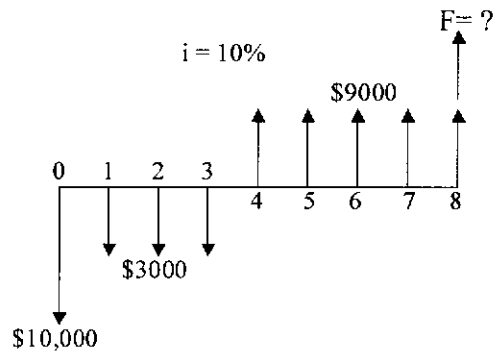
1.9 Rate of return = (45/966)(100)
= 4.65%

1.17 Equivalent cost now: P + 0.1P = 16,000
1.1P = 16,000
P = $14,545.45

1.22 Simple: 1,000,000 = 500,000 + 500,000(i)(5)
i = 20% per year simple

Compound: $1{,}000{,}000 = 500{,}000(1 + i)^5$
$(1 + i)^5 = 2.0000$
$(1 + i) = (2.0000)^{0.2}$
i = 14.87%

1.39 The cash flow diagram is:



2.9 F = 1,700,000(F/P,18%,1)
= 1,700,000(1.18)
= $2,006,000

2.31 (a) $CF_3 = 280{,}000 - 2(50{,}000)$
= $180,000
(b) A = 280,000 – 50,000(A/G,12%,5)
= 280,000 – 50,000(1.7746)
= $191,270

2.40 For g = i, P = 60,000(0.1)[15/(1 + 0.04)]
= $86,538

2.54 400,000 = 320,000 + 50,000(A/G,i,5)
(A/G,i,5) = 1.6000
Interpolate between i = 22% and i = 24%
i = 22.6%

3.4 P = 100,000(P/A,15%,3) + 200,000(P/A,15%,2)(P/F,15%,3)
= 100,000(2.2832) + 200,000(1.6257)(0.6575)
= $442,100

3.17 $A = 600(A/P,12\%,5) + 4000(P/A,12\%,4)(A/P,12\%,5)$
$= 600(0.27741) + 4000(3.0373)(0.27741)$
$= \$3536.76$

3.27 Move all cash flows to year 9.
$0 = -800(F/A,14\%,2)(F/P,14\%,8) + 700(F/P,14\%,7) + 700(F/P,14\%,4)$
$-950(F/A,14\%,2)(F/P,14\%,1) + x - 800(P/A,14\%,3)$
$0 = -800(2.14)2.8526) + 700(2.5023) + 700(1.6890)$
$-950(2.14)(1.14) + x - 800(2.3216)$
$x = \$6124.64$

4.9 i/6months = 0.14/2 = 7%

4.23 $P = 5000(P/F,4\%,16)$
$= 5000(0.5339)$
$= \$2669.50$

4.45 $i = e^{0.12} - 1$
$= 12.75\%$

4.53 $P = 150{,}000(P/F,12\%,2)(P/F,10\%,3)$
$= 150{,}000(0.7972)(0.7513)$
$= \$89{,}840$

5.9 $PW_A = -80{,}000 - 30{,}000(P/A,12\%,3) + 15{,}000(P/F,12\%,3)$
$= -80{,}000 - 30{,}000(2.4018) + 15{,}000(0.7118)$
$= \$-141{,}377$

5.15 $PW_{plastic} = -75{,}000 - 27{,}000(P/A,10\%,6) - 75{,}000(P/F,10\%,2)$
$- 75{,}000(P/F,10\%,4)$
$= -75{,}000 - 27{,}000(4.3553) - 75{,}000(0.8264) - 75{,}000(0.6830)$
$= \$-305{,}798$

$PW_{aluminum} = -125{,}000 - 12{,}000(P/A,10\%,6) - 95{,}000(P/F,10\%,3)$
$+ 30{,}000(P/F,10\%,6)$
$= -125{,}000 - 12{,}000(4.3553) - 95{,}000(0.7513) + 30{,}000(0.5645)$
$= \$-231{,}702$

Use aluminum case

5.21 $FW_A = -300{,}000(F/P,12\%,10) - 900{,}000(F/A,12\%,10)$
$= -300{,}000(3.1058) - 900{,}000(17.5487)$

= $-16,725,570

FW_B = -1,200,000(F/P,12%,10) – 200,000(F/A,12%,10)
– 150,000(F/A,12%,10)
= -1,200,000(3.1058) – 200,000(17.5487) – 150,000(17.5487)
= $-9,869,005

Select Plan B

5.33 CC_E = [-200,000(A/P,3%,8) + 30,000 + 50,000(A/F,3%,8)]/0.03
= [-200,000(0.14246) + 30,000 + 50,000(0.11246)]/0.03
= $237,700

CC_F = [-300,000(A/P,3%,16) + 10,000 + 70,000(A/F,3%,16)]/0.03
= [-300,000(0.07961) + 10,000 + 70,000(0.04961)]/0.03
= $-347,010

CC_G = -900,000 + 40,000/0.03
= $433,333

Select alternative G.

6.7 AW_X = -85,000(A/P,12%,3) – 30,000 + 40,000(A/F,12%,3)
= -85,000(0.41635) – 30,000 + 40,000(0.29635)
= $-53,536

AW_Y = -97,000(A/P,12%,3) – 27,000 + 48,000(A/F,12%,3)
= -97,000(0.41635) – 27,000 + 48,000(0.29635)
= $-53,161

Select robot Y by a small margin.

6.13 AW_{land} = -110,000(A/P,12%,3) –95,000 + 15,000(A/F,12%,3)
= -110,000(0.41635) –95,000 + 15,000(0.29635)
= $-136,353

AW_{incin} = -800,000(A/P,12%,6) –60,000 + 250,000(A/F,12%,6)
= -800,000(0.24323) –60,000 + 250,000(0.12323)
= $-223,777

$AW_{contract}$ = $-190,000

Use land application.

6.21 P_{-1} = 1,000,000(P/A,10%,11) + 100,000(P/G,10%,11)
= 1,000,000(6.4951) + 100,000(26.3963)
= $9,134,730

Amt in yr 10 = 9,134,730(F/P,10%,11)
= 9,134,730(2.8531)
= $26,062,298

AW = 26,062,298(0.10)
= $2,606,230

7.8 0 = -130,000 – 49,000(P/A,i%,8) + 78,000(P/A,i%,8) + 1000(P/G,i%,8)
+ 23,000(P/F,i%,8)

Solve by trial and error or Excel
i = 19.2% (Excel)

7.11 (a) 0 = -(220,000 + 15,000 + 76,000)(A/P,i%,36) + 12,000(2.00 – 1.05) + 2000
+ 100,000(A/F,i%,36)
0 = -(311,000)(A/P,i%,36) + 13,400 + 100,000(A/F,i%,36)

Solve by trial and error or Excel
i = 3.3% per month (Excel)

(b) Nominal per year = 3.3(12)
= 39.6% per year

Effective per year = $(1 + 0.396/12)^{12} - 1$
= 47.6% per year

7.26 (a) There are two sign changes, indicating that there may be two real-number rate of return values.

(b) 0 = -30,000 + 20,000(P/F,i%,1) + 15,000(P/F,i%,2) - 2000(P/F,i%,3)
Solve by trial and error or Excel
i = 7.43% per year (Excel)

7.33 Apply net reinvestment procedure.

$F_0 = 3000$ $F_0 > 0$; use c
$F_1 = 3000(1 + 0.14) - 2000$
$= 1420$ $F_1 > 0$; use c
$F_2 = 1420(1 + 0.14) + 1000$
$= 2618.80$ $F_2 > 0$; use c
$F_3 = 2618.80(1 + 0.14) – 6000$
$= -3014.57$ $F_3 < 0$; use i'
$F_4 = -3014.57(1 + i') + 3800$

Set $F_4 = 0$ and solve for i'.
$0 = -3014.57(1 + i') + 3800$
i' = 26.1%

7.37 (a) i = 5,000,000(0.06)/4 = $75,000 per quarter

After brokerage fees, the City got $4,500,000. However, *before* brokerage fees, the ROR equation from the City's standpoint is:

$0 = 4{,}600{,}000 - 75{,}000(P/A,i\%,120) - 5{,}000{,}000(P/F,i\%,120)$

Solve for i by trial and error or Excel

i = 1.65% per quarter (Excel)

(b) Nominal i per year = 1.65(4)
= 6.6% per year

Effective i per year = $(1 + 0.066/4)^4 - 1$
= 6.77% per year

8.16 $0 = -10{,}000 + 1200(P/A,i,4) + 12{,}000(P/F,i,2) + 1000(P/F,i,4)$

Solve for i by trial and error or Excel
i = 30.3% (Excel)
Select machine B.

8.22 Find ROR for incremental cash flow over LCM of 4 years

$0 = -50{,}000(A/P,i,4) + 5000 + (40{,}000 - 5000)(P/F, i,2)(A/P, i,4) + 2000(A/F,i,4)$

Solve for i by trial and error or Excel
i = 6.1% (Excel)

i < MARR; select semiautomatic machine

8.28 (a) A vs DN: $0 = -30{,}000(A/P,i,8) + 4000 + 1000(A/F,i,8)$
Solve for i by trial and error or Excel
i = 2.1% (Excel)
Method A is *not* acceptable

B vs DN: $0 = -36{,}000(A/P,i,8) + 5000 + 2000(A/F,i,8)$
Solve for i by trial and error or Excel
i = 3.4% (Excel)
Method B is *not* acceptable

C vs DN: $0 = -41{,}000(A/P,i,8) + 8000 + 500(A/F,i,8)$
Solve for i by trial and error or Excel

i = 11.3% (Excel)
Method C *is* acceptable

D vs DN: 0 = - 53,000(A/P,i,8) + 10,500 - 2000(A/F,i,8)
Solve for i by trial and error or Excel
i = 11.1% (Excel)
Method D *is* acceptable

(b) A vs DN: 0 = -30,000(A/P,i,8) + 4000 + 1000(A/F,i,8)
Solve for i by trial and error or Excel
i = 2.1% (Excel)
Eliminate A

B vs DN: 0 = - 36,000(A/P,i,8) + 5000 + 2000(A/F,i,8)
Solve for i by trial and error or Excel
i = 3.4% (Excel)
Eliminate B

C vs DN: 0 = - 41,000(A/P,i,8) + 8000 + 500(A/F,i,8)
Solve for i by trial and error or Excel
i = 11.3% (Excel)
Eliminate DN

C vs D: 0 = - 12,000(A/P,i,8) + 2,500 - 2500(A/F,i,8)
Solve for i by trial and error or Excel
i = 10.4% (Excel)
Eliminate D

Select method C

9.16 Convert all estimates to PW values.

PW disbenefits = 45,000(P/A,6%,15)
= 45,000(9.7122)
= $437,049
PW M&O Cost = 300,000(P/A,6%,15)
= 300,000(9.7122)
= $2,913,660

$$B/C = \frac{3,800,000 - 437,049}{2,200,000 + 2,913,660}$$

= 3,362,951/5,113,660
= 0.66

9.22 Alternative B has a larger total annual cost; it must be incrementally justified. Use PW values. Benefit is the difference in damage costs. For B incrementally over A:

Incr cost = (800,000 – 600,000) + (70,000 – 50,000)(P/A,8%,20)
= $200,000 + 20,000(9.8181)
= $396,362

Incr benefit = (950,000 – 250,000)(P/F,8%,6)
= 700,000(0.6302)
= 441,140

Incr B/C = 441,140/396,362
= 1.11

Select alternative B.

9.33 Compare A to DN since it is not necessary to select one of the sites.

A vs DN

AW of Cost = 50(A/P,10%,5) + 3
= 50(0.26380) + 3
= 16.19

AW of Benefits = 20 – 0.5
= 19.5

$B/C = \frac{19.5}{16.19}$
= 1.20 > 1.0 Eliminate DN.

B vs A

ΔC = (90 – 50)(A/P,10%,5) + (4 – 3)
= 40(0.26380) + 1
= $11.552

ΔB = (29 – 20) – (1.5 – 0.5) = 8

$\Delta B/C$ = 8/11.552
= 0.69 < 1.0 Eliminate B.

C vs A

ΔC = (200 – 50)(A/P,10%,5) + (6 – 3)
= 150(0.26380) + 3
= 42.57

ΔB = (61 – 20) – (2.1 – 0.5) = 39.4

$\Delta B/C$ = 39.4/42.57
= 0.93 < 1.0 Eliminate C

Select site A