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

Created by
Mohd Asif
B.Tech
Electronics Engineering
Uttarakhand Technical University
College Teacher
Arshad Khan
Cross-Checked by
Lavitha Pereira

October 18, 2013

Book Description

Title: Engineering Economics

Author: R. Panneerselvam

Publisher: Phi Learning, Delhi

Edition: 1

Year: 2010

ISBN: 978-81-203-1743-7

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

Chapter 1

Introduction

Scilab code Exa 1.1 Break even sales quantity margin of safety

```scilab
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
```

```
 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
```

```
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
```

```scilab
        Machine Hour rate      Cost");
 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
```

```scilab
      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 10th 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 : ");
```

```
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
```

31

```scilab
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

```scilab
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
```

```
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
```

```scilab
        /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  e q u i v a l e n t  n e t  r e t u r n  of
        a l t e r n a t i v e  B  i s  more  than  t h a t  of  a l t e r n a t i v e  A.
         Thus  the  company  should  s e l e c t  a l t e r n a t i v e  A" ) ;
28  // Note  :  C a l c u l a t i o n  in  the  book  i s  not  a c c u r a t e .
```

Scilab code Exa 6.4 Which Machine would you choose

```
 1  // Exa  6 . 4
 2  c l c ;
 3  c l e a r ;
 4  c l o s e ;
 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  y e a r s
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  e q u i v a l e n t  c o s t  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  y e a r s
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_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
```

44

```
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
```

47

```
 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
```

```
 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

```
 1  //Exa 6.10
```

49

```scilab
 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

```scilab
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 %
```

```
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
```

product line in % per annum :");

_____

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. : ");
```

```scilab
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;
```

```
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

```
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.)");
```

```
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
```

```
 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
```

```
                  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
```

```scilab
   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

```scilab
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.
```

```scilab
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;
```

```scilab
 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)
```

```scilab
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

```
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

```
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
```

104

```
      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 >= 6");
10 disp("7*X1+X2 >= 14");
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("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 fllows 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
```

109

```
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
```

```
                       −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.");
```