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

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Book Description

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

Chapter 1

Introduction

Scilab code Exa 1.1 Break even sales quantity margin of safety

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

Scilab code Exa 1.2 Find contribution profit BEP MS

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

Scilab code Exa 1.3 Find contribution profit BEP MS

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

```
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
```

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

Scilab code Exa 2.5 Find Economic advantage of selection

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

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

Scilab code Exa 2.6 Find most economical sequence of operations

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

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

    Total      143.25");

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

    Total      124.80");

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

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

Chapter 3

Interest Formulas and their Applications

Scilab code Exa 3.1 Find maturity value

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

Scilab code Exa 3.2 What is the single payment

```
1 //Exa3_2
```

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

Scilab code Exa 3.3 Find maturity value

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

Scilab code Exa 3.4 Find Equivalent Amount

```
//Exa3_4
clc;
clear;
close;
//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
```

```
A=P*(((i/100)*(1+i/100)^n)/((1+i/100)^n-1));
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

```
//Exa3_7
clc;
clear;
close;
//given data is :
A1=4000;//in rupees
G=500;//in rupees
n=10;//in years
i=15;//% per annum
A=A1+G*(((1+i/100)^n-(i/100)*n-1)/((i/100)*(1+i/100)
   ^n-(i/100)));
F=A*(((1+i/100)^n-1)/(i/100));
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

```
//Exa3_8
clc;
clear;
close;
//given data is :
A1=8500;//in rupees
G=-500;//in rupees
n=10;//in years
```

```
i=15;//% per annum
A=A1+G*(((1+i/100)^n-(i/100)*n-1)/((i/100)*(1+i/100)
   ^n-(i/100)));
F=A*(((1+i/100)^n-1)/(i/100));
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

```
//Exa3_9
clc;
clear;
close;
//given data is :
P=5000;//in rupees
n=10;//in years
i=12;//% per annum
m=4;//no. of interest periods per year for quarterly
N=n*m;
r=i/m;
F=P*(1+r/100)^N;
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
```

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

Scilab code Exa 5.3 Select best alternative

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

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

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

```
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

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

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

Scilab code Exa 5.5 Which Machine should be selected

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

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

Chapter 6

Annual Equivalent Method

Scilab code Exa 6.1 Decision to provide rental car to Executive

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

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

Scilab code Exa 6.2 Determine Best Alternative

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

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

Scilab code Exa 6.3 Determine Best Alternative

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

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

Scilab code Exa 6.4 Which Machine would you choose

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

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

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

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

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

Scilab code Exa 6.6 Determine the more economical choice

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

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

Scilab code Exa 6.7 Determine Which Alternative to Select

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

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

Scilab code Exa 6.8 Which Machine should be purchased

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

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

Scilab code Exa 6.9 Determine Best Alternative for Lakshimi

```
1 //Exa 6.9
```

```
clc;
clear;
close;
//Alternative 1 :
disp("Alternative 1 : ");
DP=60000;//in Rs
P1=15000;//in Rs
n=1;//in years
i=12;//in % Compounded anually
//Formula : (P/F,i,n) : 1/((1+i/100)^n)
PW1=DP+P1*1/((1+i/100)^n);//in RS
disp(PW1,"The annual equivalent for this alternative
    in RS. : ");
//Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i
   /100)^n)-1)
n=4;//in years
AE1=PW1*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
disp(AE1,"The annual equivalent for this alternative
    in RS. : ");

//Alternative 2 :
disp("Alternative 2 : ");
P4y=90000;//in Rs
AE2=P4y*(i/100)/(((1+i/100)^n)-1);//in Rs.
disp(AE2,"The annual equivalent for this alternative
    in RS. : ");
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.");
//Note : Calculation in the book is not accurate.
```

Scilab code Exa 6.10 Which tyre should be buy

```
//Exa 6.10
```

```
clc;
clear;
close;
//Brand A :
disp("Brand A : ");
w=12;//in months
P=1200;//in Rs/tyre
i=12;//in % nominal rate(Compounded anually)
i=i/12;//in % compounded monthly
//Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
AE_A=P*((i/100)*(1+i/100)^w)/(((1+i/100)^w)-1);//in RS
disp(AE_A,"The annual equivalent for this brand in RS. : ");

//Brand B :
disp("Brand B : ");
w=24;//in months
P=1800;//in Rs/tyre
i=12;//in % nominal rate(Compounded anually)
i=i/12;//in % compounded monthly
//Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
AE_B=P*((i/100)*(1+i/100)^w)/(((1+i/100)^w)-1);//in RS
disp(AE_B,"The annual equivalent for this brand in RS. : ");

//Brand C :
disp("Brand C : ");
w=36;//in months
P=2100;//in Rs/tyre
i=12;//in % nominal rate(Compounded anually)
i=i/12;//in % compounded monthly
//Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
AE_C=P*((i/100)*(1+i/100)^w)/(((1+i/100)^w)-1);//in
```

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

Chapter 7

Rate of Return Method

Scilab code Exa 7.1 Find the Rate of Return

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

```
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. : ");
```

```
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;
```

```
clear;
close;
//Alternative 1:
disp("Alternative 1:");
Io=500000;//in Rs
Ar=170000;//in Rs
n=5;//in years
//Formula : (P/A,i,n)=(((1+i/100)^n)-1)/((i/100)*(1+i/100)^n)
// when i=15 %
i1=15;//in % per annum
PW1=-Io+Ar*(((1+i1/100)^n)-1)/((i1/100)*(1+i1/100)^n);//in RS
disp(PW1,"The present worth(PW(15%)) for i=10% in RS . : ");
// when i=17 %
i2=17;//in % per annum
PW2=-Io+Ar*(((1+i2/100)^n)-1)/((i2/100)*(1+i2/100)^n);//in RS
disp(PW2,"The present worth(PW17(%)) for i=10% in RS . : ");
// when i=20 %
i3=20;//in % per annum
PW3=-Io+Ar*(((1+i3/100)^n)-1)/((i3/100)*(1+i3/100)^n);//in RS
disp(PW3,"The present worth(PW(20%)) for i=10% in RS . : ");
// when i=22 %
i4=22;//in % per annum
PW4=-Io+Ar*(((1+i4/100)^n)-1)/((i4/100)*(1+i4/100)^n);//in RS
disp(PW4,"The present worth(PW(22%)) for i=10% in RS . : ");
disp("Present worth for i=15% is suitable.");
i=i3+(PW3-0)*(i4-i3)/(PW3-PW4);//in Rs.
disp(i,"Therefore, the rate of return of alternative 1 in % per annum :");

```

```
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.)
```

```
                    D(Rs.)          E(Rs.)          F(Rs.)
        G(rs.)      H(rs.)");
disp("  1               0               0.8929
                    0.00            0.00        4000.00
          1.1200      4480.00");
disp("  2             200               0.7972
     159.44          159.44          4159.44      0.5917
          2461.14");
disp("  3             400               0.7118
     284.72          444.16          4444.16      0.4163
          1850.10");
disp("  4             600               0.6355
     381.30          825.46          4825.46      0.3292
          1588.54");
disp("  5             800               0.5674
     453.92         1279.38          5279.38      0.2774
          1464.50");
disp("  6            1000               0.5066
     506.60         1785.98          5785.98      0.2432
          1407.15");
disp("  7            1200               0.4524
     542.88         2328.86          6328.86      0.2191
          1386.65");
disp("  8            1400               0.4039
     565.46         2894.32          6894.32      0.2013
          1387.83");
disp("  9            1600               0.3606
     576.96         3471.28          7471.28      0.1877
          1402.36");
disp(" 10            1800               0.3220
     579.60         4050.88          8050.88      0.1770
          1425.00");
disp("Economic life of the machine : 7 years");
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
```

```
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
```

```
clc;
clear;
close;
//Given data :
p1=(100-96)/100;//unitless
p2=(96-89)/100;//unitless
p3=(89-68)/100;//unitless
p4=(68-37)/100;//unitless
p5=(37-13)/100;//unitless
p6=(13-0)/100;//unitless
N0=1000;//no. of resistors
N1=N0*p1;//no. of resistors
N2=N0*p2+N1*p1;//no. of resistors
N3=N0*p3+N1*p2+N2*p1;//no. of resistors
N4=N0*p4+N1*p3+N2*p2+N3*p1;//no. of resistors
N5=N0*p5+N1*p4+N2*p3+N3*p2+N4*p1;//no. of resistors
N6=N0*p6+N1*p5+N2*p4+N3*p3+N4*p2+N5*p1    ;//no. of
   resistors
//Calculation of individual replacement cost
Life=0;//in months
p=[p1 p2 p3 p4 p5 p6];//Unitless
for i=1:6
    Life=Life+i*p(i);
end
disp(Life,"Expected life of each transistor in
   months : ")
disp(round(1000/Life),"Average No. of failures/month
    :  ");
disp(round(1000/Life)*10,"Therefore, cost of
   individual replacement in Rs. : ")


//Calculation of group replacement cost
disp("Cost/transistor when replaced simultaneously =
    Rs. 4");
disp("Cost/transistor when replaced individually =
   Rs. 10");
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
```

```
clc;
clear;
close;
//Given data :
P=100000;//in Rs
F=20000;//in Rs
n=8;//in years
Sum=n*(n+1)/2;//sum of the years
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");
disp("The calculations of Dt and Bt for different
   values of t are summarized in table below using
   the formulae : ");
disp("Dt=Rate*(P-F)");
disp("Bt=B(t-1)-Dt");
disp("End of year          Depreciation
   Book value");
disp("    (t)                  (Dt)              (Bt=B
   (t-1)-Dt)");
disp("     0
   100000.00");
disp("     1                  17777.77
   82222.23");
disp("     2                  15555.55
   66666.68");
disp("     3                  13333.33
   53333.35");
disp("     4                  11111.11
   42222.24");
disp("     5                   8888.88
   33333.36");
disp("     6                   6666.66
   26666.70");
disp("     7                   4444.44
   22222.26");
disp("     8                   2222.22
   20000.04");
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
```

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

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

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

Scilab code Exa 9.8 Compute D5 and B7

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

Scilab code Exa 9.9 Find Depreciation of the equipment

```
1 //Exa 9.9
```

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

Chapter 10

Evaluation of Public Alternatives

Scilab code Exa 10.1 Check Project justified based on BC ratio

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

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

Scilab code Exa 10.2 Check Govt should implement the project

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

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

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

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

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

Scilab code Exa 10.4 Find BC ratio

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

```
P=2500000000;//in Rs.
Agt=10000000;//in Rs.
Ai=1000000;//in Rs.
Com=48000;//in Rs./year/employee
C1=Com*300;//in Rs.
i=10;//in % per annum
//Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
C2=P*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);//in Rs
disp(C2,"Annual equivalent initial cost in Rs. : ");
CA=C2+C1;//in Rs
disp(CA,"Total Annual equivalent cost of the project in Rs. : ");
//Benefit to the state :
disp("Benefit to the state :")
W=30000000;//in Rs.
//Formula : (A/P,i,n) : ((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1)
A1=W*((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);//in Rs.
Agpy=10000000;//in ton/year
A2=Agpy*(30-10);//in Rs.
AvgAI=1000000;//in tons Km.
G=20000000;//in Rs.
//Formula : (A/G,i,n) :(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i/100)^n)-i/100)
A3=A2+G*(((1+i/100)^n)-i*n/100-1)/(((i/100)*(1+i/100)^n)-i/100) ;//in Rs.
disp(A3,"Annual equivalent average of transport cost saving in Rs. : ");
BA=A1+A3;//in Rs.
disp(BA,"Total annual equivalent benefits to the state : ");
BCratio=BA/CA;//unitless
disp(BCratio,"BCratio : ");
disp("The benefit cost ratio is more than 1,the project is justified.");
```

Scilab code Exa 10.5 Which Project should be selected

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

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

Chapter 11

Inflation Adjusted Decisions

Scilab code Exa 11.1 What Equal Amount should he save

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

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

Scilab code Exa 11.2 Find Economic Life

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

```
    Hence the economic life of the machine is 14
    years.");
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");
i=20;//in  per year
Cum=0;//initialising
Op_cost=40000;//in RS.
Main_cost=60000;//in Rs.
OpMain=Op_cost+Main_cost;//in Rs.
S=400000;//in Rs.
for n=1:15
    PF=1/((1+i/100)^n);
    PW=OpMain*PF;//in Rs.
    Cum=Cum+PW
    PW_S=PF*S;//in RS.
    TPW=500000+Cum-PW_S;//in Rs.
    AP=((i/100)*(1+i/100)^n)/(((1+i/100)^n)-1);
    AEM=TPW*AP;//in RS
    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));
    Op_cost=Op_cost+5000;//in Rs.
    Main_cost=Main_cost+6000;//in Rs.
    S=S-50000;//in Rs.
end
```

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

```
//Exa 11.3
clc;
```

```
clear;
close;
IR=5;//in % per year
i=15;//in % per year
//Machine X :
disp("Machine X : ");
Ppx=1500000;//in Rs.
n=7;//in years
S=200000;//in Rs.
AMC=300000;//in Rs.
disp("End of year     AMC     InflationFactor
   InflatedAmount     P/F     PW");
format('v',9)
Pw=0;//For initialising
for n=1:7
    FP=(1+IR/100)^n
    IA=AMC*FP;//in Rs.
    PF=1/((1+i/100)^n);
    PW=IA*PF;//in Rs.
    Pw=Pw+PW;//in Rs.
    disp("      "+string(n)+"          "+string(AMC)+"
              "+string(FP)+"            "+string(IA)
       +"           "+string(PF)+"       "+string(PW))
       ;
end
disp(Pw,"Present worth of inflated annual operating
   and maintenance cost in Rs. : ");
PWX=Ppx+Pw-S*1/((1+i/100)^n);
disp(PWX,"Present worth of machine X in Rs. : ");
//Machine Y
disp("Machine Y : ");
Ppy=2000000;//in Rs.
n=7;//in years
S=300000;//in Rs.
AMC=250000;//in Rs.
disp("End of year     AMC     InflationFactor
   InflatedAmount     P/F     PW");
format('v',9)
```

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

Scilab code Exa 11.4 Find the single deposit

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

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

Chapter 12

Inventory Control

Scilab code Exa 12.1 Economic Order Quantity and Orders per year

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

Scilab code Exa 12.2 Find EOQ and cycle time

```
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
```

```
Cs=12;//in units/year
EOQ=sqrt(2*Co*D*(Cs+Cc)/(Cc*Cs));//in units
Q=round(EOQ);//units
disp(Q,"Ordering quantity in units : ");
Q1=sqrt(2*Co*D*Cs/(Cc*(Cs+Cc)));//in units
disp(round(Q1),"Maximum Inventory in units : ");
disp(round(Q-Q1),"Maximum shortage quantity in units
    : ");
t=Q/D;//in year
t=t*365;//in days
disp(round(t),"Cycle time in days: ");
t1=Q1/D;//in year
t1=t1*365;//in days
disp(round(t1),"Inventory period(t1) in days : ");
t2=t-t1;//in days
disp(round(t2),"Shortage period(t2) in days : ");
disp(D/Q,"No. of Orders/year : ");
```

Scilab code Exa 12.4 Find Various parameter of Inventory System

```
//Exa 12.4
clc;
clear;
close;
//given data :
r=12000;//in units/year
k=2000*12;//in units/year
Co=400;//in Rs./setup
Cc=0.20*12;//in Rs./year
Cs=15;//in Rs./unit/year

EOQ=sqrt((2*Co*k*r*(Cc+Cs)/(Cc*(k-r)*Cs)));//in
   units
Q=round(EOQ);//units
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(1500units) is less than the
     break even quantity, the company should buy the
     cabinets for its TV production.")
```

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

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

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

Chapter 16

Linear Programming

Scilab code Exa 16.1 Formulate Linear Programming Model

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

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

Scilab code Exa 16.2 Determine Optimal combination of food types

```
//Exa 16.2
clc;
clear;
close;
//given data :
disp("Let X1 be the No. of packets of food type1
    suggested for babies, and");
disp("X2 be the No. of packets of food type1
    suggested for babies.");
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 : "
    );
disp("maximize Z = 2*X1 + 3*X2");
disp("subject to");
disp("X1+X2 >= 6")
disp("7*X1+X2 >= 14");
disp("X1,X2 >= 0");
```

Scilab code Exa 16.3 Solve LP problem

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

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

Scilab code Exa 16.4 `Solve LP problem`

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

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

Scilab code Exa 16.5 Solve LP model

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

```
disp("maximize Z = 6*X1 + 8*X2");
disp("subject to");
disp("5*X1+10*X2 <= 60");
disp("4*X1+4*X2 <= 40");
disp("X1,X2 >= 0");
disp("The canonical form of the above LP problem is :");
disp("maximize Z = 6*X1 + 8*X2 + 0*S1 + 0*S2");
disp("subject to");
disp("5*X1+10*X2+S1 = 60");
disp("4*X1+4*X2+S2 = 40");
disp("X1,X2,S1,S2 >= 0");
disp("S1, S2 are slack variables.");
disp("The initial simplex table of the above problem is shownin table below : ");
disp("CBi                Cj          6          8          0          0");
disp("          Basic Variable    X1         X2         S1         S2     Solution     Ratio");
disp(" 0                S1          5          10         1          0         60         60/10=6**");
disp(" 0                S2          4          4          0          1         40         40/4=10");
disp("                  Zj          0          0          0          0          0");
disp("                Cj-Zj         6          8*         0          0");
disp("* key column        ** key row");
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`

```
//Exa 16.6
```

```
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.");
```