Scilab Textbook Companion for
Engineering Economics
by R. Panneerselvam[1]

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

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List of Scilab Codes

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Chapter 1

Introduction

Scilab code Exa 1.1 Break even sales quantity margin of safety

```
1  //Exa1.1
2  clc;
3  clear;
4  close;
5  //given data :
6  FC=2000000;//in Rs
7  v=100;//in Rs
8  s=200;//in Rs
9  Q=60000;//in units
10  //Part a : Break even quantity
11  BEQ=FC/(s-v);//in units
12  disp(BEQ,"Break even quantity in units : ");
13  //Part b : Break even sales
14  BES=FC*s/(s-v);//in Rs
15  disp(BES,"Break even sales in Rs. : ");
16  //Part c : Contribution & margin of safety
17  Con=s*Q-v*Q;//in Rs
18  disp(Con,"Contribution in units : ");
19  Mos=Q*s-BES;//in Rs
20  disp(Mos,"Margin of safety in Rs. : ");
```

Scilab code Exa 1.2 Find contribution profit BEP MS

```
1  //Exa1.2
2  clc;
3  clear;
4  close;
5  //given data :
6  FC=25000;//in Rs
7  v=45000;//in Rs
8  s=120000;//in Rs
9  //Part a : Contribution
10 Con=s-v;//in Rs
11 disp(Con,"Contribution in Rs : ");
12 //Part b : Profit
13 Prof=Con-FC;//in Rs
14 disp(Prof,"Profit in Rs : ");
15 //Part c : BEP
16 PVratio=Con*100/s;//in %
17 BEP=FC*100/PVratio;//in Rs
18 disp(BEP,"BEP in Rs : ");
19 //Part d : M.S.
20 MS=Prof*100/PVratio;//in Rs
21 disp(MS,"M.S. in Rs : ");
```

Scilab code Exa 1.3 Find contribution profit BEP MS

```
1  //Exa1.3
2  clc;
3  clear;
4  close;
5  //given data :
6  FC=15000;//in Rs
```

9

```
7  v=35000;//in Rs
8  s=80000;//in Rs
9  //Part a : Contribution
10 Con=s-v;//in Rs
11 disp(Con,"Contribution in Rs : ");
12 //Part b : Profit
13 Prof=Con-FC;//in Rs
14 disp(Prof,"Profit in Rs : ");
15 //Part c : BEP
16 PVratio=Con*100/s;//in %
17 BEP=FC*100/PVratio;//in Rs
18 disp(round(BEP),"BEP in Rs : ");
19 //Part d : M.S.
20 MS=Prof*100/PVratio;//in Rs
21 disp(round(MS),"M.S. in Rs : ");
```

Chapter 2

Elementary Economic Analysis

Scilab code Exa 2.1 Find Economic advantage

```
1  //Exa2.1
2  clc;
3  clear;
4  close;
5  //Part a : Cost of using aluminium metal for the jet
       engine part
6  //given data :
7  w1=1.2;//in Kg
8  //let c1=cost of making aluminium casting
9  //let c2=cost of machining aluminium casting per
      unit
10 //let Tc=Total cost of jet engine part made of
      aluminium per unit
11 c1=80;//in Rs/Kg
12 c2=150;//in Rs
13 Tc1=c1*w1+c2;//in Rs
14 disp(Tc1,"Total cost of jet engine part made of
      aluminium per unit in Rs : ");
15
16 //Part b : Cost of jet engine part made of steel/
      unit
```

```
17  //given data :
18  w2=1.35;//in Kg
19  //let c1=cost of making steel casting
20  //let c2=cost of machining steel casting per unit
21  //let c3=penalty of excess weight of steel casting
22  //let Tc=Total cost of jet engine part made of steel
         per unit
23  c1=35;//in Rs/Kg
24  c2=170;//in Rs
25  c3=1300;//in Rs/Kg
26  Tc2=c1*w2+c2+c3*(w2-w1);//in Rs
27  disp(Tc2,"Total cost of jet engine part made of
         steel per unit in Rs : ");
28  disp(Tc2-Tc1,"DECISION : The total cost/unit of a
         jet engine part made of aluminium is less than
         that for an engine made of steel. Hence,
         aluminium is suggested for making jet engine part
         . The economic advantage of aluminium over steel
         per unit in Rs : ")
```

Scilab code Exa 2.2 Select best alternative and Find Economic advantage

```
1  //Exa2.2
2  clc;
3  clear;
4  close;
5  //given data for table with wooden top
6  wood=0.1;//in m^3
7  WoodCost=12000;//in Rs/m^3
8  Table=1;//in units
9  TableTopCost=3000;//in Rs/unit
10 LegBushes=4;//units
11 LegBushesCost=10;//Rs/units
12 Nails=100;//in grams
13 NailsCost=300;//in Rs/Kg
```

```scilab
14  TotalLabour =15;//in Hours
15  TotalLabourCost =50;//in Rs/Hours
16  //Part a : Cost of table with wooden top
17  WoodCostframelegs = WoodCost * wood;//in Rs
18  WoodTopCost =3000;//in Rs
19  BushesCost = LegBushesCost * LegBushes;//in Rs
20  NailsCost = Nails * NailsCost /1000;//in Rs
21  LabourCost = TotalLabourCost * TotalLabour;//in Rs
22  TotalCost1 = WoodCostframelegs + WoodTopCost + BushesCost +
        NailsCost + LabourCost;//in Rs
23  disp(TotalCost1 ,"Cost of Table with wooden top in Rs
        : ");
24
25  //given data for table with granite top
26  wood =0.15;//in m^3
27  WoodCost =12000;//in Rs/m^3
28  Granite =1.62;//in m^2
29  GraniteCost =800;//in Rs/m^2
30  LegBushes =4;//units
31  LegBushesCost =25;//Rs/units
32  Nails =50;//in grams
33  NailsCost =300;//in Rs/Kg
34  TotalLabour =8;//in Hours
35  TotalLabourCost =50;//in Rs/Hours
36  //Part b : Cost of table with granite top
37  WoodCostframelegs = WoodCost * wood;//in Rs
38  GraniteTopCost = Granite * GraniteCost;//in Rs
39  BushesCost = LegBushesCost * LegBushes;//in Rs
40  NailsCost = Nails * NailsCost /1000;//in Rs
41  LabourCost = TotalLabourCost * TotalLabour;//in Rs
42  TotalCost2 = WoodCostframelegs + GraniteTopCost +
        BushesCost + NailsCost + LabourCost;//in Rs
43  disp(TotalCost2 ,"Cost of Table with Granite top in
        Rs : ");
44  //Economic Advantage
45  disp(TotalCost1 - TotalCost2 ,"Economic advantage of
        table with granite top in Rs : ")
```

Scilab code Exa 2.3 Find Economic advantage of best alternative

```
1  //Exa2.3
2  clc;
3  clear;
4  close;
5  //given data
6  LatheCost=200;//in Rs/hour
7  grinderCost=150;//in Rs/hour
8  //given data for Design A
9  HoursOfLathe=16;//in hours/1000Unit
10 HoursOfGrinder=4.5;//in hours/1000Unit
11 TotalCostA=LatheCost*HoursOfLathe+grinderCost*
      HoursOfGrinder;//in Rs/1000unit
12 disp(TotalCostA*100000/1000,"Total cost of design A
      per 100,000 units : ");
13
14 //given data for Design B
15 HoursOfLathe=7;//in hours/1000Unit
16 HoursOfGrinder=12;//in hours/1000Unit
17 TotalCostB=LatheCost*HoursOfLathe+grinderCost*
      HoursOfGrinder;//in Rs/1000unit
18 disp(TotalCostB*100000/1000,"Total cost of design A
      per 100,000 units : ");
19 //Economic Advantage
20 disp(TotalCostA*100-TotalCostB*100,"Economic
      advantage of design B over design A per 100,000
      units in Rs : ");
```

Scilab code Exa 2.4 Find optimum tank dimensions and total expected savings

```
1  //Exa2.4
```

```
 2  clc;
 3  clear;
 4  close;
 5  //given data for original design
 6  Tanks=4;//units
 7  TankDia=5.2;//in meter
 8  TankRad=TankDia/2;//in meters
 9  TankHeight=7;//in meters
10  HeightDiaRatio=TankHeight/TankDia;//unitless
11  VolPerTank=(22/7)*TankRad^2*TankHeight;//in m^3
12  //given data for new design
13  disp("Cost of old design = 111% of cost of new
        design(Optimal Design)");
14  disp("Optimal Ratio of height to diameter = 4:1 ");
15  disp("h:d = 4:1");
16  disp("4*d = h");
17  disp("r = h/8");
18  disp("Since volume remains the same, Volume = (22/7)
        *(h/8)^2*h");
19  h=VolPerTank/(22/7)*64;//in meters
20  r=h/8;//in meters
21  d=2*r;//in meters
22  CostNewDesign=900000*(100/111);//in Rs
23  disp(900000-CostNewDesign,"Expected savings by
        redesign in Rs : ");
```

Scilab code Exa 2.5 Find Economic advantage of selection

```
1  //Exa2.5
2  clc;
3  clear;
4  close;
5  distance=2500;//in Km
6  TransCost=1;//in Rs/Kg/100Km
7  //given data for steel window frame
```

```
 8  SteelFramePrice =1000; //in Rs/Unit
 9  SteelFrameWeight =75; //in Kg/Unit
10  TotalCost1 = SteelFramePrice + TransCost *
       SteelFrameWeight * distance /100; //in Rs
11  disp ( TotalCost1 ,"Total  cost  of  steel  window  frame
       per  unit  in  Rs  : ");
12
13  //given  data  for  Aluminium  window  frame
14  AlumilniumFramePrice =1500; //in Rs/Unit
15  AlumilniumFrameWeight =28; //in Kg/Unit
16  TotalCost2 = AlumilniumFramePrice + TransCost *
       AlumilniumFrameWeight * distance /100; //in Rs
17  disp ( TotalCost2 ,"Total  cost  of  Alumilnium  window
       frame  per  unit  in  Rs  : ");
18  disp ( TotalCost1 - TotalCost2 ,"DECISION : The  total
       cost  per  unit  of  the  aluminium  window  frame  is
       less  than  that  of  steel  window  frame . Hence ,
       Alumilnium  window  frame  is  recommended . The
       Economic  advantage  per  unit  of  the  Alumilnium
       window  frame  over  steel  window  frame  in  Rs  :   ")
```

Scilab code Exa 2.6 Find most economical sequence of operations

```
 1  //Exa2 .6
 2  clc ;
 3  clear ;
 4  close ;
 5  //Cost  of  component  using  process  sequence  1
 6  disp ("The  process  sequence  1  of  the  component  is  as
       follows  :  Turning  −  Milling  −  Shaping  −  Drilling"
       ) ;
 7  disp (" Calculations  are  summarized  in  form  of  table
       below  : ");
 8  disp (" Operation       Operation         Time
       Machine  Hour  rate        Cost");
```

16

```scilab
 9  disp ("     No.                              Min      Hour
                  Rs.                  Rs.");
10  disp ("     1                   Turning          5     0.083
                   200              16.60");
11  disp ("     2                   Milling          8     0.133
                   400              53.20");
12  disp ("     3                   Shapiing         10    0.167
                   350              58.45");
13  disp ("     4                   Drilling         3     0.050
                   300              15.00");
14  disp ("

      Total        143.25");
15
16  //Cost of component using process sequence 2
17  disp ("The process sequence 2 of the component is as
        follows : Turning - Milling - Drilling") ;
18  disp ("Calculations are summarized in form of table
        below : ");
19  disp ("Operation       Operation        Time
        Machine Hour rate      Cost");
20  disp ("     No.                              Min      Hour
                  Rs.                  Rs.");
21  disp ("     1                   Turning          5     0.083
                   200              16.60");
22  disp ("     2                   Milling          14    0.233
                   400              93.20");
23  disp ("     4                   Drilling         3     0.050
                   300              15.00");
24  disp ("

      Total        124.80");
25
26  //Cost of component using process sequence 3
27  disp ("The process sequence 3 of the component is as
        follows : Only CNC operations") ;
28  disp ("Calculations are summarized in form of table
        below : ");
```

```
29  disp("Operation      Operation        Time
        Machine Hour rate      Cost");
30  disp("   No.                          Min     Hour
                Rs.                   Rs.");
31  disp("   1               CNC            8     0.133
                1000                   133");
32
33  disp("The process sequence 2 has the least cost.
        Therefore, it should be selected for
        manufacturing the component.")
```

Chapter 3

Interest Formulas and their Applications

Scilab code Exa 3.1 Find maturity value

```
1  //Exa3_1
2  clc;
3  clear;
4  close;
5  //given data is :
6  P=20000;//in rupees
7  n=10;//in years
8  i=18;//% per annum
9  F=P*(1+i/100)^n;
10 disp("Maturity value after 18 years is : "+string(F)
       +" Rupees.");
11 //Note : Ans in the book is not correct.
```

Scilab code Exa 3.2 What is the single payment

```
1  //Exa3_2
```

```
2 clc;
3 clear;
4 close;
5 //given data is :
6 F=100000;//in rupees
7 n=10;//in years
8 i=15;//% per annum
9 P=F/(1+i/100)^n;
10 disp("The person has to invest : "+string(P)+"
     Rupees.");
11 //Note : Ans in the book is not correct.
```

Scilab code Exa 3.3 Find maturity value

```
1 //Exa3_3
2 clc;
3 clear;
4 close;
5 //given data is :
6 A=10000;//in rupees
7 n=25;//in years
8 i=20;//% per annum
9 F=A*(((1+i/100)^n-1)/(i/100));
10 disp("The future sum of the annual equal payment
      after 25 years is : "+string(F)+" Rupees.");
```

Scilab code Exa 3.4 Find Equivalent Amount

```
1 //Exa3_4
2 clc;
3 clear;
4 close;
5 //given data is :
```

```
6  F=500000;//in rupees
7  n=15;//in years
8  i=18;//% per annum
9  A=F*((i/100)/((1+i/100)^n-1));
10 disp("The annual equal ammount which must be
       deposited for 15 years is : "+string(A)+" Rupees.
       ");
```

Scilab code Exa 3.5 Find single payment

```
1  //Exa3_5
2  clc;
3  clear;
4  close;
5  //given data is :
6  A=1000000;//in rupees
7  n=20;//in years
8  i=15;//% per annum
9  P=A*(((1+i/100)^n-1)/((i/100)*(1+i/100)^n));
10 disp("The amount of reserve which must be setup now
       is : "+string(P)+" Rupees.");
11 //Note : Ans in the book is not correct.
```

Scilab code Exa 3.6 Find the installment amount

```
1  //Exa3_6
2  clc;
3  clear;
4  close;
5  //given data is :
6  P=1000000;//in rupees
7  n=15;//in years
8  i=18;//% per annum
```

```
9  A=P*(((i/100)*(1+i/100)^n)/((1+i/100)^n-1));
10 disp("The annual equivalent installment to be paid
      by the company to the bank is : "+string(A)+"
      Rupees.");
```

Scilab code Exa 3.7 Find Total Amount of series

```
1  //Exa3_7
2  clc;
3  clear;
4  close;
5  //given data is :
6  A1=4000;//in rupees
7  G=500;//in rupees
8  n=10;//in years
9  i=15;//% per annum
10 A=A1+G*(((1+i/100)^n-(i/100)*n-1)/((i/100)*(1+i/100)
      ^n-(i/100)));
11 F=A*(((1+i/100)^n-1)/(i/100));
12 disp("At the end of 10th year, the compound amountr
      of all his payments will be : "+string(F)+"
      Rupees.");
```

Scilab code Exa 3.8 Find Total Amount of series

```
1  //Exa3_8
2  clc;
3  clear;
4  close;
5  //given data is :
6  A1=8500;//in rupees
7  G=-500;//in rupees
8  n=10;//in years
```

```
 9  i =15; //% per annum
10  A = A1+G *((( 1+ i /100) ^n -( i /100) *n -1) /(( i /100) *(1+ i /100)
       ^n -( i /100) ) );
11  F = A *((( 1+ i /100) ^n -1) /( i /100) );
12  disp (" At the end of 10 th year , the compound amountr
       of all his payments will be : "+ string (F)+"
       Rupees .");
```

Scilab code Exa 3.9 Find maturity amount

```
 1  // Exa3_9
 2  clc ;
 3  clear ;
 4  close ;
 5  // given data is :
 6  P =5000; // in rupees
 7  n =10; // in years
 8  i =12; //% per annum
 9  m =4; // no . of interest periods per year for quarterly
10  N = n * m ;
11  r = i / m ;
12  F = P *(1+ r /100) ^N ;
13  disp (" Maturity value after 10 years is : "+ string (F)
       +" Rupees .");
```

Chapter 4

Present Worth Method of Comparison

Scilab code Exa 4.1 Suggest Best Technology

```
1  //Exa 4.1
2  clc ;
3  clear ;
4  close ;
5  // Technology 1 :
6  disp ( " Technology 1 : " ) ;
7  P =1200000; // in Rs
8  A =400000; // in Rs
9  i =20; // in % per annum
10 n =10; // in years
11 // Formula : (P/A,i ,n )=(((1+ i /100) ^n ) -1)/(( i /100) *(1+
       i /100) ^n )
12 PW = - P + A *(((1+ i /100) ^n ) -1)/(( i /100) *(1+ i /100) ^n ) ; // in
        RS
13 disp ( PW , " The present worth for this technology in RS
       . : " ) ;
14
15 // Technology 2 :
16 disp ( " Technology 2 : " ) ;
```

24

```
17  P=2000000;//in Rs
18  A=600000;//in Rs
19  i=20;//in % per annum
20  n=10;//in years
21  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
        i/100)^n)
22  PW=-P+A*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in
        RS
23  disp(PW,"The present worth for this technology in RS
        . : ");
24
25  //Technology 3 :
26  disp("Technology 3 : ");
27  P=1800000;//in Rs
28  A=500000;//in Rs
29  i=20;//in % per annum
30  n=10;//in years
31  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
        i/100)^n)
32  PW=-P+A*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in
        RS
33  disp(PW,"The present worth for this technology in RS
        . : ");
34  disp("It is clear from the calculations that the
        present worth of technology 2 is the highest
        among all technologies. Therefore technology 2 is
         suggested for implementation to expand the
        production.");
```

Scilab code Exa 4.2 Determine which bid should be accepted

```
1  //Exa 4.2
2  clc;
3  clear;
4  close;
```

```
5  //Bid 1: Alpha Elevator Inc.
6  disp("Bid 1: Alpha Elevator Inc. ");
7  P=450000;//in Rs
8  A=27000;//in Rs
9  i=15;//in % per annum
10 n=15;//in years
11 //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
      i/100)^n)
12 PW=P+A*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in
      RS
13 disp(PW,"The present worth for this bid in RS. : ");
14
15 //Bid 2: Beta Elevator Inc.
16 disp("Bid 2: Beta Elevator Inc. ");
17 P=540000;//in Rs
18 A=28500;//in Rs
19 i=15;//in % per annum
20 n=15;//in years
21 //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
      i/100)^n)
22 PW=P+A*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in
      RS
23 disp(PW,"The present worth for this bid in RS. : ");
24 disp("The total present worth cost of bid 1 is less
      than that of bid 2. Hence bid 1 is to be selected
       for implementation. That is, the Elevator from
      Alpha Elevator Inc. is to be purchased and
      installed in the new building.");
```

Scilab code Exa 4.3 Which proposal should be selected

```
1  //Exa 4.3
2  clc;
3  clear;
4  close;
```

```
 5 //Investment proposal A :
 6 P1=-10000;//in Rs
 7 P2=3000;//in Rs
 8 P3=3000;//in Rs
 9 P4=7000;//in Rs
10 P5=6000;//in Rs
11 i=18;//in % per annum
12 //Formula : (P/F,i,n) : 1/((1+i/100)^n)
13 PW_A=P1+P2*1/((1+i/100)^1)+P3*1/((1+i/100)^2)+P4
      *1/((1+i/100)^3)+P5*1/((1+i/100)^4);//in RS
14 disp(PW_A,"The present worth of A in RS. : ");
15
16 //Investment proposal B :
17 P1=-10000;//in Rs
18 P2=6000;//in Rs
19 P3=6000;//in Rs
20 P4=3000;//in Rs
21 P5=3000;//in Rs
22 i=18;//in % per annum
23 //Formula : (P/F,i,n) : 1/((1+i/100)^n)
24 PW_B=P1+P2*1/((1+i/100)^1)+P3*1/((1+i/100)^2)+P4
      *1/((1+i/100)^3)+P5*1/((1+i/100)^4);//in RS
25 disp(PW_B,"The present worth of B in RS. : ");
26 disp("At i=18%, the present worth of proposal B is
       higher than that of proposal A. Therefore, select
        proposal B.")
```

Scilab code Exa 4.4 `Suggest Best Alternative`

```
1 //Exa 4.4
2 clc;
3 clear;
4 close;
5 //Alternative 1 :
6 disp("In 1st alternative down payment : Rs.
```

```
      16 ,00 ,000") ;
 7  //Alternative  2 :
 8  P0=400000;//in  Rs
 9  P=200000;//in  Rs
10  i=18;//in  %  per  annum
11  n=10;//in  years
12  //Formula  :  (P/A,i ,n)  :  (((1+i/100)^n)-1)/((i/100)
        *(1+i/100)^n)
13  PW=P0+P*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in
        RS
14  disp(PW,"The  present  worth  of  alternative  2  in  RS.  :
        ") ;
15  disp("The  present  worth  of  2nd  alternative  is  less
        than  that  of  first  one  i.e.,  complete  downpayment
        of  Rs.  1600000.  Hence,  select  2nd  alternative.")
        ;
```

Scilab code Exa 4.5 Select best Investment Plan

```
 1  //Exa  4.5
 2  clc ;
 3  clear ;
 4  close ;
 5  //Plan  1 :
 6  P0=-1000;//in  Rs
 7  P=12000;//in  Rs
 8  i=12;//in  %  per  annum
 9  n=15;//in  years
10  //Formula  :  (P/F,i ,n)  :  1/((1+i/100)^n)
11  PW1=P0+P*1/((1+i/100)^n);//in  RS
12  disp(PW1,"The  present  worth  of  Plan-1  in  RS.  :  ");
13
14  //Plan  2 :
15  P0=-1000;//in  Rs
16  P=4000;//in  Rs
```

```
17  i=12; //in % per annum
18  n1=10; //in years
19  n2=15; //in years
20  //Formula : (P/F,i,n) : 1/((1+i/100)^n)
21  PW2=P0+P*1/((1+i/100)^n1)++P*1/((1+i/100)^n2); //in
        RS
22  disp(PW2,"The present worth of Plan-2 in RS. : ");
23  disp("The present worth of Plan-1 is more than that
        of Plan-1. Therefore plan 1 is the best plan from
         the investors point of view.");
```

Scilab code Exa 4.6 Find Best Investment Alternative

```
1   //Exa 4.6
2   clc;
3   clear;
4   close;
5   //Novel Investment Ltd. Plan :
6   P0=-10000; //in Rs
7   P=800000; //in Rs
8   i=12; //in % per annum
9   n=20; //in years
10  //Formula : (P/F,i,n) : 1/((1+i/100)^n)
11  //Formula : (P/A,i,n) : (((1+i/100)^n)-1)/((i/100)
        *(1+i/100)^n)
12  PW1=P0*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n)+P
        *1/((1+i/100)^n); //in RS
13  disp(PW1,"The present worth of Plan-1 in RS. : ");
14
15  //Innovative Investment Ltd. Plan :
16  P0=-10000; //in Rs
17  P=1500000; //in Rs
18  i=12; //in % per annum
19  n1=20; //in years
20  n2=25; //in years
```

```
21  //Formula :  (P/F,i,n) :  1/((1+i/100)^n)
22  PW2=P0*(((1+i/100)^n1)-1)/((i/100)*(1+i/100)^n1)+P
       *1/((1+i/100)^n2);//in RS
23  disp(PW2,"The present worth of Plan-1 in RS. : ");
24  disp("The present worth of Innovative Investment Ltd
       . Plan is more than that of Novel Investment Ltd.
        Plan. Therefore Innovative Investment Ltd. Plan
       is the best plan from the investors point of view
       .");
```

Scilab code Exa 4.7 Find Present Worth of Business

```
 1  //Exa 4.7
 2  clc;
 3  clear;
 4  close;
 5  //Given data :
 6  P=12000;//in Rs
 7  A1=10000;//in Rs
 8  G=1000;//in Rs
 9  i=18;//in % per annum
10  n=10;//in years
11  //Formula :  (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
       i/100)^n)
12  //Formula :  (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
13  PW=-P+(A1+G*(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i
       /100)^n)-i/100))*(((1+i/100)^n)-1)/((i/100)*(1+i
       /100)^n);//in RS
14  disp(PW,"The present worth of the small business in
       RS. : ");
```

Chapter 5

Future Worth Method

Scilab code Exa 5.1 Select best alternative

```
1  //Exa 5.1
2  clc;
3  clear;
4  close;
5  //Alternative A :
6  disp("Alternative A : ");
7  P=5000000;//in Rs
8  A=2000000;//in Rs
9  i=18;//in % per annum
10 n=4;//in years
11 //Formula : (F/P,i,n) : (1+i/100)^n
12 //Formula : (F/A,i,n) : (((1+i/100)^n)-1)/(i/100)
13 FW_A=(-P*(1+i/100)^n)+(A*(((1+i/100)^n)-1)/(i/100));
        //in RS
14 disp(FW_A,"The future worth amount of alternative A
        in RS. : ");
15
16 //Alternative B :
17 disp("Alternative B : ");
18 P=4500000;//in Rs
19 A=1800000;//in Rs
```

```
20  i =18;//in % per annum
21  n =4;//in years
22  //Formula : (F/P,i,n) : (1+i/100)^n
23  //Formula : (F/A,i,n) : (((1+i/100)^n)−1)/(i/100)
24  FW_B=(-P*(1+i/100)^n)+(A*(((1+i/100)^n)-1)/(i/100));
       //in RS
25  disp(FW_B,"The future worth amount of alternative B
       in RS. : ");
26  disp("The future worth of alternative A is greater
       than that of alternative B. Thus, alternative A
       should be selected.");
27  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 5.2 Evaluate the alternatives based on future worth method

```
 1  //Exa 5.2
 2  clc;
 3  clear;
 4  close;
 5  //Alternative 1 :
 6  disp("Alternative 1: ");
 7  FC=2000000;//in Rs
 8  AI=800000;//in Rs
 9  ATax=80000;//in Rs
10  NetAI=AI-ATax;//in Rs
11
12  i=12;//in % per annum
13  n=20;//in years
14  //Formula : (F/P,i,n) : (1+i/100)^n
15  //Formula : (F/A,i,n) : (((1+i/100)^n)−1)/(i/100)
16  FW_1=(-FC*(1+i/100)^n)+(NetAI*(((1+i/100)^n)-1)/(i
       /100));//in RS
17  disp(FW_1,"The future worth amount of alternative 1
       in RS. : ");
18
```

```
19 //Alternative 2 :
20 disp (" Alternative 2: ");
21 FC =3600000; // in Rs
22 AI =980000; // in Rs
23 ATax =150000; // in Rs
24 NetAI = AI - ATax ; // in Rs
25
26 i =12; // in % per annum
27 n =20; // in years
28 //Formula : (F/P,i ,n) : (1+i/100)^n
29 //Formula : (F/A,i ,n) : (((1+i/100)^n)−1)/(i/100)
30 FW_2 =( - FC *(1+ i /100) ^n )+( NetAI *(((1+ i /100) ^n ) -1) /( i
      /100) ); // in RS
31 disp ( FW_2 ," The future worth amount of alternative 2
      in RS . : " );
32 disp (" The future worth of alternative 1 is greater
      than that of alternative 2. Thus , building the
      gas station is the best alternative . ");
33 //Note : Calculation in the book is not accurate .
```

Scilab code Exa 5.3 Select best alternative

```
1 //Exa 5.3
2 clc ;
3 clear ;
4 close ;
5 //Evaluation at i=8%
6 disp (" Evaluation at i =8%" );
7 //Alternative 1 :
8 disp (" Alternative 1 : " );
9 P =500000; // in Rs
10 A1 =50000; // in Rs
11 G =50000; // in Rs
12 i =8; // in % per annum
13 n =6; // in years
```

```
14  //Formula :  (F/P,i,n) :  (1+i/100)^n
15  //Formula :  (F/A,i,n) :  (((1+i/100)^n)-1)/(i/100)
16  //Formula :  (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
17  FW_1=(-P*(1+i/100)^n)+(A1+G*(((1+i/100)^n)-i*n
       /100-1)/(((i/100)*(1+i/100)^n)-i/100))*(((1+i
       /100)^n)-1)/(i/100);//in RS
18  disp(FW_1,"The future worth amount of alternative 1
       in RS. : ");
19
20  //Alternative 2 :
21  disp("Alternative 2 : ");
22  P=700000;//in Rs
23  A1=70000;//in Rs
24  G=70000;//in Rs
25  i=8;//in % per annum
26  n=6;//in years
27  //Formula :  (F/P,i,n) :  (1+i/100)^n
28  //Formula :  (F/A,i,n) :  (((1+i/100)^n)-1)/(i/100)
29  //Formula :  (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
30  FW_2=(-P*(1+i/100)^n)+(A1+G*(((1+i/100)^n)-i*n
       /100-1)/(((i/100)*(1+i/100)^n)-i/100))*(((1+i
       /100)^n)-1)/(i/100);//in RS
31  disp(FW_2,"The future worth amount of alternative 2
       in RS. : ");
32  disp("The future worth of alternative 2 is greater
       than that of alternative 1. Thus, alternative 2
       must be selected.");
33
34  //Evaluation at i=9%
35  disp("Evaluation at i=9%");
36  //Alternative 1 :
37  disp("Alternative 1 : ");
38  P=500000;//in Rs
39  A1=50000;//in Rs
40  G=50000;//in Rs
41  i=9;//in % per annum
```

```
42  n=6;//in years
43  //Formula :  (F/P,i,n)  :  (1+i/100)^n
44  //Formula :  (F/A,i,n)  :  (((1+i/100)^n)-1)/(i/100)
45  //Formula :  (A/G,i,n)  :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
46  FW_1=(-P*(1+i/100)^n)+(A1+G*(((1+i/100)^n)-i*n
       /100-1)/(((i/100)*(1+i/100)^n)-i/100))*(((1+i
       /100)^n)-1)/(i/100);//in RS
47  disp(FW_1,"The future worth amount of alternative 1
       in RS. : ");
48
49  //Alternative 2 :
50  disp("Alternative 2 : ");
51  P=700000;//in Rs
52  A1=70000;//in Rs
53  G=70000;//in Rs
54  i=9;//in % per annum
55  n=6;//in years
56  //Formula :  (F/P,i,n)  :  (1+i/100)^n
57  //Formula :  (F/A,i,n)  :  (((1+i/100)^n)-1)/(i/100)
58  //Formula :  (A/G,i,n)  :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
59  FW_2=(-P*(1+i/100)^n)+(A1+G*(((1+i/100)^n)-i*n
       /100-1)/(((i/100)*(1+i/100)^n)-i/100))*(((1+i
       /100)^n)-1)/(i/100);//in RS
60  disp(FW_2,"The future worth amount of alternative 2
       in RS. : ");
61  disp("The future worth of alternative 2 is greater
       than that of alternative 1. Thus, alternative 2
       must be selected.");
62
63  //Evaluation at i=20%
64  disp("Evaluation at i=20%");
65  //Alternative 1 :
66  disp("Alternative 1 : ");
67  P=500000;//in Rs
68  A1=50000;//in Rs
69  G=50000;//in Rs
```

35

```
70  i=20;//in % per annum
71  n=6;//in years
72  //Formula : (F/P,i,n) : (1+i/100)^n
73  //Formula : (F/A,i,n) : (((1+i/100)^n)−1)/(i/100)
74  //Formula : (A/G,i,n) :(((1+i/100)^n)−i*n/100−1)/(((
       i/100)*(1+i/100)^n)−i/100)
75  FW_1=(-P*(1+i/100)^n)+(A1+G*(((1+i/100)^n)-i*n
       /100-1)/(((i/100)*(1+i/100)^n)-i/100))*(((1+i
       /100)^n)-1)/(i/100);//in RS
76  disp(FW_1,"The future worth amount of alternative 1
       in RS. : ");
77
78  //Alternative 2 :
79  disp("Alternative 2 : ");
80  P=700000;//in Rs
81  A1=70000;//in Rs
82  G=70000;//in Rs
83  i=20;//in % per annum
84  n=6;//in years
85  //Formula : (F/P,i,n) : (1+i/100)^n
86  //Formula : (F/A,i,n) : (((1+i/100)^n)−1)/(i/100)
87  //Formula : (A/G,i,n) :(((1+i/100)^n)−i*n/100−1)/(((
       i/100)*(1+i/100)^n)−i/100)
88  FW_2=(-P*(1+i/100)^n)+(A1+G*(((1+i/100)^n)-i*n
       /100-1)/(((i/100)*(1+i/100)^n)-i/100))*(((1+i
       /100)^n)-1)/(i/100);//in RS
89  disp(FW_2,"The future worth amount of alternative 2
       in RS. : ");
90  disp("The negative sign of alternatives future worth
        indicates that alternative 2 incurs loss. Thus,
       none of the two alternatives should be selected.
       ");
91  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 5.4 Find Best Alternative

```scilab
1  //Exa 5.4
2  clc;
3  clear;
4  close;
5  //Alternative 1 :
6  disp("Alternative 1 :");
7  P=8000000;//in Rs
8  A=800000;//in Rs
9  i=20;//in % per annum
10 n=12;//in years
11 Salvage=500000;//in Rs
12 //Formula : (1+i/100)^n
13 //Formula : (F/A,i,n) : (((1+i/100)^n)-1)/(i/100)
14 FW1=P*(1+i/100)^n+A*(((1+i/100)^n)-1)/(i/100)-
       Salvage;//in RS
15 disp(FW1,"The future worth for this alternative in
       RS. : ");
16
17 //Alternative 2 :
18 disp("Alternative 2 :");
19 P=7000000;//in Rs
20 A=900000;//in Rs
21 i=20;//in % per annum
22 n=12;//in years
23 Salvage=400000;//in Rs
24 //Formula : (1+i/100)^n
25 //Formula : (F/A,i,n) : (((1+i/100)^n)-1)/(i/100)
26 FW2=P*(1+i/100)^n+A*(((1+i/100)^n)-1)/(i/100)-
       Salvage;//in RS
27 disp(FW2,"The future worth for this alternative in
       RS. : ");
28
29 //Alternative 3 :
30 disp("Alternative 3 :");
31 P=9000000;//in Rs
32 A=850000;//in Rs
33 i=20;//in % per annum
34 n=12;//in years
```

```
35  Salvage =700000; //in Rs
36  //Formula :  (1+i/100)^n
37  //Formula :  (F/A,i,n) :  (((1+i/100)^n)−1)/(i/100)
38  FW3=P*(1+i/100)^n+A*(((1+i/100)^n)-1)/(i/100)-
       Salvage; //in RS
39  disp (FW3 ,"The future worth for this alternative in
       RS. : ");
40  disp ("The future worth of alternative 2 is less than
        that of other two alternatives. Thus, Ms.
       Krishna castings should buy the annealing furnace
        from manufacturer 2.");
41  //Note :  Calculation in the book is not accurate.
```

Scilab code Exa 5.5 Which Machine should be selected

```
 1  //Exa 5.5
 2  clc;
 3  clear;
 4  close;
 5  //Machine A :
 6  disp ("Machine A: ");
 7  P=400000; //in Rs
 8  A=40000; //in Rs
 9  S=200000; //in Rs
10  i=12; //in % per annum
11  n=4; //in years
12  //Formula :  (F/P,i,n) :  (1+i/100)^n
13  //Formula :  (F/A,i,n) :  (((1+i/100)^n)−1)/(i/100)
14  FW_A=(P*(1+i/100)^n)+(A*(((1+i/100)^n)-1)/(i/100))-S
       ; //in RS
15  disp (FW_A ,"The future worth amount of Machine A in
       RS. : ");
16
17  //Machine B :
18  disp ("Machine AB: ");
```

```
19  P=800000;//in Rs
20  A=0;//in Rs
21  S=550000;//in Rs
22  i=12;//in % per annum
23  n=4;//in years
24  //Formula : (F/P,i,n) : (1+i/100)^n
25  //Formula : (F/A,i,n) : (((1+i/100)^n)-1)/(i/100)
26  FW_B=(P*(1+i/100)^n)+(A*(((1+i/100)^n)-1)/(i/100))-S
       ;//in RS
27  disp(FW_B,"The future worth amount of Machine B in
       RS. : ");
28  disp("The future worth of Machine A is less than
       that of Machine B. Thus, Machine A should be
       selected.");
29  //Note : Calculation in the book is not accurate.
```

Chapter 6

Annual Equivalent Method

Scilab code Exa 6.1 Decision to provide rental car to Executive

```
1 //Exa 6.1
2 clc;
3 clear;
4 close;
5 //GIVEN DATA :
6 disp("Average No. of Km run/year = 20000 Km");
7 disp("No. of Km/litre of petrol = 9 Km");
8 disp("Therefore,");
9 disp("Petrol consumption/year = 20000/9 = 2222.2
    litre");
10 disp("Cost/litre of petrol for the 1st year = Rs. 21
    ");
11 disp("Cost/litre of petrol for the 2nd year = Rs. 21
    + Re. 1 = Rs. 22 ");
12 disp("Cost/litre of petrol for the 3rd year = Rs. 22
    + Re. 1 = Rs. 23 ");
13 disp("Cost/litre of petrol for the 4th year = Rs. 23
    + Re. 1 = Rs. 24 ");
14
15 disp("Fuel expenditure for 1st year = 2222.2 * 21 =
    Rs. 46666.20");
```

```
16  disp("Fuel  expenditure  for  2nd  year  =  2222.2  ∗  22  =
        Rs.  48888.40");
17  disp("Fuel  expenditure  for  3rd  year  =  2222.2  ∗  23  =
        Rs.  51110.60");
18  disp("Fuel  expenditure  for  4th  year  =  2222.2  ∗  24  =
        Rs.  53332.80");
19  disp("The  annual  equal  increment  of  the  above
        expendiyure  is  Rs.  2222.20(G)");
20
21  A1=46666.20;//in  Rs.
22  G=2222.20;//in  Rs.
23  i=18;//in  %  per  annum
24  n=4;//in  years
25  A=A1+G*(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i/100)
        ^n)-i/100)  ;
26  disp(A,"Annual  equal  amount  spending  for  petrol  in
        Rs.  :  ");
27  disp("This  amoount  is  less  than  the  annual  rental
        value  of  Rs.  60000.  Therefore ,  the  company  should
         continue  to  provide  its  own  car  to  its  executive
        .  ");
```

Scilab code Exa 6.2 `Determine Best Alternative`

```
1  //Exa  6.2
2  clc ;
3  clear ;
4  close ;
5  //Alternative  1  :
6  disp("Alternative  1:  ");
7  P=500000;//in  Rs
8  A=200000;//in  Rs
9  i=20;//in  %  per  annum
10 n=15;//in  years
11 //Formula  :  (A/P,i ,n)  :  ((i/100)*(1+i/100)^n)/(((1+i
```

```
        /100)^n)-1)
12  AE_1=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+A;// 
        in RS
13  disp(AE_1,"The Annual equivalent cost of alternative 
        1 in RS. : ");
14
15  //Alternative 2 :
16  disp(" Alternative 2: ");
17  P=400000;//in Rs
18  A=300000;//in Rs
19  i=20;//in % per annum
20  n=15;//in years
21  //Formula :  (A/P,i,n) :  ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
22  AE_2=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+A;// 
        in RS
23  disp(AE_2,"The Annual equivalent cost of alternative 
        1 in RS. : ");
24
25  //Alternative 3 :
26  disp(" Alternative 3: ");
27  P=600000;//in Rs
28  A=150000;//in Rs
29  i=20;//in % per annum
30  n=15;//in years
31  //Formula :  (A/P,i,n) :  ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
32  AE_3=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+A;// 
        in RS
33  disp(AE_3,"The Annual equivalent cost of alternative 
        1 in RS. : ");
34  disp("The annual equivalent cost of manufacturer 3 
        is less than that of other two. Therefore , 
        company should buy advanced machine centre from 
        manufacturer 3. ");
35  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.3 Determine Best Alternative

```
1  //Exa 6.3
2  clc;
3  clear;
4  close;
5  //Alternative A :
6  disp("Alternative A: ");
7  P=150000;//in Rs
8  A=60000;//in Rs
9  S=15000;//in Rs
10 i=25;//in % per annum
11 n=5;//in years
12 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
13 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
14 AE_A=-P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+A+S
      *(i/100)/(((1+i/100)^n)-1);//in RS
15 disp(AE_A,"The Annual equivalent revenue of
      alternative A in RS. : ");
16 //Alternative B :
17 disp("Alternative B: ");
18 P=175000;//in Rs
19 A=70000;//in Rs
20 S=35000;//in Rs
21 i=25;//in % per annum
22 n=5;//in years
23 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
24 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
25 AE_B=-P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+A+S
      *(i/100)/(((1+i/100)^n)-1);//in RS
26 disp(AE_B,"The Annual equivalent revenue of
      alternative A in RS. : ");
```

```
27  disp("The annual equivalent net return of
        alternative B is more than that of alternative A.
         Thus the company should select alternative A");
28  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.4 Which Machine would you choose

```
1  //Exa 6.4
2  clc;
3  clear;
4  close;
5  //Machine X :
6  disp("Machine X : ");
7  P=150000;//in Rs
8  A=0;//in Rs
9  S=0;//in Rs
10 i=15;//in % per annum
11 n=12;//in years
12 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
13 AE_X=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);//in
       RS
14 disp(AE_X,"The Annual equivalent cost of machine X
       in RS. : ");
15
16 //Machine Y :
17 disp("Machine Y : ");
18 P=240000;//in Rs
19 A=4500;//in Rs
20 S=60000;//in Rs
21 i=15;//in % per annum
22 n=12;//in years
23 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
24 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
```

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```
25  AE_Y=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+A-S*(
       i/100)/(((1+i/100)^n)-1);//in RS
26  disp(AE_Y,"The Annual equivalent cost of machine X
       in RS. : ");
27  disp("The annual equivalent cost of machine X is
       less than that of machine Y.So machine X is more
       cost effective machine. ");
28  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.5 Should Power Line routed around or over the lake

```
 1  //Exa 6.5
 2  clc;
 3  clear;
 4  close;
 5  //Alternative 1 : Around the lake
 6  disp("Alternative 1 : Around the lake");
 7  FC=15*150000;//in Rs
 8  MC=15*6000;//in Rs
 9  PL=15*15000;//in Rs
10  MCPL=MC+PL;//in Rs
11  S=15*90000;//in Rs
12  i=15;//in % per annum
13  n=15;//in years
14  //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
15  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
16  AE1=FC*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+MCPL-
       S*(i/100)/(((1+i/100)^n)-1);//in RS
17  disp(AE1,"The Annual equivalent cost for this
       alternative in RS. : ");
18
19  //Alternative 1 : Under the lake
20  FC=5*750000;//in Rs
21  MC=5*12000;//in Rs
```

```
22  PL=5*15000;//in Rs
23  MCPL=MC+PL;//in Rs
24  S=5*150000;//in Rs
25  i=15;//in % per annum
26  n=15;//in years
27  //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
28  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
29  AE2=FC*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+MCPL-
       S*(i/100)/(((1+i/100)^n)-1);//in RS
30  disp(AE2,"The Annual equivalent cost for this
       alternative in RS. : ");
31  disp("The annual equivalent cost of alternative 1 is
        less than that of alternative 2. Therefore,
       select the route around the lake for laying the
       power line.");
32  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.6 Determine the more economical choice

```
 1  //Exa 6.6
 2  clc;
 3  clear;
 4  close;
 5  //Alternative 1 : Purchase of diesel Taxi
 6  disp("Alternative 1 : Purchase of diesel Taxi");
 7  VC=390000;//in Rs
 8  LpY=60000/30;//in litres
 9  FcY=2000*8;//in Rs
10  AllExp=FcY+9000+15000;//in Rs
11  S=60000;//in Rs
12  i=20;//in % per annum
13  n=4;//in years
14  //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
15  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
```

```
       /100)^n)-1)
16  AE1=VC*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+
       AllExp-S*(i/100)/(((1+i/100)^n)-1);//in RS
17  disp(AE1,"The Annual equivalent cost for this
       alternative in RS. : ");
18
19  //Alternative 2 : Purchase of petrol Taxi
20  disp("Alternative 2 : Purchase of petrol Taxi");
21  VC=360000;//in Rs
22  LpY=60000/20;//in litres
23  FcY=3000*20;//in Rs
24  AllExp=FcY+6000+15000;//in Rs
25  S=90000;//in Rs
26  i=20;//in % per annum
27  n=3;//in years
28  //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
29  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
30  AE2=VC*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+
       AllExp-S*(i/100)/(((1+i/100)^n)-1);//in RS
31  disp(AE2,"The Annual equivalent cost for this
       alternative in RS. : ");
32  disp("The annual equivalent cost of purchase and
       operation of cars with diesel engine is less than
        that of cars with petrol engine. Therefore, the
       taxy company should buy cars with diesel engine."
       );
33  //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.7 Determine Which Alternative to Select

```
1  //Exa 6.7
2  clc;
3  clear;
4  close;
```

```
5 //Alternative 1 : Purchase car for cash
6 disp("Alternative 1 : Purchase car for cash");
7 Pprice=390000;//in Rs
8 n=3;//in years
9 n=n*12;//in months
10 S=120000;//in Rs
11 i=12;//in % nominal rate(Compounded anually)
12 i=i/12;//in % compounded monthly
13 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
14 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
15 ME1=Pprice*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)-S
      *(i/100)/(((1+i/100)^n)-1);//in RS
16 disp(ME1,"The Monthly equivalent cost for this
      alternative in RS. : ");
17
18 //Alternative 2 : Use of car under lease
19 disp("Alternative 2 : Use of car under lease");
20 LeaseAmount=10500;//in Rs
21 MonthlyEquiCost=LeaseAmount;//in Rs.
22 disp(MonthlyEquiCost,"The Monthly equivalent cost
      for this alternative in RS. : ");
23 disp("The monthly equivalent cost of alternative 1
      is less than that of alternative 2. hence the
      salesman should purchase the car for cash.")
```

Scilab code Exa 6.8 Which Machine should be purchased

```
1 //Exa 6.8
2 clc;
3 clear;
4 close;
5 //Machine A :
6 disp("Machine A : ");
7 IC=300000;//in Rs
```

```
8  n=4;//in years
9  S=200000;//in Rs
10 AM=30000;//in Rs
11 i=15;//in % per annum
12 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
13 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
     /100)^n)-1)
14 AE_A=IC*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+AM-S
     *(i/100)/(((1+i/100)^n)-1);//in RS
15 disp(AE_A,"The Annual equivalent cost of machine X
     in RS. : ");
16
17 //Machine B :
18 disp("Machine B : ");
19 IC=600000;//in Rs
20 n=4;//in years
21 S=300000;//in Rs
22 AM=0;//in Rs
23 i=15;//in % per annum
24 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
25 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
     /100)^n)-1)
26 AE_B=IC*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+AM-S
     *(i/100)/(((1+i/100)^n)-1);//in RS
27 disp(AE_B,"The Annual equivalent cost of machine X
     in RS. : ");
28 disp("The annual equivalent cost of machine A is
     less than that of machine B.So machine A is more
     cost effective machine. It is advised to buy
     machine A ");
29 //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.9 Determine Best Alternative for Lakshimi

```
1 //Exa 6.9
```

```scilab
2  clc;
3  clear;
4  close;
5  //Alternative 1 :
6  disp("Alternative 1 : ");
7  DP=60000;//in Rs
8  P1=15000;//in Rs
9  n=1;//in years
10 i=12;//in % Compounded anually
11 //Formula : (P/F,i,n) : 1/((1+i/100)^n)
12 PW1=DP+P1*1/((1+i/100)^n);//in RS
13 disp(PW1,"The annual equivalent for this alternative
       in RS. : ");
14 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
15 n=4;//in years
16 AE1=PW1*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
17 disp(AE1,"The annual equivalent for this alternative
       in RS. : ");
18
19 //Alternative 2 :
20 disp("Alternative 2 : ");
21 P4y=90000;//in Rs
22 AE2=P4y*(i/100)/(((1+i/100)^n)-1);//in Rs.
23 disp(AE2,"The annual equivalent for this alternative
       in RS. : ");
24 disp("The annual equivalent cost of alternative 2 is
        less than that of alternative 1. Hence, Joshi
      Lakshimi should select alternative 2 for
      purchasing the home equipment.");
25 //Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.10 Which tyre should be buy

```scilab
1  //Exa 6.10
```

```
2  clc;
3  clear;
4  close;
5  //Brand A :
6  disp("Brand A : ");
7  w=12;//in months
8  P=1200;//in Rs/tyre
9  i=12;//in % nominal rate(Compounded anually)
10 i=i/12;//in % compounded monthly
11 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
12 AE_A=P*((i/100)*(1+i/100)^w)/(((1+i/100)^w)-1);//in
      RS
13 disp(AE_A,"The annual equivalent for this brand in
      RS. : ");
14
15 //Brand B :
16 disp("Brand B : ");
17 w=24;//in months
18 P=1800;//in Rs/tyre
19 i=12;//in % nominal rate(Compounded anually)
20 i=i/12;//in % compounded monthly
21 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
22 AE_B=P*((i/100)*(1+i/100)^w)/(((1+i/100)^w)-1);//in
      RS
23 disp(AE_B,"The annual equivalent for this brand in
      RS. : ");
24
25 //Brand C :
26 disp("Brand C : ");
27 w=36;//in months
28 P=2100;//in Rs/tyre
29 i=12;//in % nominal rate(Compounded anually)
30 i=i/12;//in % compounded monthly
31 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
32 AE_C=P*((i/100)*(1+i/100)^w)/(((1+i/100)^w)-1);//in
```

```
           RS
33  disp ( AE_C ,"The  annual  equivalent  for  this  brand  in
          RS .  :  " ) ;
34
35  // Brand  D  :
36  disp ("Brand  D  :  " ) ;
37  w =48; // in  months
38  P =2700; // in  Rs / tyre
39  i =12; // in  %  nominal  rate ( Compounded  anually )
40  i = i /12; // in  %  compounded  monthly
41  // Formula  :  (A/P, i ,n)  :  (( i /100) *(1+ i /100) ^n ) /(((1+ i
          /100) ^n ) −1)
42  AE_D = P *(( i /100) *(1+ i /100) ^w ) /(((1+ i /100) ^w ) -1) ; // in
          RS
43  disp ( AE_D ,"The  annual  equivalent  for  this  brand  in
          RS .  :  " ) ;
44
45  disp ("Here  common  multiple  lives  of  tyres  is
          considered .  This  is  144  months .  Therefore ,  the
          comparison  is  nade  on  144  months  basis ." ) ;
46  disp ("The  annual  equivalent  cost  of  Brand  C  is  less
          than  that  of  other  brands .  hence ,  it  should  be
          used  in  the  vehicles  of  the  trucking  company .  It
          should  be  replaced   for  times  during  the  144
          months  period ." ) ;
```

Chapter 7

Rate of Return Method

Scilab code Exa 7.1 Find the Rate of Return

```
1  //Exa 7.1
2  clc ;
3  clear ;
4  close ;
5  //Given data :
6  Ii =100000; //in Rs
7  Ar =30000; //in Rs
8  n =5; //in years
9  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
       i/100)^n)
10 // when i=10 %
11 i1 =10; //in % per annum
12 PW1 =-Ii+Ar*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^n
       ); //in RS
13 disp(PW1,"The present worth for i=10% in RS. : ");
14 // when i=15 %
15 i2 =15; //in % per annum
16 PW2 =-Ii+Ar*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^n
       ); //in RS
17 disp(PW2,"The present worth for i=15% in RS. : ");
18 // when i=18 %
```

53

```
19  i3=18;//in % per annum
20  PW3=-Ii+Ar*(((1+i3/100)^n)-1)/((i3/100)*(1+i3/100)^n
       );//in RS
21  disp(PW3,"The present worth for i=18% in RS. : ");
22  disp("Present worth for i=15% is suitable.");
23  i=15+(PW2-0)*(i3-i2)/(PW2-PW3);//in Rs.
24  disp(i,"Therefore, the rate of return for the new
       business in % per annum :");
```

Scilab code Exa 7.2 Find the Rate of Return

```
1  //Exa 7.2
2  clc;
3  clear;
4  close;
5  //Given data :
6  Io=2000000;//in Rs
7  ANP=350000;//in Rs
8  S=0;//in Rs
9  n=10;//in years
10  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
       i/100)^n)
11  // when i=10 %
12  i1=10;//in % per annum
13  PW1=-Io+ANP*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^
       n);//in RS
14  disp(PW1,"The present worth for i=10% in RS. : ");
15  // when i=12 %
16  i2=12;//in % per annum
17  PW2=-Io+ANP*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^
       n);//in RS
18  disp(PW2,"The present worth for i=15% in RS. : ");
19  disp("Present worth for i=10% is suitable.");
20  i=10+(PW1-0)*(i2-i1)/(PW1-PW2);//in Rs.
21  disp(i,"Therefore, the rate of return of the new
```

Scilab code Exa 7.3 Find Best Alternative based on Rat of Return method

```
1  //Exa 7.3
2  clc;
3  clear;
4  close;
5  //Alternative 1:
6  disp("Alternative 1:");
7  Io=150000;//in Rs
8  Ap=45570;//in Rs
9  n=5;//in years
10 //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
      i/100)^n)
11 // when i=10 %
12 i1=10;//in % per annum
13 PW1=-Io+Ap*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^n
      );//in RS
14 disp(PW1,"The present worth for i=10% in RS. : ");
15 // when i=12 %
16 i2=12;//in % per annum
17 PW2=-Io+Ap*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^n
      );//in RS
18 disp(PW2,"The present worth for i=10% in RS. : ");
19 // when i=15 %
20 i3=15;//in % per annum
21 PW3=-Io+Ap*(((1+i3/100)^n)-1)/((i3/100)*(1+i3/100)^n
      );//in RS
22 disp(PW3,"The present worth for i=10% in RS. : ");
23 // when i=18 %
24 i4=18;//in % per annum
25 PW4=-Io+Ap*(((1+i4/100)^n)-1)/((i4/100)*(1+i4/100)^n
      );//in RS
26 disp(PW4,"The present worth for i=10% in RS. : ");
```

```
27  disp("Present worth for i=15% is suitable.");
28  i=i3+(PW3-0)*(i4-i3)/(PW3-PW4);//in Rs.
29  disp(i,"Therefore, the rate of return of alternative
        in % per annum :");
30
31  //Alternative 2:
32  disp("Alternative 2:");
33  Io=210000;//in Rs
34  Ap=58260;//in Rs
35  n=5;//in years
36  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
        i/100)^n)
37  // when i=12 %
38  i1=12;//in % per annum
39  PW1=-Io+Ap*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^n
        );//in RS
40  disp(PW1,"The present worth for i=12% in RS. : ");
41  // when i=13 %
42  i2=13;//in % per annum
43  PW2=-Io+Ap*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^n
        );//in RS
44  disp(PW2,"The present worth for i=13% in RS. : ");
45  disp("Present worth for i=12% is suitable.");
46  i=i1+(PW1-0)*(i2-i1)/(PW1-PW2);//in Rs.
47  disp(i,"Therefore, the rate of return of alternative
        2 in % per annum :");
48
49  //Alternative 3:
50  disp("Alternative 3:");
51  Io=255000;//in Rs
52  Ap=69000;//in Rs
53  n=5;//in years
54  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
        i/100)^n)
55  // when i=11 %
56  i1=11;//in % per annum
57  PW1=-Io+Ap*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^n
        );//in RS
```

```
58  disp(PW1,"The present worth for i=11% in RS. : ");
59  // when i=12 %
60  i2=12;//in % per annum
61  PW2=-Io+Ap*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^n
        );//in RS
62  disp(PW2,"The present worth for i=12% in RS. : ");
63  disp("Present worth for i=11% is suitable.");
64  i=i1+(PW1-0)*(i2-i1)/(PW1-PW2);//in Rs.
65  disp(i,"Therefore, the rate of return of the
        alternative 3 in % per annum :");
66  disp("");
67  disp("It is clear that rate of return for
        alternative 3v is less than the minimum
        attractive rate of return of 12 %. So it should
        not be considered for comparison. the remaining
        two alternatives are qualified for consideration.
         Among the alternatives 1 and 2, the rate of
        return of 1 is greater than that of 2. ence,
                alternative 1 should be selected. ");
```

Scilab code Exa 7.4 `Compute Rate of Return`

```
1   //Exa 7.4
2   clc;
3   clear;
4   close;
5   //Given data
6   A0=-1275;//in Rs
7   A1=150;//in Rs
8   G=150;//in Rs
9   i=10;//in % per annum
10  n=5;//in years
11  //Formula : (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((
        i/100)*(1+i/100)^n)-i/100)
12  A=A1+G*(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i/100)
```

```
        ^n)-i/100) ;//in RS
13  disp(A,"The annual equivalent of the positive cash
       flows in RS. : ");
14  //Formula : (P/A,i,n) : (((1+i/100)^n)-1)/((i/100)
       *(1+i/100)^n)
15  i1=10;//in % per annum
16  PW1=A0+(A1+G*(((1+i1/100)^n)-i1*n/100-1)/(((i1/100)
       *(1+i1/100)^n)-i1/100))*(((1+i1/100)^n)-1)/((i1
       /100)*(1+i1/100)^n);''//i1n Rs.
17  disp(PW1,"PW(10) :");
18  i2=12;//i2n % per annum
19  PW2=A0+(A1+G*(((1+i2/100)^n)-i2*n/100-1)/(((i2/100)
       *(1+i2/100)^n)-i2/100))*(((1+i2/100)^n)-1)/((i2
       /100)*(1+i2/100)^n);''//i2n Rs.
20  disp(PW2,"PW(12) :");
21  i3=15;//i3n % per annum
22  PW3=A0+(A1+G*(((1+i3/100)^n)-i3*n/100-1)/(((i3/100)
       *(1+i3/100)^n)-i3/100))*(((1+i3/100)^n)-1)/((i3
       /100)*(1+i3/100)^n);''//i3n Rs.
23  disp(PW3,"PW(15) :");
24  i4=18;//in % per annum
25  PW4=A0+(A1+G*(((1+i4/100)^n)-i4*n/100-1)/(((i4/100)
       *(1+i4/100)^n)-i4/100))*(((1+i4/100)^n)-1)/((i4
       /100)*(1+i4/100)^n);''//in Rs.
26  disp(PW4,"PW(18) :");
27
28  disp("Present worth for i=15% is suitable.");
29  i=i3+(PW3-0)*(i4-i3)/(PW3-PW4);//in Rs.
30  disp(i,"Therefore, the rate of return for the given
       cash flow in % per annum :");
```

Scilab code Exa 7.5 Suggest Best Alternative

```
1  //Exa 7.5
2  clc;
```

```scilab
3  clear;
4  close;
5  //Alternative 1:
6  disp("Alternative 1:");
7  Io=500000;//in Rs
8  Ar=170000;//in Rs
9  n=5;//in years
10 //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
      i/100)^n)
11 // when i=15 %
12 i1=15;//in % per annum
13 PW1=-Io+Ar*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^n
      );//in RS
14 disp(PW1,"The present worth(PW(15%)) for i=10% in RS
      . : ");
15 // when i=17 %
16 i2=17;//in % per annum
17 PW2=-Io+Ar*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^n
      );//in RS
18 disp(PW2,"The present worth(PW17(%)) for i=10% in RS
      . : ");
19 // when i=20 %
20 i3=20;//in % per annum
21 PW3=-Io+Ar*(((1+i3/100)^n)-1)/((i3/100)*(1+i3/100)^n
      );//in RS
22 disp(PW3,"The present worth(PW(20%)) for i=10% in RS
      . : ");
23 // when i=22 %
24 i4=22;//in % per annum
25 PW4=-Io+Ar*(((1+i4/100)^n)-1)/((i4/100)*(1+i4/100)^n
      );//in RS
26 disp(PW4,"The present worth(PW(22%)) for i=10% in RS
      . : ");
27 disp("Present worth for i=15% is suitable.");
28 i=i3+(PW3-0)*(i4-i3)/(PW3-PW4);//in Rs.
29 disp(i,"Therefore, the rate of return of alternative
       1 in % per annum :");
30
```

```scilab
31  //Alternative 2:
32  disp("Alternative 2:");
33  Io=800000;//in Rs
34  Ar=270000;//in Rs
35  n=5;//in years
36  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
       i/100)^n)
37  // when i=20 %
38  i3=20;//in % per annum
39  PW3=-Io+Ar*(((1+i3/100)^n)-1)/((i3/100)*(1+i3/100)^n
       );//in RS
40  disp(PW3,"The present worth(PW(20%)) for i=10% in RS
       . : ");
41  // when i=22 %
42  i4=22;//in % per annum
43  PW4=-Io+Ar*(((1+i4/100)^n)-1)/((i4/100)*(1+i4/100)^n
       );//in RS
44  disp(PW4,"The present worth(PW(22%)) for i=10% in RS
       . : ");
45  disp("Present worth for i=15% is suitable.");
46  i=i3+(PW3-0)*(i4-i3)/(PW3-PW4);//in Rs.
47  disp(i,"Therefore, the rate of return of alternative
        2 in % per annum :");
48  disp("Since the rate of return of alternative 1 is
       greater than that of the alternative 2, select
       alternative 1. ");
```

Chapter 8

Replacement and Maintenance Analysis

Scilab code Exa 8.1 When should equipment be replaced

```scilab
1  //Exa 8.1
2  clc;
3  clear;
4  close;
5  //given data :
6  //When i=0%
7  disp("When i = 0% :");
8  FC=4000;//in Rs.
9  i=0;//in % per annum
10 MC1=0;//in Rs.
11 disp("Tabulation to determine economic life : ");
12 disp("End of       Maintenance      Summation of
       Avg cost of      Avg FC if      Avg total");
13 disp(" year       cost at end       maintenance
       maintenance      replaced at      cost through");
14 disp("            of year            costs
       through year      year given      year given");
15 disp("  A           B(Rs.)          C(Rs.)
                D(Rs.)          E(Rs.)          F(Rs.)");
```

```scilab
16  disp("   1                     0                         0
                                0           4000              4000");
17  disp("   2                   200                       200
                              100           2000              2100");
18  disp("   3                   400                       600
                              200        1333.33          1533.33");
19  disp("   4                   600                      1200
                              300           1000             1300");
20  disp("   5                   800                      2000
                              400            800             1200");
21  disp("   6                  1000                      3000
                              500         666.67          1166.67");
22  disp("   7                  1200                      4200
                              600         571.43          1171.43");
23  disp("Economic life of the machine : 6 years");
24  disp("Column C summarizes the summation of
        maintenance costs for each replacement period.
        The value corresponding to any end of year in
        this column represents the total maintenance
        costs of using the equipment till the end of that
         year. It gives the Economic life of the machine
        : 6 years");
25
26  //When i=12%
27  disp("When i = 12% :");
28  i=12;//in % per annum
29  FC=4000;//in Rs.
30  disp("Tabulation to determine economic life : ");
31  disp("End of       Maintenance           P/F         PW as
        of begin    Summation of      PW of           A/P
        Annual equi");
32  disp(" year        cost at end          12%            of
        year of          PW of         cumulative      12%
            total cost");
33  disp("               of year            n
        maintenance      maintenance    maintenance      n
            of year");
34  disp("   A             B(Rs.)          C(Rs.)
```

```scilab
                    D(Rs.)              E(Rs.)              F(Rs.)
            G(rs.)          H(rs.)");
35  disp("   1                 0                 0.8929
                      0.00              0.00            4000.00
            1.1200       4480.00");
36  disp("   2               200                 0.7972
       159.44            159.44           4159.44          0.5917
            2461.14");
37  disp("   3               400                 0.7118
       284.72            444.16           4444.16          0.4163
            1850.10");
38  disp("   4               600                 0.6355
       381.30            825.46           4825.46          0.3292
            1588.54");
39  disp("   5               800                 0.5674
       453.92           1279.38           5279.38          0.2774
            1464.50");
40  disp("   6              1000                 0.5066
       506.60           1785.98           5785.98          0.2432
            1407.15");
41  disp("   7              1200                 0.4524
       542.88           2328.86           6328.86          0.2191
            1386.65");
42  disp("   8              1400                 0.4039
       565.46           2894.32           6894.32          0.2013
            1387.83");
43  disp("   9              1600                 0.3606
       576.96           3471.28           7471.28          0.1877
            1402.36");
44  disp("  10              1800                 0.3220
       579.60           4050.88           8050.88          0.1770
            1425.00");
45  disp("Economic life of the machine : 7 years");
46  disp("For this problem, the annual equivalent total
       cost is minimum at the end of year 7. Therefore,
       the economic life of the equipment is 7 year.");
```

Scilab code Exa 8.2 Find Economic Life

```
1  //Exa 8.2
2  clc;
3  clear;
4  close;
5  //Given data :
6  FC=20000;//in Rs.
7  i=15;//in % per annum
8  disp("The other details are summarized in Table 8.3.
        It can be seen from the book.");
9  disp("Total annual equivalent cost = [cumulative sum
        of PW as of beginning of year 1 of operation &
       maintenance cost + FC - PW as of beginning of
       year 1 of salvage]*(A/P,15,n)");
10 disp("In column L, the annual equivalent cost is
       minimum for n=5. Therefore, the economic life of
       the machine is 5 years. ");
```

Scilab code Exa 8.3 Determine Economic Life

```
1  //Exa 8.3
2  clc;
3  clear;
4  close;
5  //Given data :
6  FC=20000;//in Rs.
7  i=15;//in % per annum
8  disp("The details are summarized in Table 8.4. It
       can be seen from the book.");
9  disp("Total annual equivalent cost = [summation of
       PW of maintenance cost + FC]]*(A/P,15,n)");
```

```
10 disp(" ( column E + Rs . 6000)∗ Column G");
11 disp(" Column F ∗ Column G");
12 disp(" In column H, the minimum annual equivalent
       cost occurs when n=8. Therefore , the economic
       life of the machine B is 8 years . ");
13 disp(" RESULT : Min annual equivalent cost for
       machine A : Rs . 2780");
14 disp(" Min annual equivalent cost for machine B : Rs .
        3672.30");
```

Scilab code Exa 8.4 Is it worth replacing the present machine

```
1 //Exa 8.4
2 clc;
3 clear;
4 close;
5 // Alternative 1: Present machine :
6 Pprice =200000; // in Rs
7 P=120000; // in Rs
8 F=25000; // in Rs
9 A=25000; // in Rs
10 i=12; // in % per annum
11 n=6; // in years
12 //Formula : (A/P, i ,n) : (( i /100)∗(1+ i /100)^n)/(((1+ i
      /100)^n)−1)
13 AE1 =(P-F)∗((i/100)∗(1+i/100)^n)/(((1+i/100)^n)-1)+F∗
      i/100+A; // in RS
14 disp( AE1 ,"The annual equivalent cost (AE(12%)) of
      this alternative in RS. : ");
15
16 // Alternative 2: New machine :
17 P=150000; // in Rs
18 F=20000; // in Rs
19 A=14000; // in Rs
20 i=12; // in % per annum
```

```
21  n=6;//in years
22  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
23  AE2=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
        i/100+A;//in RS
24  disp(AE2,"The annual equivalent cost(AE(12%)) of
        this alternative in RS. : ");
25  disp("Since, The equivalent cost of new machine is
        less than that of present machine, it is
        suggested that the present machine be replaced
        with the new machine.");
```

Scilab code Exa 8.5 Whether to keep or replace old engine

```
 1  //Exa 8.5
 2  clc;
 3  clear;
 4  close;
 5  //Alternative 1: Old deisel Engine :
 6  Pprice=50000;//in Rs
 7  P=15000;//in Rs
 8  F=8000;//in Rs
 9  A=14000;//in Rs
10  i=15;//in % per annum
11  n=5;//in years
12  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
13  AE1=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
        i/100+A;//in RS
14  disp(AE1,"The annual equivalent cost(AE(15%)) of
        this alternative in RS. : ");
15
16  //Alternative 2: New deisel Engine :
17  P=65000;//in Rs
18  F=13000;//in Rs
```

```
19  A=9000;//in Rs
20  i=15;//in % per annum
21  n=20;//in years
22  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
23  AE2=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
       i/100+A;//in RS
24  disp(AE2,"The annual equivalent cost(AE(15%)) of
       this alternative in RS. : ");
25  disp("Since, The equivalent cost of Old deisel
       Engine is less than that of New deisel Engine, it
        is suggested to keep the Old deisel Engine.");
```

Scilab code Exa 8.6 Recommend about Reinforce or Replace existing Bridge

```
 1  //Exa 8.6
 2  clc;
 3  clear;
 4  close;
 5  //Alternative 1: Reinforce the existing bridge
 6  disp("Alternative 1: Reinforce the existing bridge."
       );
 7  P=660000;//in Rs
 8  F=400000;//in Rs
 9  A=96000;//in Rs
10  i=10;//in % per annum
11  n=5;//in years
12  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
13  AE1=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
       i/100+A;//in RS
14  disp(AE1,"The annual equivalent cost(AE(10%)) of
       this alternative in RS. : ");
15
16  //Alternative 2: Replace the existing bridge by a
```

```
            new prestressed concrete bridge
17 disp("Alternative 2: Replace the existing bridge by
      a new prestressed concrete bridge.");
18 P=150000;//in Rs
19 X=420000;//in Rs
20 i=10;//in % per annum
21 n=40;//in years
22 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
23 AE2=(P-X)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
      i/100+A;//in RS
24 disp(AE2,"The annual equivalent cost(AE(10%)) of
      this alternative in RS. : ");
25 disp("Since, The equivalent cost of alternative 2 is
       less than that of alternative 1, it is suggested
       that alternative 2 should be selected.");
26 //Note  : calculations in the book is not accurate.
```

Scilab code Exa 8.7 Find Best Alternative

```
 1 //Exa 8.7
 2 clc;
 3 clear;
 4 close;
 5 //Alternative 1: Augmenting the present 10 hp motor
      with an additional 5 hp motor
 6 disp("Alternative 1: Augmenting the present 10 hp
      motor with an additional 5 hp motor.");
 7 //Calculation of annual equivalent cost of 10 hp
      motor
 8 P=10000;//in Rs
 9 F=1500;//in Rs
10 A=1600;//in Rs
11 i=15;//in % per annum
12 n=7;//in years
```

```scilab
13  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
14  AE1=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
      i/100+A;//in RS
15  disp(AE1,"The annual equivalent cost(AE(10%)) of 10
      hp motor  in RS. : ");
16
17  //Calculation of annual equivalent cost of 5 hp
      motor
18  P=10000;//in Rs
19  F=800;//in Rs
20  A=1000;//in Rs
21  i=15;//in % per annum
22  n=7;//in years
23  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
24  AE2=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*
      i/100+A;//in RS
25  disp(AE2,"The annual equivalent cost(AE(10%)) of 10
      hp motor  in RS. : ");
26  disp(AE1+AE2,"Total annual equivalent cost of
      alternative in Rs. : ");
27
28
29  //Alternative 2: Replacing the present 10 hp motor
      with a new 15 hp motor
30  disp("Alternative 2: Replacing the present 10 hp
      motor with a new 15 hp motor.");
31  P=35000;//in Rs
32  F=4000;//in Rs
33  A=500;//in Rs
34  i=15;//in % per annum
35  n=7;//in years
36  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
37  AE=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*i
      /100+A;//in RS
38  disp(AE,"The annual equivalent cost of alternative 2
```

```
         in RS. : ");
39  disp("Since, The equivalent cost of alternative 1 is
        less than that of alternative 2, it is suggested
        that the present 10 hp motor be augmented with
        an additional 5 hp motor.");
40  //Note  : calculations in the book is not accurate.
```

Scilab code Exa 8.8 Find Comparative use value

```
1   //Exa 8.8
2   clc;
3   clear;
4   close;
5   //Alternative 1: Old Machine :
6   disp("Let the comparative use value of old machine
        be X.")
7   F=1000;//in Rs
8   A=7500;//in Rs
9   i=12;//in % per annum
10  n=4;//in years
11  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
12  disp("AE(12%)=(X-F)*((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)+F*i/100+A;//in RS")
13
14  //Alternative 2: New Machine :
15  P=10000;//in Rs
16  F=4000;//in Rs
17  A=500;//in Rs
18  i=15;//in % per annum
19  n=4;//in years
20  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
21  AE=(P-F)*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)+F*i
        /100+A;//in RS
```

```
22  disp(AE,"The annual equivalent cost(AE(15%)) of n in
        RSew machine : ");
23  disp("Now equating both annual equivalent cost we
        get the X.");
24  disp("X = Rs. 7334.14");
25  disp("The comparative use value of old machine is Rs
        . 7334.14, which is less than the price(Rs. 8000)
         offered by the company which is supplying the
        new machine in the event of replacing the old
        machine by nw machine. ");
26  disp("Therefore, it is advisable to replace the old
        machine with the new one.");
```

Scilab code Exa 8.9 Find Equal Intervals for transistor replacement

```
1  //Exa 8.9
2  clc;
3  clear;
4  close;
5  //Given data :
6  p1=0.07;//unitless
7  p2=0.11;//unitless
8  p3=0.12;//unitless
9  p4=0.18;//unitless
10  p5=0.21;//unitless
11  p6=0.20;//unitless
12  p7=0.11;//unitless
13  N0=100;//no. of transistors
14  N1=N0*p1;//no. of transistors
15  N2=N0*p2;//no. of transistors
16  N3=N0*p3;//no. of transistors
17  N4=N0*p4;//no. of transistors
18  N5=N0*p5;//no. of transistors
19  N6=N0*p6;//no. of transistors
20  N7=N0*p7;//no. of transistors
```

```
21  //Calculation of individual replacement cost
22  Life=0;//in weeks
23  p=[p1 p2 p3 p4 p5 p6 p7];//Unitless
24  for i=1:7
25      Life=Life+i*p(i);
26  end
27  disp(Life,"Expected life of each transistor in weeks
        : ")
28  disp(round(100/Life),"Average No. of failures/week :
        ");
29
30  //Calculation of group replacement cost
31  disp("Cost of transistor when replaced
        simultaneously = Rs. 3");
32  disp("Cost of transistor when replaced individually
        = Rs. 9");
33  disp("The cost of group replacement policy for
        seeral replacement periods are summarized in
        Table 8.6. This table can be seen from the book."
        );
34  disp("From table it is clear that the avg cost/week
        is minimum for the 4th week. Hence, the group
        replacement period is 4 weeks.");
35  disp("Individual replacement cost/week = Rs. 207");
36  disp("Minimum group replacement ost/week = Rs.
        196.50");
37  disp("Since the min group replacement cost/week is
        less than the individual replacement cost/week,
        the group replacement policy is the best, and
        hence all the transistors should be replaced in 4
         weeks.")
```

Scilab code Exa 8.10 Find Optimum Replacement plan

```
1  //Exa 8.10
```

```scilab
 2  clc;
 3  clear;
 4  close;
 5  //Given data :
 6  p1=(100-96)/100;//unitless
 7  p2=(96-89)/100;//unitless
 8  p3=(89-68)/100;//unitless
 9  p4=(68-37)/100;//unitless
10  p5=(37-13)/100;//unitless
11  p6=(13-0)/100;//unitless
12  N0=1000;//no. of resistors
13  N1=N0*p1;//no. of resistors
14  N2=N0*p2+N1*p1;//no. of resistors
15  N3=N0*p3+N1*p2+N2*p1;//no. of resistors
16  N4=N0*p4+N1*p3+N2*p2+N3*p1;//no. of resistors
17  N5=N0*p5+N1*p4+N2*p3+N3*p2+N4*p1;//no. of resistors
18  N6=N0*p6+N1*p5+N2*p4+N3*p3+N4*p2+N5*p1    ;//no. of
         resistors
19  //Calculation of individual replacement cost
20  Life=0;//in months
21  p=[p1 p2 p3 p4 p5 p6];//Unitless
22  for i=1:6
23      Life=Life+i*p(i);
24  end
25  disp(Life,"Expected life of each transistor in
         months : ")
26  disp(round(1000/Life),"Average No. of failures/month
          :   ");
27  disp(round(1000/Life)*10,"Therefore, cost of
         individual replacement in Rs. : ")
28
29
30  //Calculation of group replacement cost
31  disp("Cost/transistor when replaced simultaneously =
          Rs. 4");
32  disp("Cost/transistor when replaced individually =
         Rs. 10");
33  disp("The cost of group replacement policy for
```

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```
              several replacement periods are summarized in
              Table 8.7. This table can be seen from the book."
              );
34   disp("From table it is clear that the avg cost/month
              is minimum for the 3rd month. Hence, the group
              replacement period is 3 months.");
35   disp("Individual replacement cost/month = Rs. 2480")
              ;
36   disp("Minimum group replacement ost/month = Rs.
              2426.67");
37   disp("Since the min group replacement cost/month is
              less than the individual replacement cost/month,
              the group replacement policy is the best, and
              hence all the transistors should be replaced in 3
              months.")
```

Chapter 9

Depreciation

Scilab code Exa 9.1 Determine Depreciation Charge

```
1 //Exa 9.1
2 clc;
3 clear;
4 close;
5 //Given data :
6 P=100000;//in Rs
7 F=20000;//in Rs
8 n=8;//in years
9 Dt=(P-F)/n;//in Rs.
10 disp("In this method of depreciation, the value of
      Dt is same for all the years. The calculations
      pertaining to Bt for different values of t are
      summarized in table below : ");
11 disp("End of year                 Depreciation
      Book value");
12 disp("     (t)                          (Dt)                           (Bt=B
      (t-1)-Dt)");
13 disp("       0
      100000");
14 disp("     1                              10000
      90000");
```

```
15  disp ("     2                10000
        80000 ") ;
16  disp ("     3                10000
        70000 ") ;
17  disp ("     4                10000
        60000 ") ;
18  disp ("     5                10000
        50000 ") ;
19  disp ("     6                10000
        40000 ") ;
20  disp ("     7                10000
        30000 ") ;
21  disp ("     8                10000
        20000 ") ;
22  disp (" If we are interested in computing Dt and Bt
        for a specific period (t), the formulae can be
        used. in this approach, it should be noted that
        the depreciation is the same for all the periods.
        ") ;
```

Scilab code Exa 9.2 Compute Depreciation and Book value

```
1  //Exa 9.2
2  clc ;
3  clear ;
4  close ;
5  // Given data :
6  P =100000; // in Rs
7  F =20000; // in Rs
8  n =8; // in years
9  D5 =(P-F)/n; // in Rs.
10  disp (D5 ,"D5 in Rs. : ") ;
11  disp ("( This is independent of the time period )") ;
12  t =5; // in years
13  Bt =P-t *(P-F)/n; // in Rs
```

```
14  disp(Bt,"B5 in Rs. : ")
```

Scilab code Exa 9.3 Calculation of declining balance method

```
1  //Exa 9.3
2  clc;
3  clear;
4  close;
5  //Given data :
6  P=100000;//in Rs
7  F=20000;//in Rs
8  n=8;//in years
9  k=0.2
10 Dt=(P-F)/n;//in Rs.
11 disp("The calculations pertaining to Dt and Bt for
       different values of t are summarized in table
       below using the formulae : ");
12 disp("Dt=k*B(t-1)");
13 disp("Bt=B(t-1)-Dt");
14
15 disp("End of year           Depreciation
       Book value");
16 disp("    (t)                    (Dt)                (Bt=B
       (t-1)-Dt)");
17 disp("    0
       100000.00");
18 disp("    1                   20000.00
       80000.00");
19 disp("    2                   16000.00
       64000.00");
20 disp("    3                   12800.00
       51200.00");
21 disp("    4                   10240.00
       40960.00");
22 disp("    5                    8192.00
```

```
        32768.00");
23 disp("     6                    6553.60
        26214.40");
24 disp("     7                    5242.88
        20971.52");
25 disp("     8                    4194.
        16777.22");
26 disp("If we are interested in computing Dt and Bt
        for a specific period (t), the formulae can be
        used. in this approach, it should be noted that
        the depreciation is the same for all the periods.
        ");
```

Scilab code Exa 9.4 Compute Depreciation and Book value

```
1  //Exa 9.4
2  clc;
3  clear;
4  close;
5  //Given data :
6  P=100000;//in Rs
7  F=20000;//in Rs
8  n=8;//in years
9  k=0.2
10 t=5;//in years
11 Dt=k*(1-k)^(t-1)*P;//in Rs.
12 disp(Dt,"D5 in Rs. : ");
13 Bt=((1-k)^t)*P;//in Rs.
14 disp(Bt,"B5 in Rs. : ")
```

Scilab code Exa 9.5 Calculations of sum of the years digits method

```
1  //Exa 9.5
```

```scilab
 2 clc;
 3 clear;
 4 close;
 5 //Given data :
 6 P=100000;//in Rs
 7 F=20000;//in Rs
 8 n=8;//in years
 9 Sum=n*(n+1)/2;//sum of the years
10 disp("The rates for years 1-8, are respectively
      8/36,7/36,6/36,5/36,4/36,3/36,2/36,1/36");
11 disp("The calculations of Dt and Bt for different
      values of t are summarized in table below using
      the formulae : ");
12 disp("Dt=Rate*(P-F)");
13 disp("Bt=B(t-1)-Dt");
14 disp("End of year             Depreciation
      Book value");
15 disp("     (t)                     (Dt)                     (Bt=B
      (t-1)-Dt)");
16 disp("     0
      100000.00");
17 disp("     1                   17777.77
      82222.23");
18 disp("     2                   15555.55
      66666.68");
19 disp("     3                   13333.33
      53333.35");
20 disp("     4                   11111.11
      42222.24");
21 disp("     5                    8888.88
      33333.36");
22 disp("     6                    6666.66
      26666.70");
23 disp("     7                    4444.44
      22222.26");
24 disp("     8                    2222.22
      20000.04");
25 disp("If we are interested in computing Dt and Bt
```

```
      for a specific period (t), then the usage of the
        formulae would be better.");
```

Scilab code Exa 9.6 Find Depreciation and Book value

```
1  //Exa 9.6
2  clc;
3  clear;
4  close;
5  //Given data :
6  P=100000;//in Rs
7  F=20000;//in Rs
8  n=8;//in years
9  t=5;//in years
10 Dt=(n-t+1)*(P-F)/(n*(n+1)/2);//in Rs.
11 disp(Dt,"D5 in Rs. : ");
12 Bt=(P-F)*((n-t)/n)*((n-t+1)/(n+1))+F;//in Rs.
13 disp(Bt,"B5 in Rs. : ")
```

Scilab code Exa 9.7 Calculations regarding sinking fund method

```
1  //Exa 9.7
2  clc;
3  clear;
4  close;
5  //Given data :
6  P=100000;//in Rs
7  F=20000;//in Rs
8  n=8;//in years
9  i=12;//in % per annum
10 A=(P-F)*(i/100)/(((1+i/100)^n)-1);//in Rs.
11 disp("In this method of depreciation, a fixed amount
         of Rs. "+string(A)+" will be depreciated at the
```

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```
      end of every year from the earning of the asset.
      The deprecited amount will earn intrest for the
      remaining period of life of the asset at an
      intrest rate of 12 %, compounded anually.");
12 disp(A,"Depreciation at the end of year 1(D1) in Rs.
      : ");
13 disp(A+A*i/100,"Depreciation at the end of year 2(D2
      ) in Rs. : ");
14 disp(A+(A+(A+A*i/100))*i/100,"Depreciation at the
      end of year 3(D3) in Rs. : ");
15 disp("The calculations along with boook values are
      summarized in table below : ");
16 disp("End of year          Fixed Depreciation
              Net Depreciation          Book value");
17 disp("    (t)                           (Rs.)
                             Dt(Rs.)                  Bt(Rs.)
      ");
18 disp("     0                           6504

      100000.00");
19 disp("     1                           6504
                             6504.00
      82222.23");
20 disp("     2                           6504
                             7284.48
      66666.68");
21 disp("     3                           6504
                             8158.62
      53333.35");
22 disp("     4                           6504
                             9137.65
      42222.24");
23 disp("     5                           6504
                             10324.17
      33333.36");
24 disp("     6                           6504
                             11462.27
      26666.70");
```

```
25 disp("      7                              6504
                        12837.74
      22222.26");
26 disp("      8                              6504
                        14378.27
      20000.04");
```

Scilab code Exa 9.8 Compute D5 and B7

```
1  //Exa 9.8
2  clc;
3  clear;
4  close;
5  //Given data :
6  P=100000;//in Rs
7  F=20000;//in Rs
8  n=8;//in years
9  i=12;//in % per annum
10 //Formula : (A/F,i,n) : (i/100)/(((1+i/100)^n)-1)
11 //Formula : (F/P,i,n) : (1+i/100)^n
12 //Formula : (F/A,i,n) : (((1+i/100)^n)-1)/(i/100)
13 t=5;//in Years
14 Dt=(P-F)*(i/100)/(((1+i/100)^n)-1)*(1+i/100)^(t-1);
      //in Rs.
15 disp(Dt,"D5 in Rs. : ");
16 t=7;//in Years
17 Bt=P-(P-F)*(i/100)/(((1+i/100)^n)-1)*(((1+i/100)^t)
      -1)/(i/100);//in Rs.
18 disp(Bt,"B7 in Rs. : ")
```

Scilab code Exa 9.9 Find Depreciation of the equipment

```
1  //Exa 9.9
```

```
 2  clc;
 3  clear;
 4  close;
 5  //Given data :
 6  P=8000000;//in Rs
 7  F=50000;//in Rs
 8  X=75000;//in Km
 9  x=2000;//in Km
10  n=8;//in years
11  i=12;//in % per annum
12  D=(P-F)*x/X;//in Rs.
13  disp(D,"Depreciation for year 3 in Rs. : ");
```

Chapter 10

Evaluation of Public Alternatives

Scilab code Exa 10.1 Check Project justified based on BC ratio

```
1 //Exa 10.1
2 clc;
3 clear;
4 close;
5 //Given data
6 Ii=4000000; //in Rs.
7 AM=150000; //in Rs.
8 AFS=600000; //in Rs.
9 Einc=50000; //in Rs.
10 i=12; //in % per annum
11 n=15; //in years
12 //Total present worth of costs:
13 //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
       i/100)^n)
14 Cp=AM*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n); //in
       Rs
15 TPW=Ii+Cp; //in RS
16 disp(TPW,"Total present worth of costs in RS. : ");
17
```

```
18  //Total present worth of fuel savings:
19  AI=600000;//in Rs.
20  G=50000;//in Rs.
21  i=12;//in % per annum
22  n=15;//in years
23  //Formula : (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
24  A=AI+G*(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i/100)
       ^n)-i/100);//in RS
25  Bp=A*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in Rs
       .
26  disp(Bp,"Present worth of fuel savings in Rs. : ");
27  BCratio=Bp/(Ii+Cp);//unitless
28  disp(BCratio,"BCratio : ");
29  disp("Since BC ratio is more than 1, the
       construction of the bridge across the river is
       justified.");
```

Scilab code Exa 10.2 Check Govt should implement the project

```
1  //Exa 10.2
2  clc;
3  clear;
4  close;
5  //Given data
6  Ic=80000000;//in Rs.
7  Aps=6000000;//in Rs.
8  Afs=3000000;//in Rs.
9  Aib=5000000;//in Rs.
10 Arb=2000000;//in Rs.
11 Amc=3000000;//in Rs.
12 i=12;//in % per annum
13 n=50;//in years
14 TAB=Afs+Aib+Arb;//in Rs.
15 //Present worth of Benefit:
```

```
16  //Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+
        i/100)^n)
17  PW_B=TAB*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//
        in Rs
18  disp(PW_B,"Total present worth of benefits in RS. :
        ");
19
20  //Present worth of costs:
21  //Formula : (P/A,i,n) : (((1+i/100)^n)-1)/((i/100)
        *(1+i/100)^n)
22  PW_C=Ic+Amc*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n)-
        Aps*(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n);//in
        RS
23  disp(PW_C,"Present worth of costs in Rs. : ");
24  BCratio=PW_B/PW_C;//unitless
25  disp(BCratio,"BCratio : ");
26  disp("Since BC ratio is more than 1, the state govt.
         can implement the hydroelectric project.");
```

Scilab code Exa 10.3 Which Project would you select using BC ratio

```
1  //Exa 10.3
2  clc;
3  clear;
4  close;
5  //Alternative A1 :
6  disp("Alternative A1 :")
7  P=3000000;//in Rs.
8  B=900000;//in Rs.
9  i=10;//in % per annum
10  n=5;//in years
11  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
12  AE1=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);//in
        Rs
```

```
13  disp(AE1,"Annual equivalent of initial cost in Rs. :
        ");
14  BCratio=B/AE1;//unitless
15  disp(BCratio,"BCratio : ");
16
17  //Alternative A2 :
18  disp("Alternative A2 :")
19  P=6000000;//in Rs.
20  B=1500000;//in Rs.
21  i=10;//in % per annum
22  n=7;//in years
23  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
24  AE2=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);//in
        Rs
25  disp(AE2,"Annual equivalent of initial cost in Rs. :
        ");
26  BCratio=B/AE2;//unitless
27  disp(BCratio,"BCratio : ");
28  disp("The benefit cost ratio of alternative 2 is
        more than that of alternative A1. Hence,
        alternative A2 is to be selected. The comparisoon
         is made on a 35 years period which is the
        minimum common multiple of the lives of
        alternative 1 and 2");
```

Scilab code Exa 10.4 Find BC ratio

```
1  //Exa 10.4
2  clc;
3  clear;
4  close;
5  //Cost to the state :
6  disp("Cost to the state :")
7  n=20;//in years
```

```scilab
 8  P=2500000000; //in Rs.
 9  Agt=10000000; //in Rs.
10  Ai=1000000; //in Rs.
11  Com=48000; //in Rs./year/employee
12  C1=Com*300; //in Rs.
13  i=10; //in % per annum
14  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
15  C2=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1); //in Rs
16  disp(C2,"Annual equivalent initial cost in Rs. : ");
17  CA=C2+C1; //in Rs
18  disp(CA,"Total Annual equivalent cost of the project
        in Rs. : ");
19  //Benefit to the state :
20  disp("Benefit to the state :")
21  W=30000000; //in Rs.
22  //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
       /100)^n)-1)
23  A1=W*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1); //in Rs
       .
24  Agpy=10000000; //in ton/year
25  A2=Agpy*(30-10); //in Rs.
26  AvgAI=1000000; //in tons Km.
27  G=20000000; //in Rs.
28  //Formula : (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((
       i/100)*(1+i/100)^n)-i/100)
29  A3=A2+G*(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i
       /100)^n)-i/100) ; //in Rs.
30  disp(A3,"Annual equivalent average of transport cost
        saving in Rs. : ");
31  BA=A1+A3; //in Rs.
32  disp(BA,"Total annual equivalent benefits to the
       state : ");
33  BCratio=BA/CA; //unitless
34  disp(BCratio,"BCratio : ");
35  disp("The benefit cost ratio is more than 1,the
       project is justified.");
```

Scilab code Exa 10.5 Which Project should be selected

```
1  //Exa 10.5
2  clc;
3  clear;
4  close;
5  i=9;//% per annum
6  n=50;//in years
7  //Project A :
8  disp("Project A : ");
9  P_A=150000000;//in RS.
10 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
11 AE_A=P_A*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);
12 OMC_A=2000000;//in Rs.
13 Psy_A=10000000;//in Rs.
14 Cpy_A=AE_A+OMC_A-Psy_A;//in Rs.
15 disp(Cpy_A,"Costs/year : ");
16 Fcs_A=2500000;//in Rs.
17 Ib_A=3500000;//in Rs.
18 Rb_A=1000000;//in RS.
19 Bpy_A=Fcs_A+Ib_A+Rb_A;//in Rs.
20 disp(Bpy_A,"Benefits/year : ");
21 BCratio_A=Bpy_A/Cpy_A;//unitless
22 disp(BCratio_A,"BC Ratio of project A : ")
23 //Project B :
24 disp("Project B : ");
25 P_B=250000000;//in Rs.
26 //Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
      /100)^n)-1)
27 AE_B=P_B*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);
28 OMC_B=2500000;//in Rs.
29 Psy_B=12000000;//in Rs.
30 Cpy_B=AE_B+OMC_B-Psy_B;//in Rs.
```

```
31  disp(Cpy_B,"Costs/year : ");
32  Fcs_B=3500000;//in Rs.
33  Ib_B=4500000;//in Rs.
34  Rb_B=2000000;//in RS.
35  Bpy_B=Fcs_B+Ib_B+Rb_B;//in Rs.
36  disp(Bpy_B,"Benefits/year : ");
37  BCratio_B=Bpy_B/Cpy_B;//unitless
38  disp(BCratio_B,"BC Ratio of project B : ")
39  //Project C :
40  disp("Project C : ");
41  P_C=400000000;//in Rs.
42  //FormulC : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
        /100)^n)-1)
43  AE_C=P_C*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);
44  OMC_C=3500000;//in Rs.
45  Psy_C=18000000;//in Rs.
46  Cpy_C=AE_C+OMC_C-Psy_C;//in Rs.
47  disp(Cpy_C,"Costs/year : ");
48  Fcs_C=5000000;//in Rs.
49  Ib_C=6000000;//in Rs.
50  Rb_C=3500000;//in RS.
51  Bpy_C=Fcs_C+Ib_C+Rb_C;//in Rs.
52  disp(Bpy_C,"Benefits/year : ");
53  BCratio_C=Bpy_C/Cpy_C;//unitless
54  disp(BCratio_C,"BC Ratio of project C : ")
55  disp("From the computations it is clear that only
        alternative A is eligible because other two
        alternatives have BC ratio less than one.")
```

Chapter 11

Inflation Adjusted Decisions

Scilab code Exa 11.1 `What Equal Amount should he save`

```
1  //Exa 11.1
2  clc;
3  clear;
4  close;
5  disp("Few steps are as follows : ");
6  disp("Step 1 : The estimated future requirementt per
        year in terms of todays rupees from his age 61
       through 70 is Rs. 24000.");
7  disp("Step 2 : The formula which is given below is
       used to get future equivalent of Rs. 24000 with
       the inflation of 9% per year.");
8  disp("Formula : P*(1+IR)^n");
9  P=24000;//in Rs.
10 IR=9;//in % per year
11 Age=61;//in years
12 for n=21:30
13     IV=P*(1+IR/100)^n;//in Rs
14     disp("Age in years : "+string(Age)+". ""Inflated
            value of Rs. 24000 at end of year : "+string
          (n)+" in Rs. "+string(round(IV)));
15     Age=Age+1;//in Years
```

```
16  end ;
17  PW =0;//For  initialising
18  n =21;// in  years
19  for  m =1:10
20      IV=P*(1+IR/100)^n;// in  Rs
21      n=n+1;
22      i =15;// in  %  per  year
23      PW=PW+IV/(1+i/100)^m;
24  end
25  disp(PW,"Present  equivalent  of  withdrawls  in  Rs .  :  "
        );
26  //The  annual  equivalent  amount  :
27  i =15;// in  %  per  year
28  n =20;// in  years
29  //Formula  :  (A/F,i ,n)  :  (i/100)/(((1+i/100)^n)−1)
30  A=PW*(i/100)/(((1+i/100)^n)-1);// in  Rs .
31  disp(A,"The  annual  equivalent  amount  in  Rs .  :  ");
32  disp("RECOMMENDATION  :  The  person  has  to  invest  an
        amount  of  Rs .  "+string(A)+"  at  the  end  of  every
        year  starting  from  his  age  41  through  60  which
        will  enable  him  to  make  a  withdrawl  at  the  end  of
         every  year  starting  from  his  age  61  through  70."
        );
```

Scilab code Exa 11.2 `Find Economic Life`

```
1  //Exa  11.2
2  clc ;
3  clear ;
4  close ;
5  disp("The  method  of  finding  the  economic  life  of  the
         machine  witha  discounting  factor  of  20%  at  zero
        inflation  rate  is  summarized  in  table  below .  From
         the  table  it  is  clear  that  total  annual  cost  is
        minimum  if  the  machine  is  used  for  14  years .
```

```
          Hence the economic life of the machine is 14
      years.");
 6 disp("End of year      Op_cost      Main_cost      Op+
      Main      P/F,i,n      PW      Cummulative
      Salvage      PW_S    TPW      A/P,i,n      AEM");
 7 i=20;//in  per year
 8 Cum=0;//initialising
 9 Op_cost=40000;//in RS.
10 Main_cost=60000;//in Rs.
11 OpMain=Op_cost+Main_cost;//in Rs.
12 S=400000;//in Rs.
13 for n=1:15
14     PF=1/((1+i/100)^n);
15     PW=OpMain*PF;//in Rs.
16     Cum=Cum+PW
17     PW_S=PF*S;//in RS.
18     TPW=500000+Cum-PW_S;//in Rs.
19     AP=((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);
20     AEM=TPW*AP;//in RS
21     disp("          "+string(n)+"          "+string(
         Op_cost)+"          "+string(Main_cost)+"
              "+string(OpMain)+"      "+string(PF)+"
          "+string(PW)+"          "+string(Cum)+"
              "+string(S)+"          "+string(PW_S)+"
              "+string(TPW)+"          "+string(AP)+"
              "+string(AEM));
22     Op_cost=Op_cost+5000;//in Rs.
23     Main_cost=Main_cost+6000;//in Rs.
24     S=S-50000;//in Rs.
25 end
```

Scilab code Exa 11.3 Determine the best machine based on Present Worth

```
1 //Exa 11.3
2 clc;
```

```
3  clear ;
4  close ;
5  IR =5; //in % per  year
6  i =15; //in % per  year
7  //Machine X :
8  disp (" Machine X : ") ;
9  Ppx =1500000; //in  Rs.
10 n =7; //in  years
11 S =200000; //in  Rs.
12 AMC =300000; //in  Rs.
13 disp ("End of  year     AMC      InflationFactor
       InflatedAmount     P/F      PW") ;
14 format ('v',9)
15 Pw =0; //For  initialising
16 for  n =1:7
17     FP =(1+ IR /100) ^n
18     IA = AMC * FP ; //in  Rs.
19     PF =1/((1+ i /100) ^n) ;
20     PW = IA * PF ; //in  Rs.
21     Pw = Pw + PW ; //in  Rs.
22     disp ("      "+ string (n) +"         "+ string ( AMC )+"
                  "+ string ( FP )+"            "+ string ( IA )
         +"             "+ string ( PF )+"        "+ string ( PW ))
          ;
23 end
24 disp (Pw ," Present worth of  inflated  annual  operating
       and  maintenance  cost  in Rs. : ") ;
25 PWX = Ppx + Pw -S *1/((1+ i /100) ^n) ;
26 disp ( PWX ," Present worth of  machine X in Rs. : ") ;
27 // Machine Y
28 disp (" Machine Y : ") ;
29 Ppy =2000000; //in  Rs.
30 n =7; //in  years
31 S =300000; //in  Rs.
32 AMC =250000; //in  Rs.
33 disp ("End of  year     AMC      InflationFactor
       InflatedAmount     P/F      PW") ;
34 format ('v',9)
```

```
35  Pw=0; //For initialising
36  for n=1:7
37      FP=(1+IR/100)^n
38      IA=AMC*FP; //in Rs.
39      PF=1/((1+i/100)^n);
40      PW=IA*PF; //in Rs.
41      Pw=Pw+PW; //in Rs.
42      disp("      "+string(n)+"              "+string(AMC)+"
                 "+string(FP)+"                "+string(IA)
         +"              "+string(PF)+"          "+string(PW))
            ;
43  end
44  disp(Pw,"Present worth of inflated annual operating
        and maintenance cost in Rs. : ");
45  PWY=Ppy+Pw-S*1/((1+i/100)^n);
46  disp(PWY,"Present worth of machine Y in Rs. : ");
47  disp("Since the present worth of Machine X is less
        than Machine Y, select Machine X")
48  //Note : Calculations are not accurate in the book
```

Scilab code Exa 11.4 Find the single deposit

```
1  //Exa 11.4
2  clc;
3  clear;
4  close;
5  IR=6; //in % per year
6  i=18; //in % per year
7  AFR=5000000; //in Rs.
8  n=7; //in years
9  AI=500000; //in Rs.
10 disp("End of year      AFR       InflationFactor
        InflatedAmount      P/F      PW");
11 TPW=0; //Initialising
12 format('v',10)
```

```
13  for n =1:5
14      IF =(1+ IR /100) ^n ;
15      IA = IF * AFR ; // in Rs .
16      PF =1/(( 1+ i /100) ^n ) ;
17      PW = PF * IA ; // in Rs .
18      TPW = PW + TPW ; // in Rs .
19      disp ("          "+ string ( n ) +"            "+ string ( AFR ) +
            "              "+ string ( IF ) +"            "+ string ( IA ) +"
              "+ string ( PF ) +"        "+ string ( PW ) ) ;
20      AFR = AFR + AI ; // in Rs .
21  end ;
22  disp ( TPW ," The value of the single deposit to be made
        now to recieve the specified series for the next
        five years is Rs . : ")
```

Chapter 12

Inventory Control

Scilab code Exa 12.1 Economic Order Quantity and Orders per year

```
1  //Exa 12.1
2  clc;
3  clear;
4  close;
5  //given data :
6  D=24000;//in units/year
7  Co=150;//in Rs./order
8  Pprice=75;//Rs./unit
9  Cpupy=18;//in % of Pprice/unit
10 Cc=Pprice*Cpupy/100;//in Rs.
11 EOQ=sqrt((2*Co*D)/Cc);//in units
12 disp(round(EOQ),"Economic order quantity in units :
       ");
13 n=D/round(EOQ);//no. of orders/year
14 disp(n,"No. of orders/year : ");
15 T=round(EOQ)/D;// time between successive orders in
       year
16 T=T*12;//in months
17 T=T*30;//in Days
18 disp(round(T),"Time between successive orders in
       days : ");
```

Scilab code Exa 12.2 Find EOQ and cycle time

```scilab
1  //Exa 12.2
2  clc;
3  clear;
4  close;
5  //given data :
6  r=12000;//in units/year
7  k=24000;//in units/year
8  Co=175;//in Rs./setup
9  Cc=15;//in Rs./unit/year
10 EOQ=sqrt((2*Co*r)/(Cc*(1-r/k)));//in units
11 Q=ceil(EOQ);//units
12 disp(Q,"Economic order quantity in units : ");
13 t1=Q/k;//in year
14 t1=t1*12*30;//in days
15 t2=(Q/r)*(1-r/k);//in year
16 t2=t2*12*30;//in days
17 disp(round(t1+t2),"Cycle time in days :");
18 disp(r/Q,"No. of setups/year : ");
```

Scilab code Exa 12.3 Find Optimum Values of various parameter

```scilab
1  //Exa 12.3
2  clc;
3  clear;
4  close;
5  //given data :
6  D=30000;//in units/year
7  Cc=2;//in Rs./unit/year
8  Co=100;//in Rs./orde
```

```
9  Cs=12;//in units/year
10 EOQ=sqrt(2*Co*D*(Cs+Cc)/(Cc*Cs));//in units
11 Q=round(EOQ);//units
12 disp(Q,"Ordering quantity in units : ");
13 Q1=sqrt(2*Co*D*Cs/(Cc*(Cs+Cc)));//in units
14 disp(round(Q1),"Maximum Inventory in units : ");
15 disp(round(Q-Q1),"Maximum shortage quantity in units
       : ");
16 t=Q/D;//in year
17 t=t*365;//in days
18 disp(round(t),"Cycle time in days: ");
19 t1=Q1/D;//in year
20 t1=t1*365;//in days
21 disp(round(t1),"Inventory period(t1) in days : ");
22 t2=t-t1;//in days
23 disp(round(t2),"Shortage period(t2) in days : ");
24 disp(D/Q,"No. of Orders/year : ");
```

Scilab code Exa 12.4 Find Various parameter of Inventory System

```
1  //Exa 12.4
2  clc;
3  clear;
4  close;
5  //given data :
6  r=12000;//in units/year
7  k=2000*12;//in units/year
8  Co=400;//in Rs./setup
9  Cc=0.20*12;//in Rs./year
10 Cs=15;//in Rs./unit/year
11
12 EOQ=sqrt((2*Co*k*r*(Cc+Cs)/(Cc*(k-r)*Cs)));//in
       units
13 Q=round(EOQ);//units
14 disp(Q,"Ordering quantity in units : ");
```

```
15
16  Q1=sqrt(2*Co*Cc*r*(k-r)/(Cs*(Cc+Cs)*k));//in units
17  disp(round(Q1),"Maximum Inventory in units : ");
18  Q2=(Q*(k-r)/k)-Q1;//in Units
19  disp(round(Q2),"Maximum shortage quantity in units :
        ");
20  t=Q/r;//in year
21  t=t*365;//in days
22  disp(round(t),"Cycle time in days: ");
23  t1=(Q2/r)*365;//in days
24  t2=(Q2/(k-r))*365;//in days
25  t3=(Q1/(k-r))*365;//in days
26  t4=(Q1/r)*365;//in days
27  disp(round(t1),"Period of shortage in days : ");
28  disp(round(t2),"Period of production satisfying back
        order in days : ");
29  disp(ceil(t3),"Period of production satisfying
        period requirement in days : ");
30  disp(ceil(t4),"Period of consumption only in days :
        ");
```

Chapter 13

Make or Buy Decision

Scilab code Exa 13.1 Would it be profitable to make fixtures

```
1 //Exa 13.1
2 clc;
3 clear;
4 close;
5 //Cost to make :
6 disp("Cost to make : ")
7 //given data :
8 material=300;//in Rs.
9 labour=250;//in Rs.
10 overhead=100;//in Rs.
11 VC=material+labour+overhead;//in Rs.
12 demand=5000;//in units
13 TVC=demand*VC;//in Rs.
14 FC=1000000;//in Rs.
15 TC=FC+TVC;//in Rs.
16 disp(TC,"Total cost in Rs. : ");
17
18 //Cost to buy :
19 disp("Cost to buy : ")
20 //given data :
21 Pcost=900*demand;//in Rs.
```

```
22  FC=1000000;//in Rs.
23  TC=FC+Pcost;//in Rs.
24  disp(TC,"Total cost in Rs. : ");
25  disp("The cost of making fixtures is less than the
        cost of buying fixtures from outside. Therefore,
        the organisation should make the fixtures.")
```

Scilab code Exa 13.2 Determine Best Option

```
1  //Exa 13.2
2  clc;
3  clear;
4  close;
5  //Buy Option :
6  disp("Buy Option :")
7  //given data :
8  Pbuy=8;//in Rs/unit
9  D=2000;//in units/year
10 Co=120;//in Rs./order
11 Cc=1.60;//in Rs./units/year
12 Q1=sqrt(2*Co*D/Cc);//in units
13 TC=D*Pbuy+D*Co/Q1+Q1*Cc/2;//in Rs.
14 disp(TC,"Total cost of buying in Rs. : ")
15 //Make Option :
16 disp("Make Option :")
17 //given data :
18 Pmake=5;//in Rs/unit
19 Co=60;//in Rs./setup
20 Cc=1;//in Re1/units/year
21 r=2000;//in units/year
22 k=8000;//in units/year
23 Q2=sqrt(2*Co*r/(Cc*(1-r/k)));//in units
24 TC=D*Pmake+D*Co/Q2+Q2*Cc*(k-r)/(2*k);//in Rs.
25 disp(TC,"Total cost of making in Rs. : ")
26 disp("The cost of making is less than the cost of
```

buying . Therefore , the firm should go in for
making option .");

Scilab code Exa 13.3 Should the manufacturer make or buy the cabinet

```
1  //Exa 13.3
2  clc;
3  clear;
4  close;
5  //given data :
6  SP=500;//in Rs.
7  VC=300;//in Rs.
8  FC=400000;//in RS.
9  BEP=FC/(SP-VC);//in units
10 disp(BEP,"BEP in units : ");
11 disp("Since the demand(1500 units) is less than the
       break even quantity , the company should buy the
       cabinets for its TV production .")
```

Scilab code Exa 13.4 Should the company make or buy the product

```
1  //Exa 13.4
2  clc;
3  clear;
4  close;
5  //given data :
6  volume=8000;//in units
7  //Process A :
8  disp("Process A :");
9  FC=500000;//in RS.
10 VC=175;//in Rs.
11 AC=FC+VC*volume;//in Rs.
12 disp(AC,"Annual Cost of Process A in Rs. :");
```

```
13
14  //Process B :
15  disp(" Process B :");
16  FC=600000;//in RS.
17  VC=150;//in Rs.
18  AC=FC+VC*volume;//in Rs.
19  disp(AC," Annual Cost of Process A in Rs. :");
20
21  //Buy option:
22  disp(" Buy Option :");
23  Pprice=125;//in RS./Unit
24  VC=175;//in Rs.
25  AC=Pprice*volume;//in Rs.
26  disp(AC," Annual Cost of Buy in Rs. :");
27  disp(" Since the annual cost of buy option is the
        minimum among all the alternatives , the company
        should buy the product .")
```

Chapter 16

Linear Programming

Scilab code Exa 16.1 Formulate Linear Programming Model

```
1  //Exa 16.1
2  clc;
3  clear;
4  close;
5  //given data :
6  disp("The data of the problem are summarized below :
      ");
7  disp("Machine                     Products
    Limit on ");
8  disp("                           P1           P2
    machine hours");
9  disp("Lathe                       5           10
            60");
10 disp("Milling                     4            4
            40");
11 disp("Profit/unit                 6            8");
12 disp("Let X1 be the production volume of the product
    .P1, and");
13 disp("X2 be the production volume of the product ,P2.
    ");
14 disp("The corresponding linear programming model to
```

```
       determine the production volume of each product
       such that the total profit is maximized is as
       shown below : ");
15 disp(" maximize  Z = 6*X1 + 8*X2");
16 disp(" subject to");
17 disp("5*X1+10*X2 <= 60")
18 disp("4*X1+4*X2 <= 40")
19 disp("X1,X2 >= 0")
```

Scilab code Exa 16.2 Determine Optimal combination of food types

```
1 //Exa 16.2
2 clc;
3 clear;
4 close;
5 //given data :
6 disp("Let X1 be the No. of packets of food type1
      suggested for babies, and");
7 disp("X2 be the No. of packets of food type1
      suggested for babies.");
8 disp("The corresponding linear programming model to
      determine the No. of packets of each food type to
       be suggested for babies with the minimum cost
      such that the minimum daily required vitamin in
      each food type is satisfied is as shown below : "
      );
9 disp(" maximize  Z = 2*X1 + 3*X2");
10 disp(" subject to");
11 disp("X1+X2 >= 6")
12 disp("7*X1+X2 >= 14");
13 disp("X1,X2 >= 0");
```

Scilab code Exa 16.3 Solve LP problem

```
1  //Exa 16.3
2  clc;
3  clear;
4  close;
5  //given data :
6  disp("Given the following LP model :")
7  disp("maximize Z = 6*X1 + 8*X2");
8  disp("subject to");
9  disp("5*X1+10*X2 <= 60");
10 disp("4*X1+4*X2 <= 40");
11 disp("X1,X2 >= 0");
12 disp("The introduction of non−negative constraints
       X1>=0 and X2>=0 will eliminate the 2nd, 3rd and 4
       th quadrants of XY plane.");
13 disp("Compute the cordinates to plot equations
       relting to the constraints on the XY plane as
       shown below : ");
14 disp("5*X1+10*X2 <= 60");
15 disp("When X1=0 : X2=6");
16 disp("When X2=0 : X1=12");
17 X1=0:12;
18 X2=(60-5*X1)/10;
19 plot2d(X1,X2);
20 disp("Consider the 2nd constraint in the form :");
21 disp("4*X1+4*X2 <= 40");
22 disp("When X1=0 : X2=10");
23 disp("When X2=0 : X1=10");
24 X1=0:10;
25 X2=(40-4*X1)/4;
26 plot2d(X1,X2);
27 disp("The closed polygon is the feasible region at
       each of the corner points of the closed polygon
       is computed as follows by substituting its
       coordinates in the objective function :");
28 ZA=6*0+8*0;
29 ZB=6*10+8*0;
30 ZC=6*8+8*2;
31 ZD=6*0+8*6;
```

```
32  disp("ZA=6*0+8*0=0...
33      ZB=6*10+8*0=60...
34      ZC=6*8+8*2=64...
35      ZD=6*0+8*6=48");
36  disp("Since the type of the objective function is
        maximization, the solution corresponding to the
        maximum Z value should be selected as the optimum
         solution. The Z value is maximum for the corner
        point C. Hence, the corresponding solution is ");
37  disp("X1 = 8   X2 = 2 and Z(Optimum) = 64");
```

Scilab code Exa 16.4 `Solve LP problem`

```
1  //Exa 16.4
2  clc;
3  clear;
4  close;
5  //given data :
6  disp("Given the following LP model :")
7  disp("minimize Z = 2*X1 + 3*X2");
8  disp("subject to");
9  disp("X1+X2 &gt;= 6");
10 disp("7*X1+X2 &gt;= 14");
11 disp("X1,X2 &gt;= 0");
12 disp("The introduction of non-negative constraints
        X1&gt;=0 and X2&gt;=0 will eliminate the 2nd, 3rd
         and 4th quadrants of XY plane.");
13 disp("Compute the cordinates to plot equations
        relating to the constraints on the XY plane as
        shown below : ");
14 disp("X1+X2 = 6");
15 disp("When X1=0 : X2=6");
16 disp("When X2=0 : X1=6");
17 X1=0:6;
18 X2=(6-X1);
```

```
19  plot2d(X1,X2);
20  disp("Consider the 2nd constraint in the form :");
21  disp("7*X1+X2 = 14");
22  disp("When X1=0 : X2=14");
23  disp("When X2=0 : X1=2");
24  X1=0:2;
25  X2=(14-7*X1);
26  plot2d(X1,X2);
27  disp("The Optimum solution will be in any one of the
        corners A, B and C");
28  disp("The objective function value at each of these
      corner points of the feasible solution space is
      computed as follows by substituting its
      coordinates in the objective function.")
29  ZA=2*0+3*14;
30  ZB=2*(4/3)+3*(14/3);
31  ZC=2*6+3*0;
32  disp("ZA=6*0+8*0=0...
33      ZB=6*10+8*0=60...
34      ZC=6*8+8*2=64");
35  disp("Since the type of the objective function is
      minimization, the solution corresponding to the
      minimum Z value should be selected as the optimum
       solution. The Z value is minimum for the corner
      point C. Hence, the corresponding solution is ");
36  disp("X1 = 6   X2 = 0 and Z(Optimum) = 12");
```

Scilab code Exa 16.5 `Solve LP model`

```
1  //Exa 16.3
2  clc;
3  clear;
4  close;
5  //given data :
6  disp("Given the following LP model :")
```

```scilab
 7  disp("maximize Z = 6*X1 + 8*X2");
 8  disp("subject to");
 9  disp("5*X1+10*X2 <= 60");
10  disp("4*X1+4*X2 <= 40");
11  disp("X1,X2 >= 0");
12  disp("The canonical form of the above LP problem is
       :");
13  disp("maximize Z = 6*X1 + 8*X2 + 0*S1 + 0*S2");
14  disp("subject to");
15  disp("5*X1+10*X2+S1 = 60");
16  disp("4*X1+4*X2+S2 = 40");
17  disp("X1,X2,S1,S2 >= 0");
18  disp("S1, S2 are slack variables.");
19  disp("The initial simplex table of the above problem
        is shownin table below : ");
20  disp("CBi                    Cj             6            8
                0                   0");
21  disp("          Basic Variable     X1            X2
            S1              S2        Solution       Ratio");
22  disp(" 0                      S1            5            10
                1               0            60            60/10=6**"
     );
23  disp(" 0                      S2            4            4
                0               1            40            40/4=10");
24  disp("                       Zj                0            0
                0               0           0");
25  disp("                       Cj-Zj             6            8*
                0               0");
26  disp("* key column         ** key row");
27  disp("The value at the intersection of the keyrow
        and key column is called the key element.");
```

Scilab code Exa 16.6 Solve LP model using simplex method

```scilab
 1  //Exa 16.6
```

```scilab
 2  clc;
 3  clear;
 4  close;
 5  //given data :
 6  disp("Given the following LP model :")
 7  disp("minimize Z = 2*X1 + 3*X2");
 8  disp("subject to");
 9  disp("X1+X2 >= 6");
10  disp("7*X1+X2 >= 14");
11  disp("X1,X2 >= 0");
12  disp("Standard Form : The standard form of the above
        model is as follows :");
13  disp("minimize Z = 2*X1 + 3*X2");
14  disp("subject to");
15  disp("X1+X2-S1 >= 6");
16  disp("7*X1+X2-S2 >= 14");
17  disp("X1,X2,S1,S2 >= 0");
18  disp("S1, S2 are surplus variables which are
        introduced to balance the constraints.");
19  disp("Canonical Form : The Canonical form of the
        above model is as follows :");
20  disp("minimize Z = 2*X1 + 3*X2 + M1*R1 + M2*R2");
21  disp("subject to");
22  disp("X1+X2-S1+R1 >= 6");
23  disp("7*X1+X2-S2+R2 >= 14");
24  disp("X1,X2,S1,S2,R1,R2 >= 0");
25  disp("R1, R2 are artificial variables which are
        introduced to have basic variables in each of the
         constraints.");
26
27  disp("The initial simplex table of the above problem
        is shownin table below : ");
28  disp("CBi              Cj              2              3
                0              0              M              M'");
29  disp("          Basic Variable      X1              X2
              S1              S2              R1              R2
              Solution          Ratio");
30  disp(" M                R1              1              1
```

```matlab
                  -1              0              1              0
            6                      6");
31  disp(" M                    R2              7              1
                0              -1              0              1
              14                    2**");
32  disp("                      Zj              8M              2M
              -M              -M              M              M
            20M");
33  disp("                      Cj-Zj          2-8*M          3-2*M
              M              M              0              0");
34  disp("* key column          ** key row");
35  disp("The value at the intersection of the keyrow
      and key column is called the key element.");
```