Scilab Textbook Companion for Higher Engineering Mathematics by B. S. Grewal[1]

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May 19, 2016

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

Book Description

Title: Higher Engineering Mathematics

Author: B. S. Grewal

Publisher: Khanna Publishers, New Delhi

Edition: 40

Year: 2007

ISBN: 8174091955

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

List of Figures

Chapter 1

Solution of equation and curve fitting

Scilab code Exa 1.1 finding the roots of quadratic equations

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

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

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

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

```
1 clear
2 clc
3 x=poly([0],'x');
4 p=x^3-7*(x^2)+36
5 disp("the roots of above equation are ")
6 roots(p)
```

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

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

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

```
1 clear
2 clc
3 x=poly([0],'x');
4 p=2*(x^4)-15*(x^3)+35*(x^2)-30*x+8
5 disp("the roots of above equation are ")
6 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 ")
```

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

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

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

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

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

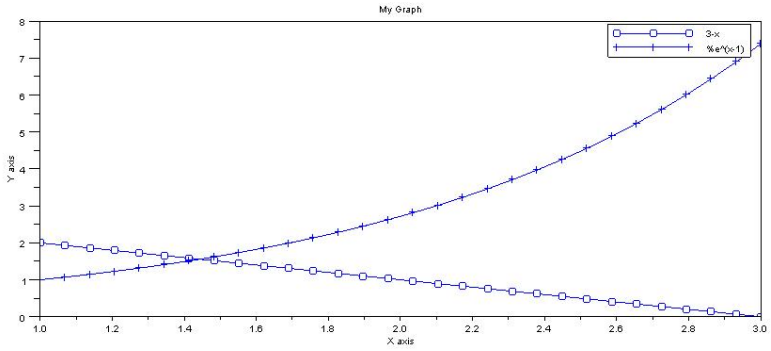

Figure 1.1: Finding the solution of equation by drawing graphs

```
11 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

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

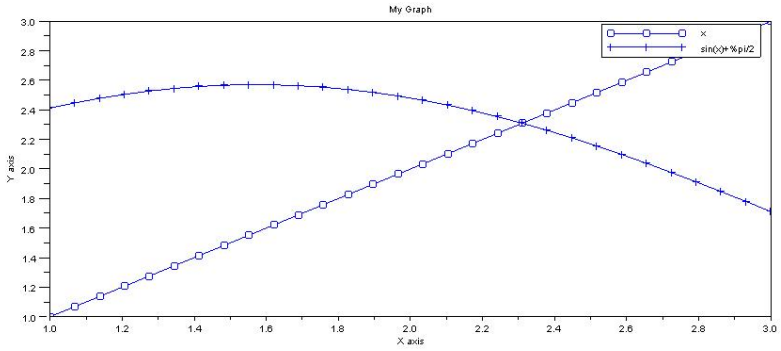

Figure 1.2: Finding the solution of equation by drawing graphs

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 ")
```

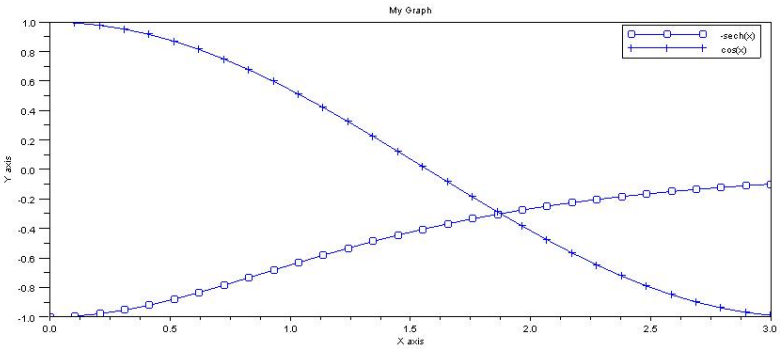

Figure 1.3: Finding the solution of equation by drawing graphs

Chapter 2

Determinants and Matrices

Scilab code Exa 2.1 Calculating Determinant

```
1 clc
2 syms a;
3 syms h;
4 syms g;
5 syms b;
6 syms f;
7 syms c;
8 A=[a h g;h b f;g f c]
9 det(A)
```

Scilab code Exa 2.2 Calculating Determinant

```
1 clear
2 clc
3 a=[0 1 2 3;1 0 3 0;2 3 0 1;3 0 1 2]
4 disp("determinant of a is ")
5 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]
```

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

Scilab code Exa 2.19 Solving equation of matrices

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

Scilab code Exa 2.20 Nth power of a given matrix

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

Scilab code Exa 2.23 Inverse of matrix

```
1 clear
2 clc
3 A=[1 1 3;1 3 -3;-2 -4 -4]
4 disp("inverse of A is ")
5 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)
```

```
5 disp("rank of A")
6 rank(A)
```

Scilab code Exa 2.28 Inverse of a matrix

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

Scilab code Exa 2.31 Solving equation using matrices

```
1 clear
2 clc
3 disp("the equations can be re written as AX=B where
    X=[x1;x2;x3;x4] and ")
4 A=[1 -1 1 1;1 1 -1 1;1 1 1 -1;1 1 1 1]
5 B=[2;-4;4;0]
6 disp("determinant of A=")
7 det(A)
8 disp("inverse of A =")
9 inv(A)
10 disp("X=")
11 inv(A)*B
```

Scilab code Exa 2.32 Solving equation using matrices

```
1 clear
2 clc
```

```
3 disp("the equations can be re written as AX=B where
    X=[x;y;z] and ")
4 A=[5 3 7;3 26 2;7 2 10]
5 B=[4;9;5]
6 disp("determinant of A=")
7 det(A)
8 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

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

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

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

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

Scilab code Exa 2.38 Inverse of a matrix

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

Scilab code Exa 2.39 Transpose and product of matrices

```
1 clear
2 clc
3 A=[-2/3 1/3 2/3;2/3 2/3 1/3;1/3 -2/3 2/3]
4 disp("A transpose is equal to ")
5 A'
6 disp("A*(transpose of A)=")
7 A*A'
8 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;
```

```
12 disp("hence,the characteristic equation is (x-a)(x-b
   )(x-c) ")
13 p=(x-a)*(x-b)*(x-c)
14 disp("A^8-5*A^7+7*A^6-3*A^5+A^4-5*A^3+8*A^2-2*A+I ="
   )
15 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

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

Scilab code Exa 2.49 eigen values and vectors of given matrix

```
1 clear
2 clc
3 A=[1 1 3;1 5 1;3 1 1]
4 disp("R is matrix of transformation and D is a
   diagonal matrix ")
5 [R D]=spec(A)
6 disp("R is normalised,let P denotes unnormalised
   version of R.Then ")
7 P(:,1)=R(:,1)*sqrt(2);
8 P(:,2)=R(:,2)*sqrt(3);
9 P(:,3)=R(:,3)*sqrt(6)
10 disp("A^4=")
11 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

```
1  //ques4.1
2  //clear
3  //cd SCI
4  //cd ("..")
5  //cd ("..")
6  //exec symbolic.sce
7  clc
8  disp(' we have to find yn for F=cosxcos2xcos3x ');
9  syms x
10 F=cos(x)*cos(2*x)*cos(3*x);
11 n=input('Enter the order of differentiation ");
12 disp('calculating  yn ');
13 yn=diff(F,x,n)
14 disp('the expression for yn is ');
15 disp(yn);
```

Scilab code Exa 4.5 finding nth derivative

```
1  //ques4.1
2  //clear
3  //cd SCI
4  //cd ("..")
5  //cd ("..")
6  //exec symbolic.sce
7  clc
8  disp(' we have to find yn for F=cosxcos2xcos3x ');
9  syms x
10 F=x/((x-1)*(2*x+3));
11 n=input('Enter the order of differentiation :  ");
12 disp('calculating  yn ');
13 yn=diff(F,x,n)
14 disp('the expression for yn is ');
15 disp(yn);
```

Scilab code Exa 4.6 finding nth derivative

```
1  //ques4.1
2  //clear
3  //cd SCI
4  //cd ("..")
5  //cd ("..")
6  //exec symbolic.sce
7  clc
8  disp(' we have to find yn for F=cosxcos2xcos3x ');
9  syms x a
10 F=x/(x^2+a^2);
11 n=input('Enter the order of differentiation :  ");
12 disp('calculating  yn ');
13 yn=diff(F,x,n)
14 disp('the expression for yn is ');
15 disp(yn);
```

Scilab code Exa 4.7 finding nth derivative

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

Scilab code Exa 4.8 proving the given differential equation

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

```
12 //n=input('Enter the order of differentiation ");
13 disp('calculating  yn for various values of n');
14 for n=1:4
15
16   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);
17   disp(n);
18   disp('the expression for yn is ');
19   disp(F);
20   disp('Which is equal to 0 ');
21
22 end
23 disp('Hence proved');
```

Scilab code Exa 4.9 proving the given differential equation

```
1 //ques4.1
2 //clear
3 //cd SCI
4 //cd ("..")
5 //cd ("..")
6 //exec symbolic.sce
7 clc
8 disp(' y=e^(a(sin^-1)x)) --sign inverse x ');
9 syms x a
10 y=%e^(a*(asin(x)));
11 disp('we have to prove (1-x^2)y(n+2)-(2n+1)xy(n+1)-(
     n^2+a^2)yn ') ;
12 //n=input('Enter the order of differentiation ");
13 disp('calculating  yn for various values of n');
14 for n=1:4
15
16   //yn=diff(F,x,n)
17   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);
```

```
18    disp(n);
19    disp('the expression for yn is ');
20    disp(F);
21    disp('Which is equal to 0 ');
22
23  end
24  disp('Hence proved');
```

Scilab code Exa 4.10 proving the given differential equation

```
1  clc
2  disp(' y^(1/m)+y^-(1/m)=2x   ');
3  disp(' OR y^(2/m)-2xy^(1/m)+1');
4  disp('OR y=[x+(x^2-1)]^m and y=[x-(x^2-1)]^m ');
5
6  syms x m
7  disp('For y=[x+(x^2-1)]^m ');
8   y=(x+(x^2-1))^m
9  disp('we have to prove (x^2-1)y(n+2)+(2n+1)xy(n+1)+(
       n^2-m^2)yn ') ;
10 //n=input('Enter the order of differentiation ");
11 disp('calculating  yn for various values of n');
12 for n=1:4
13
14    //yn=diff(F,x,n)
15    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);
16    disp(n);
17    disp('the expression for yn is ');
18    disp(F);
19    disp('Which is equal to 0 ');
20
21 end
22 disp('For y=[x-(x^2-1)]^m ');
23   y=(x-(x^2-1))^m
```

```
24 disp('we have to prove (x^2-1)y(n+2)+(2n+1)xy(n+1)+(
     n^2-m^2)yn ') ;
25 //n=input('Enter the order of differentiation ");
26 disp('calculating  yn for various values of n');
27 for n=1:4
28
29   //yn=diff(F,x,n)
30   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);
31   disp(n);
32   disp('the expression for yn is ');
33   disp(F);
34   disp('Which is equal to 0 ');
35
36 end
37 disp('Hence proved');
```

Scilab code Exa 4.11 verify roles theorem

```
1 clc
2 disp('for roles theorem F9x) should be
     differentiable in (a,b) and f(a)=f(b)');
3 disp(' Here f(x)=sin(x)/e^x');
4 disp('');
5 syms x
6 y=sin(x)/%e^x;
7
8 y1=diff(y,x);
9 disp(y1);
10 disp('putting this to zero we get tan(x)=1 ie x=pi/4
     ');
11 disp('value pi/2 lies b/w 0 and pi. Hence roles
     theorem is verified');
```

Scilab code Exa 4.16 expansion using maclaurins series

```
1 //ques16
2 disp('Maclaurins series');
3 disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)
    +.....');
4 syms x a
5 //function y=f(a)
6   y=tan(a);
7 //endfunction
8 n=input('enter the number of expression in series :
    ');
9 a=1;
10 t=eval(y);
11 a=0;
12 for i=2:n
13   y1=diff(y,'a',i-1);
14   t=t+x^(i-1)*eval(y1)/factorial(i-1);
15 end
16 disp(t)
```

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

```
1 //ques16
2 disp('Maclaurins series');
3 disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)
    +.....');
4 syms x a
5
6   y=%e^(sin(a));
7   n=input('enter the number of expression in seris :
      ');
```

```
8    a=0;
9  t=eval(y);
10 a=0;
11 for i=2:n
12   y1=diff(y,'a',i-1);
13    t=t+x^(i-1)*eval(y1)/factorial(i-1);
14 end
15 disp(t)
```

Scilab code Exa 4.18 expansion using maclaurins series

```
1  //ques18
2  disp('Maclaurins series');
3  disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)
     +.....');
4  syms x a
5
6    y=log(1+(sin(a))^2);
7    n=input('enter the number of differentiation
       involved in  maclaurins series : ');
8    a=0;
9  t=eval(y);
10 a=0;
11 for i=2:n
12   y1=diff(y,'a',i-1);
13    t=t+x^(i-1)*eval(y1)/factorial(i-1);
14 end
15 disp(t)
```

Scilab code Exa 4.19 expansion using maclaurins series

```
1  //ques19
2  disp('Maclaurins series');
```

```
3 disp('f(x)=f(0)+xf1(0)+x^2/2!*f2(0)+x^3/3!*f3(0)
    +.....');
4 syms x a b
5
6   y=%e^(a*asin(b));
7   n=input('enter the number of expression in seris :
      ');
8   b=0;
9 t=eval(y);
10
11 for i=2:n
12   y1=diff(y,'b',i-1);
13    t=t+x^(i-1)*eval(y1)/factorial(i-1);
14 end
15 disp(t)
```

Scilab code Exa 4.20 expansion using taylors series

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

Scilab code Exa 4.21 taylor series

```
1 //ques21
2 disp('Taylor series');
3 disp('f(x+h)=f(x)+hf1(x)+h^2/2!*f2(x)+h^3/3!*f3(x)
    +.....');
```

```
4 disp('To finf the taylor expansion of tan-1(x+h)')
5 syms x h
6
7   y=atan(x);
8   n=input('enter the number of expression in seris :
        ');
9
10 t=y;
11
12 for i=2:n
13   y1=diff(y,'x',i-1);
14    t=t+h^(i-1)*(y1)/factorial(i-1);
15 end
16 disp(t)
```

Scilab code Exa 4.22 evaluating limit

```
1 //ques22
2 disp('Here we need to find find the limit of f(x) at
      x=0')
3 syms x
4 y=(x*%e^x-log(1+x))/x^2;
5 //disp('The limit at x=0 is : ');
6 //l=limit(y,x,0);
7 //disp(l)
8 f=1;
9 while f==1
10 yn=x*%e^x-log(1+x);
11 yd=x^2;
12 yn1=diff(yn,'x',1);
13 yd1=diff(yd,'x',1);
14 x=0;
15 a=eval(yn1);
16 b=eval(yd1);
17 if a==b then
```

```
18    yn=yn1;
19    yd=yd1;
20  else
21    f=0;
22
23  end
24  end
25  h=a/b;
26  disp(h);
```

Scilab code Exa 4.32 tangent to curve

```
1  //ques 32
2  disp('Equation of tangent');
3  syms x a y;
4  f=(a^(2/3)-x^(2/3))^(3/2);
5  s=diff(f,x);
6
7  Y1=s*(-x)+y;
8  X1=-y/s*x;
9  g=x-(Y1-s*(X1-x));
10 disp('Equation is g=0 where g is');
11 disp(g);
```

Scilab code Exa 4.34 finding equation of normal

```
1  //ques34
2  disp('Equation of tangent');
3  syms x a t y
4  xo=a*(cos(t)+t*sin(t));
5  yo=a*(sin(t)-t*cos(t));
6  s=diff(xo,t)/diff(yo,t);
7  y=yo+s*(x-xo);
```

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

Scilab code Exa 4.35 finding angle of intersection of curve

```
1 //ques35
2 disp("The two given curves are x^=4y and y^2=4x
     which intersects at (0,0) and (4,4)');
3 disp('for (4,4)');
4 x=4;
5 syms x
6 y1=x^2/4;
7 y2=2*x^(1/2);
8 m1=diff(y1,x,1);
9 m2=diff(y2,x,1);
10 x=4;
11 m1=eval(m1);
12 m2=eval(m2);
13
14 disp('Angle between them is(radians) :-');
15 t=atan((m1-m2)/(1+m1*m2));
16 disp(t);
```

Scilab code Exa 4.37 prove given tangent statement

```
1 //ques37
2 syms a t
3 x=a*(cos(t)+log(tan(t/2)));
4 y=a*sin(t);
5 s=diff(x,t,1)/diff(y,t,1);
6 disp('length of tangent ');
7 l=y*(1+s)^(0.5);
8 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

```
1  //ques41
2  clc
3  disp('tanu=dQ/dr*r');
4  syms Q a;
5
6  r=2*a/(1-cos(Q));
7
8  u=atan(r/diff(r2,Q,1));
9  u=eval(u);
10 p=r*sin(u);
11 syms r;
12 Q=acos(1-2*a/r);
13
14 //cos(Q)=1-2*a/r;
15 p=eval(p);
16 disp(p);
```

Scilab code Exa 4.43 finding radius of curvature of cycloid

```
1  //ques43
2  syms a t
3  x=a*(t+sin(t));
4  y=a*(1-cos(t));
5  s2=diff(y,t,2)/diff(x,t,2);
6  s1=diff(y,t,1)/diff(x,t,1);
7
8  r=(1+s1^2)^(3/2)/s2;
9  disp('The radius of curvature is : ');
10 disp(r);
```

Scilab code Exa 4.46 radius of curvature of cardoid

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

Scilab code Exa 4.47 cordinates of centre of curvature

```
1 //qus47
2 disp('The centre of curvature');
3 syms x a y
4 y=2*(a*x)^0.5;
5 y1=diff(y,x,1);
6 y2=diff(y,x,2);
7 xx=x-y1*(1+y1)^2/y2;
8 yy=y+(1+y1^2)/y2;
9 disp('the coordinates x,y are resp :');
10
11 disp(xx);
12 disp(yy);
```

Scilab code Exa 4.48 proof statement cycloid

```
1 //ques48
2 disp('centre of curvature of given cycloid ');
3 syms a t
4 x=a*(t-sin(t));
5 y=a*(1-cos(t));
6 y1=diff(y,t,1);
7 y2=diff(y,t,2);
8 xx=x-y1*(1+y1)^2/y2;
9 yy=y+(1+y1^2)/y2;
10
11 disp('the coordinates x,y are resp :');
12 disp(xx);
13 disp(yy);
14 disp('which another parametric equation of cycloid '
   );
```

Scilab code Exa 4.52 maxima and minima

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

Scilab code Exa 4.61 finding the asymptotes of curve

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

Chapter 5

Partial Differentiation And Its Applications

Scilab code Exa 5.5 Partial derivative of given function

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

Scilab code Exa 5.14 Partial derivative of given function

```
1 clc
2 syms x y
3 u=asin((x+y)/(x^0.5+y^0.5))
4 a=diff(u,x)
5 b=diff(u,y)
6 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)
```

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

Scilab code Exa 5.25.3 Partial derivative of given function

```
1  clc
2  syms r l m
3  x=r*cos(l)*sin(m)
4  y=r*sin(l)*sin(m)
5  z=r*cos(m)
6  a=diff(x,r)
7  b=diff(x,m)
8  c=diff(x,l)
9  d=diff(y,r)
10 e=diff(y,m)
11 f=diff(y,l)
12 g=diff(z,r)
13 h=diff(z,m)
14 i=diff(z,l)
15 A=[a b c;d e f;g h i]
16 det(A)
```

Scilab code Exa 5.26 Partial derivative of given function

```
1 clc
2 syms x1 x2 x3
3 y1=(x2*x3)/x1
4 y2=(x3*x1)/x2
5 y3=(x1*x2)/x3
6 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

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

Scilab code Exa 6.1.2 indefinite integral

```
1 //ques1
2 disp('Indefinite integral');
3 syms x
4 f=integ((cos(x))^7,x);
5 disp(f);
```

Scilab code Exa 6.2.1 definite integral

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

Scilab code Exa 6.2.2 Definite Integration of a function

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

Scilab code Exa 4.2.3 definite integral

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

Scilab code Exa 6.2.3 definite integral

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

Scilab code Exa 6.4.1 definite integral

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

Scilab code Exa 4.4.2 definite integral

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

Scilab code Exa 6.5 definite integral

```
1  //error no internal error
2  //ques5
3  clc
4  disp('definite integral');
5  syms x m n
6  n=input('Enter n :');
7  m=input('Enter m : ');
8  g=(cos(x))^m*cos(n*x);
9  f=integ(g,x,0,%pi/2);
10 disp(float(f));
11 g2=(cos(x))^(m-1)*cos((n-1)*x);
12 f2=m/(m+n)*integ(g2,x,0,%pi/2);
13 disp(float(f2));
14 disp('Equal');
```

Scilab code Exa 6.6.1 reducing indefinite integral to simpler form

```
1  //ques6
2  clc
3  disp('definite integral');
4  syms x a
5  n=input('Enter n :');
6  g=exp(a*x)*(sin(x))^n;
7
8  f=integ(g,x);
9  disp(f);
```

Scilab code Exa 6.7.1 Indefinite Integration of a function

```
1  clc
2  syms x
3  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
```

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

Scilab code Exa 6.12 Definite Integration of a function

```
1 clear
2 clc
3 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

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

Scilab code Exa 6.14 finding the limit of the function

```
1 //ques14
2 clc
3 syms x
```

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

Scilab code Exa 6.15 Definite Integration of a function

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

Scilab code Exa 6.16 Definite Integration of a function

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

Scilab code Exa 6.24 Calculating the area under two curves

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

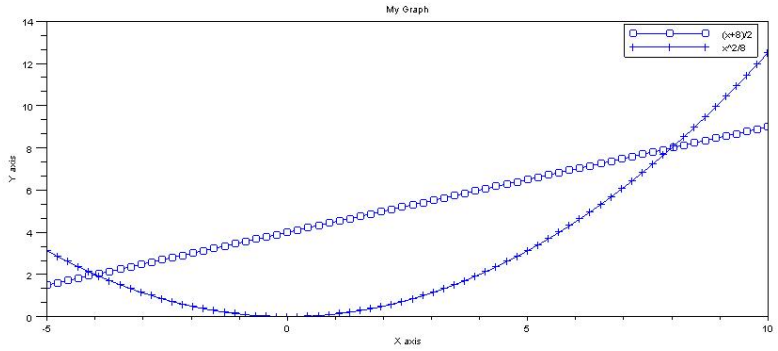

Figure 6.1: Calculating the area under two curves

```
11 disp("from the graph,it is clear that the points of
       intersection are x=-4 and x=8.")
12 disp("So,our region of integration is from x=-4 to x
       =8")
13 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

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

Scilab code Exa 9.1.3 to find the limit at infinity

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

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

```
1 clc
2 syms n
```

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

Scilab code Exa 9.2.2 to check for the type of series

```
1 clc
2 disp('5-4-1+5-4-1+5-4-1+5-4-1+.....=0,5,1
    according to the no. of terms.')
3 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

```
1 clc
2 syms n;
3 v=1/((1/n)^2)
4 u=(2/n-1)/(1/n*(1/n+1)*(1/n+2))
5 disp(limit(u/v,n,0));
6 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

```
1 clc
2 syms n;
3 v=n
4 u=((1/n)^2)/((3/n+1)*(3/n+4)*(3/n+7))
5 disp(limit(u/v,n,0));
6 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

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

Scilab code Exa 10.2 finding fourier series of given function

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

Scilab code Exa 10.3 finding fourier series of given function

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

Scilab code Exa 10.4 finding fourier series of given function

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

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

```
1  //ques5
2  clc
3  disp('finding the fourier series of given function')
     ;
4  syms  x l
5  s=0;
6  n=input('enter the no of terms upto each of sin
     terms in the expansion : ');
7  for i=1:n
8
9     bi=2/%pi*integ(x*sin(i*x),x,0,%pi);
10   s=s+float(bi)*sin(i*x);
11 end
12 disp(float(s));
```

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

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

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

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

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

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

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

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

```
1  //ques9
2  clc
3  disp('finding the fourier series of given function')
     ;
4  syms  x l
5
6  s=0;
7  n=input('enter the no of terms upto each of sin or
     cos terms in the expansion : ');
8  for i=1:n
9  //   ai=1/l*integ(exp(-x)*cos(i*%pi*x/l),x,-l,l);
10   bi=integ(x*sin(i*%pi*x/2),x,0,2);
11   s=s+float(bi)*sin(i*%pi*x/2);
12 end
13 disp(float(s));
```

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

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

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

```
1 //ques3
2 clc
3 disp('finding the fourier series of given function')
    ;
4 syms  x
5 ao=0;
6 s=ao;
7 n=input('enter the no of terms upto each of sin or
    cos terms in the expansion : ');
8 for i=1:n
9     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));
10   s=s+float(bi)*sin(i*%pi*x);
11 end
12 disp(float(s));
```

Scilab code Exa 10.12 finding fourier series of given function

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

```
11    s=s+float(ai)*cos(i*x)+float(bi)*sin(i*x);
12  end
13  disp(float(s));
```

Scilab code Exa 10.13 finding complex form of fourier series

```
1  //ques13
2  clc
3  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 :');
4  syms n x
5  cn=1/2*integ(exp(-x)*exp(-%i*%pi*n*x),x,-1,1);
6  fnx=float(cn)*exp(%i*n*%pi*x);
7
8  disp(float(fnx));
```

Scilab code Exa 10.14 practical harmonic analysis

```
1  //ques15
2  //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]
3  //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]
4  disp('Practical harmonic analysis');
5  syms x
6  xo=input('Input xo matrix : ');
7  yo=input('Input yo matrix : ');
8  ao=2*sum(yo)/length(xo);
9  s=ao/2;
10 n=input('No of sin or cos term in expansion : ');
11 for i=1:n
12   an=2*sum(yo.*cos(i*xo))/length(yo);
```

```
13    bn=2*sum(yo.*sin(i*xo))/length(yo);
14    s=s+float(an)*cos(i*x)+float(bn)*sin(i*x);
15
16    end
17    disp(s);
```

Scilab code Exa 10.15 practical harmonic analysis

```
1  //error
2  //ques15,16,17
3  //yo=[1.98 1.30 1.05 1.30 -0.88 -.25 1.98]
4  //x0=[0 1/6 1/3 1/2 2/3 5/6 1]
5  disp('Practical harmonic analysis');
6  syms x T
7  xo=input('Input xo matrix (in factor of T) : ');
8  yo=input('Input yo matrix : ');
9  ao=2*sum(yo)/length(xo);
10 s=ao/2;
11 n=input('No of sin or cos term in expansion : ');
12  i=1
13   an=2*(yo.*cos(i*xo*2*%pi))/length(yo);
14   bn=2*(yo.*sin(i*xo*2*%pi))/length(yo);
15   s=s+float(an)*cos(i*x*2*%pi/T)+float(bn)*sin(i*x
       *2*%pi/T);
16
17   disp(s);
18   disp('Direct current :');
19  i=sqrt(an^2+bn^2);
```

Scilab code Exa 10.16 practical harmonic analysis

```
1  //error
2  //ques15,16,17
```

```
3  //yo=[1.98  1.30  1.05  1.30  -0.88  -.25  1.98]
4  //x0=[0  1/6  1/3  1/2  2/3  5/6  1]
5  disp('Practical harmonic analysis');
6  syms x T
7  xo=input('Input xo matrix (in factor of T) : ');
8  yo=input('Input yo matrix : ');
9  ao=2*sum(yo)/length(xo);
10 s=ao/2;
11 n=input('No of sin or cos term in expansion : ');
12  i=1
13   an=2*(yo.*cos(i*xo*2*%pi))/length(yo);
14   bn=2*(yo.*sin(i*xo*2*%pi))/length(yo);
15   s=s+float(an)*cos(i*x*2*%pi/T)+float(bn)*sin(i*x
       *2*%pi/T);
16
17   disp(s);
18   disp('Direct current :');
19  i=sqrt(an^2+bn^2);
```

Scilab code Exa 10.17 practical harmonic analysis

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

```
15    s=s+float(an)*cos(i*x*2*%pi/T)+float(bn)*sin(i*x
         *2*%pi/T);
16
17    disp(s);
18    disp('Direct current :');
19   i=sqrt(an^2+bn^2);
```

Chapter 13

Linear Differential Equations

Scilab code Exa 13.1 solvinf linear differential equation

```
1  //ques1
2  clc
3  disp('solution of the given linear differential
       equation is given by : ');
4  syms c1 c2 x
5  m=poly(0,'m');
6  f=m^2+m-2;
7  r=roots(f);
8  disp(r);
9  y=0;
10 //for i=1:length(r)
11   //syms c(i)
12   //y=y+c(i)*exp(r(i)*x);
13   //end
14   y=c1*exp(r(1)*x)+c2*exp(r(2)*x);
15   disp('y=');
16   disp(y);
```

Scilab code Exa 13.2 solving linear differential equation

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

Scilab code Exa 13.3 solving linear differential equation

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

Scilab code Exa 13.4 solving linear differential equation

```
1  //ques4
2  clc
```

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

Scilab code Exa 13.5 finding particular integral

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

Scilab code Exa 13.6 finding particular integral

```
1 //ques6
2 clc
3 disp('solution of the given linear differential
     equation is given by : ');
4 m=poly(0,'m');
5 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
```

```
3 disp('solution of the given linear differential
     equation is given by : ');
4 m=poly(0,'m');
5 f=m^3+4*m;
6 disp('using 1/f(D)exp(ax)=x/f1(D)*exp(ax) if f(m)=0'
     );
7 disp('y=x*1/(3D^2+4)*sin2x');
8 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 ');
9 disp('y=-x/8*sin2x');
10 disp('y=');
11 y=-x*sin(2*x)/8;
12 disp(y);
```

Scilab code Exa 13.9 finding particular integral

```
1 //ques9
2 clc
3 disp('solution of the given linear differential
     equation is given by : ');
4 m=poly(0,'m');
5
6 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 ');
7 g=x^2+2*x+4;
8 f=g-diff(g,x)+diff(g,x,2);
9 y=integ(f,x);
10 disp('y=');
11 disp(y);
```

Scilab code Exa 13.10 finding particular integral

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

Scilab code Exa 13.11 solving the given linear equation

```
1 //ques11
2 clc
3 disp('solution of the given linear differential
     equation is given by : ');
4 disp('CF + PI');
5 syms c1 c2 x
6 m=poly(0,'m');
7 f=(m-2)^2;
8 r=roots(f);
9 disp(r);
10 disp('CF is given by ');
11 cf=(c1+c2*x)*exp(r(1)*x);
12 disp(cf);
13 disp('-------------------------------------');
14 disp('PI =8*{1/(D-2)^2[exp(2x)]+{1/(D-2)^2[sin(2x)
     ]+{1/(D-2)^2[x^2]}');
15 disp('using identities it reduces to : ');
16 pi=4*x^2*exp(2*x)+cos(2*x)+4*x+3;
17 disp(pi);
18 y=cf+pi;
19 disp('The solution is : y=');
20 disp(y);
```

Scilab code Exa 13.12 solving the given linear equation

```
1 //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);
```

```
11 disp('CF is given by ');
12 cf=c1*exp(r(1)*x)+c2*exp(r(2)*x);
13 disp(cf);
14 disp('-----------------------------------------');
15 disp('PI =*{1/(D^2-1)[x*sin(3x)+cos(x)]');
16 disp('using identities it reduces to : ');
17 pi=-1/10*(x*sin(3*x)+3/5*cos(3*x))-cos(x)/2;
18 disp(pi);
19 y=cf+pi;
20 disp('The solution is : y=');
21 disp(y);
```

Scilab code Exa 13.14 solving the given linear equation

```
1 //ques14
2 clc
3
4 disp('solution of the given linear differential
     equation is given by : ');
5 disp('CF + PI');
6 syms c1 c2 c3 c4 x
7 m=poly(0,'m');
8 f=(m^4+2*m^2+1);
9 r=roots(f);
10 disp(r);
11 disp('CF is given by ');
12 cf=real((c1+c2*x)*exp(r(1)*x)+(c3+c4*x)*exp(r(3)*x))
     ;
13 disp(cf);
14 disp('-----------------------------------------');
15 disp('PI =*{1/(D^4+2*D+1)[x^2*cos(x)]');
16 disp('using identities it reduces to : ');
17 pi=-1/48*((x^4-9*x^2)*cos(x)-4*x^3*sin(x));
18 disp(pi);
19 y=cf+pi;
```

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

Chapter 21

Laplace Transform

Scilab code Exa 21.1.1 finding laplace transform

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

Scilab code Exa 21.1.2 finding laplace transform

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

Scilab code Exa 21.1.3 finding laplace transform

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

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

Scilab code Exa 21.2.1 finding laplace transform

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

Scilab code Exa 21.2.2 finding laplace transform

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

Scilab code Exa 21.2.3 finding laplace transform

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

Scilab code Exa 21.4.1 finding laplace transform

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

Scilab code Exa 21.4.2 finding laplace transform

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

Scilab code Exa 21.5 finding laplace transform

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

Scilab code Exa 21.7 finding laplace transform

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

Scilab code Exa 21.8.1 finding laplace transform

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

Scilab code Exa 21.8.2 finding laplace transform

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

Scilab code Exa 21.8.3 finding laplace transform

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

Scilab code Exa 21.8.4 finding laplace transform

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

Scilab code Exa 21.9.1 finding laplace transform

```
1 //error
2 //ques7
3 clc
4 disp('To find the laplace of given function in t ');
5 syms t s a
6 f=(1-exp(t))/t;
7
8 l=laplace(f,t,s)
9 disp(l);
```

Scilab code Exa 21.9.2 finding laplace transform

```
1 //ques9
2 clc
3 disp('To find the laplace of given function in t ');
4 syms t s a b
5 f=(cos(a*t)-cos(b*t))/t;
6
7 l=laplace(f,t,s)
8 disp(l);
```

Scilab code Exa 21.10.1 finding laplace transform

```
1 //ques10(i)
2 clc
3 disp('To find the the given integral find the
     laplace of tsin(t) and put s=2 ');
4 syms t s m
5 f=sin(t)*t;
6
7 l=laplace(f,t,s)
8 s=2
9
10 disp(eval(l));
```

Scilab code Exa 21.10.3 finding laplace transform

```
1 //error
2 //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

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

Scilab code Exa 21.12.3 finding inverse laplace transform

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

Scilab code Exa 21.13.1 finding inverse laplace transform

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

Scilab code Exa 21.13.2 finding inverse laplace transform

```
1 //error no output
2 //ques11
3
4 disp('To find the inverse laplace transform of the
     function');
5 syms s t a
6 f=s/(s^4+4*a^4);
7 il=ilaplace(f,s,t);
8 disp(il);
```

Scilab code Exa 21.14.1 finding inverse laplace transform

```
1
2 //ques14
3 disp('To find the inverse laplace transform of the
     function');
4 syms s t a
5 f=s^2/(s-2)^3;
6 il=ilaplace(f,s,t);
7 disp(il);
```

Scilab code Exa 21.14.2 finding inverse laplace transform

```
1
2 //ques14
3 disp('To find the inverse laplace transform of the
     function');
4 syms s t a
5 f=(s+3)/((s^2-4*s+13));
6 il=ilaplace(f,s,t);
7 disp(il);
```

Scilab code Exa 21.15.1 finding inverse laplace transform

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

Scilab code Exa 21.15.2 finding inverse laplace transform

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

Scilab code Exa 21.16.1 finding inverse laplace transform

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

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

Scilab code Exa 21.16.2 finding inverse laplace transform

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

Scilab code Exa 21.16.3 finding inverse laplace transform

```
1 //no output
2 //ques15
3 disp('To find the inverse laplace transform of the
    function');
4 syms s t a
5
6 f=1/((s^2+a^2)^2);
7 il=ilaplace(f,s,t);
8 disp(il);
```

Scilab code Exa 21.17.1 finding inverse laplace transform

```
1 //no output
```

```
2 //ques15
3 disp('To find the inverse laplace transform of the
     function');
4 syms s t a
5
6 f=(s+2)/(s^2*(s+1)*(s-2));
7 il=ilaplace(f,s,t);
8 disp(il);
```

Scilab code Exa 21.17.2 finding inverse laplace transform

```
1 //no output
2 //ques15
3 disp('To find the inverse laplace transform of the
     function');
4 syms s t a
5
6 f=(s+2)/(s^2+4*s+5)^2;
7 il=ilaplace(f,s,t);
8 disp(il);
```

Scilab code Exa 21.19.1 finding inverse laplace transform

```
1 //error no output
2 //ques18
3 disp('To find the inverse laplace transform of the
     function');
4 syms s t a
5
6 f=s/(s^2+a^2)^2;
7 il=ilaplace(f,s,t);
8 disp(il);
```

Scilab code Exa 21.19.2 finding inverse laplace transform

```
1 //error no output
2 //ques18
3 disp('To find the inverse laplace transform of the
     function');
4 syms s t a b
5
6 f=s^2/((s^2+a^2)*(s^2+b^2));
7 il=ilaplace(f,s,t);
8 disp(il);
```

Scilab code Exa 21.28.1 finding laplace transform

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

Scilab code Exa 21.28.2 finding laplace transform

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

Scilab code Exa 21.34 finding laplace transform

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

Chapter 22

Integral Transform

Scilab code Exa 22.1 finding fourier sine integral

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

Scilab code Exa 22.2 finding fourier transform

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

Scilab code Exa 22.3 finding fourier transform

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

Scilab code Exa 22.4 finding fourier sine transform

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

Scilab code Exa 22.5 finding fourier cosine transform

```
1 //ques5
2 syms x s
```

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

Scilab code Exa 22.6 finding fourier sine transform

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

Chapter 23

Statistical Methods

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

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

```
28    f+=A(2,i)
29  end
30  disp(f)
31  disp('mean=')
32  b/f
33  d=0;
34  disp('sum of all elements of fifth row=')
35  for i=1:16
36    d+=A(5,i)
37  end
38  disp('mean  by step deviation method=')
39  25+(2*d/f)
```

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

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

```
    =')
14 Q3=25+((3*49/4-36)*5)/5
15 disp('semi interquartile range=')
16 (Q3-Q1)/2
```

Scilab code Exa 23.4 Analysis of statistical data

```
 1 clear
 2 clc
 3 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')
 4 A(1,:)=[1 2 3 4 5 6 7 8 9 10];
 5 B(1,:)=[11 12 13 14 15 16 17 18 19 20];
 6 disp('the second row of A annd B denotes the
    corresponding marks in physics ')
 7 A(2,:)=[53 54 52 32 30 60 47 46 35 28];
 8 B(2,:)=[25 42 33 48 72 51 45 33 65 29];
 9 disp('the third row denotes the corresponding marks
    in chemistry ')
10 A(3,:)=[58 55 25 32 26 85 44 80 33 72];
11 B(3,:)=[10 42 15 46 50 64 39 38 30 36];
12 disp('median marks in physics =arithmetic mean of 10
     thand 11 th student =')
13 (28+25)/2
14 disp('median marks in chemistry =arithmetic mean of
    10 thand 11 th student =')
15 (72+10)/2
```

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

```
1 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)
```

```
29 f=0;
30 disp('sum of all elements of second row=')
31 for i=1:9
32   f+=A(2,i)
33 end
34 disp(f)
35 disp('mean=')
36 b/f
37 d=0;
38 disp('sum of all elements of fifth row=')
39 for i=1:9
40   d+=A(5,i)
41 end
42 disp('mean wage=')
43 32.5+(8*d/f)
44 disp('standard deviation=')
45 8*(b/f-(d/f)^2)
```

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

```
1  clear
2  clc
3  disp('the first row of A denotes the scores of A
      and that of B denotes that of B')
4  A(1,:)=[12 115 6 73 7 19 119 36 84 29];
5  B(1,:)=[47 12 16 42 4  51 37 48 13 0];
6  disp('the second row of A annd B denotes the
      corresponding deviation ')
7  for i=1:10
8    A(2,i)= A(1,i)-51;
9    B(2,i)=B(1,i)-51;
10     end
11 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
```

```
50   disp('coefficient of variation of A=')
51   (g/f)*100
52   disp('coefficient of variation of B=')
53   (i/h)*100
```

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

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

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

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

Scilab code Exa 23.13 Calculating coefficient of correlation

```
1  clear
2  clc
3  disp('the first row of A denotes the corresponding I
     .R. of students ')
4  A(1,:)=[105 104 102 101 100 99 98 96 93 92];
5  disp('the second row denotes the corresponding
     deviation of I.R.')
6  for i=1:10
7    A(2,i)=A(1,i)-99;
8  end
9  disp('the third row denotes the square of
     corresponding deviation of I.R. ')
10 for i=1:10
11   A(3,i)=A(2,i)^2;
12 end
13 disp('the fourth row denotes the corresponding  E.R.
      of students ')
14   A(4,:)=[101 103 100 98 95 96 104 92 97 94];
15 disp('the fifth row denotes the corresponding
     deviation of E.R. ')
16 for i=1:10
17   A(5,i)=A(4,i)-98;
18 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
```

```
55    e=e+A(5,i);
56  end
57  e
58  f=0;
59  disp('the sum of elements of  sixth row=d')
60  for i=1:10
61    f=f+A(6,i);
62  end
63  f
64  g=0;
65  disp('the sum of elements of  seventh row=d')
66  for i=1:10
67    g=g+A(7,i);
68  end
69  g
70  disp('coefficient of correlation=')
71  g/(c*f)^0.5
```

Chapter 24

Numerical Methods

Scilab code Exa 24.1 finding the roots of equation

```
1  clc
2  clear
3  x=poly(0,'x');
4  p=x^3-4*x-9
5  disp("Finding roots of this equation by bisection
       method");
6  disp('f(2) is -ve and f(3) is +ve so a root lies
       between 2 and 3');
7  l=2;
8  m=3;
9  function y=f(x)
10   y=x^3-4*x-9;
11 endfunction
12 for i=1:4
13     k=1/2*(l+m);
14 if(f(k)<0)
15     l=k;
16 else
17   m=k;
18   end
19 end
```

```
20 disp(k)
```

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

```
1  //ques 2
2  disp('f(x)=xe^x-cos(x)');
3  function y=f(x)
4    y=x*%e^(x)-cos(x);
5  endfunction
6
7  disp('we are required to find the roots of f(x) by
       the method of false position');
8  disp('f(0)=-ve and f(1)=+ve so s root lie between 0
       and 1');
9  disp('finding the roots by false position method');
10
11 l=0;
12 m=1;
13 for i=1:10
14     k=l-(m-l)*f(l)/(f(m)-f(l));
15   if(f(k)<0)
16     l=k;
17   else
18     m=k;
19   end
20 end
21 //fprintf('The roots of the equation is %g',k)
22 disp('The root of the equation is :');
23 disp(k);
```

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

```
1  //ques 2
2  disp('f(x)=x*log(x)-1.2');
3  function y=f(x)
4    y=x*log10(x)-1.2;
5  endfunction
6
7  disp('we are required to find the roots of f(x) by
       the method of false position');
8  disp('f(2)=-ve and f(3)=+ve so s root lie between 2
       and 3');
9  disp('finding the roots by false position method');
10
11 l=2;
12 m=3;
13 for i=1:3
14     k=l-(m-l)*f(l)/(f(m)-f(l));
15   if(f(k)<0)
16     l=k;
17   else
18     m=k;
19   end
20 end
21 //fprintf('The roots of the equation is %g',k)
22 disp('The root of the equation is :');
23 disp(k);
```

Scilab code Exa 24.5 real roots of equation by newtons method

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

```
18    disp(k);
19    x0=k;
20  end
```

Scilab code Exa 24.7 evaluating square root by newtons iterative method

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

Scilab code Exa 24.10 solving equations by guass elimination method

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

```
2  //Linear equation system 'Ax=r' by Gauss elimination
       method.
3  clc
4  clear
5
6  disp('Solution of N-equation [A][X]=[r]')
7  n=input ('Enter number of Equations :');
8  A=input ('Enter Matrix [A]:');
9  r=input ('Enter Matrix [r]:');
10 D=A;d=r;
11
12 //create upper triangular matrix
13 s=0;
14 for j=1:n-1
15     if A(j,j)==0
16         k=j;
17         for k=k+1:n
18             if A(k,j)==0
19                 continue
20             end
21             break
22         end
23         B=A(j,:); C=r(j);
24         A(j,:)=A(k,:); r(j)=r(k);
25         A(k,:)=B; r(k)=C;
26     end
27     for i=1+s:n-1
28         L=A(i+1,j)/A(j,j);
29         A(i+1,:)=A(i+1,:)-L*A(j,:);
30         r(i+1)=r(i+1)-L*r(j);
31     end
32     s=s+1;
33 end
34 //Solution of equations
35 x(n)=r(n)/A(n,n);
36 for i=n-1:-1:1
37     sum=0;
38     for j=i+1:n
```

```
39          sum=sum+A(i,j)*x(j);
40      end
41      x(i)=(1/A(i,i))*(r(i)-sum);
42  end
43
44  //hecking with scilab functions
45  p=inv(D)*d;
46  //Output
47  disp('@
    ------------------------------------------------------------------
    @')
48  disp('Output [B][x]=[b]')
49  disp('Upper riangular Matrix [B] =');disp(A)
50  disp('Matrix [b] =');disp(r)
51  disp('solution of linear equations :');disp(x')
52  disp('solve with matlab functions(for checking):');
    disp(p)
    ------------------------------------------------------------------
```

Scilab code Exa 24.12 solving equations by guass elimination method

```
1  //ques 10 , ques 11
2  //Linear equation system 'Ax=r' by Gauss elimination
       method.
3  clc
4  clear
5
6  disp('Solution of N-equation [A][X]=[r]')
7  n=input ('Enter number of Equations :');
8  A=input ('Enter Matrix [A]:');
9  r=input ('Enter Matrix [r]:');
10 D=A;d=r;
11
12 //create upper triangular matrix
13 s=0;
14 for j=1:n-1
```

```
15      if A(j,j)==0
16          k=j;
17          for k=k+1:n
18              if A(k,j)==0
19                  continue
20              end
21              break
22          end
23          B=A(j,:); C=r(j);
24          A(j,:)=A(k,:); r(j)=r(k);
25          A(k,:)=B; r(k)=C;
26      end
27      for i=1+s:n-1
28          L=A(i+1,j)/A(j,j);
29          A(i+1,:)=A(i+1,:)-L*A(j,:);
30          r(i+1)=r(i+1)-L*r(j);
31      end
32      s=s+1;
33  end
34  //Solution of equations
35  x(n)=r(n)/A(n,n);
36  for i=n-1:-1:1
37      sum=0;
38      for j=i+1:n
39          sum=sum+A(i,j)*x(j);
40      end
41      x(i)=(1/A(i,i))*(r(i)-sum);
42  end
43
44  //hecking with scilab functions
45  p=inv(D)*d;
46  //Output
47  disp('@
      ------------------------------------------------------------------
      @')
48  disp('Output [B][x]=[b]')
49  disp('Upper riangular Matrix [B] =');disp(A)
50  disp('Matrix [b] =');disp(r)
```

```
51 disp('solution of linear equations :');disp(x')
52 disp('solve with matlab functions(for checking):');
   disp(p)
```

Scilab code Exa 24.13 solving equations by guass elimination method

```
1  //ques 10 , ques 11
2  //Linear equation system 'Ax=r' by Gauss elimination
       method.
3  clc
4  clear
5
6  disp('Solution of N-equation [A][X]=[r]')
7  n=input ('Enter number of Equations :');
8  A=input ('Enter Matrix [A]:');
9  r=input ('Enter Matrix [r]:');
10 D=A;d=r;
11
12 //create upper triangular matrix
13 s=0;
14 for j=1:n-1
15     if A(j,j)==0
16         k=j;
17         for k=k+1:n
18             if A(k,j)==0
19                 continue
20             end
21             break
22         end
23         B=A(j,:); C=r(j);
24         A(j,:)=A(k,:); r(j)=r(k);
25         A(k,:)=B; r(k)=C;
26     end
27     for i=1+s:n-1
28         L=A(i+1,j)/A(j,j);
```

```
29          A(i+1,:)=A(i+1,:)-L*A(j,:);
30          r(i+1)=r(i+1)-L*r(j);
31      end
32      s=s+1;
33  end
34  //Solution of equations
35  x(n)=r(n)/A(n,n);
36  for i=n-1:-1:1
37      sum=0;
38      for j=i+1:n
39          sum=sum+A(i,j)*x(j);
40      end
41      x(i)=(1/A(i,i))*(r(i)-sum);
42  end
43
44  //hecking with scilab functions
45  p=inv(D)*d;
46  //Output
47  disp('@
    ------------------------------------------------------------------
    @')
48  disp('Output [B][x]=[b]')
49  disp('Upper riangular Matrix [B] =');disp(A)
50  disp('Matrix [b] =');disp(r)
51  disp('solution of linear equations :');disp(x')
52  disp('solve with matlab functions(for checking):');
    disp(p)
```

Chapter 26

Difference Equations and Z Transform

Scilab code Exa 26.2 finding difference equation

```
1  //ques2
2  syms n a b yn0 yn1 yn2
3  yn=a*2^n+b*(-2)^n;
4  disp('yn=');
5  disp(yn);
6  n=n+1;
7  yn=eval(yn);
8  disp('y(n+1)=yn1=');
9  disp(yn);
10 n=n+1;
11 yn=eval(yn);
12 disp('y(n+2)=yn2=');
13 disp(yn);
14 disp('Eliminating a b fropm these equations we get :
       ');
15 A=[yn0 1 1;yn1 2 -2;yn2 4 4]
16 y=det(A);
17 disp('The required difference equation :');
18 disp(y);
```

```
19 disp('=0');
```

Scilab code Exa 26.3 solving difference equation

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

Scilab code Exa 26.4 solving difference equation

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

Scilab code Exa 26.6 firming fibonacci difference equation

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

Scilab code Exa 26.7 solving difference equation

```
1 //ques4
2 syms  c1 c2 c3 n
3 disp('Cumulative function is given by E^2-4*E+3
    =0 ');
4 E=poly(0,'E');
5 f=E^2-4*E+3;
6 r=roots(f);
7 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

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

Scilab code Exa 26.11 solving difference equation

```
1 //ques11
2 clc
3 syms  c1 c2 c3 n
4 disp('Cumulative function is given by E^2-2*E+1
    =0 ');
5 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=');
```

```
15 disp(cf);
16 //particular integral calulation manually
17 disp('solving for PI ');
18 disp('We get PI=');
19 pi=-4/5*x-19/25+4^x/4;
20 ux=cf+pi;
21 disp('ux=');
22 disp(ux);
23 disp('Putting in (i) we get vx=');
24 vx=c1*2^x-3*c2*6^x-3/5*x-34/25-4^x/4;
25 disp(vx);
```

Scilab code Exa 26.15.2 Z transform

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

Scilab code Exa 26.16 evaluating u2 and u3

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

```
12 disp(u3);
```

Chapter 27

Numerical Solution of Ordinary Differential Equations

Scilab code Exa 27.1 solving ODE with picards method

```
1  //ques1
2  syms x
3  disp('solution through picards method');
4  n=input('The no of iterations required');
5  disp('y(0)=1 and y(x)=x+y');
6  yo=1;
7  yn=1;
8  for i = 1:n
9    yn=yo+integ(yn+x,x,0,x);
10 end
11 disp('y=');
12 disp(yn);
```

Scilab code Exa 27.2 solving ODE with picards method

```
1  //error
```

```
2  //ques2
3  syms x
4  disp('solution through picards method');
5  n=input('The no of iterations required');
6  disp('y(0)=1 and y(x)=x+y');
7  yo=1;
8  y=1;
9  for i = 1:n
10
11   f=(y-x)/(y+x);
12   y=yo+integ(f,x,0,x);
13 end
14 disp('y=');
15 x=0.1;
16 disp(eval(y));
```

Scilab code Exa 27.5 solving ODE using Eulers method

```
1  //ques5
2  clc
3  disp('Solution using Eulers Method ');
4  disp x y;
5  n=input('Input the number of iteration :-');
6  x=0;
7  y=1;
8  for i=1:n
9
10 y1=x+y;
11 y=y+0.1*y1;
12 x=x+0.1;
13 end
14 disp('The value of y is :-');
15 disp(y);
```

Scilab code Exa 27.6 solving ODE using Eulers method

```
1  //ques5
2  clc
3  disp('Solution using Eulers Method ');
4  disp x y;
5  n=input('Input the number of iteration :-');
6  x=0;
7  y=1;
8  for i=1:n
9
10 y1=(y-x)/(y+x);
11 y=y+0.02*y1;
12 x=x+0.1;
13 disp(y);
14 end
15 disp('The value of y is :-');
16 disp(y);
```

Scilab code Exa 27.7 solving ODE using Modified Eulers method

```
1  //ques7
2  clc
3  disp('Solution using Eulers Method ');
4  disp x y;
5  n=input('Input the number of iteration :-');
6  x=0.1;
7  m=1;
8  y=1;
9  yn=1;
10 y1=1;
11 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);
```

```
11 k=0.301;
12 for i=1:n
13
14 yn=y;
15
16
17   for i=1:4
18   m=(k+y1)/2;
19   yn=y+0.2*m;
20   y1=log10(yn+x);
21   disp(yn);
22 end
23 disp('-----------------------------');
24 y=yn;
25 m=y1;
26   yn=yn+0.2*m;
27   disp(yn);
28   x=x+0.2;
29   yn=y;
30   k=m;
31 end
32 disp('The value of y is :-');
33 disp(y);
```

Scilab code Exa 27.9 solving ODE using Modified Eulers method

```
1 //ques7
2 clc
3 disp('Solution using Eulers Method ');
4 disp x y;
5 n=input('Input the number of iteration :-');
6 x=0.2;
7 m=1;
8 y=1;
9 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');
```

```
4  function yy=f(x,y)
5    yy=x+y^2;
6  endfunction
7
8  x=0;
9  y=1;
10 h=0.1;
11 k1=h*f(x,y);
12 k2=h*f(x+1/2*h,y+1/2*k1);
13 k3=h*f(x+1/2*h,y+1/2*k2);
14 k4=h*f(x+h,y+k3);
15 k=1/6*(k1+2*k2+2*k3+k4);
16 disp('the required approximate value is :-');
17 y=y+k;
18 disp(y);
19 disp('to find y(0.4) put x=0.2 y=above value ie
     1.196 h=0.2 ');
20 x=0.1;
21 h=0.1;
22 k1=h*f(x,y);
23 k2=h*f(x+1/2*h,y+1/2*k1);
24 k3=h*f(x+1/2*h,y+1/2*k2);
25 k4=h*f(x+h,y+k3);
26 k=1/6*(k1+2*k2+2*k3+k4);
27 disp('the required approximate value is :-');
28 y=y+k;
29 disp(y);
```

Scilab code Exa 27.14 solving ODE using milnes method

```
1  //ques14
2  clc
3  syms x
4  yo=0;
5  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;
```

```
43 disp(eval(y3));
44 disp('f3=');
45 f3=float(eval(x-y3^2));
46 disp(f3);
47 //-------------------------------------------------------
48 disp('Using predictor method to find y4');
49 x=0.8;
50 y4=eval(yo+4/3*h*(2*f1-f2+2*f3));
51 disp('y4=');
52 disp(float(y4));
53 f4=float(eval(x-y^2));
54 disp('f4=');
55 disp(f4);
56 disp('Using predictor method to find y5');
57 x=1.0;
58 y5=eval(y1+4/3*h*(2*f2-f3+2*f4));
59 disp(float(y5));
60 f5=float(eval(x-y^2));
61 disp('f5=');
62 disp(f5);
63 disp('Hence y(1)=');
64 disp(float(y5));
```

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

```
1 //ques15
2 clc
3 disp('Runga kutta method');
4
5 function yy=f(x,y)
6   yy=x*y+y^2;
7 endfunction
8 y0=1;
9 x=0;
10 y=1;
```

```
11 h=0.1;
12 k1=h*f(x,y);
13 k2=h*f(x+1/2*h,y+1/2*k1);
14 k3=h*f(x+1/2*h,y+1/2*k2);
15 k4=h*f(x+h,y+k3);
16 ka=1/6*(k1+2*k2+2*k3+k4);
17 disp('the required approximate value is :-');
18 y1=y+ka;
19 y=y+ka;
20 disp(y);
21 //x=0.1;
22 //y1=float(eval(y));
23
24 disp('to find y(0.4) put x=0.2 y=above value ie
      1.196 h=0.2 ');
25 x=0.1;
26 h=0.1;
27 k1=h*f(x,y);
28 k2=h*f(x+1/2*h,y+1/2*k1);
29 k3=h*f(x+1/2*h,y+1/2*k2);
30 k4=h*f(x+h,y+k3);
31 kb=1/6*(k1+2*k2+2*k3+k4);
32 disp('the required approximate value is :-');
33 y2=y+kb;
34 y=y+kb;
35 disp(y);
36 //x=0.2;
37 //y2=float(eval(y));
38
39 disp('to find y(0.4) put x=0.2 y=above value ie
      1.196 h=0.2 ');
40 x=0.2;
41 h=0.1;
42 k1=h*f(x,y);
43 k2=h*f(x+1/2*h,y+1/2*k1);
44 k3=h*f(x+1/2*h,y+1/2*k2);
45 k4=h*f(x+h,y+k3);
46 kc=1/6*(k1+2*k2+2*k3+k4);
```

```
47 disp('the required approximate value is :-');
48 y3=y+kc;
49 y=y+kc;
50 disp(y);
51 //x=0.3;
52 //y3=float(eval(y));
53 f0=f(0,y0);
54 f1=f(0.1,y1);
55 f2=f(0.2,y2);
56 f3=f(0.3,y3);
57 disp('y0 y1 y2 y3 are respectively : ');
58 disp(y3,y2,y1,y0);
59 disp('f0 f1 f2 f3 are respectively : ');
60 disp(f3 ,f2, f1 ,f0 );
61 disp('finding y4 using predictors milne method x=0.4
     ');
62 h=0.1;
63 y4=y0+4*h/3*(2*f1-f2+2*f3);
64 disp('y4=');
65 disp(y4);
66 disp('f4=');
67 f4=f(0.4,y4);
68
69 disp('using corrector method :');
70 y4=y2+h/3*(f2+4*f3+f4);
71 disp('y4=');
72 disp(y4);
73 disp('f4=');
74 f4=f(0.4,y4);
75 disp(f4);
```

Scilab code Exa 27.16 solving ODE using adamsbashforth method

```
1 //ques16
2 clc
```

```
3  function yy=f(x,y)
4    yy=x^2*(1+y);
5  endfunction
6
7  y3=1
8  y2=1.233
9  y1=1.548
10 y0=1.979
11
12 f3=f(1,y3)
13 f2=f(1.1,y2)
14 f1=f(1.2,y1)
15 f0=f(1.3,y0)
16 disp('using predictor method');
17 h=0.1
18 y11=y0+h/24*(55*f0-59*f1+37*f2-9*f3)
19 disp('y11=');
20 disp(y11);
21 x=1.4;
22 f11=f(1.4,y11);
23 disp('using corrector method');
24 y11=y0+h/24*(9*f11+19*f0-5*f1+f2);
25 disp('y11=');
26 disp(y11);
27 f11=f(1.4,y11);
28 disp('f11=');
29 disp(f11);
```

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

```
1  //ques17
2  clc
3  disp('Runga kutta method');
4
5  function yy=f(x,y)
```

```
6     yy=x-y^2;
7   endfunction
8   y0=1;
9   x=0;
10  y=1;
11  h=0.1;
12  k1=h*f(x,y);
13  k2=h*f(x+1/2*h,y+1/2*k1);
14  k3=h*f(x+1/2*h,y+1/2*k2);
15  k4=h*f(x+h,y+k3);
16  ka=1/6*(k1+2*k2+2*k3+k4);
17  disp('the required approximate value is :-');
18  y1=y+ka;
19  y=y+ka;
20  disp(y);
21  //x=0.1;
22  //y1=float(eval(y));
23
24  disp('to find y(0.4) put x=0.2 y=above value ie
       1.196 h=0.2 ');
25  x=0.1;
26  h=0.1;
27  k1=h*f(x,y);
28  k2=h*f(x+1/2*h,y+1/2*k1);
29  k3=h*f(x+1/2*h,y+1/2*k2);
30  k4=h*f(x+h,y+k3);
31  kb=1/6*(k1+2*k2+2*k3+k4);
32  disp('the required approximate value is :-');
33  y2=y+kb;
34  y=y+kb;
35  disp(y);
36  //x=0.2;
37  //y2=float(eval(y));
38
39  disp('to find y(0.4) put x=0.2 y=above value ie
       1.196 h=0.2 ');
40  x=0.2;
41  h=0.1;
```

```
42 k1=h*f(x,y);
43 k2=h*f(x+1/2*h,y+1/2*k1);
44 k3=h*f(x+1/2*h,y+1/2*k2);
45 k4=h*f(x+h,y+k3);
46 kc=1/6*(k1+2*k2+2*k3+k4);
47 disp('the required approximate value is :-');
48 y3=y+kc;
49 y=y+kc;
50 disp(y);
51 //x=0.3;
52 //y3=float(eval(y));
53 f0=f(0,y0);
54 f1=f(0.1,y1);
55 f2=f(0.2,y2);
56 f3=f(0.3,y3);
57 disp('y0 y1 y2 y3 are respectively : ');
58 disp(y3,y2,y1,y0);
59 disp('f0 f1 f2 f3 are respectively : ');
60 disp(f3 ,f2, f1 ,f0 );
61 disp('Using adams method');
62 disp('Using the predictor ');
63 h=0.1;
64 y4=y3+h/24*(55*f3-59*f2+37*f1-9*f0);
65 x=0.4;
66 f4=f(0.4,y4);
67 disp('y4=');
68 disp(y4);
69 disp('using corrector method');
70 y4=y3+h/24*(9*f4+19*f3-5*f2+f1);
71 disp('y4=');
72 disp(y4);
73 f4=f(0.4,y4);
74 disp('f4=');
75 disp(f4);
```

Scilab code Exa 27.18 solving simultanious ODE using picards method

```
1  //ques18
2  clc
3  disp('Picards method');
4  x0=0;
5  y0=2;
6  z0=1;
7  syms x
8  function yy=f(x,y,z)
9    yy=x+z;
10 endfunction
11
12 function yy=g(x,y,z)
13   yy=x-y^2;
14 endfunction
15 disp('first approximation');
16 y1=y0+integ(f(x,y0,z0),x,x0,x);
17 disp('y1=');
18 disp(y1);
19 z1=z0+integ(g(x,y0,z0),x,x0,x);
20 disp('z1=');
21 disp(z1);
22
23 disp('second approximation');
24 y2=y0+integ(f(x,y1,z1),x,x0,x);
25 disp('y2=');
26 disp(y2);
27 z2=z0+integ(g(x,y1,z1),x,x0,x);
28 disp('z2=');
29 disp(z2);
30
31 disp('third approximation');
32 y3=y0+integ(f(x,y2,z2),x,x0,x);
33 disp('y3=');
34 disp(y3);
35 z3=z0+integ(g(x,y2,z2),x,x0,x);
36 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);
```

```
26 //at x=0.2
27 x=0.2;
28 y=y0+k;
29 y1=z0+l;
30 disp('y=');
31 disp(float(y));
32 disp('y1=');
33 disp(float(y1));
34
35 y
```

Scilab code Exa 27.20 solving ODE using milnes method

```
1 //ques20
2 clc
```

Chapter 28

Numerical Solution of Partial Differential Equations

Scilab code Exa 28.1 classification of partial differential equation

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

Scilab code Exa 28.2 solving elliptical equation

```
1  //ques28.2
2  disp('See figure in question');
3  disp('From symmetry u7=u1 , u8=u2 , u9=u3 , u3=u1 ,
       u6=u4, u9=u7');
4  disp('u5=1/4*(2000+2000+1000+1000)=1500');
5  u5=1500;
6  disp('u1=1/4(0=1500+1000+2000)=1125');
7  u1=1125;
8  disp('u2=1/4*(1125+1125+1000+1500)=1188');
9  u2=1188;
10 disp('u4=1/4(2000+1500+1125+1125)=1438');
11 u4=1438;
12 disp(u1,u2,u4,u5)
13 disp('Iterations : ');
14 //n=input('Input the number of iterations required :
       ');
15 for i=1:6
16 u11=1/4*(1000+u2+500+u4);
17 u22=1/4*(u11+u1+1000+u5);
18 u44=1/4*(2000+u5+u11+u1);
19 u55=1/4*(u44+u4+u22+u2);
20 disp(' ');
21 disp(u55,u44,u22,u11);
22 u1=u11;
23 u2=u22;
24 u4=u44;
25 u5=u55;
26 end
```

Scilab code Exa 28.3 evaluating function satisfying laplace equation

```
1  //ques3
2  clear
3  clc
4  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);
```

```
42      end
43      s=s+1;
44  end
45  //Solution of equations
46  x(n)=r(n)/A(n,n);
47  for i=n-1:-1:1
48      sum=0;
49      for j=i+1:n
50          sum=sum+A(i,j)*x(j);
51      end
52      x(i)=(1/A(i,i))*(r(i)-sum);
53  end
54
55  //hecking with scilab functions
56  p=inv(D)*d;
57  //Output
58  disp('@
    ------------------------------------------------------------------
    @')
59  disp('Output [B][x]=[b]')
60  disp('Upper riangular Matrix [B] =');disp(A)
61  disp('Matrix [b] =');disp(r)
62  disp('solution of linear equations :');disp(x')
```

Scilab code Exa 28.5 solving parabolic equation

```
1  //ques5
2  clear
3  clc
4  disp('Here c^2=4 , h=1 , k=1/8 , therefore alpha=(c
       ^2)*k/(h^2)');
5  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)'
       );
6  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
```

```
4  disp('Here c^2=1 , h=1/3 , k=1/36 , therefore t=(c
       ^2)*k/(h^2)=1/4');
5  disp('So bendre-schmidits recurrence relation ie u(i
       )(j+1)=1/4(u(i-1)(j)+u(i+1)(j)+2u(i,j)');
6  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');
7  c=1;
8  h=1/3;
9  k=1/36;
10 t=(c^2)*k/(h^2);
11 A=ones(9,9);
12
13 for i=1:9
14   for j=1:9
15   A(1,i)=0;
16   A(2,i)=0;
17   A(i,1)=sin(%pi/3*(i-1));
18
19 end
20 end
21 //A(2,1)=0.866;
22 //A(3,1)=0.866;
23 for i=2:8
24   for j=2:8
25     // A(i,j)=1/4*(A(i-1,j-1)+A(i+1,j-1)+2*A(i-1,j
         -1));
26      A(i,j)=t*A(i-1,j-1)+t*A(i+1,j-1)+(1-2*t)*A(i-1,
          j-1);
27 end
28 end
29 for i=2:8
30    j=2;
31   disp(A(i,j));
32
33 end
```

Scilab code Exa 28.7 solving wave equation

```
1  //ques7
2  clear
3  clc
4  disp('Here c^2=16 , taking h=1 , finding k such that
       c^2t^2=1 ');
5  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)');
6  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)');
7  c=4;
8  h=1;
9  k=(h/c);
10 t=k/h;
11 A=zeros(6,6);
12 disp('Also from 1st derivative (u(i)(j+1)-u(i,j-1))
     /2k=g(x)  and g(x)=0 in this case');
13 disp('So if j=0 this gives u(i)(1)=1/2*(u(i-1)(0)+u(
     i+1)(0))')
14 for i=0:5
15   for j=2:9
16   A(1,i+1)=0;
17   A(6,i+1)=0;
18   A(i+1,1)=(i)^2*(5-i);
19
20
21 end
22 end
23 for i=1:4
24     A(i+1,2)=1/2*(A(i,1)+A(i+2,1));
25
26   end
```

```
27    for i=3:5
28    for j=3:5
29
30      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);
31  end
32  end
33
34  for i=1:5
35  for j=1:5
36    disp(A(i,j));
37  end
38  end
```

Scilab code Exa 28.8 solving wave equation

```
1  //ques8
2  clear
3  clc
4  disp('Here c^2=4 , taking h=1 , finding k such that
       c^2t^2=1 ');
5  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)');
6  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)');
7  c=2;
8  h=1;
9  k=(h/c);
10 t=k/h;
11 A=zeros(6,6);
12 disp('Also from 1st derivative (u(i)(j+1)-u(i,j-1))
       /2k=g(x)  and g(x)=0 in this case');
13 disp('So if j=0 this gives u(i)(1)=1/2*(u(i-1)(0)+u(
       i+1)(0))')
```

```
14 for i=0:5
15   for j=2:9
16   A(1,i+1)=0;
17   A(5,i+1)=0;
18   A(i+1,1)=(i)*(4-i);
19
20
21 end
22 end
23 for i=1:4
24     A(i+1,2)=1/2*(A(i,1)+A(i+2,1));
25
26   end
27   for i=3:5
28   for j=3:5
29
30     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);
31 end
32 end
33
34 for i=1:5
35 for j=1:5
36   disp(A(i,j));
37 end
38 end
```

Chapter 34

Probability and Distributions

Scilab code Exa 34.1 Calculating probability

```
1 clear
2 clc
3 disp('from the principle of counting,the required no
    .of ways are 12*11*10*9=')
4 12*11*10*9
```

Scilab code Exa 34.2.1 Calculating the number of permutations

```
1 clear
2 clc
3 disp('no.of permutations=9!/(2!*2!*2!) ')
4 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
```

```
3 function [x]=C(a,b)
4 x=factorial(a)/(factorial(b)*factorial(a-b))
5 endfunction
6 disp('no. of committees=C(6,3)*C(4,2)=')
7 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

```
1 clear
2 clc
3 disp('the probability of getting a four is 1/6=')
4 1/6
```

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

```
1 clear
2 clc
3 disp('the probability of getting an even no. 1/2=')
4 1/2
```

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

```
1 clear
2 clc
3 disp('the probability of 53 sundays is 2/7=')
4 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)
```

```
10 disp('probability=')
11 5/84
```

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

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

Scilab code Exa 34.14.1 Finding the probability

```
1 clear
2 clc
3 disp('probability of first card being a king=4/52')
4 4/52
5 disp('probability of second card being a queen=4/52'
    )
6 4/52
7 disp('probability of drawing both cards in
    succession=4/52*4/52=')
8 4/52*4/52
```

Scilab code Exa 34.15.1 Finding the probability

```
1 clear
2 clc
```

```
3 disp('probability of getting 7 in first toss and not
      getting it in second toss=1/6*5/6')
4 1/6*5/6
5 disp('probability of not getting 7 in first toss and
      getting it in second toss=5/6*1/6')
6 5/6*1/6
7 disp('required probability=1/6*5/6+5/6*1/6')
8 1/6*5/6+5/6*1/6
```

Scilab code Exa 34.15.2 Finding the probability

```
1 clear
2 clc
3 disp('probability of not getting 7 in either toss
    =5/6*5/6')
4 5/6*5/6
5 disp('probability of getting 7 at least once
    =1-5/6*5/6')
6 1-5/6*5/6
```

Scilab code Exa 34.15.3 Finding the probability

```
1 clear
2 clc
3 disp('probability of getting 7 twice=1/6*1/6')
4 1/6*1/6
```

Scilab code Exa 34.16 Finding the probability

```
1 clear
```

```
2 clc
3 disp('probability of engineering subject being
    chooosen=(1/3*3/8)+(2/3*5/8)=')
4 (1/3*3/8)+(2/3*5/8)
```

Scilab code Exa 34.17 Finding the probability

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

Scilab code Exa 34.18 Finding the probability

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

Scilab code Exa 34.19.1 Finding the probability

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

```
5 endfunction
6 disp('total no.of possible outcomes=C(10,2)=')
7 C(10,2)
8 disp('no. of favourable outcomes=5*5=')
9 5*5
10 disp('p=')
11 25/49
```

Scilab code Exa 34.19.2 Finding the probability

```
1 clear
2 clc
3 disp('total no.of possible outcomes=10*9=')
4 10*9
5 disp('no. of favourable outcomes=5*5+5*5=')
6 5*5+5*5
7 disp('p=')
8 50/90
```

Scilab code Exa 34.19.3 Finding the probability

```
1 clear
2 clc
3 disp('total no.of possible outcomes=10*9=')
4 10*10
5 disp('no. of favourable outcomes=5*5+5*5=')
6 5*5+5*5
7 disp('p=')
8 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
```

```
3 disp('probability of problem not getting solved
    =1/2*2/3*3/4=')
4 1/2*2/3*3/4
5 disp('probability of problem getting solved
    =1-(1/2*2/3*3/4)=')
6 1-(1/2*2/3*3/4)
```

Scilab code Exa 34.25 finding the probability

```
1 clc
2 disp('total frequency= integrate (f,x,0,2 )=')
3 n=integrate ('x^3','x',0,1)+integrate ('(2-x)^3','x'
    ,1,2)
4 disp('u1 about origin=')
5 u1=(1/n)*(integrate ('(x)*(x^3)','x',0,1)+integrate
    ('(x)*((2-x)^3)','x',1,2))
6 disp('u2 about origin=')
7 u2=(1/n)*(integrate ('(x^2)*(x^3)','x',0,1)+
    integrate('(x^2)*((2-x)^3)','x',1,2))
8 disp('standard deviation=(u2-u1^2)^0.5=')
9 (u2-u1^2)^0.5
10 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`)')
11 (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

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

```
4 (0.45*0.03)/(0.45*0.03+0.25*0.05+0.3*0.04)
```

Scilab code Exa 34.27 finding the probability

```
1 clear
2 clc
3 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')
4 (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

```
1 clc
2 disp('probability of no success=8/27')
3 disp('probability of a success=1/3')
4 disp('probability of one success=4/9')
5 disp('probability of two successes=2/9')
6 disp('probability of three successes=2/9')
7 A=[0 1 2 3;8/27 4/9 2/9 1/27]
8 disp('mean=sum of i*pi=')
9 A(1,1)*A(2,1)+A(1,2)*A(2,2)+A(1,4)*A(2,4)+A(1,3)*A
    (2,3)
10 disp('sum of i*pi^2=')
11 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)
12 disp('variance=(sum of i*pi^2)-1=')
13 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)
```

```
11 disp(eval(a))
12 disp('p(x>=6)=')
13 b=A(2,7)+A(2,8)
14 eval(b)
15 disp(eval(b))
16 disp('p(3<x<5)=')
17 c=A(2,2)+A(2,3)+A(2,4)+A(2,5)
18 eval(c)
19 disp(eval(c))
```

Scilab code Exa 34.31 finding the probability

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

Scilab code Exa 34.33 finding the probability

```
1 clc
2 syms k;
3 disp('total probability= integrate (f,x,0,6 )=')
4 p=integrate ('k*x','x',0,2)
5 q=integrate ('2*k','x',2,4)
6 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`)')
```

```
11 (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

```
1  clear
2 clc
3 function [x]=C(a,b)
4 x=factorial(a)/(factorial(b)*factorial(a-b))
5 endfunction
6 disp('probability that exactly two will be defective
   =C(12,2)*(0.1)^2*(0.9)^10=')
7 C(12,2)*(0.1)^2*(0.9)^10
8 disp('probability that at least two will be
   defective=1-(C(12,0)*(0.9)^12+C(12,1)*(0.1)*(0.9)
   ^11)=')
9 1-(C(12,0)*(0.9)^12+C(12,1)*(0.1)*(0.9)^11)
10 disp('the probability that none will be defective =C
   (12,12)*(0.9)^12=')
11 C(12,12)*(0.9)^12
```

Scilab code Exa 34.39 finding the probability

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

```
9 256*(495/4096)
```

Scilab code Exa 34.40 finding the probability

```
1 clear
2 clc
3 function [x]=C(a,b)
4 x=factorial(a)/(factorial(b)*factorial(a-b))
5 endfunction
6 disp('probability of a defective part=2/20=0.1')
7 disp('probability of a non defective part=0.9')
8 disp('probabaility of at least three defectives ina
    sample =')
9 1-(C(20,0)*(0.9)^20+C(20,1)*(0.1)*(0.9)^19+C(20,2)
    *(0.1)^2*(0.9)^18')
10 disp('no. of samples having three defective parts
    =1000*0.323=')
11 1000*0.323
```

Chapter 35

Sampling and Inference

Scilab code Exa 35.1 calculating the SD of given sample

```
1  clc
2  disp('suppose the coin is unbiased ')
3  disp('then probability of getting the head in a toss
     =1/2')
4  disp('then,expected no. of successes=a=1/2*400 ')
5  a=1/2*400
6  disp('observed no. of successes =216')
7  b=216
8  disp('the excess of observed value over expected
     value=')
9  b-a
10 disp('S.D. of simple sampling = (n*p*q)^0.5=c')
11 c=(400*0.5*0.5)^0.5
12 disp('hence,z=(b-a)/c=')
13 (b-a)/c
14 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 ')
```

```
10 z=(m1-m2)/(d*((1/n1)+(1/n2))^0.5)
11 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

```
1  clc
2  disp('m1,d1 and n1 denotes mean,deviation and no. of
       objects in first sample')
3  m1=67.85
4  d1=2.56
5  n1=6400
6  disp('m2,d2 and n2 denotes mean,deviation and no. of
       objects in second sample')
7  m2=68.55
8  d2=2.52
9  n2=1600
10 disp('S.E. of the difference of the mean heights is
      ')
11 e=((d1^2/n1)+(d2^2/n2))^0.5
12 m1-m2
13 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

```
1  clear
2  clc
3  n=9
4  disp('first of row denotes the different values of
      sample ')
5  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
```

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

Scilab code Exa 34.15 Standard deviation of a sample

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

```
21 end
22 A
23 a=0;
24 disp('the sum of elements of fourth row= ')
25 for i=1:11
26   a=a+A(4,i);
27 end
28 a
29 b=0;
30 disp('the sum of elements of sixth row= ')
31 for i=1:11
32   b=b+A(6,i);
33 end
34 b
35 disp('standard deviation')
36 d=(b/(n-1))^0.5
37 t=(1-0)*(n)^0.5/2.24
```