Scilab Textbook Companion for Linear Algebra by Seymour[1]

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July 18, 2019

[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: Linear Algebra

Author: Seymour

Publisher: Mcgraw Hill New Delhi

Edition: 4

Year: 2009

ISBN: 978-0-07-154353-8

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

Chapter 1

Vectors and spatial vectors

Scilab code Exa 1.1 Vectors

```
1 // PG-2
2 clc;
3 close;
4 clear;
5 //(b)
6 A=[1,-1,0;1,1,0;0,0,1];
7 B=[4;2;4];
8 C=-linsolve(A,B);// linsolve is used for solution of
      linear equation
9 disp('(b)');
10 disp('(x-y,x+y,z-1)=(4,2,3)');
11 disp(C,'[x;y;z]=');
```

Scilab code Exa 1.2 Vectors Operations

```
1 // PG-3
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
```

```
clc;
close;
clear;
//(a)
u=[2,4,-5];
v=[1,-6,9];
A=u+v;
B=7*u;
C=-v;
D=3*u-5*v;
disp('(a)');
disp(u,'u=');
disp(v,'v=');
disp(A,'u+v=');
disp('value u+v is incorrect in book  correct value is u+v=(3,-2,4)');
disp(B,'7u=');
disp(C,'-v=');
disp(D,'3u-5v=');
// (b)
disp('(b)');
disp('zero vector 0=(0,0,...,0) u=(a1,a2,...,an)');
disp('u+0=u');
//(c)
u=[2;3;-4];
v=[3;-1;-2];
A=2*u-3*v;
disp('(c)');
disp(u,'u=');
disp(v,'v=');
disp(A,'2u-3v=');
// value u+v is incorrect in book  correct value is u+v=(3,-2,4)  (in part 1.2.a)
```

Scilab code Exa 1.3 Vectors Operations

```
1  //PG-4
2  clc;
3  close;
4  clear;
5  //(a)
6  u=[1,-2,3];
7  v=[4,5,-1];
8  w=[2,7,4];
9  A=u*v';
10 B=u*w';
11 C=v*w';
12 disp('(a)')
13 disp(u,'u=');
14 disp(v,'v=');
15 disp(w,'w=');
16 disp(A,'u.v');
17 disp(B,'u.w');
18 disp('u and w are orthogonal');
19 disp(C,'v.w');
20 // (b)
21 u=[2;3;-4];
22 v=[3;-1;-2];
23 A=u'*v;
24 disp('-------------');
25 disp('(b)')
26 disp(u,'u=');
27 disp(v,'v=');
28 disp(A,'u.v');
```

Scilab code Exa 1.4 Vectors Operations

```
1  //PG-5
2  clc;
3  close;
4  clear;
```

```
5  //(a)
6  u=[1,-2,-4,5,3];
7  A=u*u';
8  B=sqrt(A);
9  disp('(a)');
10 disp(u,'u=');
11 disp(A,'||u||^2=');
12 disp(B,'||u||=sqrt(55)=');
13 //(b)
14 v=[1,-3,4,2];
15 w=[1/2,-1/6,5/6,1/6];
16 A=sqrt(v*v');
17 B=sqrt(w*w');
18 // In this code we obtain values in decimal of squer
       root values
19 C=v/A;
20 disp(v,'v=');
21 disp(w,'w=');
22 disp(A,'v.v=');
23 disp(B,'w.w=');
24 disp(C,'v/||v||=');
```

Scilab code Exa 1.5 Vectors Operations

```
1  //PG-6
2  clc;
3  close;
4  clear;
5  //(a)
6  u=[1,-2,3];
7  v=[2,4,5];
8  A=u*u';
9  B=sqrt(A);
10 C=v*v';
11 D=sqrt(C);
```

```
12 E=(u*v')/(B*D);
13 F=(u*v')*v/(C);
14 disp('(a)');
15 disp(u,'u=');
16 disp(A,'||u||^2=');
17 disp(B,'||u||=sqrt(14)=');
18 disp(v,'v=');
19 disp(C,'||v||^2=');
20 disp(D,'||v||=sqrt(45)=');
21 disp(E,'cos(thita)=');
22 disp(F,'prpj(u,v)');
23 // In this code we obtain values in decimal of squer
       root values
```

Scilab code Exa 1.6 Vectors Operations

```
1  //PG-8
2  clc;
3  close;
4  clear;
5  //(a)
6  // 2x-5y+7z=4
7  P=[1,1,1];
8  Q=[5,4,2];
9  v=Q-P;
10 u=[2,-5,7];
11 A=u*v';
12 disp('(a)');
13 disp(A,'u.v u is orthogonal to v');
14 //(b)
15 p=[1,3,-4,2];
16 u=[4,-2,5,6];
17 k=u*p';
18 //A=['x1','x2','x3','x4']*u';
19 disp('(b)');
```

```
20 disp(k,'k=');
21 disp(k,'4x1-2x2+5x3+6x4=');
22 //(c)
23 P=[1,2,3,-4];
24 u=[5,6,-7,8];
25 Q=P+u;
26 // x1=5t+1,x2=6t+2,x3=-7t+3,x4=8t-4
27 //L(t)=[x1,x2,x3,x4] where t=1
28 disp('(c)');
29 disp(Q,'Q=');
```

Scilab code Exa 1.7 Vector Tangent

```
1 //PG-9
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 t=poly([0],'t')
8 F=["sin(t)","cos(t)","t"];
9 V=["cos(t)","-sin(t)","1"];
10 // sin^2(t)+cos^2(t)=1;
11 A=1+1;
12 //T=V/A;
13 disp(F,'F(t)=');
14 disp(V,'V(t)=');
15 disp(A,'||V(t)||^2=');
16 disp('V(t)/||V(t)||=[cost/sqrt(2),-sint/sqrt(2),1/
   sqrt(2)]');
```

Scilab code Exa 1.8 Operation on Vectors

```
// PG-9
clc;
close;
clear;
// u=3i+5j-2k
// v=4i-8j+7k
u=[3,5,-2];
v=[4,-8,7];
A=u+v;
disp('(a)');
disp(A,'u+v=');
disp('7i-3j+5k');
B=3*u-2*v;
disp('(b)');
disp(B,'3u-2v=');
disp('i+31j-20k');
C=u*v';
disp('(c)');
disp(C,'u.v=');
D=sqrt(u*u');
disp('(d)');
disp(D,'||u||=');

// Answer of 3u-2v is wrong in book correct answer
   is 3u-2v=i+31j-20k
```

Scilab code Exa 1.9 Cross Product

```
// PG-10
// Scilab Version-  6.0.1
// Operating System-  Window 7
clc;
close();
clear;
// (a)  u=4i+3j+6k, v=2i+5j-3k
```

```
A=[4,3,6;2,5,-3];
u=[4,3,6];
v=[2,5,-3];
B=cross(u,v);
disp('(a)');
disp(A);
disp(B,'uXv=');
icomp=B(1,1);
jcomp=B(1,2);
kcomp=B(1,3);
disp(kcomp,'component of k cap of uXv',jcomp,'
   component of j cap of uXv',icomp,'component of i
   cap of uXv');
u=[2,-1,5];
v=[3,7,6];
A=[2,-1,5;3,7,6];
B=cross(u,v);
disp('(b)');
disp(A);
disp(B,'uXv=');
```

Scilab code Exa 1.10 Operations on Complex Numbers

```
//PG-12
clc;
close;
clear;
z=2+3*%i;
w=5-2*%i;
A=z+w;
B=z*w;
C=conj(z);
D=w/z;
E=sqrt(real(z)^2+imag(z)^2);
F=sqrt(real(w)^2+imag(w)^2);
```

```
13 disp(z,'z=');
14 disp(w,'w=');
15 disp(A,'z+w=');
16 disp(B,'zw=');
17 disp(C,'zbar=');
18 disp(D,'w/z=');
19 disp(E,'|z|=');
20 disp(F,'|w|=');
21 // In this code we obtain decimal values of square
      root values
```

Scilab code Exa 1.11 Operations on Complex Vectors

```
1 //PG-13
2 clc;
3 close;
4 clear;
5 u=[2+3*%i,4-%i,3];
6 v=[3-2*%i,5*%i,4-6*%i];
7 A=u+v;
8 B=(5-2*%i)*u;
9 disp(u,'u=');
10 disp(v,'v=');
11 disp(A,'u+v=');
12 disp(B,'(5-2i)u=')
```

Scilab code Exa 1.12 Operations on Complex Vectors

```
1 //PG-13
2 clc;
3 close;
4 clear;
5 u=[2+3*%i,4-%i,3+5*%i];
```

```
6  v=[3-4*%i,5*%i,4-2*%i];
7  A=u*v';
8  B=u*u';
9  C=sqrt(B);
10 D=conj(A)
11 disp(u,'u=');
12 disp(v,'v=');
13 disp(A,'uv=');
14 disp(B,'uu=');
15 disp(C,'|u|=');
16 disp(D,'(u.v)bar=');
```

Chapter 2

Algebra of Matrices

Scilab code Exa 2.1 Matrices

```
1  // PG-28
2  clc;
3  close;
4  clear;
5  //(a)
6  A=[1,-4,5;0,3,-2];
7  B=(A(1,:));
8  C=A(2,:);
9  D=A(:,1);
10 E=A(:,2);
11 F=A(:,3);
12 disp('(a)');
13 disp(A,'A=');
14 disp(C,'and',B,'Rows are -');
15 disp(F,E,D,'Columns are -');
16 //(b)
17 O=zeros(2,4);
18 disp('(b)');
19 disp(O,'2 cross 4 zero matrix is');
20 //(c)
21 //x+y=3, x-y=1, 2z+t=7, z-t=5;
```

```
22 A=[1,1,0,0;1,-1,0,0;0,0,2,1;0,0,1,-1];
23 B=[3;1;7;5];
24 C=-linsolve(A,B);// linsolve is used for solution of
       linear equation
25 disp('(c)')
26 disp(C,'[x; y; z; t]=');
```

Scilab code Exa 2.2 Operations on Matrices

```
1 // PG-29
2 clc;
3 close;
4 clear;
5 A=[1,-2,3;0,4,5];
6 B=[4,6,8;1,-3,-7];
7 C=A+B;
8 D=3*A;
9 E=2*A-3*B;
10 disp(A,'A=');
11 disp(B,'B=');
12 disp(C,'A+B=');
13 disp(D,'3A=');
14 disp(E,'2A-3B=');
```

Scilab code Exa 2.4 Multiplication of Matrices

```
1 // PG-30
2 clc;
3 close;
4 clear;
5 // (a)
6 A=[7,-4,5];
7 B=[3;2;-1];
```

```
C=A*B;
disp(A,'A=');
disp(B,'B=');
disp(C,'A*B=');
// (b)
D=[6,-1,8,3];
E=[4;-9;-2;5];
F=D*E;
disp(D,'D=');
disp(E,'E=');
disp(F,'D*E=');
```

Scilab code Exa 2.5 Multiplication of Matrices

```
// PG-31
// Scilab Version- 6.0.1
// Operating System- Window 7
clc;
close;
clear;
// (a)
disp('(a)')
A=[1,3;2,-1];
B=[2,0,-4;5,-2,6];
C=A*B;
disp(A,'A=');
disp(B,'B=');
disp(C,'A*B=');
// (b)
disp('(b)')
A=[1,2;3,4];
B=[5,6;0,-2];
F=A*B;
G=B*A;
disp(A,'A=');
```

```
22 disp(B,'B=');
23 disp(F,'AB=');
24 disp(G,'BA=');
25 disp('AB!=BA  means AB not equal to BA');
```

Scilab code Exa 2.6 Operations on Matrices

```
1  // PG-32
2  // Scilab Version-  6.0.1
3  // Operating System-  Window 7
4  clc;
5  close;
6  clear;
7  A=[1,2,3;-4,-4,-4;5,6,7];
8  B=[2,-5,1;0,3,-2;1,2,-4];
9  C=A+B;
10 D=2*A;
11 E=A';
12 F=A*B;
13 G=B*A;
14 disp(A,'A=');
15 disp(B,'B=');
16 disp(C,'A+B=');
17 disp(D,'2A=');
18 disp(E,'A^T=');
19 disp(F,'AB=');
20 disp(G,'BA=');
```

Scilab code Exa 2.7 Trace of Matrices

```
1  // PG-33
2  clc;
3  close;
```

```
clear;
A=[1,-4,7]; // diagonal of A
B=[2,3,-4]; // diagonal of B
C=sum(A); // trace of A=tr(A)
D=sum(B); // trace of B=tr(B)
E=C+D;  // tr(A+B)=tr(A)+tr(B)
F=2*C;  // tr(2A)=2tr(a)
G=5+0-35;  //tr(AB)
H=27-24-33; //tr(BA)
disp(A,'diagonal of A=');
disp(B,'diagonal of B=');
disp(C,'trace of A=tr(A)=');
disp(D,'trace of B=tr(B)=');
disp(E,'tr(A+B)=tr(A)+tr(B)=');
disp(F,'tr(2A)=2tr(a)=');
disp(G,'tr(AB)=');
disp(H,'tr(BA)=');
disp('tr(AB)=tr(BA)');
```

Scilab code Exa 2.8 Identity Matrix

```
// PG-33
clc;
close;
clear;
I=eye(3,3);
A=5*I';
disp(I,'identity matrix=');
disp(A,'5I=');
```

Scilab code Exa 2.9 Operations on Matrices

```
// PG-34
```

```
2  clc;
3  close;
4  clear;
5  A=[1,2;3,-4];
6  B=A*A;
7  C=B*A;
8  F=2*A^2-3*A+5*eye(2,2);
9  G=A^2+3*A-10*eye(2,2);
10 disp(A,'A');
11 disp(B,'A^2=');
12 disp(C,'A^3=')
13 disp(F,'F(A)');
14 disp(G,'g(A)')
```

Scilab code Exa 2.10 Multiplication of Matrices

```
1  //PG-34
2  clc;
3  close;
4  clear;
5  A=[2,5;1,3];
6  B=[3,-5;-1,2];
7  C=A*B;
8  D=B*A;
9  disp(A,'A');
10 disp(B,'B');
11 disp(C,'AB');
12 disp(D,'BA');
13 disp('A and B are inverses');
```

Scilab code Exa 2.11 Inverse of Matrix

```
1  //PG-35
```

```
clc;
close;
clear;
A=[2,3;4,5];
B=[1,3;2,6];
F=det(A);
G=det(B);
disp(A,'A=');
disp(B,'B=');
if(F==0)
disp('inverse is not possible');
else
  C=inv(A);
  disp(C,'inverse of A is')
end
    if(G==0)
        disp('inverse of B is not possible');
else
    D=det(B);
    disp(D,'inverse of B is');
    end
```

Scilab code Exa 2.12 Operations on Matrices

```
// PG-37
clc;
close;
clear;
A=[2,-3,5;-3,6,7;5,7,-8];
B=[0,3,-4;-3,0,5;4,-5,0];
C=[1,0,0;0,0,1];
disp(A,'A=');
disp(B,'B=');
disp(C,'C=');
if(A==A')
```

```
12      disp('A^T=A  Thus A is symmetric');
13  elseif(A'==-A)
14      disp('A^T=-A  Thus A is skew symmetric');
15  else
16      disp('A is neither symmetric nor skew symmetric'
            );
17      end
18  if(B==B')
19      disp('B^T=B  Thus B is symmetric');
20  elseif(B'==-B)
21      disp('B^T=-B  Thus B is skew symmetric');
22  else
23      disp('B is neither symmetric nor skew symmetric'
            );
24  end
25  if(C==C')
26      disp('C^T=C  Thus C is symmetric');
27  elseif(C'==-C)
28      disp('C^T=-C  Thus C is skew symmetric');
29  else
30      disp('C is neither symmetric nor skew symmetric'
            );
31      end
```

Scilab code Exa 2.13 Operations on Matrices

```
1  // PG-37
2  clc;
3  close;
4  clear;
5  A=[1/9,8/9,-4/9;4/9,-4/9,-7/9;8/9,1/9,4/9];
6  B=A*A';
7  disp(A,'A=');
8  disp(B,'AA^T=I=');
9  disp('Thus A^T=A^-1 A is orthogonal');
```

Scilab code Exa 2.14 Operations on Matrices

```
1 // PG-38
2 clc;
3 close;
4 clear;
5 A=[6,-3;3,6];
6 B=A*A';
7 C=(A')*A;
8 disp(A,'A=');
9 disp(B,'A*( Transpose of A)=');
10 disp(C,'(Transpose of A)*A');
11 disp('A(A^T)=(A^T)A');
```

Scilab code Exa 2.15 Operations on Complex Matrix

```
1 // PG-38
2 clc;
3 close;
4 clear;
5 A=[2+8*%i,5-3*%i,4-7*%i;6*%i,1-4*%i,3+2*%i];
6 B=A';
7 disp(A,'A=');
8 disp(B,'A^H');
```

Scilab code Exa 2.16 Operations on Complex Matrix

```
1 // PG-39
2 clc;
```

```
3  close;
4  clear;
5  A=[3,1-2*%i,4+7*%i;1+2*%i,-4,-2*%i;4-7*%i,2*%i,5];
6  B=(1/2)*[1,-%i,-1+%i;%i,1,1+%i;1+%i,-1+%i,0];
7  C=[2+3*%i,1;%i,1+2*%i];
8  D=B*B';
9  E=C*C';
10 F=C'*C;
11 disp(A,'A=');
12 disp(B,'B=');
13 disp(C,'C=');
14 disp('the diagonal elements of A are real and
      symmetric elements of A are conjugate so A is
      Hermitian');
15 disp(D,'(BˆH)B=I=')
16 disp('(BˆH)B=I Thus BˆH=Bˆ-1  means B is unitary');
17 disp(E,'CCˆH=');
18 disp(F,'CˆH.C=');
19 disp('CCˆH=CˆH.C complex matrix C is normal');
```

Scilab code Exa 2.17 Diagonal Matrices

```
1  // PG-41
2  clc;
3  close;
4  clear;
5  A=[1,2,0;3,4,5;0,0,6];
6  B=[1,0,0,0;2,3,4,0;5,0,6,0;0,7,8,9];
7  C=[1,0,0;0,2,3;0,4,5];
8  D=[1,2,0;3,4,5;0,6,7];
9  disp(A,'A=');
10 disp('A is upper triangular');
11 disp(B,'B=');
12 disp('B is lower triangular');
13 disp(C,'C=');
```

```
14 disp('C is diagonal');
15 disp(D,'D=');
16 disp('D is neither upper triangular nor lower
      triangular');
```

Chapter 3

Systems of Linear Equations

Scilab code Exa 3.1 Solution of Linear Equations

```
1  // PG-58
2  // Scilab Version- 6.0.1
3  // Operating System- Window 7
4  clc;
5  close;
6  clear;
7  x=5;
8  y=2;
9  z=1;
10 A=x+2*y-3*z; //x+2*y-3*z=6
11 if A==6 then
12     disp('u=(5,2,1) is a solution of the equation');
13 else
14     disp('u=(5,2,1) is not a solution of the
          equation');
15 end
16 x=1;
17 y=2;
18 z=3;
19 A=x+2*y-3*z; //x+2*y-3*z=6
20 if A==6 then
```

```
21      disp('w=(1,2,3) is a solution of the equation');
22  else
23      disp('w=(1,2,3) is not a solution of the
            equation');
24  end
```

Scilab code Exa 3.2 Solution of Linear Equations

```
1  // PG-58
2  clc;
3  close;
4  clear;
5  //(a)
6  // u=(-8,6,1,1)
7  x1=-8;
8  x2=6;
9  x3=1;
10 x4=1;
11 A=x1+x2+4*x3+3*x4;
12 B=2*x1+3*x2+x3-2*x4;
13 C=x1+2*x2-5*x3+4*x4;
14 disp('(a)');
15 disp(A,'A=');
16 disp(B,'B=');
17 disp(C,'C=')
18 if(A==5 & B==1 & C==3)
19      disp('u=(-8,6,1,1) is a solution of above
            equations');
20 else
21      disp('u=(-8,6,1,1) is not a solution of above
            equations');
22      end
23 //(b)
24 // v=(-10,5,1,2)
25 x1=-10;
```

```
x2=5;
x3=1;
x4=2;
D=x1+x2+4*x3+3*x4;
E=2*x1+3*x2+x3-2*x4;
F=x1+2*x2-5*x3+4*x4;
disp('(b)');
disp(D,'A=');
disp(E,'B=');
disp(F,'C=')
if(D==5 & E==1 & F==3)
    disp('v=(-10,5,1,2) is a solution of above
       equations');
else
    disp('v=(-10,5,1,2) is not a solution of above
       equations');
    end
```

Scilab code Exa 3.3 Solution of Linear Equations

```
// PG-60
clc;
close;
clear;
// u=(-8,6,1,1)
x1=-8;
x2=6;
x3=1;
x4=1;
A=x1+x2+4*x3+3*x4;
B=2*x1+3*x2+x3-2*x4;
C=x1+2*x2-5*x3+4*x4;
L=3*A-2*B+4*C;
disp(A,'L1=');
disp(B,'L2=');
```

```
16 disp(C,'L3=');
17 disp(L,'L=');
18 if(L==25)
19     disp('u=(-8,6,1,1) is also a solution of L');
20 else
21     disp('u=(-8,6,1,1) is not a solution of L');
22     end
```

Scilab code Exa 3.4 Solution of Linear Equations

```
1  //PG-62
2  clc;
3  close;
4  clear;
5  //(a)
6  //4x-1=x+6;
7  //  y=4x-1,y=x+6
8  A=[-4,1;-1,1];
9  B=[-1;6];
10 C=inv(A)*B;
11 x=C(1,:);
12 disp('(a)-----> 4x-1=x+6')
13 disp(x,'x=');
14 //(b)
15 //2x-5-x=x+3;
16 //  y=2x-5-x,y=x+3
17 A=[-1,1;-1,1];
18 B=[-5;3];
19 //C=inv(A)*B;
20 //x=C(1,:);
21 disp('(b)------> 2x-5-x=x+3')
22 disp('The equation has no solution');
23 //(c)
24 //4+x-3=2x+1-x;
25 //  y=4+x-3,y=2x+1-x
```

```
26 A=[-1,1;-1,1];
27 B=[1;1];
28 //C=inv(A)*B;
29 //x=C(1,:);
30 disp('(c)-----> 4+x-3=2x+1-x')
31 disp('The equation has no solution');
```

Scilab code Exa 3.5 Solution of Linear Equations

```
1 //PG-63
2 clc;
3 close;
4 clear;
5 // 2x-3y=-8,3x+4y=5
6 A=[2,-3;3,4];
7 B=[-8;5];
8 C=-linsolve(A,B);// linsolve is used for solution of
      linear equation
9 disp(C,'[x; y]');
```

Scilab code Exa 3.6 Solution of Linear systems

```
1 // PG-64
2 clc;
3 close;
4 clear;
5 //(a)
6 //x-3y=4, -2x+6y=5
7 A=[1,-3;-2,6];
8 B=[4;5];
9 C=-linsolve(A,B);// linsolve is used for solution of
      linear equation
10 disp(C,'[x; y] system have no solution');
```

Scilab code Exa 3.7 Solution of Linear systems

```
1 // PG-69
2 clc;
3 close;
4 clear;
5 //(a)
6 //x+2y-3z=1, 2x+5y-8z=4,3x+8y-13z=7
7 A=[1,2,-3;2,5,-8;3,8,-13];
8 B=[1;4;7];
9 C=-linsolve(A,B);// linsolve is used for solution of
      linear equation
10 disp(C,'[x; y; z]=');
```

Scilab code Exa 3.8 Solution of Linear systems

```
1 // PG-70
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 //L1= x1+3*x2-2*x3+5*x4-4;
8 // L2=2*x1+8*x2-x3+9*x4-9;
9 // L3=3*x1+5*x2-12*x3+17*x4-7
10 //"(1) Replace L2 by -2L1+ L 2 and (2)
       Replace L3 by -3L1+ L 3
11 // x1+3*x2-2*x3+5*x4-4=0;
12 // 2*x12*x2+3*x3-x4-1=0;
13  // -4*x2-6*x3+2*x4+5=0
14 A=[1,3,-2,5;0,2,3,-1;0,-4,-6,2];
```

```
15  B=[4;1;-5];
16 C=[1,3,-2,5,4;0,2,3,-1,1;0,-4,-6,2,-5];    // A/B
17 R1=C(1,:);
18 R2=C(2,:);
19 R3=C(3,:);
20 D=[R1;R2;R3+2*R2];
21 disp(A);
22 disp(B);
23 disp(C);
24 disp(D);
25 disp("0 equal to -3 is not possible .So this system
     do not have solution")
26 disp('the system have no solution because there are
     3 equations with four variables');
27 // Scilab function for this example is not possible
     because there are 3 equations with four variables
```

Scilab code Exa 3.9 Echelon Matrix

```
1 // PG-71
2 clc;
3 close;
4 clear;
5 A
     =[0,2,3,4,5,9,0,7;0,0,0,3,4,1,2,5;0,0,0,0,0,5,7,2;0,0,0,0,0,0,8,6

6 a=A(1,2);
7 b=A(2,4);
8 c=A(3,6);
9 d=A(4,7)
10 disp(A,'A=');
11 disp(a,'a1j1=');
12 disp(b,'a2j2=');
13 disp(c,'a3j3=');
14 disp(d,'a4j4=');
```

```
15 disp('where j1=2,j2=4,j3=6,j4=7 Here r=8');
```

Scilab code Exa 3.10 Echelon Matrix

```
1  //PG-71
2  clc;
3  close;
4  clear;
5  A
      =[2,3,2,0,4,5,-6;0,0,0,1,-3,2,0;0,0,0,0,0,6,2;0,0,0,0,0,0,0];

6  B=[1,2,3;0,0,1;0,0,0];
7  C=[0,1,3,0,0,4;0,0,0,1,0,-3;0,0,0,0,1,2];
8  disp(A,'A=');
9  disp('A is in row canonical form');
10 disp(B,'B=');
11 disp('B is not in row canonical form');
12 disp(C,'C=');
13 disp('C is not in row canonical form');
```

Scilab code Exa 3.11 Different Forms of Matrix

```
1  // PG-74
2  clc;
3  close;
4  clear;
5  //(a)
6  A=[1,2,-3,1,2;2,4,-4,6,10;3,6,-6,9,13];
7  R1=A(1,:);
8  R2=A(2,:);
9  R3=A(3,:);
10 B=[R1;R2-2*R1;R3-3*R1];
11 R1=B(1,:);
```

```
12 R2=B(2,:);
13 R3=B(3,:);
14 C=[R1;R2;R3-(3/2)*R2];
15 disp(A,'A=');
16 disp('(a)');
17 disp(B,'B=');
18 disp(C,'echelon form of A=');
19 //(b)
20 B=rref([A]);
21 disp('(b)');
22 disp(B,'canonical form of A=');
```

Scilab code Exa 3.12 Solution of Linear systems

```
1 // PG-75
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 //(a)
8 // x1+x2-2x3+4x4=5, 2x1+2x2-3x3+x4=3, 3x1+3x2-4x3-2
    x4=1
9 M=[1,1,-2,4,5;2,2,-3,1,3;3,3,-4,-2,1];
10 N=rref(M);
11 disp('(a)');
12 disp(M,'M=');
13 disp(N);
14 disp('x1 and x3 are the pivot variables and x2 and
    x4 are the free variabbles');
15 //(b)
16 // x1+x2-2x3+3x4=4, 2x1+3x2+3x3-x4=3, 5x1+7x2+4x3+x4
    =5
17 M=[1,1,-2,3,4;2,3,3,-1,3;5,7,4,1,5];
18 R1=M(1,:);
```

```
19 R2=M(2,:);
20 R3=M(3,:);
21 N=[R1;R2-2*R1;R3-5*R1];
22 R2=N(2,:);
23 R3=N(3,:);
24 P=[R1;R2;R3-2*R2]
25 disp('(b)');
26 disp(M,'M=');
27 disp(N,'~');
28 disp(P,'~');
29 disp('the system has no solution');
30 //(c)
31 //x+2y+z=3; 2x+5y-z=-4, 3x-2y-z=5
32 M=[1,2,1,3;2,5,-1,-4;3,-2,-1,5];
33 N=rref(M);
34 A=[1,2,1;2,5,-1;3,-2,-1]
35 B=[3;-4;5];
36 C=inv(A)*B;
37 x=C(1,:);
38 y=C(2,:);
39 z=C(3,:);
40 disp('(c)');
41 disp(M,'M=');
42 disp(N);
43 disp(x,'x=');
44 disp(y,'y=');
45 disp(z,'z=');
```

Scilab code Exa 3.13 Solution of Linear Equations

```
1 // PG-77
2 clc;
3 close;
4 clear;
5
```

```
// x1+2x2-4x3+7x4=4, 3x1-5x2+6x3-8x4=8, 4x1-3x2-2x3
   +6x4=11
A=[1,2,-4,7;3,-5,6,-8;4,-3,-2,6];
X=["x1";"x2";"x3";"x4"];
B=[4;8;11];
//AX=B
x1=3;
x2=1;
x3=2;
x4=1;
A=x1+2*x2-4*x3+7*x4;
B=3*x1-5*x2+6*x3-8*x4;
C=4*x1-3*x2-2*x3+6*x4;
if(A==4 & B==8 & C==11)
    disp('u=[3,1,2,1] is a solution of the system');
else
     disp('u=[3,1,2,1] is not a solution of the
        system');
 end
```

Scilab code Exa 3.14 Solution of Linear Equations

```
//PG-78
clc;
close;
clear;
//x+2y+3z=1, x+3y+6z=3, 2x+6y+13z=5
A=[1,2,3;1,3,6;2,6,13];
B=[1;3;5];
C=inv(A);
D=C*B;
x=D(1,:);
y=D(2,:);
z=D(3,:);
disp(A,'A=');
```

```
14 disp(B,'B=');
15 disp(C,'A^-1=');
16 disp(x,'x=');
17 disp(y,'y=');
18 disp(z,'z=');
```

Scilab code Exa 3.15 Solution of Linear Equations

```
1  //PG-80
2  clc;
3  close;
4  clear;
5  // (a)
6  v=[4;9;19];
7  u1=[1,-2,3];
8  u2=[3,-7,10];
9  u3=[2,1,9];
10 // x+3y+2z=4 , -2x-7y+z=9 , 3x+10y+9z=19
11 A=[1,3,2;-2,-7,1;3,10,9];
12 B=inv(A)*v;
13 x=B(1,:);
14 y=B(2,:);
15 z=B(3,:);
16 disp('(a)');
17 disp(x,'x=');
18 disp(y,'y=');
19 disp(z,'z=');
20 disp('v=4u1-2u2+3u3');
21 // (b)
22 // x+2y+z=2 , 2x+3y+3z=3 , -3x-4y-5z=-5
23 disp('(b)');
24 disp('The system has no solution');
```

Scilab code Exa 3.16 Orthogonal Vectors

```
1  // PG-80
2  clc;
3  close;
4  clear;
5  u1=[1,1,1];
6  u2=[1,-3,2];
7  u3=[5,-1,-4];
8  A=u1*u2';
9  B=u2*u3';
10 C=u1*u3';
11 disp(A,'u1.u2=');
12 disp(B,'u2.u3=');
13 disp(C,'u1.u3=');
14 disp('vectors are pairwise orthogonal')
```

Scilab code Exa 3.17 Solution of Linear Equations

```
1  // PG-82
2  // Scilab Version- 6.0.1
3  // Operating System- Window 7
4  clc;
5  close;
6  clear;
7  //(a)
8  // x+y-z=0, 2x-3y+z=0, x-4y+2z=0 => x+y-z=0, -5y+3z
       =0
9  z=5; // set z=5
10 // x+y=5;
11 // 5*y=15;
12 A=[1,1;0,5];
13 B=[5;15];
14 C=inv(A)*B;
15 x=C(1,:);
```

```
y=C(2,:);
u=[x,y,z];
disp('(a)');
disp(x,'x=');
disp(y,'y=');
disp(z,'z=');
disp('is a particular solution',u,'The system has a
    nonzero solution u= ');
//(b)
// x+y-z=0, 2x+4y-z=0, 3x+2y+2z=0
A=[1,1,-1;2,4,-1;3,2,2];
B=[0;0;0];
C=inv(A)*B;
x=C(1,:);
y=C(2,:);
z=C(3,:);
disp('(b)');
disp('The system has only one solution');
disp(x,'x=');
disp(y,'y=');
disp(z,'z=');
//(c)
// x1+2x2-3x3+4x4=0, 2x1-3x2+5x3-7x4=0, 5x1+6x2-9x3
    +8x4=0
disp('(c)');
disp('The system has a nonzero solution because
    there are four unknowns but only three equations
    ');
```

Scilab code Exa 3.18 Solution of Linear Equations

```
// PG-82
clc;
close;
clear;
```

```
5  // x1+2x2-3x3+2x4-4x5=0, 2x1+4x2-5x3+x4-6x5=0, 5x1
       +10x2-13x3+4x4-16x5=0 => x1+2x2-3x3+2x4-4x5=0, x3
       -3x4+2x5=0
6  x1=-2;
7  x2=1;
8  x3=0;
9  x4=0;
10 x5=0;
11 A=x1+2*x2-3*x3+2*x4-4*x5;
12 B=x3-3*x4+2*x5;
13 if(A==0 & B==0)
14      disp('u1=[-2,1,0,0,0] is the solution of the
           system');
15 end
16 x1=7;
17 x2=0;
18 x3=3;
19 x4=1;
20 x5=0;
21 A=x1+2*x2-3*x3+2*x4-4*x5;
22 B=x3-3*x4+2*x5;
23 if(A==0 & B==0)
24      disp('u2=[7,0,3,1,0] is the solution of the
           system');
25 end
26 x1=-2;
27 x2=0;
28 x3=-2;
29 x4=0;
30 x5=1;
31 A=x1+2*x2-3*x3+2*x4-4*x5;
32 B=x3-3*x4+2*x5;
33 if(A==0 & B==0)
34      disp('u3=[-2,0,-2,0,1] is the solution of the
           system');
35 end
```

Scilab code Exa 3.19 Row interchange and replace

```
1  //PG-84
2  clc;
3  close;
4  clear;
5  E=eye(3,3);
6  R1=E(1,:);
7  R2=E(2,:);
8  R3=E(3,:);
9  E1=[R1;R3;R2];
10 E2=[R1;-6*R2;R3];
11 E3=[R1;R2;-4*R1+R3];
12 disp(E,'E=');
13 disp(E1,'E1=');
14 disp(E2,'E2=');
15 disp(E3,'E3=');
```

Scilab code Exa 3.20 Inverse of Matrix

```
1  // PG-85
2  clc;
3  close;
4  clear;
5  A=[1,0,2;2,-1,3;4,1,8];
6  B=inv(A);
7  disp(A,'A=');
8  disp(B,'A^-1');
```

Scilab code Exa 3.21 Column interchange and replace

```
1  //PG-86
2  clc;
3  close;
4  clear;
5  F=eye(3,3);
6  C1=F(:,1);
7  C2=F(:,2);
8  C3=F(:,3);
9  F1=[C3,C2,C1];
10 F2=[C1,C2,-2*C3];
11 F3=[C1,C2,-3*C2+C3];
12 disp(F,'F=');
13 disp(F1,'F1=');
14 disp(F2,'F2=');
15 disp(F3,'F3=');
```

Scilab code Exa 3.22 Triangular Form of Matrix

```
1  //PG-88
2  clc;
3  close;
4  clear;
5  A=[1,2,-3;-3,-4,13;2,1,-5];
6  R1=A(1,:);
7  R2=A(2,:);
8  R3=A(3,:);
9  M=[R1;3*R1+R2;-2*R1+R3];
10 R1=M(1,:);
11 R2=M(2,:);
12 R3=M(3,:);
13 U=[R1;R2;(3/2)*R2+R3];
14 L=A*inv(U);
15 disp(A,'A=');
```

```
16 disp(M,'M=');
17 disp(U,'U=');
18 disp(L,'L=');
19 disp('A=LU');
20 // we obtain -2.220D-16 at row-2 column-3 of Matrix
     L which is near to zero
```

Scilab code Exa 3.23 Solution of Linear Equations

```
1 // PG-89
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 //x+2y+z=k1, 2x+3y+3z=k2, -3x+10y+2z=k3
8 A=[1,2,1;2,3,3;-3,10,2];
9 B=["k1";"k2";"k3"];
10 disp(A,'A=');
11 disp(B,'B=');
```

Chapter 4

Vector Spaces

Scilab code Exa 4.1 Linear combination of Vectors

```
1  //PG-115
2  clc;
3  close;
4  clear;
5  v=[3,7,-4];
6  u1=[1,2,3];
7  u2=[2,3,7];
8  u3=[3,5,6];
9  x=poly([0],'x');
10 y=poly([0],'y');
11 z=poly([0],'z');
12 //[3;7;-4]=x*u1'+y*u2'+z*u3'
13 // x+2y+3z=3, 2x+3y+5z=7, 3x+7y+6z=-4
14 A=[1,2,3;2,3,5;3,7,6];
15 B=[3;7;-4];
16 C=inv(A)*B;
17 x=C(1,:);
18 y=C(2,:);
19 z=C(3,:);
20 disp(x,'x=');
21 disp(y,'y=');
```

```
22 disp(z,'z=');
```

Scilab code Exa 4.2 Solution of Linear Equations

```
1  //PG-115
2  clc;
3  close;
4  clear;
5  t=poly([0],'t');
6  v=3*t^2+5*t-5;
7  p1=t^2+2*t+1;
8  p2=2*t^2+5*t+4;
9  p2=t^2+3*t+6;
10 x=poly([0],'x');
11 y=poly([0],'y');
12 z=poly([0],'z');
13 // (1)
14 // 3*t^2+5*t-5=x*(t^2+2*t+1)+y*(2*t^2+5*t+4)+z*(t
       ^2+3*t+6)
15 // x+2y+z=3 , 2x+5y+3z=5 , x+4y+6z=-5
16 A=[1,2,1;2,5,3;1,4,6];
17 V=[3;5;-5];
18 B=inv(A)*V;
19 x=B(1,:);
20 y=B(2,:);
21 z=B(3,:);
22 disp('(1)');
23 disp(x,'x=');
24 disp(y,'y=');
25 disp(z,'z=');
26 disp('v=3p1+p2-2p3');
27 // (2)
28 // set t=0 in (1) to obtain x+4y+6z=-5
29 // set t=1 in (1) to obtain 4x+11y+10z=3
30 // set t=-1 in (1) to obtain y+4z=-7
```

```
31 disp('(2)');
32 disp(x,'x=');
33 disp(y,'y=');
34 disp(z,'z=');
35 disp('v=3p1+p2-2p3');
```

Scilab code Exa 4.3 Linear combination of Vectors

```
1  //PG-116
2  clc;
3  close;
4  clear;
5  //(a)
6  e1=[1,0,0];
7  e2=[0,1,0];
8  e3=[0,0,1];
9  v=5*e1-6*e2+2*e3;
10 disp('(a)');
11 disp(v,'v=');
12 //(b)
13 w1=[1,1,1];
14 w2=[1,1,0];
15 w3=[1,0,0];
16 v=2*w1-8*w2+11*w3;
17 disp('(b)');
18 disp(v,'v=');
19 //(c)
20 u1=[1,2,3];
21 u2=[1,3,5];
22 u3=[1,5,9];
23 disp('(c)');
24 disp('cannot obtian v=[2,7,8] by u1,u2 ,u3.
     Accordingly u1,u2 ,u3 do not span R^3');
```

Scilab code Exa 4.5 Linear combination of Matrices

```
1  //PG-117
2  clc;
3  close;
4  clear;
5  E11=[1,0;0,0];
6  E12=[0,1;0,0];
7  E21=[0,0;1,0];
8  E22=[0,0;0,1];
9  A=5*E11-6*E12+7*E21+8*E22;
10 disp(A,'A=');
```

Scilab code Exa 4.9 Linear combination of Vectors

```
1  //PG-121
2  clc;
3  close;
4  clear;
5  u1=[1,2,-1,3];
6  u2=[2,4,1,-2];
7  u3=[3,6,3,-7];
8  w1=[1,2,-4,11];
9  w2=[2,4,-5,14];
10 //(b)
11 A=[u1;u2;u3];
12 B=[w1;w2];
13 C=rref(A);
14 D=rref(B);
15 disp(A,'A=');
16 disp(C,'Row canonical form of A');
17 disp(B,'B=')
```

```
18 disp(D,'Row canonical form of B');
```

Scilab code Exa 4.10 Dependency of Vectors

```
1  //PG-122
2  clc;
3  close;
4  clear;
5  //(a)
6  u=[1,1,0];
7  v=[1,3,2];
8  w=[4,9,5];
9  A=3*u+5*v-2*w;
10 disp('(a)');
11 disp(A,'3*u+5*v-2*w=');
12 //(b)
13 u=[1,2,3];
14 v=[2,5,7];
15 w=[1,3,5];
16 x=poly([0],'x');
17 y=poly([0],'y');
18 z=poly([0],'z');
19 //=x*u'+y*v'+z*w'=[0,0,0]
20 // x+2y+3z=0, 2x+5y+3z=0, 3x+7y+5z=0
21 A=[1,2,3;2,5,3;3,7,5];
22 B=[0;0;0];
23 C=inv(A)*B;
24 x=C(1,:);
25 y=C(2,:);
26 z=C(3,:);
27 disp('(b)')
28 disp(x,'x=');
29 disp(y,'y=');
30 disp(z,'z=');
```

Scilab code Exa 4.11 Dependency of Vectors

```
1  //PG-126
2  clc;
3  close;
4  clear;
5  //(a)
6  u=[1,1,1,1];
7  v=[0,1,1,1];
8  w=[0,0,1,1];
9  x=[0,0,0,1];
10 disp('(a)');
11 disp('Thus, the vectors are linearly independent,
      and, because dim R^4=4, the four vectors form a
      basis of R^4');
12 //(c)
13 u=[257,-132,58];
14 v=[43,0,-17];
15 w=[521,-317,94];
16 x=[328,-512,-731];
17 disp('(c)');
18 disp('the four vectors must be linearly dependent,
      because they come from the three-dimensional
      vector space  R^3')
```

Scilab code Exa 4.13 Vectors

```
1  //PG-128
2  clc;
3  close;
4  clear;
5  u1=[1,2,1,3,2];
```

```
u2=[1,3,3,5,3];
u3=[3,8,7,13,8];
u4=[1,4,6,9,7];
u5=[5,13,13,25,19];
M=[u1',u2',u3',u4',u5'];
A
   =[1,1,3,1,5;0,1,2,2,3;0,0,0,1,2;0,0,0,0,0;0,0,0,0,0]

disp(M,'M');
disp(A,'echelon form of M');
```

Scilab code Exa 4.16 Solution of Linear Equations

```
//PG-131
clc;
close;
clear;
t=poly([0],'t');
v=2*t^2-5*t+9;
p1=t+1;
p2=t-1;
p2=t^2-2*t+1;
x=poly([0],'x');
y=poly([0],'y');
z=poly([0],'z');
// (1)
// 2*t^2-5*t+9=x*(t+1)+y*(t-1)+z*(t^2-2*t+1)
// x+y-2z=-5 , x-y+z=9 , z=2
A=[1,1,-2;1,-1,1;0,0,1];
V=[-5;9;2];
B=inv(A)*V;
x=B(1,:);
y=B(2,:);
z=B(3,:);
disp(x,'x=');
```

```
23 disp(y,'y=');
24 disp(z,'z=');
25 disp('v=3p1-4p2+2p3');
26 disp('[v]=[3,-4,2]');
```

Scilab code Exa 4.17 Solution of Linear systems

```
1  //PG-131
2  clc;
3  close;
4  clear;
5  v=[5,3,4];
6  u1=[1,-1,0];
7  u2=[1,1,0];
8  u3=[0,1,1];
9  x=poly([0],'x');
10 y=poly([0],'y');
11 z=poly([0],'z');
12 //[5;3;4]=x*u1'+y*u2'+z*u3'
13 //  x+y=5, -x+y+z=3,z=4
14 A=[1,1,0;-1,1,1;0,0,1];
15 B=[5;3;4];
16 C=inv(A)*B;
17 x=C(1,:);
18 y=C(2,:);
19 z=C(3,:);
20 disp(x,'x=');
21 disp(y,'y=');
22 disp(z,'z=');
```

Scilab code Exa 4.18 Dependency of Matrices

```
1  //PG-133
```

```
2  // Scilab Version-  6.0.1
3  // Operating System-  Window 7
4  clc;
5  close;
6  clear;
7  u1=[1,2,-3];
8  u2=[4,0,1];
9  u3=[1,3,-4];
10 u4=[6,5,4];
11 u5=[3,8,-11];
12 u6=[16,10,9];
13 A=[u1;u2];
14 B=[u3;u4];
15 C=[u5;u6];
16 D=[u1,u2];
17 E=[u3,u4];
18 F=[u5,u6];
19 M=[D;E;F];
20 R1=M(1,:);
21 R2=M(2,:);
22 R3=M(3,:);
23 N=[R1;R2-R1;R3-3*R1];
24 R2=N(2,:);
25 R3=N(3,:);
26 P=[R1;R2;R3-2*R2]
27 disp(A,'A=');
28 disp(B,'B=');
29 disp(C,'C=');
30 disp(M,'M=');
31 disp(N,'~');
32 disp(P,'echelon form of M')
```

Chapter 5

Linear Mapping

Scilab code Exa 5.1 Functions

```
1  //PG-165
2  clc;
3  close;
4  clear;
5  //(a)
6  x=-3;
7  f=x*x;
8  disp('(a)');
9  disp(f,'f(-3)=');
10 f=9;
11 x=sqrt(f);//x=f^-1(9)
12 disp(-x,'and',x,'x=');
```

Scilab code Exa 5.2 Derivative and Integral

```
1  //PG-165
2  clc;
3  close;
```

```
clear;
// (a)
t=poly([0],'t');
p=3*t^2-5*t+2;
d=6*t-5;
disp('(a)')
disp(p,'p(t)=');
disp(d,'D(p)=');
// (b)
J=integrate('3*t^2-5*t+2','t',0,1);
disp('(b)');
disp(J,'J(p)=1/2=');
```

Scilab code Exa 5.3 Graphs of Function

```
//PG-166
// Scilab Version- 6.0.1
// Operating System- Window 7
clc;
close;
clear;
x=-3:.02:3;
f=2^x;
g=x^3-x;
h=x^2;
figure
title('f(x)=2^x');
xlabel("x");
ylabel("f(x)");
plot(x,f);
figure
title('g(x)=x^3-x');
xlabel("x");
ylabel("g(x)");
plot(x,g);
```

```
figure
title('h(x)=x^2');
xlabel("x");
ylabel("h(x)");
plot(x,h);
```

Scilab code Exa 5.9 Linear Mapping

```
//PG-171
clc;
close;
clear;
//(a)
//F(x,y,z,t)=(x-y+z+t,2x-2y+3z+4t,3x-3y+4z+5t)
x=1;
y=0;
z=0;
t=0;
F1=[x-y+z+t,2*x-2*y+3*z+4*t,3*x-3*y+4*z+5*t];
disp('(a)')
disp(F1,'F(1,0,0,0)=');
x=0;
y=1;
z=0;
t=0;
F2=[x-y+z+t,2*x-2*y+3*z+4*t,3*x-3*y+4*z+5*t];
disp(F2,'F(1,0,0,0)=');
x=0;
y=0;
z=1;
t=0;
```

```
F3=[x-y+z+t,2*x-2*y+3*z+4*t,3*x-3*y+4*z+5*t];
disp(F3,'F(1,0,0,0)=');
x=0;
y=0;
z=0;
t=1;
F4=[x-y+z+t,2*x-2*y+3*z+4*t,3*x-3*y+4*z+5*t];
disp(F4,'F(1,0,0,0)=');
M=[F1;F2;F3;F4];
A=[1,2,3;0,1,1;0,0,0;0,0,0];
B=rank(M);
disp(M,'M=');
disp(A,'echelon form of A');
disp(B,'Rank of F=')
//(b)
//F(x,y,z,t)=(x-y+z+t,2x-2y+3z+4t,3x-3y+4z+5t)
   =(0,0,0)
x=-1;
y=1;
z=0;
t=0;
A=x-y+z+t;
B=2*x-2*y+3*z+4*t
C=3*x-3*y+4*z+5*t;
disp('(b)');
if(A==0 & B==0 & C==0)
    disp('(-1,1,0,0) is a solution of the system');
else
    disp('(-1,1,0,0) is not a solution of the system
       ')
end
x=1;
y=0;
z=-2;
t=1;
A=x-y+z+t;
B=2*x-2*y+3*z+4*t
C=3*x-3*y+4*z+5*t;
```

```
60 if(A==0 & B==0 & C==0)
61     disp('(1,0,2,1) is a solution of the system');
62 else
63     disp('(1,0,2,1) is not a solution of the system'
       )
64 end
```

Scilab code Exa 5.11 Linear Mapping

```
1 //PG-174
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 //F(x,y,z)=(0,x,y)
8 //(F+1)(a,b,c)=(0,a,b)+(a,b,c)=(a,a+b,b+c)
9 // F^3(a,b,c)=F^2(0,a,b)=F(0,0,a)=(0,0,0)
10 disp('Thus, F^3=0,the zero mapping in A(V). This
    means F is a zero of the polynomial p(t)=t^3')
```

Scilab code Exa 5.13 Linear Operator

```
1 //PG-175
2 clc;
3 close;
4 clear;
5 //(a)
6 //F(x,y)=(2x+y,3x+2y), F(x,y)=(0,0)
7 //2x+y=0, 3x+2y=0
8 A=[2,1;3,2];
9 B=[0;0];
10 C=inv(A)*B
```

```
11 x=C(1,:);
12 y=C(2,:);
13 disp('(a)');
14 disp(x,'x=');
15 disp(y,'y=');
16 //(b)
17 //F(x,y)=(2x+y,3x+2y), F(x,y)=(s,t)
18 //2x+y=s, 3x+2y=t
19 //x=2s-t, y=-3s+2t
20 disp('(b)');
21 disp('F^-1(s,t)=(2s-t,-3s+2t) or F^-1(x,y)=(2x-y,-3x
   +2y)');
```

Chapter 6

Linear Mappings and Matrices

Scilab code Exa 6.1 `Linear Operator`

```
1  //PG-196
2  clc;
3  close;
4  clear;
5  //F(x,y)=(2x+3y,4x-5y)
6  //(a)
7  u1=[1;2];
8  u2=[2;5];
9  S=[u1,u2];
10 //(1)
11 //F(u1)=F([1;2])=[8;-6]=x*[1;2]+y*[2;5], x+2y=8, 2x
       +5y=-6
12 A=[1,2;2,5];
13 B=[8;-6]
14 C=inv(A)*B
15 x=C(1,:);
16 y=C(2,:);
17 disp('(a)');
18 disp(x,'x=');
19 disp(y,'y=');
20 disp('F(u1)=52u1-22u2');
```

```
21 //(2)
22 //F(u2)=F([2;5])=[19;-17]=x*[1;2]+y*[2;5], x+2y=19,
     2x+5y=-17
23 A=[1,2;2,5];
24 B=[19;-17]
25 C=inv(A)*B
26 x=C(1,:);
27 y=C(2,:);
28 disp(x,'x=');
29 disp(y,'y=');
30 disp('F(u2)=129u1-55u2');
31 Fs=[52,129;-22,-55];
32 disp(Fs,'Fs=');
33 //(b)
34 e1=[1,0];
35 e2=[0,1];
36 S=[e1,e2];
37 F1=2*e1+4*e2; // F1=F(1,0)
38 F2=3*e1-5*e2;  // F2=F(0,1)
39 A=[F1',F2'];
40 disp('(b)');
41 disp(F1,'F(e1)=F(1,0)='); // In book value of F(e1)
     =(2,2) which is wrong correct is F(e1)=(2,4)
42 disp(F2,'F(e2)=F(0,1)=');
43 disp(A,'[F]E=')
```

Scilab code Exa 6.2 Compute Matrix

```
1 //PG-196
2 // Scilab Version-  6.0.1
3 // Operating System-  Window 7
4 clc;
5 clear all;
6 close;
7 t=poly([0],'t');
```

```
%p_sint=poly([0],'sin');
%p_cost=poly([0],'exp');
%p_exp3t=poly([0],'exp');
M=[0,%p_cost,0;-%p_sint,0,0;0,0,3*%p_exp3t];
A=horner(M,1);
disp(A,'D=');
disp(" value of D is wrong in book correct value is
   D=[0,1,0;-1,0,0;0,0,3]");
// value of D is wrong in book correct value is D
   =[0,1,0;-1,0,0;0,0,3]
```

Scilab code Exa 6.3 Find the Matrix

```
//PG-197
clc;
close;
clear;
//F(x,y)=(2x+3y,4x-5y)
u1=[1;-2];
u2=[2;-5];
S=[u1,u2];
//[a;b]=x*[1;-2]+y*[2;-5], x+2y=a, -2x-5y=b
// x=5a+2b, y=-2a-b
F1=8*u1-6*u2; // F1=F(1,-2)
F2=11*u1-11*u2;  // F2=F(2,-5)
A=[8,11;-6,-11];
disp(F1,'F(u1)=F(1,-2)=');
disp(F2,'F(u2)=F(2,-5)=');
disp(A,'[F]s=')
```

Scilab code Exa 6.4 Linear Operator

```
//PG-198
```

```
clc;
close;
clear;
//F(x,y)=(2x+3y,4x-5y)
u1=[1;-2];
u2=[2;-5];
S=[u1,u2];
v=[5,-7];
F1=[-11,55];
[v]=[11,-3]';
[F1]=[55,-33]';
A=[8,11;-6,-11]*[v];
disp(F1,'F(v)=');
disp([F1],'[F(v)]=');
disp(A,'[F][v]=[F(v)]=');
```

Scilab code Exa 6.5 Vectors and systems

```
//PG-200
clc;
close;
clear;
u1=[1;2];
u2=[3;5];
S=[u1,u2];
w1=[1;-1];
w2=[1;-2];
S1=[w1,w2]; // S1=S'
//(a)
// [1;-1]=x*[1;2]+y*[3;5], x+3y=1, 2x+5y=-1
A=[1,,3;2,5];
B=[1;-1];
C=inv(A)*B
x=C(1,:);
y=C(2,:);
```

```
18 disp('(a)');
19 disp(x,'x=');
20 disp(y,'y=');
21 // v1=-8u1+3u2, v2=-11u1+4u2
22 P=[-8,-11;3,4];
23 disp(P,'P=');
24 //(b)
25 // u1=4v1-3v2, u2=11v1-8u2
26 Q=[4,11;-3,-8];
27 D=inv(P);
28 disp('(b)');
29 disp(Q,'Q=');
30 disp(D,'P^-1=Q=');
```

Scilab code Exa 6.6 Operations on vectors

```
1 //PG-200
2 clc;
3 close;
4 clear;
5 e1=[1,0,0];
6 e2=[0,1,0];
7 e3=[0,0,1];
8 u1=[1,0,1];
9 u2=[2,1,2];
10 u3=[1,2,2];
11 E=[e1,e2,e3];
12 S=[u1,u2,u3];
13 //(a)
14 u1=e1+e3;
15 u2=2*e1+e2+2*e2;
16 u3=e1+2*e2+2*e3;
17 P=[1,2,1;0,1,2;1,2,2];
18 disp('(a)');
19 disp(P,'P=');
```

```
20 //(b)
21 e1=-2*u1+2*u2-u3;
22 e2=-2*u1+u2;
23 e3=3*u1-2*u2+u3;
24 Q=[-2,-2,3;2,1,-2;-1,0,1];
25 M=[P,eye(3,3)];
26 A=[eye(3,3),Q];
27 B=inv(P)
28 disp('(b)');
29 disp(Q,'Q=');
30 disp(B,'P^-1=Q=');
31 disp(M,'M=');
32 disp(A,'[I,P^-1]=');
```

Scilab code Exa 6.7 `Vectors and systems`

```
1 //PG-202
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 e1=[1,0,0];
8 e2=[0,1,0];
9 e3=[0,0,1];
10 u1=[1,0,1];
11 u2=[2,1,2];
12 u3=[1,2,2];
13 E=[e1,e2,e3];
14 S=[u1,u2,u3];
15 //(a)
16 // [1;3;5]=x*[1;0;1]+y*[2;1;2]+z*[1;2;2], x+2y+z=1,
    y+2z=3, x+2y+2z=5
17 P=[1,2,1;0,1,2;1,2,2];
18 B=[1;3;5];
```

```
C=inv(P)*B
x=C(1,:);
y=C(2,:);
z=C(3,:);
v=7*u1-5*u2+4*u3;
disp('(a)');
disp(x,'x=');
disp(y,'y=');
disp(z,'z=');
disp(C,'[v]s=');
// Thus again
v=7*u1-5*u2+4*u3;
//(b)
A=[1,3,-2;2,-4,1;3,-1,2];
A1=11*u1-9*u2+6*u3; // A1=A(u1)=(-1,3,5)
A2=21*u1-14*u2+8*u3; // A2=A(u2)=(1,2,9)
A3=17*u1-8*u2+2*u3; // A3=A(u3)=(3,-4,5)
B=[11,21,17;-9,-14,-8;6,8,2];
M=inv(P)*A*P;
disp(A,'A=');
disp(B,'B=');
disp('In book equation of A(u1)=11*u1-5*u2+6*u3 is
   wrong. correct is A(u1)=11*u1-9*u2+6*u3. So B
   will change according to the correct equation So
   correct values of matrix B is B
   =[11,21,17;-9,-14,-8;6,8,2]')
disp(M,'B=P^-1.A.P=');
disp(' correct values of matrix B is B
   =[11,21,17;-9,-14,-8;6,8,2]')
// In book equation of A(u1)=11*u1-5*u2+6*u3 is
   wrong. correct is A(u1)=11*u1-9*u2+6*u3. So B
   will change according to the correct equation
// So correct values of matrix B is B
   =[11,21,17;-9,-14,-8;6,8,2]
```

Scilab code Exa 6.8 Linear Operator

```
1  //PG-204
2  clc;
3  close;
4  clear;
5  e1=[1,0];
6  e2=[0,1];
7  u1=[1,2];
8  u2=[2,5];
9  E=[e1,e2];
10 S=[u1,u2];
11 //F(x,y)=(2x+3y,4x-5y)
12 A=[2,3;4,-5];
13 // using matrix A
14 C=det(A);
15 E=diag(A);
16 G=sum(E);
17 B=[52,129;-22,-55];
18 // using matrix B
19 D=det(B);
20 F=diag(B);
21 H=sum(F);
22 disp(A,'A=');
23 disp('using matrix A');
24 disp(C,'(i)  det(A)=Determinant of F=');
25 disp(G,'(ii)  Trace of F=tr(A)=');
26 disp(B,'B=');
27 disp('using matrix B');
28 disp(D,'(i)  det(B)=Determinant of F=');
29 disp(H,'(ii)  Trace of F=tr(B)=');
```

Chapter 7

Inner Product Spaces Orthogonality

Scilab code Exa 7.1 Linear combination of Vectors

```
1 //PG-227
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 // <3u1-4u2,2v1-5v2+6v3>=6<u1,v1>-15<u1,v2>+18<u1,v3
    >-8<u2,v1>+20<u2,v2>-24<u2,v3>
8 // <2u-5v,4u+6v>=8<u,u>+12<u,v>-20<v,u>-30<v,v>=8<u,
    u>-8<v,u>-30<v,v>
9 // <u,v>=<v,u>
10 // Scilab function can not be used because the
    quation is a derivative type
```

Scilab code Exa 7.2 Operations on vectors

```
// PG-228
clc;
close;
clear;
u=[1,3,-4,2];
v=[4,-2,2,1];
w=[5,-1,-2,6];
// (a)
A=3*u-2*v;
B=u*w';
C=v*w';
D=A*w'
E=3*B-2*C;
disp('(a)');
disp(D,'<3u-2v,w>=');
disp(E,'3<u,w>-2<v,w>=');
disp('<3u-2v,w>=3<u,w>-2<v,w>');
// (b)
F=sqrt(u*u');
G=sqrt(v*v');
H=u/F;
I=v/G;
disp('(b)');
disp(F,'||u||=sqrt(30)=');
disp(G,'||v||=');
disp(H,'u/||u||=');
disp(I,'v/||v||=');
// in this code we obtain values in decimal
```

Scilab code Exa 7.3 Integration

```
// PG-228
clc;
close;
clear;
```

```
t=poly([0],'t');
f=3*t-5; // f=f(t)
g=t^2;  // g=g(t)
// (a)
// f(t)g(t)=3t^3-5t^2
x0=0;
x1=1;
X=integrate('3*t^3-5*t^2','t',x0,x1);
disp('(a)');
disp(X,'Integration of f(t)g(t) =11/12=');
// (b)
//||f||^2=9t^2-30t+25
//||g||^2=t^4
Y=integrate('9*t^2-30*t+25','t',x0,x1);
Z=integrate('t^4','t',x0,x1);
A=sqrt(Y);
B=sqrt(Z);
disp('(b)');
disp(Y,'Integration of ||f||^2 =');
disp(Z,'Integration of ||g||^2 =1/5=');
disp(A,'||f||=sqrt(13)=');
disp(B,'||g||=sqrt(1/5)=');
```

Scilab code Exa 7.5 Operations on vectors

```
// PG-230
clc;
close;
clear;
// (a)
 u=[2,3,5];
 v=[1,-4,3];
 A=u*v';
 B=sqrt(u*u');
 C=sqrt(v*v');
```

```
11  D=A/(B*C);
12  disp('(a)')
13  disp(A,'<u,v>=');
14  disp(B,'||u||=');
15  disp(C,'||v||=');
16  disp(D,'cos(thita)=');
17 disp('Thita is an acute angle, because cos(thita) is
       positive')
18 // (b)
19 t=poly([0],'t');
20 f=3*t-5; // f=f(t)
21 g=t^2;  // g=g(t)
22 // f(t)g(t)=3t^3-5t^2
23 x0=0;
24 x1=1;
25 X=integrate('3*t^3-5*t^2','t',x0,x1);
26 disp('(b)');
27 disp(X,'Integration of f(t)g(t) =11/12=');
28 //||f||^2=9t^2-30t+25
29 //||g||^2=t^4
30 Y=integrate('9*t^2-30*t+25','t',x0,x1);
31 Z=integrate('t^4','t',x0,x1);
32 A=sqrt(Y);
33 B=sqrt(Z);
34 disp(A,'||f||=sqrt(13)=');
35 disp(B,'||g||=sqrt(1/5)=');
36 C=X/(A*B);
37 disp(C,'cos(thita)=');
38 disp('Thita is an obtuse angle, because cos(thita)
     is negative')
```

Scilab code Exa 7.6 Operations on vectors and Integration

```
1  // PG-231
2  clc;
```

```
close;
 clear;
 // (a)
 u=[1,1,1];
 v=[1,2,-3];
 w=[1,-4,3]
 A=u*v';
 B=u*w';
 C=v*w';
 disp('(a)');
 disp(A,'<u,v>=');
 disp(B,'<u,w>=');
 disp(C,'<v,w>=');
  disp('Thus, u orthogonal to v and w, but v and w
     are not orthogonal');
  // (b)
  X=integrate('sin(t)*cos(t)','t',-%pi,%pi);
  disp('(b)');
 disp(X,'Integration of sin(t)cos(t) =');
 disp('Thus, sint and cost are orthogonal function
    in the vector space C[-pi,pi]');
```

Scilab code Exa 7.7 Find Nonzero Vector

```
//PG-231
clc;
close;
clear;
u1=[1,2,1];
u2=[2,5,4];
// x+2y+z=0 , 2x+5y+4z=0
z=1  // set
// x+2y=-1 , 2x+5y=-4
A=[1,2;2,5];
v=[-1;-4];
```

```
12 B=inv(A)*v;
13 x=B(1,:);
14 y=B(2,:);
15 w=[x,y,z];
16 w1=w/sqrt(w*w');
17 disp(x,'x=');
18 disp(y,'y=');
19 disp(z,'z=');
20 disp(w,'w=');
21 disp(w1,'w(unit vector)=w/||w||=');
22 // In this code we obtain decimal values of unit
   vector
```

Scilab code Exa 7.8 Solution of Linear Equation

```
1 //PG-232
2 clc;
3 close;
4 clear;
5 u1=[1,3,-4];
6 // x+3y-4z=0
7 //(1)
8 y=1;z=0; // set then
9 x=-3
10 w1=[x,y,z];
11 disp('(1)');
12 disp(w1,'w1=');
13 //(2)
14 y=0;z=1; // set then
15 x=4
16 w1=[x,y,z];
17 disp('(2)');
18 disp(w1,'w1=');
```

Scilab code Exa 7.9 Orthogonal Vectors

```
1  //PG-233
2  clc;
3  close;
4  clear;
5  // (a)
6  e1=[1,0,0];
7  e2=[0,1,0];
8  e3=[0,0,1];
9  E={e1,e2,e3};
10 A1=e1*e2';
11 A2=e1*e3';
12 A3=e2*e3';
13 A4=e1*e1';
14 A5=e2*e2';
15 A6=e3*e3';
16 disp(A1,'<e1,e2>=');
17 disp(A2,'<e1,e3>=');
18 disp(A3,'<e2,e3>=');
19 disp(A4,'<e1,e1>=');
20 disp(A5,'<e2,e2>=');
21 disp(A6,'<e3,e3>=');
22 disp('<e1,e2>=<e1,e3>=<e2,e3>=0');
23 disp('<e1,e1>=<e2,e2>=<e3,e3>=1');
24 // (b)
25 // <f,g>=integration of f*g in interval -pi to pi
26 // {1,cost,cos2t,cos3t,...,sint,sin2t,sin3t,...}
   These are orthogonal sets
```

Scilab code Exa 7.10 Operations on vectors

```
1  //PG-236
2  clc;
3  close;
4  clear;
5  v1=[1,1,1,1];
6  v2=[1,2,4,5];
7  v3=[1,-3,-4,-2];
8  w1=v1;
9  w2=v2-(12/4).*w1;
10 w3=10*(v3+(8/4).*w1+(7/10).*w2);
11 A=w1*w1';
12 B=w2*w2';
13 C=w3*w3';
14 u1=w1/sqrt(A);
15 u2=w2/sqrt(B);
16 u3=w3/sqrt(C);
17 disp(w1,'w1=');
18 disp(w2,'w2=');
19 disp(w3,'w3=');
20 disp(A,'||w1||^2=');
21 disp(B,'||w2||^2=');
22 disp(C,'||w3||^2=');
23 disp(u1,'u1=');
24 disp(u2,'u2=');
25 disp(u3,'u3=');
26 // In this code we obtain values in decimal
```

Scilab code Exa 7.12 Orthogonal Matrix

```
1  //PG-233
2  clc;
3  close;
4  clear;
5  // (a)
6  P=[1/sqrt(3),1/sqrt(3),1/sqrt(3);0,1/sqrt(2),1/sqrt
```

```
    (2);2/sqrt(6),-1/sqrt(6),-1/sqrt(6)];
disp('(a)');
disp(P,'P=');
disp('The rows of P are orthogonal to each other and
    are unit vectors. Thus P is an orthogonal matrix
    ');
// (b)
P=['cos(thita)','sin(thita)';'-sin(thita)','cos(
    thita)'];
disp('(b)');
disp(P,'P=');
disp('P is an orthogonal matrix');
```

Scilab code Exa 7.13 Determinant of Matrices

```
//PG-238
// Scilab Version- 6.0.1
// Operating System- Window 7
clc;
close;
clear;
A=[1,3;3,4];
B=[1,-2;-2,-3];
C=[1,-2;-2,5];
D=det(A);
E=det(B);
F=det(C);
disp(A,'A=');
disp(B,'B=');
disp(C,'C=');
if D>0 then
    disp('is positive',D,'Determinant of A=');
elseif D<0
    disp('is negative',D,'Determinant of A=');
else
```

```
21      disp('is zero',D,'Determinant of A=');
22  end
23  if E>0 then
24      disp('is positive',E,'Determinant of B=');
25  elseif E<0
26      disp('is negative',E,'Determinant of B=');
27  else
28      disp('is zero',E,'Determinant of B=');
29  end
30  if F>0 then
31      disp('is positive',F,'Determinant of C=');
32  elseif F<0
33      disp('is negative',F,'Determinant of C=');
34  else
35      disp('is zero',F,'Determinant of C=');
36  end
```

Scilab code Exa 7.14 Operations on vectors

```
1    // PG-238
2    clc;
3    close;
4    clear;
5    u1=[1,1,0];
6    u2=[1,2,3];
7    u3=[1,3,5];
8    A1=u1*u1';
9    B=u1*u2';
10   C=u1*u3';
11   D=u2*u2';
12   E=u2*u3';
13   F=u3*u3';
14   A=[A1,B,C;B,D,E;C,E,F];
15   disp(A1,'<u1,u1>=');
16   disp(B,'<u1,u2>=');
```

```
17  disp(C,'<u1,u3>=');
18  disp(D,'<u2,u2>=');
19  disp(E,'<u2,u3>=');
20  disp(F,'<u3,u3>=');
21  disp(A,'A=');
```

Scilab code Exa 7.17 Operations on vectors

```
1  //PG-233
2  clc;
3  close;
4  clear;
5  u=[1,-5,3];
6  v=[4,2,-3];
7  // (a)
8  A1=-min(u);
9  A2=max(v);
10 disp('(a)');
11 disp(A1,'||u|| infinite=');
12 disp(A2,'||v|| infinite=');
13 // (b)
14 A3=1+5+3;
15 A4=4+2+3;
16 disp('(b)');
17 disp(A3,'||u||1=');
18 disp(A4,'||v||1=');
19 // (c)
20 A5=sqrt(u*u');
21 A6=sqrt(v*v');
22 disp('(c)');
23 disp(A5,'||u||2=');
24 disp(A6,'||v||2=');
25 // (d)
26 A=u-v;
27 A7=-min(A);
```

```
28 A8=3+7+6;
29 A9=sqrt(A*A');
30 disp('(d)');
31 disp(A7,'d(infinite)(u,v)=');
32 disp(A8,'d1(u,v)=');
33 disp(A9,'d2(u,v)=');
34 // In this code we obtain decimal values of square
      root
```

Chapter 8

Determinants

Scilab code Exa 8.1 Determinants

```
1 // PG-264
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 //(a)
8 A=det(27);
9 B=det(-7);
10 C=A';
11 D=B';
12 disp('(a)')
13 disp(A,'determinant of 27');
14 disp(C,'transpose matrix form of determinant of 27
     is');
15 disp(B,'determinant of -7');
16 disp(D,'transpose matrix form of determinant of -7
     is');
17 disp('det(t-3}=t-3');
18 disp("transpose matrix form of determinant of t-3 is
      t-3")
```

```
19 //(b)
20 A=det([5,3;4,6]);
21 B=det([3,2;-5,7]);
22 C=A';
23 D=B';
24 disp('(b)')
25 disp(A,'|5 3;4 6|=');
26 disp(C,'transpose matrix form of |5 3;4 6| is');
27 disp(B,'|3,2;-5,7|=');
28 disp(D,'transpose matrix form of |3,2;-5,7| is');
```

Scilab code Exa 8.2 Determinant of Matrices

```
1 // PG-265
2 clc;
3 close;
4 clear;
5 //4x-3y=15,2x+5y=1
6 A=[4,-3;2,5];
7 Nx=[15,-3;1,5];
8 Ny=[4,15;2,1];
9 D=det(A);
10 B=det(Nx);
11 C=det(Ny);
12 disp(A,'A=');
13 disp(D,'determinant of A');
14 disp(Nx,'Nx=');
15 disp(B,'determinant of Nx');
16 disp(Ny,'Ny=');
17 disp(C,'determinant of Ny');
18 disp(B/D,'x=');
19 disp(C/D,'y=');
```

Scilab code Exa 8.3 Determinant of Matrices

```
1  // PG-266
2  clc;
3  close;
4  clear;
5  A=[2,1,1;0,5,-2;1,-3,4];
6  B=[3,2,1;-4,5,-1;2,-3,4];
7  C=det(A);
8  D=det(B);
9  disp(A,'A=');
10 disp(B,'B=');
11 disp(C,'determinant of A=');
12 disp(D,'determinant of B=');
```

Scilab code Exa 8.4 Determinant of Matrix

```
1  // PG-266
2  clc;
3  close;
4  clear;
5  A=[1,2,3;4,-2,3;0,5,-1];
6  B=det(A);
7  disp(A,'A=')
8  disp(B,'determinant of A=');
```

Scilab code Exa 8.5 Factorial

```
1  // PG-267
2  clc;
3  close;
4  clear;
5  A=factorial(2);
```

```
B=factorial(3);
disp(A,'factorial of 2');
disp(B,'factorial of 3');
```

Scilab code Exa 8.7 Determinants

```
//PG-268
// Scilab Version- 6.0.1
// Operating System- Window 7
clc;
close;
clear;
// (a)
// A=a11;
// det(A)=a11
// (b)
// A=[a11,a12;a21,a22];
// det(A)=a11a22-a12a21
// (c)
// A=[a11,a12,a13;a21,a22,a23;a31,a32,a33];
// det(A)=a11a22a33+a12a23a31+a13a21a32-a13a22a31-
   a12a21a33-a11a23a32
```

Scilab code Exa 8.8 Minors and Cofactors

```
//PG-270
clc;
close;
clear;
A=[1,2,3;4,5,6;7,8,9];
// (a)
M23=det([1,2;7,8]);
A23=-M23;
```

```
disp(A,'A=');
disp('(a)');
disp(M23,'|M23|=');
disp(A23,'A23=');
// (b)
M31=det([2,3;5,6]);
A31=M31
disp('(b)');
disp(M31,'|M31|=');
disp(A31,'A31=');
```

Scilab code Exa 8.9 Determinant of Matrix

```
// PG-271
clc;
close;
clear;
A=[5,4,2,1;2,3,1,-2;-5,-7,-3,9;1,-2,-1,4];
B=det(A);
disp(A,'A=');
disp(B,'determinant of A=');
```

Scilab code Exa 8.10 Cofactors

```
//PG-271
clc;
close;
clear;
A=[2,3,-4;0,-4,2;1,-1,5];
A11=det([-4,2;-1,5]);
A12=-det([0,2;1,5]);
A13=det([0,-4;1,-1]);
A21=-det([3,-4;-1,5]);
```

```
A22=det([2,-4;1,5]);
A23=-det([2,3;1,-1]);
A31=det([3,-4;-4,2]);
A32=-det([2,-4;0,2]);
A33=det([2,3;0,-4]);
disp(A,'A=');
disp(A11,'A11=');
disp(A12,'A12=');
disp(A13,'A13=');
disp(A21,'A21=');
disp(A22,'A22=');
disp(A23,'A23=');
disp(A31,'A31=');
disp(A32,'A32=');
disp(A33,'A33=');
```

Scilab code Exa 8.11 Inverse of Matrix

```
// PG-272
clc;
close;
clear;
A=[2,3,-4;0,-4,2;1,-1,5];
B=det(A);
C=inv(A);
disp(A,'A=');
disp(B,'Determinant of A=');
disp(C,'A^-1=');
// In this code we obtain decimal values
```

Scilab code Exa 8.12 Solution of Linear systems

```
// PG-273
```

```
2  clc;
3  close;
4  clear;
5  // x+y+z=5,x-2y-3z=-1, 2x+y-z=3
6  A=[1,1,1;1,-2,-3;2,1,-1];
7  D=det(A);
8  B=[5,1,1;-1,-2,-3;3,1,-1];
9  M=[1,5,1;1,-1,-3;2,3,-1];
10 N=[1,1,5;1,-2,-1;2,1,3];
11 Nx=det(B);
12 Ny=det(M);
13 Nz=det(N);
14 x=Nx/D;
15 y=Ny/D;
16 z=Nz/D;
17 u=[x,y,z]
18 disp(D,'D=');
19 disp(Nx,'Nx=');
20 disp(Ny,'Ny=');
21 disp(Nz,'Nz=');
22 disp(x,'x=');
23 disp(y,'y=');
24 disp(z,'z=');
25 disp(u,'That is, the vector u=');
```

Scilab code Exa 8.13 Minors

```
1  //PG-273
2  // Scilab Version- 6.0.1
3  // Operating System- Window 7
4  clc;
5  close;
6  clear;
7  // A=[aij]
8  I=[1,2,4];
```

```
J=[2,3,5];
K=[3,5];
L=[1,4];
A=I+J;
B=sum(A);
disp(I,'I=');
disp(J,'J=');
disp(K,'Ides=');
disp(L,'Jdes=');
disp('is odd,-|M| is the signed minor and -|Mdes| is the signed complementary minor',B,'I+J=');
// minor |M| and complementary minor |M'|
// |M|=|A(I;J)|=det([a12,a13,a15;a22,a23,a25;a42,a43,a45])
// |M'|=|A(I';J')|=det([a31,a34;a51,a54])
```

Scilab code Exa 8.14 Principal Minors

```
//PG-274
// Scilab Version- 6.0.1
// Operating System- Window 7
clc;
close;
clear;
A=[1,2,-1;3,5,4;-3,1,-2];
// (a)
B=diag(A);
C1=sum(B);
disp('(a)');
disp(C1,'C1=tr(A)=');
//(b)
A11=det([1,2;3,5]);
A22=det([1,-1;-3,-2]);
A33=det([5,4;1,-2]);
C2=A11+A22+A33;
```

```
18 disp('(b)');
19 disp(A11,'A11=');
20 disp(A22,'A22=');
21 disp('In this book wrong value of A22 correct is A22
     =-5');
22 disp(A33,'A33=');
23 disp(C2,'C2=A11+A22+A33=');
24 disp('In this book wrong value of C2. Correct is C2
     =-20');
25 // (c)
26 C3=det(A);
27 disp('(c)');
28 disp(C3,'C3=');
29 // In this book wrong value of C2. Correct is C2=-20
30 // In this book wrong value of A22 correct is A22=-5
```

Scilab code Exa 8.15 Determinant of Matrix

```
1 // PG-274
2 clc;
3 close;
4 clear;
5 M
     =[2,3,4,7,8;-1,5,3,2,1;0,0,2,1,5;0,0,3,-1,4;0,0,5,2,6];

6 A=det(M);
7 disp(M,'M=');
8 disp(A,'|M|=');
```

Scilab code Exa 8.16 Determinant of Matrix

```
1 // PG-275
2 //Scilab Version-  6.0.1
```

```
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 u1=[1,1,0];
8 u2=[1,1,1];
9 u3=[0,2,3];
10 A=[u1;u2;u3];
11 B=det(A);
12 C=abs(B);
13 disp(C,'V(s)=');
```

Scilab code Exa 8.17 Determinant

```
1 //PG-275
2 clc;
3 close;
4 clear;
5 // f(x,y,z)=(2x-4y+z,x-2y+3z,5x+y-z)
6 A=[2,-4,1;1,-2,3;5,1,-1];
7 B=det(A);
8 disp(A,'A=');
9 disp(B,'det(F)=|A|=');
```

Chapter 9

Diagonalization Eigenvalues and Eigenvectors

Scilab code Exa 9.1 Operations on Matrix

```
1  // PG-293
2  clc;
3  close;
4  clear;
5  A=[1,2;3,4];
6  B=A*A;
7  // f(t)=2t^2-3t+5, g(t)=t^2-5t-2
8  I=eye(2,2);
9  f=2*B-3*A+5*I;
10 g=B-5*A-2*I;
11 disp(A,'A=');
12 disp(B,'A^2=');
13 disp(f,'F(A)=');
14 disp(g,'g(A)=');
```

Scilab code Exa 9.2 Characteristic Polynomial

```
// PG-294
clc;
close;
clear;
A=[1,3;4,5];
B=A*A;
// delta(t)=t^2-6t-7
I=eye(2,2);
C=B-6*A-7*I;
disp(A,'A=');
disp(C,'delta(A)=');
```

Scilab code Exa 9.3 Characteristic Polynomial

```
// PG-295
clc;
close;
clear;
// (a)
A=[5,3;2,10];
D=diag(A);
S=sum(D);
E=det(A);
disp('(a)');
disp(A,'A=');
disp(S,'tr(A)=');
disp(E,'det(A)=');
t=poly([0],'t');
F=t^2-S*t+E;
disp(F,'delta(t)=')
// (b)
B=[7,-1;6,2];
D=diag(B);
S=sum(D);
E=det(B);
```

```
22 disp('(b)');
23 disp(B,'B=');
24 disp(S,'tr(B)=');
25 disp(E,'det(B)=');
26 t=poly([0],'t');
27 F=t^2-S*t+E;
28 disp(F,'delta(t)=')
29 // (c)
30 C=[5,-2;4,-4];
31 D=diag(C);
32 S=sum(D);
33 E=det(C);
34 disp('(c)');
35 disp(C,'C=');
36 disp(S,'tr(C)=');
37 disp(E,'det(C)=');
38 t=poly([0],'t');
39 F=t^2-S*t+E;
40 disp(F,'delta(t)=')
```

Scilab code Exa 9.4 Characteristic Polynomial

```
1 //PG-295
2 clc;
3 close;
4 clear;
5 A=[1,1,2;0,3,2;1,3,9];
6 A11=det([3,2;3,9]);
7 A22=det([1,2;1,9]);
8 A33=det([1,1;0,3]);
9 B1=diag(A);
10 B=sum(B1);
11 C=A11+A22+A33;
12 D=det(A);
13 t=poly([0],'t');
```

```
14 E=t^3-B*t^2+C*t-D
15 disp(A,'A=');
16 disp(B,'tr(A)=');
17 disp(C,'A11+A22+A33=');
18 disp(D,'|A|=');
19 disp(E,'delta(t)=');
```

Scilab code Exa 9.5 Operations on Matrices

```
1  // PG-297
2  clc;
3  close;
4  clear;
5  A=[3,1;2,2];
6  v1=[1;-2];
7  v2=[1;1];
8  B1=A*v1;
9  C=A*v2;
10 P=[v1,v2];
11 E=inv(P);
12 D=[1,0;0,4]; // D=E*A*P
13 G=P*D*E;
14 H=A^4;
15 disp(A,'A=');
16 disp(v1,'v1=');
17 disp(v2,'v2=');
18 disp(B1,'Av1=v1=');
19 disp(C,'Av2=4v2=');
20 disp(P,'P=');
21 disp(E,'P^-1=');
22 disp(D,'D=');
23 disp(G,'PDP^-1=A=');
24 disp(H,'A^4=');
25 t=poly([0],'t');
26 f=t^3-5*t^2+3*t+6;
```

```
27 disp(f,'f(t)=');
28 t=1;
29 f=t^3-5*t^2+3*t+6;
30 I=f;
31 disp(I,'f(1)=');
32 t=4;
33 f=t^3-5*t^2+3*t+6;
34 J=f;
35 disp(J,'f(4)=');
36 t=D;
37 f=t^3-5*t^2+3*t+6*eye(2,2);
38 K=f;
39 L=P*K*E;
40 B=P*sqrt(D)*E;
41 disp(L,'f(A)=');
42 disp(B,'B=');
```

Scilab code Exa 9.6 Diagonalizable algorithm

```
1 // PG-300
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 A=[4,2;3,-1];
8 // (1)
9 B=diag(A);
10 C=sum(B);
11 E=det(A);
12 t=poly([0],'t');
13 f=t^2-C*t+E;
14 disp('(1)')
15 disp(A,'A=');
16 disp(C,'tr(A)=');
```

```
17 disp('Value of tr(A) is wrong in this book correct
     value is tr(A)=3');
18 disp(E,'|A|=');
19 disp(f,'delta(t)=');
20 // (2)
21 lam=spec(A);
22 lam1=lam(1,:);
23 lam2=lam(2,:);
24 disp('(2)')
25 disp(lam1,'lam1=');
26 disp(lam2,'lam2=');
27 // (3)
28 // (i)
29 M=A-lam1*eye(2,2);
30 // MX=0 , [-1,2;3,-6][x;y]=[0;0] , -x+2y=0 , 3x-6y=0
       => -x+2y=0
31  v1=[2,1] // is a nonzero solution
32  disp('(3)');
33  disp('(i)');
34  disp(M,'M=');
35 // (ii)
36 M=A-lam2*eye(2,2);
37  // MX=0 , [6,2;3,1][x;y]=[0;0] , 6x+2y=0 , 3x+y=0
       => 3x+y=0
38  v2=[-1,3] // is a nonzero solution
39  disp('(ii)');
40  disp(M,'M=');
41  //(4)
42  P=[v1',v2'];
43  Q=inv(P);
44 // D=Q*A*P;
45 D=[5,0;0,-2]
46  disp('(4)');
47  disp(P,'P=');
48   disp(Q,'P^-1=');
49    disp(D,'D=');
50 // Value of tr(A) is wrong in this book correct
     value is tr(A)=3
```

Scilab code Exa 9.7 Characteristic Polynomial

```
1  // PG-300
2  clc;
3 close;
4  clear;
5 B=[5,-1;1,3];
6  // (1)
7 A=diag(B);
8 C=sum(A);
9 E=det(B);
10 t=poly([0],'t');
11 f=t^2-C*t+E;
12  disp(B,'B=');
13  disp(C,'tr(B)=');
14  disp(E,'|B|=');
15  disp(f,'delta(t)=');
16 lam=spec(B);
17 lam1=lam(1,:);
18 lam2=lam(2,:);
19  disp(lam1,'lam1=');
20  disp(lam2,'lam2=');
21 M=B-lam1*eye(2,2);
22  // MX=0 , [1,-1;1,-1][x;y]=[0;0] , x-y=0 , x-y=0 =>
      x-y=0
23 v=[1,1] // it and it's multiples are only
     eigenvectors of B
24  disp(' v=[1,1] and its multiples are only
     eigenvectors of B')
```

Scilab code Exa 9.8 Characteristic Polynomial

```
1  //PG-301
2  clc;
3  close;
4  clear;
5  A=[3,-5;2,-3];
6  B1=diag(A);
7  B=sum(B1);
8  C=det(A);
9  t=poly([0],'t');
10 D=t^2-B*t+C;
11 disp(D,'delta(t)=');
12 // (a)
13 disp('(a)');
14 disp('delta(t) has no real roots. Thus A has no
      eigenvalues and no eigenvectors');
15 //(b)
16 E=(t-%i)*(t+%i);
17 F=[%i,0;0,-%i];
18 disp('(b)');
19 disp(F,'P^-1AP=');
```

Scilab code Exa 9.9 Orthogonal Matrix

```
1  // PG-301
2  clc;
3  close;
4  clear;
5  A=[2,-2;-2,5];
6  B=diag(A);
7  C=sum(B);
8  E=det(A);
9  t=poly([0],'t');
10 f=t^2-C*t+E;
11 disp(A,'A=');
12 disp(C,'tr(A)=');
```

```
13 disp(E,'|A|=');
14 disp(f,'delta(t)=');
15 lam=spec(A);
16 lam1=lam(2,:);
17 lam2=lam(1,:);
18 disp(lam1,'lam1=');
19 disp(lam2,'lam2=');
20 // (a) , for lam=6
21 M=A-lam1*eye(2,2);
22 // MX=0 , [-4,-2;-2,-1][x;y]=[0;0] , -4x-2y=0 , -2x-
     y=0 => 2x+y=0
23  u1=[1,-2] // is a nonzero solution
24  disp('(a)');
25  disp(M,'M=');
26  disp(u1,'u1=');
27 // (b) for lam=2
28 M=A-lam2*eye(2,2);
29  // MX=0 , [1,-2;-2,4][x;y]=[0;0] , x-2y=0 , -2x+4y
       =0 => x-2y=0
30  u2=[2,1] // is a nonzero solution
31  disp('(b)');
32  disp(M,'M=');
33   disp(u2,'u2=');
34  v1=u1/sqrt(u1*u1');
35   v2=u2/sqrt(u2*u2');
36  P=[v1',v2'];
37  Q=inv(P);
38 // D=Q*A*P;
39 D=[6,0;0,1]
40  disp(P,'P=');
41   disp(Q,'P^-1=');
42    disp(D,'D=');
43 // in this code we obtain decimal values
```

Scilab code Exa 9.10 Solution of quadratic Equations

```
1  //PG-303
2  clc;
3  close;
4  clear;
5  // q(x,y)=2x^2-4xy+5y^2
6  A=[2,-2;-2,5];
7  x=poly([0],'x');
8  y=poly([0],'y');
9  t=poly([0],'t');
10 s=poly([0],'s');
11 X=['x';'y'];
12 B=[6,0;0,1];
13 P=[1/sqrt(5),2/sqrt(5);-2/sqrt(5),1/sqrt(5)];
14 // x=(1/sqrt(5))*s+(2/sqrt(5))*t
15 // y=(-2/sqrt(5))*s+(1/sqrt(5))*t
16 disp(A,'A=');
17 disp(B,'P^-1AP=P^TAP=');
18 disp(P,'P=');
19 disp('x=(1/sqrt(5))*s+(2/sqrt(5))*t');
20 disp('y=(-2/sqrt(5))*s+(1/sqrt(5))*t');
```

Scilab code Exa 9.11 Minimal Polynomial

```
1  // PG-303
2  clc;
3  close;
4  clear;
5  A=[2,2,-5;3,7,-15;1,2,-4];
6  B=diag(A);
7  C=sum(B);
8  D=2-3+8; // A11+A22+A33=2-3+8
9  E=det(A);
10 t=poly([0],'t');
11 f=t^3-C*t^2+D*t-E;
12 disp(A,'A=');
```

```
13 disp(C,'tr(A)=');
14 disp(E,'|A|=');
15 disp(f,'delta(t)=');
16 F=(A-eye(3,3))*(A-3*eye(3,3));
17 disp(F,'F(A)=')
```

Scilab code Exa 9.13 Characteristic Polynomial

```
1  // PG-305
2  clc;
3  close;
4  clear;
5  M=[9,-1,5,7;8,3,2,-4;0,0,3,6;0,0,-1,8];
6  A=[9,-1;8,3];
7  B=[3,6;-1,8]
8  N=diag(A);
9  C=sum(N);
10 E=det(A);
11 t=poly([0],'t');
12 fA=t^2-C*t+E;
13 disp(A,'A=');
14 disp(C,'tr(A)=');
15 disp(E,'|A|=');
16 disp(fA,'deltaA(t)=');
17 N=diag(B);
18 C=sum(N);
19 E=det(B);
20 t=poly([0],'t');
21 fB=t^2-C*t+E;
22 disp(B,'B=');
23 disp(C,'tr(B)=');
24 disp(E,'|B|=');
25 disp(fB,'deltaB(t)=');
26 fM=fA*fB;
27 disp(fM,'deltaM(t)=')
```

Scilab code Exa 9.14 Characteristic Polynomial

```
1  //PG-306
2  clc;
3  close;
4  clear;
5  M
       =[2,5,0,0,0;0,2,0,0,0;0,0,4,2,0;0,0,3,5,0;0,0,0,0,7];

6  A1=[2,5;0,2];
7  A2=[4,2;3,5];
8  A3=[7];
9  t=poly([0],'t');
10 B1=(t-2)^2;
11 B2=(t-2)*(t-7);
12 B3=(t-7);
13 B=B1*B2*B3;
14 disp(M,'M=');
15 disp(A1,'A1=');
16 disp(A2,'A2=');
17 disp(A3,'A3=');
18 disp(B1,'m1(t)=');
19 disp(B2,'m2(t)=');
20 disp(B3,'m3(t)=');
21 disp(B,'delta(t)=(t-2)^3(t-7)^2=');
```

Chapter 10

Canonical Forms

Scilab code Exa 10.3 Minimal Polynomial

```
1  //PG-328
2  clc;
3  close;
4  clear;
5  // A^3=I
6  t=poly([0],'t');
7  f=t^3-1;
8  m=t^2+t+1;
9  disp(f,'f(t)=');
10 disp(f,'m(t)=','or',m,'m(t)=');
```

Scilab code Exa 10.5 Characteristic and Minimal Polynomials

```
1  //PG-329
2  clc;
3  close;
4  clear;
5  t=poly([0],'t');
```

```
f=((t-2)^4)*(t-5)^3;
m=((t-2)^2)*(t-5)^3;
//A=diag([2,1;0,2],[2,1;0,2],[5,1,0;0,5,1;0,0,5]);
//B=diag([2,1;0,2],[2],[2],[5,1,0;0,5,1;0,0,5]);
disp(f,'delta(t)=');
disp(m,'m(t)=');
disp('diag([2,1;0,2],[2,1;0,2],[5,1,0;0,5,1;0,0,5])
   or diag([2,1;0,2],[2],[2],[5,1,0;0,5,1;0,0,5])');
```

Scilab code Exa 10.6 Linear Operator

```
//PG-331
clc;
close;
clear;
t=poly([0],'t');
m=(t^4-4*t^3+6*t^2-4*t-7)*(t-3)^2;
// (a) diag[C((t^4-4*t^3+6*t^2-4*t-7)),C((t-3)^2),C
   ((t-3)^2)]
// (b) diag[C((t^4-4*t^3+6*t^2-4*t-7)),C((t-3)^2),C
   ((t-3)),C((t-3))]
//(a) diag
   ([0,0,0,7;1,0,0,4;0,1,0,-6;0,0,1,4],[0,-9;1,6],[0,-9;1,6])
   ;
//(b) diag
   ([0,0,0,7;1,0,0,4;0,1,0,-6;0,0,1,4],[0,-9;1,6],[3],[3])
   ;
disp(m,'m(t)=');
disp('(a)');
disp('diag
   ([0,0,0,7;1,0,0,4;0,1,0,-6;0,0,1,4],[0,-9;1,6],[0,-9;1,6])
   ');
disp('(b)');
disp('diag
   ([0,0,0,7;1,0,0,4;0,1,0,-6;0,0,1,4],[0,-9;1,6],[3],[3])
```

```
');
```

Chapter 11

Linear Functionals and the Dual Space

Scilab code Exa 11.3 Dual Basis

```
1  // PG-350
2  clc;
3  close;
4  clear;
5  v1=[2,1];
6  v2=[3,1];
7  // fi1(x,y)=ax+by, fi2(x,y)=cx+dy
8  // fi1(v1)=1 , fi1(v2)=0
9  // fi2(v1)=0 , fi2(v2)=1
10 // fi1(v1)=fi1(2,1)=2a+b=1 , fi1(v2)=fi1(3,1)=3a+b=0
11 // fi2(v1)=fi2(2,1)=2c+d=0 , fi2(v2)=fi2(3,1)=3c+d
      =0=1
12 A=[2,1;3,1];
13 B1=[1;0];
14 B2=[0;1];
15 C1=inv(A)*B1;
16 C2=inv(A)*B2;
17 a=C1(1,:);
18 b=C1(2,:);
```

```
19 c=C2(1,:);
20 d=C2(2,:);
21 disp(a,'a=');
22 disp(b,'b=');
23 disp(c,'c=');
24 disp(d,'d=');
25 x=poly([0],'x');
26 y=poly([0],'y');
27 //fi1(x,y)=a*x+b*y;
28 //  fi2(x,y)=c*x+d*y;
29  disp('fi1(x,y)=-x+3y');
30   disp('fi2(x,y)=x-2y');
```

Chapter 12

Bilinear Quadratic and Hermitian Forms

Scilab code Exa 12.2 Diagonal Matrix

```
1  // PG-362
2  clc;
3  close;
4  clear;
5  A=[1,2,-3;2,5,-4;-3,-4,8];
6  M=[A,eye(3,3)];
7  R1=M(1,:);
8  R2=M(2,:);
9  R3=M(3,:);
10 N=[R1;-2*R1+R2;3*R1+R3];
11 disp(M,'M=');
12 disp(N,'N=');
13 C1=N(:,1);
14 C2=N(:,2);
15 C3=N(:,3);
16 C4=N(:,4);
17 C5=N(:,5);
18 C6=N(:,6);
19 L=[C1,-2*C1+C2,3*C1+C3,C4,C5,C6];
```

```
disp(L,'L=');
R1=L(1,:);
R2=L(2,:);
R3=L(3,:);
K=[R1;R2;-2*R2+R3];
disp(K,'K=');
C1=K(:,1);
C2=K(:,2);
C3=K(:,3);
C4=K(:,4);
C5=K(:,5);
C6=K(:,6);
Q=[C1,C2,-2*C2+C3,C4,C5,C6];
disp(Q,'Q=');
P=[1,-2,7;0,1,-2;0,0,1]
disp(P,'P=');
//D=inv(P)*A*P
D=[1,0,0;0,1,0;0,0,-5];
disp(D,'D=')
```

Chapter 13

Linear Operators on Inner Product Spaces

Scilab code Exa 13.1 `Linear Operator`

```
1 //PG-377
2 // Scilab Version- 6.0.1
3 // Operating System- Window 7
4 clc;
5 close;
6 clear;
7 // (a)
8 disp('(a)');
9 disp('<Au,v>=((Au)^T)v=(u^T)(A^T)v=<u,(A^T)v>');
10 // (b)
11 disp('(b)');
12 disp('<Bu,v>=((Bu)^T)vbar=(u^T)(B^T)vbar=((u^T)(B*))
   bar(vbar)=<u,(B*)v>');
```

Scilab code Exa 13.3 `Operations on Complex Matrix`

```
// PG-383
clc;
close;
clear;
A=[1,1;%i,3+2*%i];
B=A';
C=A*B;
disp(A,'A=');
disp(B,'A*=');
disp(C,'AA*=(A*)A=');
disp('Thus A is the normal');
```

Scilab code Exa 13.4 Diagonal Matrices

```
//PG-384
clc;
close;
clear;
A=[2,0,0,0;0,3,0,0;0,0,3,0;0,0,0,5];
E1=[1,0,0,0;0,0,0,0;0,0,0,0;0,0,0,0];
E2=[0,0,0,0;0,1,0,0;0,0,1,0;0,0,0,0];
E3=[0,0,0,0;0,0,0,0;0,0,0,0;0,0,0,1];
//(i)
A=2*E1+3*E2+5*E3;
// (ii)
I=E1+E2+E3;
// (iii) Ei^2=Ei
// (iv) EiEj=0 for i not equal to j
disp(A,'A=');
disp(I,'I=E1+E2+E3=');
```