7-5

………….

A = $325

n = 36

$3,000

$12,375

$9,375 = $325 (*P*/*A*, *i*%, 36)

(*P*/*A*, *i*%, 36) = $9,375/$325 = 28.846

From compound interest tables, *i* = 1.25%

Nominal Interest Rate = 1.25 × 12 = 15%

Effective Interest Rate = (1 + 0.0125)12 − 1 = 16.08%

7-14

$125

$10

$20

$30

$40

$50

$60

$125 = $10 (*P*/*A*, *i*%, 6) + $10 (*P*/*G*, *i*%, 6)

at 12%, $10 (4.111) + $10 (8.930) = $130.4

at 15%, $10 (3.784) + $10 (7.937) = $117.2

*i*\* = 12% + (3%) ((130.4 − 125)/(130.4 − 117.2)) = 13.23%

7-16

The algebraic sum of the cash flows equals zero. Therefore, the rate of return is 0%.

7-20

………….

*n* = 10

$412

Yr 0

$5,000

P’

A = $1,000

*n* = ∞

At Year 0, PW of Cost = PW of Benefits

$412 + $5,000 (*P*/*F*, *i*%, 10) = ($1,000/*i*) (*P*/*F*, *i*%, 10)

Try *i* = 15%

$412 + $5,000 (0.2472) = ($1,000/0.15) (0.2472)

$1,648 = $1,648

ROR = 15%

7-34

P = $1,845

*n* = 4

A = $50

F = $2,242

Set PW of Cost = PW of Benefits

$1,845 = $50 (*P*/*A*, *i*%, 4) + $2,242 (*P*/*F*, *i*%, 4)

Try *i* = 7%

450 (3.387) + $2,242 (0.7629) = $1,879 > $1,845

Try *i* = 8%

450 (3.312) + $2,242 (0.7350) = $1,813 < $1,845

Rate of Return = 7% + (1%) [($1,879 − $1,845)/($1,879 − $1,813)]

= 7.52% for 6 months

Nominal annual rate of return = 2 (7.52%) = 15.0%

Equivalent annual rate of return = (1 + 0.0752)2 − 1 = 15.6%

7-37

The amount of cash paid will be $75,000 – $50,000 = $25,000 with $50,000 financed, so, the monthly payments will be 50000 (*A*/*P*, 8%, 4) = (50000) (0.3019) = $15,095. The reduction in cost if one pays entirely in cash is $75,000(0.10) = $7,500, so a 100% cash payment would be $75,000 − $7,500 = $67,500 (true value of equipment).

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Pay Cash** | **Borrow from Manufacturer** | **Incremental Difference** |
| 0 | –$67,500 | −$25,000 | −$42,500 |
| 1 | —— | −15,095 | 15,095 |
| 2 | —— | −15,095 | 15,095 |
| 3 | —— | −15,095 | 15,095 |
| 4 | —— | −15,095 | 15,095 |

IRR = IRR (the (1) – (2) values for the Periods 0–4) = 15.69%per year

7-43

P = $20,000

A1 = $1,100

*n* = 20

*i* = ?

*g* = 10%

The payment schedule represents a geometric gradient.

There are two possibilities: *i* ≠ *g* and *i* = *g*

Try the easier *i* = *g* computation first:

P = A1*n* (1 + *i*)−1 where g = *i* = 0.10

$20,000 = $1,100 (20) (1.10)−1 = $20,000

Rate of Return *i*\* = *g* = 10%

7-47

|  |  |
| --- | --- |
| **Year** | **Case 1 (incl. deposit)** |
| 0 | −$39,264.00 |
| 1 | +$599.00 |
| 2 | +$599.00 |
| 3 | +$599.00 |
| 4 | +$599.00 |
| 5 | +$599.00 |
| 6 | +$599.00 |
| 7 | +$599.00 |
| 8 | +$599.00 |
| 9 | +$599.00 |
| 10 | +$599.00 |
| 11 | +$599.00 |
| 12 | +$599.00 |
| . . . | +$599.00 |
| 33 | +$599.00 |
| 34 | +$599.00 |
| 35 | +$599.00 |
| 36 | +$27,854.00 −$625.00 = +$27,229.00 |

IRR = 0.86%

Nominal IRR = 10.32%

Effective IRR =10.83%

7-56

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **X** | **Y** | **(X – Y)** |
| 0 | −$5,000 | −$5,000 | $0 |
| 1 | −$3,000 | +$2,000 | −$5,000 |
| 2 | +$4,000 | +$2,000 | +$2,000 |
| 3 | +$4,000 | +$2,000 | +$2,000 |
| 4 | +$4,000 | +$2,000 | +$2,000 |
| Computed ROR | 16.9% | 21.9% | 9.7% |

Since X – Y difference between alternatives is desirable, select Alternative X.

7-58

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Alt. A | -12000 |  |  |  |  |  |  |  | 1200 |
| Alt. B | -3000 | -3000 | -3000 | -3000 | -3000 | -3000 | -3000 | -3000 |  |
| A-B | -9000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 1200 |

IRR of A  B stream = IRR (the A – B values for the Years 0–8) = 27.90%

Since ΔROR > MARR (15%), choose the higher initial cost alternative, A (purchasing the equipment).

7-64

(a) Salvage = $50,000 and community’s interest rate = 8%.

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Purchase** | **Lease** | **Purchase –**  **Lease** |
| 0 | –$480,000 | –$70,000 | –$410,000 |
| 1 | 0 | –70,000 | 70,000 |
| 2 | 0 | –70,000 | 70,000 |
| 3 | 0 | –70,000 | 70,000 |
| 4 | 0 | –70,000 | 70,000 |
| 5 | 0 | –70,000 | 70,000 |
| 6 | 0 | –70,000 | 70,000 |
| 7 | 0 | –70,000 | 70,000 |
| 8 | 0 | –70,000 | 70,000 |
| 9 | 0 | –70,000 | 70,000 |
| 10 | 50,000 | 0 | 50,000 |

NPW = 0 = −410,000 +70,000 (*P*/*A*, IRR , 9) + 50,000 (*P*/*A*, IRR, 10) and interpolating

IRR = 10% + (2%) = 10.74% (10.71% Excel). The IRR is above the community’s interest rate on the borrowed amount ($410,000) from leasing, so buy the generator.



(b) The community spends $80,000 less on fuel and maintenance than it spends on buying power.

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Purchase** | **Lease** | **Purchase –**  **Lease** |
| 0 | –$480,000 | –$70,000 | –$410,000 |
| 1 | 80,000 | –70,000 | 150,000 |
| 2 | 80,000 | –70,000 | 150,000 |
| 3 | 80,000 | –70,000 | 150,000 |
| 4 | 80,000 | –70,000 | 150,000 |
| 5 | 80,000 | –70,000 | 150,000 |
| 6 | 80,000 | –70,000 | 150,000 |
| 7 | 80,000 | –70,000 | 150,000 |
| 8 | 80,000 | –70,000 | 150,000 |
| 9 | 80,000 | –70,000 | 150,000 |
| 10 | 80,000  50,000 | 0 | 130,000 |

NPW = 0 = −410,000 + 150,000 (*P*/*A*, IRR, 9) + 130,000 (*P*/*F*, IRR, 10) and interpolating

IRR = 30% + (5%) = 34.66% (34.63% from Excel). The interest rate on the borrowed amount is now well above the firm’s interest rate, so buy the generator. The rate of return for the generator will clearly be largest for this cash flow and is given by



PW = 0 = −480,000 + 80,000 (*P*/*A*, ROR, 10) + 50,000 (*P*/*F*, ROR, 10) and interpolating

ROR = 10% + (2%) = 11.44% (11.42% from Excel).



7-68

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **A** | **B** | **A – B** |
| 0 | −$150 | −$100 | −$50 |
| 1–10 | +$25 | +$22.25 | +$2.75 |
| 11–15 | +$25 | $0 | +$25 |
| 15 | +$20 | $0 | +$20 |
| Computed ROR | 14.8% | 18% | 11.6% |

Rate of Return (A – B):

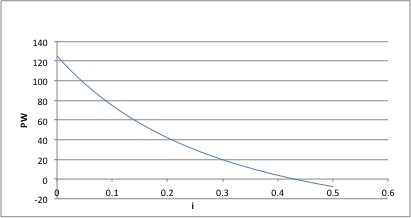
$50 = $2.75 (*P*/*A*, *i*%, 10) + $25 (*P*/*A*, *i*%, 5) (*P*/*F*, *i*%, 10) + $20 (*P*/*F*, *i*%, 15)

Rate of Return = 11.65

Select A.

7-96

We construct an Excel spreadsheet and draw the following graph:



From the graph, it looks like there is just a single axis crossing, at an IRR of about 21%. Above this interest rate, the PW is negative, and we note that if the interest rate increases without limit, the PW approaches –$110. So we conclude that the IRR is indeed about 21%.

7-101

Bill’s cashflows are as follows:

|  |  |
| --- | --- |
| **Month** | **Cash Flow** |
| 0 | –800 |
| 1–40 | –55 |
| 40 | 2,500 |

This series of cashflows follows the standard pattern: Bill invests some money, then gets a return. So we expect that his monthly IRR will have a single value, possibly negative. The equation we have to solve is:

–800–55(P/A,IRR, 40) +2,500(P/F,IRR,40) = 0

We first evaluate for IRR=0. In this case, PW = –800–55×40+2,500 = –$500

This is only going to get more negative if the IRR increases, so Bill’s actual IRR must be negative. Plotting the left side of the equation against IRR gives us IRR=-0.8%.

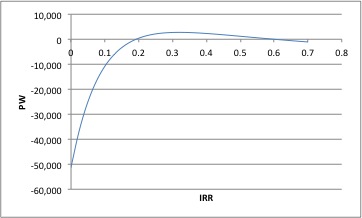
7-104

We begin by constructing a table of cashflows for the upgrade from Project B to Project A:

|  |  |
| --- | --- |
| **Year** | **Incremental Value** |
| 0 | –10,000 |
| 1–10 | –6,648 |
| 10 | –108,000 |

So we will plot the expression

PW = –10,000 +6,648(P/A,IRR,10) –108,000(P/F,IRR,10)



The graph crosses the axis at IRR=20% and IRR=60%. This tells us that, if the investor could earn a rate of return of between 20% and 60% on external investments, she could afford to pay interest at the same rate on the initial $10,000 needed to upgrade from B to A.

But we are told that the most she can earn on external investments is 6%. The graph shows that at an IRR of 6%, the PW of the upgrade would be negative, even if the investor could borrow the initial $10,000 at the same rate. And we also know that the investor wants a return of at least 7% on her projects. If she puts the initial $10,000 into this upgrade, she forgoes the opportunity to spend it on other projects, so the cost of this capital to her is at least 7%. So the upgrade is not justified.