('Solution using Eulers Method ');
disp x y;
n=input('Input the number of iteration :-');
x=0.1;
m=1;
y=1;
yn=1;
y1=1;
k=1;
```

```
for i=1:n

yn=y;


  for i=1:4
  m=(k+y1)/2;
  yn=y+0.1*m;
  y1=(yn+x);
  disp(yn);
end
disp('------------------------------');
y=yn;
m=y1;
  yn=yn+0.1*m;
  disp(yn);
  x=x+0.1;
  yn=y;
  k=m;
end
disp('The value of y is :-');
disp(y);
```

Scilab code Exa 27.8 solving ODE using Modified Eulers method

```
//ques7
clc
disp('Solution using Eulers Method ');
disp x y;
n=input('Input the number of iteration :-');
x=0.2;
m=0.301;
y=2;
yn=2;
y1=log10(2);
```

```
k=0.301;
for i=1:n

yn=y;


  for i=1:4
  m=(k+y1)/2;
  yn=y+0.2*m;
  y1=log10(yn+x);
  disp(yn);
end
disp('------------------------');
y=yn;
m=y1;
  yn=yn+0.2*m;
  disp(yn);
  x=x+0.2;
  yn=y;
  k=m;
end
disp('The value of y is :-');
disp(y);
```

Scilab code Exa 27.9 solving ODE using Modified Eulers method

```
//ques7
clc
disp('Solution using Eulers Method ');
disp x y;
n=input('Input the number of iteration :-');
x=0.2;
m=1;
y=1;
yn=1;
```

```
y1=1;
k=1;
for i=1:n

yn=y;


  for i=1:4
  m=(k+y1)/2;
  yn=y+0.2*m;
  y1=(sqrt(yn)+x);
  disp(yn);
end
disp('————————————————————————');
y=yn;
m=y1;
  yn=yn+0.2*m;
  disp(yn);
  x=x+0.2;
  yn=y;
  k=m;
end
disp('The value of y is :-');
disp(y);
```

Scilab code Exa 27.10 solving ODE using runge method

```
//ques10
disp('Runges method');
function y=f(x,y)
  y=x+y;
endfunction

x=0;
y=1;
```

```
h=0.2;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
kk=h*f(x+h,y+k1);
k3=h*f(x+h,y+kk);
k=1/6*(k1+4*k2+k3);
disp('the required approximate value is :-');
y=y+k;
disp(y);
```

Scilab code Exa 27.11 solving ODE using runge kutta method

```
//ques11
disp('Runga kutta method');
function y=f(x,y)
  y=x+y;
endfunction

x=0;
y=1;
h=0.2;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
k=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y=y+k;
disp(y);
```

Scilab code Exa 27.12 solving ODE using runge kutta method

```
//ques12
```

```
clc
disp('Runga kutta method');
function y=f(x,y)
  y=(y^2-x^2)/(x^2+y^2);
endfunction

x=0;
y=1;
h=0.2;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
k=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y=y+k;
disp(y);
disp('to find y(0.4) put x=0.2 y=above value ie 1.196 h=0.2 ');
x=0.2;
h=0.2;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
k=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y=y+k;
disp(y);
```

Scilab code Exa 27.13 solving ODE using runge kutta method

```
//ques12
clc
disp('Runga kutta method');
```

```
function yy=f(x,y)
  yy=x+y^2;
endfunction

x=0;
y=1;
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
k=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y=y+k;
disp(y);
disp('to find y(0.4) put x=0.2 y=above value ie 1.196 h=0.2 ');
x=0.1;
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
k=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y=y+k;
disp(y);
```

Scilab code Exa 27.14 solving ODE using milnes method

```
//ques14
clc
syms x
yo=0;
y=0;
```

```
h=0.2;
f=x-y^2;
y=integ(f,x,0,x);
y1=eval(yo+y);
disp('y1=');
disp(float(y1));
f=x-y^2;
y=integ(f,x,0,x);
y2=yo+y;
disp('y2=');
disp(float(y2));
//function y=f(x,y)
  y=x-y^2;
//endfunction

y=integ(f,x,0,x);
y3=yo+y;
disp('y3=');
disp(float(y3));
disp('determining the initial values for milnes method using y3 ');
disp('x=0.0  y0=0.0  f0=0');
disp('x=0.2  y1=');
x=0.2;
disp(eval(y1));
y1=eval(y1);
disp('f1=');
f1=float(eval(x-y1^2));
disp(f1);
disp('x=0.4  y2=');
x=0.4;
disp(float(eval(y2)));
disp('f2=');
f2=float(eval(x-y2^2));
disp(f2);

disp('x=0.6  y3=');
x=0.6;
```

```
disp(eval(y3));
disp('f3=');
f3=float(eval(x-y3^2));
disp(f3);
//------------------------------------------------------------
disp('Using predictor method to find y4');
x=0.8;
y4=eval(yo+4/3*h*(2*f1-f2+2*f3));
disp('y4=');
disp(float(y4));
f4=float(eval(x-y^2));
disp('f4=');
disp(f4);
disp('Using predictor method to find y5');
x=1.0;
y5=eval(y1+4/3*h*(2*f2-f3+2*f4));
disp(float(y5));
f5=float(eval(x-y^2));
disp('f5=');
disp(f5);
disp('Hence y(1)=');
disp(float(y5));
```

Scilab code Exa 27.15 solving ODE using runge kutta and milnes method

```
//ques15
clc
disp('Runga kutta method');

function yy=f(x,y)
  yy=x*y+y^2;
endfunction
y0=1;
x=0;
y=1;
```

```
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
ka=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y1=y+ka;
y=y+ka;
disp(y);
//x=0.1;
//y1=float(eval(y));

disp('to find y(0.4) put x=0.2 y=above value ie 1.196 h=0.2 ');
x=0.1;
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
kb=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y2=y+kb;
y=y+kb;
disp(y);
//x=0.2;
//y2=float(eval(y));

disp('to find y(0.4) put x=0.2 y=above value ie 1.196 h=0.2 ');
x=0.2;
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
kc=1/6*(k1+2*k2+2*k3+k4);
```

```
disp('the required approximate value is :-');
y3=y+kc;
y=y+kc;
disp(y);
//x=0.3;
//y3=float(eval(y));
f0=f(0,y0);
f1=f(0.1,y1);
f2=f(0.2,y2);
f3=f(0.3,y3);
disp('y0 y1 y2 y3 are respectively : ');
disp(y3,y2,y1,y0);
disp('f0 f1 f2 f3 are respectively : ');
disp(f3 ,f2, f1 ,f0 );
disp('finding y4 using predictors milne method x=0.4
   ');
h=0.1;
y4=y0+4*h/3*(2*f1-f2+2*f3);
disp('y4=');
disp(y4);
disp('f4=');
f4=f(0.4,y4);

disp('using corrector method :');
y4=y2+h/3*(f2+4*f3+f4);
disp('y4=');
disp(y4);
disp('f4=');
f4=f(0.4,y4);
disp(f4);
```

Scilab code Exa 27.16 solving ODE using adamsbashforth method

```
//ques16
clc
```

```
function yy=f(x,y)
  yy=x^2*(1+y);
endfunction

y3=1
y2=1.233
y1=1.548
y0=1.979

f3=f(1,y3)
f2=f(1.1,y2)
f1=f(1.2,y1)
f0=f(1.3,y0)
disp('using predictor method');
h=0.1
y11=y0+h/24*(55*f0-59*f1+37*f2-9*f3)
disp('y11=');
disp(y11);
x=1.4;
f11=f(1.4,y11);
disp('using corrector method');
y11=y0+h/24*(9*f11+19*f0-5*f1+f2);
disp('y11=');
disp(y11);
f11=f(1.4,y11);
disp('f11=');
disp(f11);
```

Scilab code Exa 27.17 solving ODE using runge kutta and adams method

```
//ques17
clc
disp('Runga kutta method');

function yy=f(x,y)
```

```
  yy=x-y^2;
endfunction
y0=1;
x=0;
y=1;
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
ka=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y1=y+ka;
y=y+ka;
disp(y);
//x=0.1;
//y1=float(eval(y));

disp('to find y(0.4) put x=0.2 y=above value ie 1.196 h=0.2 ');
x=0.1;
h=0.1;
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
kb=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y2=y+kb;
y=y+kb;
disp(y);
//x=0.2;
//y2=float(eval(y));

disp('to find y(0.4) put x=0.2 y=above value ie 1.196 h=0.2 ');
x=0.2;
h=0.1;
```

```
k1=h*f(x,y);
k2=h*f(x+1/2*h,y+1/2*k1);
k3=h*f(x+1/2*h,y+1/2*k2);
k4=h*f(x+h,y+k3);
kc=1/6*(k1+2*k2+2*k3+k4);
disp('the required approximate value is :-');
y3=y+kc;
y=y+kc;
disp(y);
//x=0.3;
//y3=float(eval(y));
f0=f(0,y0);
f1=f(0.1,y1);
f2=f(0.2,y2);
f3=f(0.3,y3);
disp('y0 y1 y2 y3 are respectively : ');
disp(y3,y2,y1,y0);
disp('f0 f1 f2 f3 are respectively : ');
disp(f3 ,f2, f1 ,f0 );
disp('Using adams method');
disp('Using the predictor ');
h=0.1;
y4=y3+h/24*(55*f3-59*f2+37*f1-9*f0);
x=0.4;
f4=f(0.4,y4);
disp('y4=');
disp(y4);
disp('using corrector method');
y4=y3+h/24*(9*f4+19*f3-5*f2+f1);
disp('y4=');
disp(y4);
f4=f(0.4,y4);
disp('f4=');
disp(f4);
```

Scilab code Exa 27.18 solving simultanious ODE using picards method

```
//ques18
clc
disp('Picards method');
x0=0;
y0=2;
z0=1;
syms x
function yy=f(x,y,z)
  yy=x+z;
endfunction

function yy=g(x,y,z)
  yy=x-y^2;
endfunction
disp('first approximation');
y1=y0+integ(f(x,y0,z0),x,x0,x);
disp('y1=');
disp(y1);
z1=z0+integ(g(x,y0,z0),x,x0,x);
disp('z1=');
disp(z1);

disp('second approximation');
y2=y0+integ(f(x,y1,z1),x,x0,x);
disp('y2=');
disp(y2);
z2=z0+integ(g(x,y1,z1),x,x0,x);
disp('z2=');
disp(z2);

disp('third approximation');
y3=y0+integ(f(x,y2,z2),x,x0,x);
disp('y3=');
disp(y3);
z3=z0+integ(g(x,y2,z2),x,x0,x);
disp('z3=');
disp(z3);
x=0.1;
disp('y(0.1)=');
disp(float(eval(y3)));
disp('z(0.1)=');
disp(float(eval(z3)));
```

Scilab code Exa 27.19 solving ssecond ODE using runge kutta method

```
//ques19
clc
syms x
function yy=f(x,y,z)
  yy=z;
endfunction
function yy=g(x,y,z)
  yy=x*y^2-y^2;
endfunction
x0=0;
y0=1;
z0=0;
h=0.2;
disp('using k1 k2.. for f and l1 l2...for g runga kutta formulae becomes ');
h=0.2;
k1=h*f(x0,y0,z0);
l1=h*g(x0,y0,z0);
k2=h*f(x0+1/2*h,y0+1/2*k1,z0+1/2*l1);
l2=h*g(x0+1/2*h,y0+1/2*k1,z0+1/2*l1);
k3=h*f(x0+1/2*h,y0+1/2*k2,z0+1/2*l2);
l3=h*g(x0+1/2*h,y0+1/2*k2,z0+1/2*l2);
k4=h*f(x0+h,y0+k3,z0+l3);
l4=h*g(x0+h,y0+k3,z0+l3);
k=1/6*(k1+2*k2+2*k3+k4);
l=1/6*(l1+2*l2+2*l3+2*l4);
```

```
//at x=0.2
x=0.2;
y=y0+k;
y1=z0+l;
disp('y=');
disp(float(y));
disp('y1=');
disp(float(y1));

y
```

Scilab code Exa 27.20 solving ODE using milnes method

```
//ques20
clc
```

Chapter 28

Numerical Solution of Partial Differential Equations

Scilab code Exa 28.1 classification of partial differential equation

```
//ques 28.1
clear
clc
disp('D=B^2-4AC');
disp('if D<0 then elliptic    if D=0 then parabolic    if D>0 then hyperboic');
disp('(i) A=x^2,B1-y^2    D=4^2-4*1*4=0    so The equation is PARABOLIC');
disp('(ii) D=4x^2(y^2-1)');
disp('for -inf<x<inf and -1<y<1 D<0');
disp('So the equation is ELLIPTIC');
disp('(iii) A=1+x^2,B=5+2x^2,C=4+x^2');
disp('D=9>0');
disp('So the equation is HYPERBOLIC');
```

Scilab code Exa 28.2 solving elliptical equation

```
//ques28.2
disp('See figure in question');
disp('From symmetry u7=u1 , u8=u2 , u9=u3 , u3=u1 , u6=u4, u9=u7');
disp('u5=1/4*(2000+2000+1000+1000)=1500');
u5=1500;
disp('u1=1/4(0=1500+1000+2000)=1125');
u1=1125;
disp('u2=1/4*(1125+1125+1000+1500)=1188');
u2=1188;
disp('u4=1/4(2000+1500+1125+1125)=1438');
u4=1438;
disp(u1,u2,u4,u5)
disp('Iterations : ');
//n=input('Input the number of iterations required : ');
for i=1:6
u11=1/4*(1000+u2+500+u4);
u22=1/4*(u11+u1+1000+u5);
u44=1/4*(2000+u5+u11+u1);
u55=1/4*(u44+u4+u22+u2);
disp(' ');
disp(u55,u44,u22,u11);
u1=u11;
u2=u22;
u4=u44;
u5=u55;
end
```

Scilab code Exa 28.3 evaluating function satisfying laplace equation

```
//ques3
clear
clc
disp('See figure in question');
disp('To find the initial values of u1 u2 u3 u4 we assume u4=0');
disp('u1=1/4*(1000+0+1000+2000)=1000');
u1=1000;
disp('u2=1/4(1000+500+1000+500)=625');
u2=625;
disp('u3=1/4*(2000+0+1000+500)=875');
u3=875;
disp('u4=1/4(875+0+625+0)=375');
u4=375;
disp(u1,u2,u3,u4)
disp('Iterations : ');
//n=input('Input the number of iterations required : ');
for i=1:6
u11=1/4*(2000+u2+1000+u3);
u22=1/4*(u11+500+1000+u4);
u33=1/4*(2000+u4+u11+500);
u44=1/4*(u33+0+u22+0);
disp(' ');
disp(u44,u33,u22,u11);
u1=u11;
u2=u22;
u4=u44;
u3=u33;
end
```

Scilab code Exa 28.4 solution of poissons equation

```
//ques4
clear
clc
disp('See figure in question');
disp('using numerical poissons equation u(i-1)(j)+u(i+1)(j)+u(i)(j-1)+u(i)(j+1)=h^2f(ih,jh)');
disp('Here f(x,y)=-10(x^2+y^2+10');
disp('Here for u1 i=1,j=2 putting in equation this gives : ');
disp('u1=1/4(u2+u3+150');
disp('similarly ');
disp('u2=1/4(u1+u4+180');
disp('u3=1/4(u1+u4+120');
disp('u4=1/4(u2+u3+150');
disp('reducing therse equations since u4=u1');
disp('4u1-u2-u3-150=0');
disp('u1-2u2+90=0');
disp('u1-2u3+60=0');
disp('Solvng these equations by Gauss jordon method ');
A=[4 -1 -1;1 -2 0;1 0 -2];
r=[150;-90;-60];
D=A;d=r;
n=3;

//create upper triangular matrix
s=0;
for j=1:n-1
    if A(j,j)==0
        k=j;
        for k=k+1:n
            if A(k,j)==0
                continue
            end
            break
        end
        B=A(j,:); C=r(j);
        A(j,:)=A(k,:); r(j)=r(k);
        A(k,:)=B; r(k)=C;
    end
    for i=1+s:n-1
        L=A(i+1,j)/A(j,j);
        A(i+1,:)=A(i+1,:)-L*A(j,:);
        r(i+1)=r(i+1)-L*r(j);
    end
    s=s+1;
end
//Solution of equations
x(n)=r(n)/A(n,n);
for i=n-1:-1:1
    sum=0;
    for j=i+1:n
        sum=sum+A(i,j)*x(j);
    end
    x(i)=(1/A(i,i))*(r(i)-sum);
end

//hecking with scilab functions
p=inv(D)*d;
//Output
disp('@------------------------------------------------------------@')
disp('Output [B][x]=[b]')
disp('Upper riangular Matrix [B] =');disp(A)
disp('Matrix [b] =');disp(r)
disp('solution of linear equations :');disp(x')
```

Scilab code Exa 28.5 solving parabolic equation

```
//ques5
clear
clc
disp('Here c^2=4 , h=1 , k=1/8 ,  therefore alpha=(c^2)*k/(h^2)');
disp('Using bendre-schmidits recurrence relation ie u(i)(j+1)=t*u(i-1)(j)+t*u(i+1)(j)+(1-2t)*u(i,j)');
disp('Now since u(0,t)=0=u(8,t) therefore  u(0,i)=0
   and u(8,j)=0 and u(x,0)=4x-1/2x^2');
c=2;
h=1;
k=1/8;
t=(c^2)*k/(h^2);
A=ones(9,9);

for i=1:9
  for j=1:9
  A(1,i)=0;
  A(9,i)=0;
  A(i,1)=4*(i-1)-1/2*(i-1)^2;

end
end
//i=2;
//j=2;
for i=2:8
  for j=2:7
 // A(i,j)=1/2*(A(i-1,j-1)+A(i+1,j-1));
 A(i,j)=t*A(i-1,j-1)+t*A(i+1,j-1)+(1-2*t)*A(i-1,j-1);
 end
end
for i=2:8
   j=2;
  disp(A(i,j));

end
```

Scilab code Exa 28.6 solving heat equation

```
//ques5
clear
clc
```

```
disp('Here c^2=1 , h=1/3 , k=1/36 , therefore t=(c^2)*k/(h^2)=1/4');
disp('So bendre-schmidits recurrence relation ie u(i)(j+1)=1/4(u(i-1)(j)+u(i+1)(j)+2u(i,j)');
disp('Now since u(0,t)=0=u(1,t) therefore u(0,i)=0 and u(1,j)=0 and u(x,0)=sin(%pi)x');
c=1;
h=1/3;
k=1/36;
t=(c^2)*k/(h^2);
A=ones(9,9);

for i=1:9
  for j=1:9
  A(1,i)=0;
  A(2,i)=0;
  A(i,1)=sin(%pi/3*(i-1));

end
end
//A(2,1)=0.866;
//A(3,1)=0.866;
for i=2:8
  for j=2:8
    // A(i,j)=1/4*(A(i-1,j-1)+A(i+1,j-1)+2*A(i-1,j-1));
     A(i,j)=t*A(i-1,j-1)+t*A(i+1,j-1)+(1-2*t)*A(i-1,j-1);
end
end
for i=2:8
   j=2;
  disp(A(i,j));

end
```

Scilab code Exa 28.7 solving wave equation

```
//ques7
clear
clc
disp('Here c^2=16 , taking h=1 , finding k such that c^2t^2=1 ');
disp('So bendre-schmidits recurrence relation ie u(i)(j+1)=(16t^2(u(i-1)(j)+u(i+1)(j))+2(1-16*t^2u(i,j)-u(i)(j-1)');
disp('Now since u(0,t)=0=u(5,t) therefore  u(0,i)=0 and u(5,j)=0 and u(x,0)=x^2(5-x)');
c=4;
h=1;
k=(h/c);
t=k/h;
A=zeros(6,6);
disp('Also from 1st derivative (u(i)(j+1)-u(i,j-1))/2k=g(x)  and g(x)=0 in this case');
disp('So if j=0 this gives u(i)(1)=1/2*(u(i-1)(0)+u(i+1)(0))')
for i=0:5
  for j=2:9
  A(1,i+1)=0;
  A(6,i+1)=0;
  A(i+1,1)=(i)^2*(5-i);


end
end
for i=1:4
    A(i+1,2)=1/2*(A(i,1)+A(i+2,1));

  end
  for i=3:5
  for j=3:5

    A(i-1,j)=(c*t)^2*(A(i-2,j-1)+A(i,j-1))+2*(1-(c*t)^2)*A(i-1,j-1)-A(i-1,j-2);
end
end

for i=1:5
for j=1:5
  disp(A(i,j));
end
end
```

Scilab code Exa 28.8 solving wave equation

```
//ques8
clear
clc
disp('Here c^2=4 , taking h=1 , finding k such that c^2t^2=1 ');
disp('So bendre-schmidits recurrence relation ie u(i)(j+1)=(16t^2(u(i-1)(j)+u(i+1)(j))+2(1-16*t^2u(i,j)-u(i)(j-1)');
disp('Now since u(0,t)=0=u(4,t) therefore  u(0,i)=0 and u(4,j)=0 and u(x,0)=x(4-x)');
c=2;
h=1;
k=(h/c);
t=k/h;
A=zeros(6,6);
disp('Also from 1st derivative (u(i)(j+1)-u(i,j-1))/2k=g(x)  and g(x)=0 in this case');
disp('So if j=0 this gives u(i)(1)=1/2*(u(i-1)(0)+u(i+1)(0))')
```

```
for i=0:5
  for j=2:9
  A(1,i+1)=0;
  A(5,i+1)=0;
  A(i+1,1)=(i)*(4-i);


end
end
for i=1:4
    A(i+1,2)=1/2*(A(i,1)+A(i+2,1));

  end
  for i=3:5
  for j=3:5

    A(i-1,j)=(c*t)^2*(A(i-2,j-1)+A(i,j-1))+2*(1-(c*t)^2)*A(i-1,j-1)-A(i-1,j-2);
end
end

for i=1:5
for j=1:5
  disp(A(i,j));
end
end
```

Chapter 34

Probability and Distributions

Scilab code Exa 34.1 Calculating probability

```
clear
clc
disp('from the principle of counting,the required no
   .of ways are 12*11*10*9=')
12*11*10*9
```

Scilab code Exa 34.2.1 Calculating the number of permutations

```
clear
clc
disp('no.of permutations=9!/(2!*2!*2!) ')
factorial(9)/(factorial(2)*factorial(2)*factorial(2)
   )
```

Scilab code Exa 34.2.2 Number of permutations

```
clear
clc
disp('no.of permutations=9!/(2!*2!*3!*3!) ')
factorial(9)/(factorial(2)*factorial(2)*factorial(3)*factorial(3))
```

Scilab code Exa 34.3.1 Calculating the number of committees

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('no. of committees=C(6,3)*C(5,2)=')
C(6,3)*C(5,2)
```

Scilab code Exa 34.3.2 Finding the number of committees

```
 clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('no. of committees=C(4,1)*C(5,2)=')
C(4,1)*C(5,2)
```

Scilab code Exa 34.3.3 Finding the number of committees

```
clear
clc
```

```
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('no. of committees=C(6,3)*C(4,2)=')
C(6,3)*C(4,2)
```

Scilab code Exa 34.4.1 Finding the probability of getting a four in a single throw of a die

```
clear
clc
disp('the probability of getting a four is 1/6=')
1/6
```

Scilab code Exa 34.4.2 Finding the probability of getting an even number in a single throw of a die

```
clear
clc
disp('the probability of getting an even no. 1/2=')
1/2
```

Scilab code Exa 34.5 Finding the probability of 53 sundays in a leap year

```
clear
clc
disp('the probability of 53 sundays is 2/7=')
2/7
```

Scilab code Exa 34.6 probability of getting a number divisible by 4 under given conditions

```
clear
clc
disp('the five digits can be arranged in 5! ways =')
factorial(5)
disp('of which 4! will begin with 0=')
factorial(4)
disp('so,total no. of five digit numbers=5!-4!=')
factorial(5)-factorial(4)
disp('the numbers ending in 04,12,20,24,32,40 will be divisible by 4')
disp('numbers ending in 04=3!')
factorial(3)
disp('numbers ending in 12=3!-2!')
factorial(3)-factorial(2)
disp('numbers ending in 20=3!')
factorial(3)
disp('numbers ending in 24=3!-2!')
factorial(3)-factorial(2)
disp('numbers ending in 32=3!-2!')
factorial(3)-factorial(2)
disp('numbers ending in 40=3!')
factorial(3)
disp('so,total no. of favourable ways=6+4+6+4+4+6=')
6+4+6+4+4+6
disp('probability=30/96=')
30/96
```

Scilab code Exa 34.7 Finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('total no.of possible cases=C(40,4)')
C(40,4)
disp('favourable outcomes=C(24,2)*C(15,1)=')
C(24,2)*C(15,1)
disp('probability=')
(C(24,2)*C(15,1))/C(40,4)
```

Scilab code Exa 34.8 Finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('total no.of possible cases=C(40,4)')
C(15,8)
disp('favourable outcomes=C(24,2)*C(15,1)=')
C(5,2)*C(10,6)
disp('probability=')
(C(5,2)*C(10,6))/C(15,8)
```

Scilab code Exa 34.9.1 Finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
```

```
disp('total no.of possible cases=C(9,3)')
C(9,3)
disp('favourable outcomes=C(2,1)*C(3,1)*C(4,1)=')
C(2,1)*C(3,1)*C(4,1)
disp('probability=')
(C(2,1)*C(3,1)*C(4,1))/C(9,3)
```

Scilab code Exa 34.9.2 Finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('total no.of possible cases=C(9,3)')
C(9,3)
disp('favourable outcomes=C(2,2)*C(7,1)+C(3,2)*C
    (6,1)+C(4,2)*C(5,1)=')
C(2,2)*C(7,1)+C(3,2)*C(6,1)+C(4,2)*C(5,1)
disp('probability=')
(C(2,2)*C(7,1)+C(3,2)*C(6,1)+C(4,2)*C(5,1))/C(9,3)
```

Scilab code Exa 34.9.3 Finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('total no.of possible cases=C(9,3)')
C(9,3)
disp('favourable outcomes=C(3,3)+C(4,3)=')
C(3,3)+C(4,3)
```

```
disp('probability=')
5/84
```

Scilab code Exa 34.13 probability of drawing an ace or spade from pack of 52 cards

```
clear
clc
disp('probability of drawing an ace or spade or both from pack of 52 cards=4/52+13/52-1/52=')
4/52+13/52-1/52
```

Scilab code Exa 34.14.1 Finding the probability

```
clear
clc
disp('probability of first card being a king=4/52')
4/52
disp('probability of second card being a queen=4/52')
4/52
disp('probability of drawing both cards in succession=4/52*4/52=')
4/52*4/52
```

Scilab code Exa 34.15.1 Finding the probability

```
clear
clc
```

```
disp('probability of getting 7 in first toss and not getting it in second toss=1/6*5/6')
1/6*5/6
disp('probability of not getting 7 in first toss and getting it in second toss=5/6*1/6')
5/6*1/6
disp('required probability=1/6*5/6+5/6*1/6')
1/6*5/6+5/6*1/6
```

Scilab code Exa 34.15.2 Finding the probability

```
clear
clc
disp('probability of not getting 7 in either toss=5/6*5/6')
5/6*5/6
disp('probability of getting 7 at least once=1-5/6*5/6')
1-5/6*5/6
```

Scilab code Exa 34.15.3 Finding the probability

```
clear
clc
disp('probability of getting 7 twice=1/6*1/6')
1/6*1/6
```

Scilab code Exa 34.16 Finding the probability

```
clear
```

```
clc
disp('probability of engineering subject being chooosen=(1/3*3/8)+(2/3*5/8)=')
(1/3*3/8)+(2/3*5/8)
```

Scilab code Exa 34.17 Finding the probability

```
clear
clc
disp('probability of white ball being choosen=2/6*6/13+4/6*5/13=' )
2/6*6/13+4/6*5/13
```

Scilab code Exa 34.18 Finding the probability

```
clear
clc
disp("chances of winning of A=1/2+(1/2)^2*(1/2)+(1/2)^4*(1/2)+(1/2)^6*(1/2)+..=' )
(1/2)/(1-(1/2)^2)
disp('chances of winning of B=1-chances of winning of A')
1-2/3
```

Scilab code Exa 34.19.1 Finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
```

```
endfunction
disp('total no.of possible outcomes=C(10,2)=')
C(10,2)
disp('no. of favourable outcomes=5*5=')
5*5
disp('p=')
25/49
```

Scilab code Exa 34.19.2 Finding the probability

```
clear
clc
disp('total no.of possible outcomes=10*9=')
10*9
disp('no. of favourable outcomes=5*5+5*5=')
5*5+5*5
disp('p=')
50/90
```

Scilab code Exa 34.19.3 Finding the probability

```
clear
clc
disp('total no.of possible outcomes=10*9=')
10*10
disp('no. of favourable outcomes=5*5+5*5=')
5*5+5*5
disp('p=')
50/100
```

Scilab code Exa 34.20 Finding the probability

```
clear
clc
A=1/4
B=1/3
AorB=1/2
AandB=A+B-AorB
disp('probability of A/B=AandB/B=')
AandB/B
disp('probability of B/A=AandB/A=')
AandB/A
disp('probability of AandBnot=A-AandB=')
A-AandB
disp('probability of A/Bnot=AandBnot/Bnot=')
(1/6)/(1-1/3)
```

Scilab code Exa 34.22 Finding the probability

```
clear
clc
disp('probability of A hitting target=3/5')
disp('probability of B hitting target=2/5')
disp('probability of C hitting target=3/4')
disp('probability that two shots hit=3/5*2/5*(1-3/4)+2/5*3/4*(1-3/5)+3/4*3/5*(1-2/5)')
3/5*2/5*(1-3/4)+2/5*3/4*(1-3/5)+3/4*3/5*(1-2/5)
```

Scilab code Exa 34.23 Finding the probability

```
clear
clc
```

```
disp('probability of problem not getting solved=1/2*2/3*3/4=')
1/2*2/3*3/4
disp('probability of problem getting solved=1-(1/2*2/3*3/4)=')
1-(1/2*2/3*3/4)
```

Scilab code Exa 34.25 finding the probability

```
clc
disp('total frequency= integrate (f,x,0,2 )=')
n=integrate ('x^3','x',0,1)+integrate ('(2-x)^3','x',1,2)
disp('u1 about origin=')
u1=(1/n)*(integrate ('(x)*(x^3)','x',0,1)+integrate('(x)*((2-x)^3)','x',1,2))
disp('u2 about origin=')
u2=(1/n)*(integrate ('(x^2)*(x^3)','x',0,1)+integrate('(x^2)*((2-x)^3)','x',1,2))
disp('standard deviation=(u2-u1^2)^0.5=')
(u2-u1^2)^0.5
disp('mean deviation about the mean=(1/n)*(integrate (|x-1|*(x^3),x,0,1)+integrate(|x-1|*((2-x)^3),x,1,2`)')
(1/n)*(integrate ('(1-x)*(x^3)','x',0,1)+integrate('(x-1)*((2-x)^3)','x',1,2))
```

Scilab code Exa 34.26 finding the probability

```
clear
clc
disp('probability=(0.45*0.03)/(0.45*0.03+0.25*0.05+0.3*0.04=')
(0.45*0.03)/(0.45*0.03+0.25*0.05+0.3*0.04)
```

Scilab code Exa 34.27 finding the probability

```
clear
clc
disp('probability=(1/3*2/6*3/5)/(1/3*2/6*3/5+1/3*1/6*2/5+1/3*3/6*1/5')
(1/3*2/6*3/5)/(1/3*2/6*3/5+1/3*1/6*2/5+1/3*3/6*1/5)
```

Scilab code Exa 34.28 finding the probability

```
clc
disp('probability of no success=8/27')
disp('probability of a success=1/3')
disp('probability of one success=4/9')
disp('probability of two successes=2/9')
disp('probability of three successes=2/9')
A=[0 1 2 3;8/27 4/9 2/9 1/27]
disp('mean=sum of i*pi=')
A(1,1)*A(2,1)+A(1,2)*A(2,2)+A(1,4)*A(2,4)+A(1,3)*A(2,3)
disp('sum of i*pi^2=')
A(1,1)^2*A(2,1)+A(1,2)^2*A(2,2)+A(1,4)^2*A(2,4)+A(1,3)^2*A(2,3)
disp('variance=(sum of i*pi^2)-1=')
A(1,1)^2*A(2,1)+A(1,2)^2*A(2,2)+A(1,4)^2*A(2,4)+A(1,3)^2*A(2,3)-1
```

Scilab code Exa 34.29 finding the probability

```
clc
syms k
A=[0 1 2 3 4 5 6;k 3*k 5*k 7*k 9*k 11*k 13*k]
disp('sumof all pi=1')
//A(2,1)+A(2,2)+A(2,3)+(A(2,4)+A(2,5)+A(2,6)+A(2,7)
disp('hence, ')
k=1/49
disp('p(x<4)=')
a=A(2,1)+A(2,2)+A(2,4)+A(2,3)
eval(a)
disp(eval(a))
disp('p(x>=5)=')
b=A(2,6)+A(2,7)
eval(b)
disp(eval(b))
disp('p(3<x<=6)=')
c=A(2,5)+A(2,6)+A(2,7)
eval(c)
disp(eval(c))
disp('p(x<=2)=')
c=A(2,1)+A(2,2) +A(2,3)
```

Scilab code Exa 34.30 finding the probability

```
clc
syms k
A=[0 1 2 3 4 5 6 7;0 k 2*k 2*k 3*k k^2 2*k^2 7*k^2+k
   ]
disp('sumof all pi=1')
//A(2,1)+A(2,2)+A(2,3)+(A(2,4)+A(2,5)+A(2,6)+A(2,7)
disp('hence, ')
k=1/10
disp('p(x<6)=')
a=A(2,1)+A(2,2)+A(2,4)+A(2,3)+A(2,4)+A(2,5)+A(2,6)
eval(a)
```

```
disp(eval(a))
disp('p(x>=6)=')
b=A(2,7)+A(2,8)
eval(b)
disp(eval(b))
disp('p(3<x<5)=')
c=A(2,2)+A(2,3)+A(2,4)+A(2,5)
eval(c)
disp(eval(c))
```

Scilab code Exa 34.31 finding the probability

```
clc
syms x;
f=%e^(-x)
disp('clearly,f>0 for every x in(1,2) and integrate(f,x,0,%inf )=')
integrate ('%e^(-y)','y',0,%inf )
disp('required probability=p(1<=x<=2)=integrate(f,x,1,2)=')
integrate('%e^(-y)','y',1,2)
disp('cumulative probability function f(2)=integrate(f,x,-%inf,2)=')
integrate('%e^(-y)','y',0,2)
```

Scilab code Exa 34.33 finding the probability

```
clc
syms k;
disp('total probability= integrate (f,x,0,6 )=')
p=integrate ('k*x','x',0,2)
q=integrate ('2*k','x',2,4)
r=integrate ('-k*x+6*k','x',4,6)
```

Scilab code Exa 34.34 finding the probability

```
clc
A=[-3 6 9;1/6 1/2 1/3]
disp('first row of A displays the value of x')
disp('the second row of x displays the probability of corresponding to x')
disp('E(x)=')
c=A(1,1)*A(2,1)+A(1,2)*(2,2)+A(1,3)*A(2,3)
disp('E(x)^2=')
b=A(1,1)^2*A(2,1)+A(1,2)^2*(2,2)+A(1,3)^2*A(2,3)
disp('E(2*x+1)^2=E(4*x^2+4*x+1)'
4*b+4*c+1
```

Scilab code Exa 34.35 finding the probability

```
clc
disp('total frequency= integrate (f,x,0,2 )=')
n=integrate ('x^3','x',0,1)+integrate ('(2-x)^3','x',1,2)
disp('u1 about origin=')
u1=(1/n)*(integrate ('(x)*(x^3)','x',0,1)+integrate ('(x)*((2-x)^3)','x',1,2))
disp('u2 about origin=')
u2=(1/n)*(integrate ('(x^2)*(x^3)','x',0,1)+integrate('(x^2)*((2-x)^3)','x',1,2))
disp('standard deviation=(u2-u1^2)^0.5=')
(u2-u1^2)^0.5
disp('mean deviation about the mean=(1/n)*(integrate (|x-1|*(x^3),x,0,1)+integrate(|x-1|*((2-x)^3),x,1,2‘)')
(1/n)*(integrate ('(1-x)*(x^3)','x',0,1)+integrate('(x-1)*((2-x)^3)','x',1,2))
```

Scilab code Exa 34.38 finding the probability

```
 clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('probability that exactly two will be defective =C(12,2)*(0.1)^2*(0.9)^10=')
C(12,2)*(0.1)^2*(0.9)^10
disp('probability that at least two will be defective=1-(C(12,0)*(0.9)^12+C(12,1)*(0.1)*(0.9)^11)=')
1-(C(12,0)*(0.9)^12+C(12,1)*(0.1)*(0.9)^11)
disp('the probability that none will be defective =C(12,12)*(0.9)^12=')
C(12,12)*(0.9)^12
```

Scilab code Exa 34.39 finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('probability of 8 heads and 4 tails in 12 trials=p(8)=C(12,8)*(1/2)^8*(1/2)^4=')
C(12,8)*(1/2)^8*(1/2)^4
disp('the expected no. of such cases in 256 sets =256*p(8) =')
```

```
256*(495/4096)
```

Scilab code Exa 34.40 finding the probability

```
clear
clc
function [x]=C(a,b)
x=factorial(a)/(factorial(b)*factorial(a-b))
endfunction
disp('probability of a defective part=2/20=0.1')
disp('probability of a non defective part=0.9')
disp('probabaility of at least three defectives ina sample =')
1-(C(20,0)*(0.9)^20+C(20,1)*(0.1)*(0.9)^19+C(20,2)*(0.1)^2*(0.9)^18')
disp('no. of samples having three defective parts =1000*0.323= ')
1000*0.323
```

Chapter 35

Sampling and Inference

Scilab code Exa 35.1 calculating the SD of given sample

```
clc
disp('suppose the coin is unbiased ')
disp('then probability of getting the head in a toss =1/2')
disp('then,expected no. of successes=a=1/2*400 ')
a=1/2*400
disp('observed no. of successes =216')
b=216
disp('the excess of observed value over expected value=')
b-a
disp('S.D. of simple sampling = (n*p*q)^0.5=c')
c=(400*0.5*0.5)^0.5
disp('hence,z=(b-a)/c=')
(b-a)/c
disp('as z<1.96,the hypothesis is accepted at  5% level of significance')
```

Scilab code Exa 35.2 Calculating SD of sample

```
clc
disp('suppose the die is unbiased ')
disp('then probability of getting 5 or 6 with one
   die=1/3')
disp('then,expected no. of successes=a=1/3*9000 ')
a=1/3*9000
disp('observed no. of successes =3240')
b=3240
disp('the excess of observed value over expected
   value=')
b-a
disp('S.D. of simple sampling = (n*p*q)^0.5=c')
c=(9000*(1/3)*(2/3))^0.5
disp('hence,z=(b-a)/c=')
(b-a)/c
disp('as z>2.58,the hypothesis has to be rejected
   at  1% level of significance')
```

Scilab code Exa 35.3 Analysis of sample

```
clc
p=206/840
disp('q=1-p')
q=1-p
n=840
disp('standard error of the population of families
   having a monthly income of rs. 250 or less=(p*q/n
   )^0.5=')
(p*q/n)^0.5
disp('hence taking 103/420 to be the estimate of
   families having a monthly income of rs. 250 or
   less,the limits are 20% and 29%  approximately')
```

Scilab code Exa 35.4 Analysis of sample

```
clear
clc
n1=900
n2=1600
p1=20/100
p2=18.5/100
disp('p=(n1*p1+n2*p2)/(n1+n2) ')
p=(n1*p1+n2*p2)/(n1+n2)
disp('q=1-p')
q=1-p
disp('e=(p*q*(1/n1+1/n2))^0.5 ')
e=(p*q*((1/n1)+(1/n2)))^0.5
z=(p1-p2)/e
disp('as z<1,the difference between the proportions
   is not significant.')
```

Scilab code Exa 35.5 Checking whether real difference will be hidden

```
clear
clc
p1=0.3
p2=0.25
disp('q1=1-p1')
q1=1-p1
disp('q2=1-p2')
q2=1-p2
n1=1200
n2=900
disp('e=((p1*q1/n1)+(p2*q2/n2))^0.5 ')
e=((p1*q1/n1)+(p2*q2/n2))^0.5
z=(p1-p2)/e
disp('hence,it is likely that real difference will
   be hidden.')
```

Scilab code Exa 35.6 Checking whether given sample can be regarded as a random sample

```
clear
clc
disp('m and n represents mean and number of objects in sample respectively')
m=3.4
n=900
M=3.25
d=1.61
disp('z=(m-M)/(d/(n^0.5)')
z=(m-M)/(d/(n^0.5))
disp('as z>1.96,it cannot be regarded as a random sample ")
```

Scilab code Exa 35.9 Checking whethet samples can be regarded as taken from the same population

```
clc
disp('m1 and n1 represents mean and no. of objects in sample 1')
disp('m2 and n2 represents mean and no. of objects in sample 2')
m1=67.5
m2=68
n1=1000
n2=2000
d=2.5
disp('on the hypothesis that the samples are drawn from the same population of d=2.5,we get ')
```

```
z=(m1-m2)/(d*((1/n1)+(1/n2))^0.5)
disp('since |z|> 1.96,thus samples cannot be regarded as drawn from the same population ')
```

Scilab code Exa 35.10 calculating SE of difference of mean hieghts

```
clc
disp('m1,d1 and n1 denotes mean,deviation and no. of objects in first sample')
m1=67.85
d1=2.56
n1=6400
disp('m2,d2 and n2 denotes mean,deviation and no. of objects in second sample')
m2=68.55
d2=2.52
n2=1600
disp('S.E. of the difference of the mean heights is ')
e=((d1^2/n1)+(d2^2/n2))^0.5
m1-m2
disp('|m1−m2| > 10e,this is highly significant.hence,the data indicates that the sailors are on the average taller than the soldiers.')
```

Scilab code Exa 35.12 Mean and standard deviation of a given sample

```
clear
clc
n=9
disp('first of row denotes the different values of sample ')
A(1,:)=[45 47 50 52 48 47 49 53 51];
```

```
disp('the second row denotes the corresponding deviation ')
for i=1:9
  A(2,i)=A(1,i)-48;
end
disp('the third row denotes the corresponding square of deviation')
for i=1:9
  A(3,i)=A(2,i)^2;
end
disp('the sum of second row elements =')
a=0;
for i=1:9
  a=a+A(2,i);
end
a
disp('the sum of third row elements ")
b=0;
for i=1:9
  b=b+A(3,i);
end
b
disp('let m be the mean ')
m=48+a/n
disp('let d be the standard deviation ')
d=((b/n)-(a/n)^2)^0.5
t=(m-47.5)*(n-1)^0.5/d
```

Scilab code Exa 35.13 Mean and standard deviation of a given sample

```
clc
disp('d and n represents the deviation and no. of objects in given sample')
n=10
d=0.04
```

```
m=0.742
M=0.700
disp('taking the hypothesis that the product is not inferior i.e. there is no significant differene between m and M')
t=(m-M)*(n-1)^0.5/d
disp('degrees of freedom=')
f=n-1
```

Scilab code Exa 34.15 Standard deviation of a sample

```
clear
clc
n=11
disp('the first row denotes the boy no. ')
A(1,:)=[1 2 3 4 5 6 7 8 9 10 11];
disp('the second row denotes the marks in test I (x1) ')
A(2,:)=[23 20 19 21 18 20 18 17 23 16 19];
disp('the third row denotes the marks in test I (x2) ')
A(3,:)=[24 19 22 18 20 22 20 20 23 20 17];
disp('the fourth row denotes the difference of marks in two tests (d)')
for i=1:11
  A(4,i)=A(3,i)-A(2,i);
end
disp('the fifth row denotes the (d-1) ')
for i=1:11
  A(5,i)=A(4,i)-1;
end
disp('the sixth row denotes the square of elements of fourth row')
for i=1:11
  A(6,i)=A(4,i)^2;
```

```
end
A
a=0;
disp('the sum of elements of fourth row= ')
for i=1:11
  a=a+A(4,i);
end
a
b=0;
disp('the sum of elements of sixth row= ')
for i=1:11
  b=b+A(6,i);
end
b
disp('standard deviation')
d=(b/(n-1))^0.5
t=(1-0)*(n)^0.5/2.24
```