17 Business Investment Decisions

**Exercise 17.1**

1. *a.* Fair market value of the future cash flows (discounted at Vencap’s cost of capital)

=  +  +  +  + 

= – $28,302 – $8900 + $16,792 + $47,526 + $29,890

= $57,006

Since the purchase price is less than the present value of the future cash flows,

the investment should be made.

*b*. The economic value, in current dollars, of Vencap will be increased by

(Present value of the expected cash flows) – (Purchase price)

The increase in economic value is $57,006 – $55,000 = $2006

3. If Vencap requires a 9% rate of return on investment, it should offer an amount

equal to the present value of the future cash flows discounted at 9%.

Price =  +  +  +  +  = $48,007

5. *a.* If Arrowsmith's cost of capital is 7%, the present value of the forecast cash flows is

 +  +  +  +  + 

= $251,072

The present value of the expected cash flows is larger than the price of the timber

rights. Arrowsmith should still buy the timber rights if its cost of capital is 7%.

*b*. The economic value of Arrowsmith Lumber would be increased by

$251,072 – $250,000 = $1072

7. The lower cost alternative should be selected. This will be the alternative having the lower present value of costs (net of any salvage or resale value).

*a.* The lease payments form a simple annuity due having

*PMT* = $1000, *n* = 48, and *i* = 0.55%. Then

*PV*(lease) = *PV*(due) = $10001.0055 = $42,317

*PV*(purchase) = $45,000 – $5000 = $41,157

The machine should be purchased since the current economic value of the

lifetime costs is $1160 less than if the machine is leased.

*b*. If the firm's cost of borrowing is *i* = 0.75% per month,

*PV*(lease) = $10001.0075 = $40,486

*PV*(purchase) = $45,000 – $5000 = $41,507

The machine should be leased since the current economic value of the

lifetime costs is $1021 less than if the machine is purchased.

9. *a.* The alternative having the lower present value of costs should be chosen. Since the college will continue to own the telephone system after 5 years, the fair comparison is purchasing the system versus leasing for 5 years followed by exercising the purchase option. For the lease, *PMT* = $1500, *n* = 20, and *i* = 1.25%.

*PV*(lease) = $3000 + *PV*(due) + $3000

= $3000 + $15001.0125 + $2340

= $32,069

The college should choose to lease the system.

*b*. Leasing will save $35,000 – $32,069 = $2931 in current dollars.

11. The alternative having the lower present value of costs should be chosen. The rental payments form a simple annuity due having *PMT* = $1000 per month and *n* = 60.

*a*. If *i* = %,

*PV*(rent) = $1000= $50,797

*PV*(purchase payments) = $180,000 + $300 – 

= $180,000 + $15,151 − $141,081

= $54,070

Mr. Harder should rent, thereby saving $54,070 − 50,797 = $3273 in current dollars.

*b*. If *i* =  = 0.5%,

*PV*(rent) = $10001.005 = $51,984

*PV*(purchase payments) = $180,000 + $300 – 

= $180,000 + $15,518 − $148,274

= $47,244

Mr. Harder should buy, thereby saving $51,984 − $47,244 = $4740.

**Exercise 17.2**

1. *a.* *NPV* = $70,000 +  – $433,000

= $390,767 + $53,205 – $433,000

= $10,972

Since the investment has a positive *NPV*, St. Lawrence Bus Lines should

sign the contract.

*b*. *NPV* = $70,000 +  – $433,000 = – $5930

At a 7% cost of capital, the investment's NPV is a negative amount. The contract should not be signed. (The magnitude of the *NPV* in relation to the amounts involved means that the future profits and resale value would not be sufficient to pay back the $433,000 financing along with a 7% rate of return to the providers of the financing.)

*c*. As the discount rate (cost of capital) increases beyond 7%, the *NPV* will remain negative and grow in magnitude. At a 8% cost of capital, the *NPV* is – $21,875. The investment should be rejected at any cost of capital above 7%.

**CF**

**2nd CLR Work**

250000 **+ / –** **ENTER**

50000 **+ / –** **ENTER**

2 **ENTER**

200000 **ENTER**

300000 **ENTER**

**NPV**

9 **ENTER**

**CPT**

*Ans*: 29,009

|  |  |  |  |
| --- | --- | --- | --- |
| 3. | *Time* | *Cash* | *Present* |
|  | *(years)* | *Flow* | *value* |
|  | 0 | –$250,000 | –$250,000 |
|  | 1 | –50,000 | – 45,872 |
|  | 2 | –50,000 | – 42,084 |
|  | 3 | 200,000 | 154,437 |
|  | 4 | 300,000 | 212,528 |
|  |  | Total (*NPV*): | $ 29,009 |

The economic value, at the start of planting,

of the 20-hectare ginseng crop is $29,009.

**CF**

**2nd CLR Work**

150000 **+ / –** **ENTER**

150000 **+ / –** **ENTER**

2 **ENTER**

0 **ENTER**

1 **ENTER**

90000 **ENTER**

6 **ENTER**

190000 **ENTER**

1 **ENTER**

**NPV**

8.5 **ENTER**

**CPT**

*Ans*: –10,779.29

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *profit* | *cash flow* |
|  | 0 | –$150,000 |  | –$150,000 |
|  | 1 | –150,000 | 0 | –150,000 |
|  | 2 | –150,000 | 0 | –150,000 |
|  | 3 | 0 | 0 | 0 |
|  | 4 to 9 | 0 | $90,000 | 90,000 |
|  | 10 | 100,000 | 90,000 | 190,000 |

*NPV* =  + 

– $150,000(1.085)

= $320,854+ $84,034 – $415,667

= – $10,779

Since the *NPV* of the new project is negative, it should be rejected.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *profit* | *cash flow* |
|  | 0 | –$ 1,900,000 |  | –$1,900,000 |
|  | 1 | –5,800,000 |  | –5,800,000 |
|  | 2 to 5 |  | $600,000 | 600,000 |
|  | 6 to 12 |  | 1,000,000 | 1,000,000 |
|  | 13 | 800,000 | 1,000,000 | 1,800,000 |

**CF**

**2nd CLR Work**

1900000 **+ / –** **ENTER**

5800000 **+ / –** **ENTER**

600000 **ENTER**

4 **ENTER**

1000000 **ENTER**

7 **ENTER**

1800000 **ENTER**

**NPV**

7 **ENTER**

**CPT**

*Ans*: –831,765

*NPV* = 

+ 

+  –  – $1,900,000

= $1,899,371 + $3,842,489 + $746,936 – $5,420,561 – $1,900,000

= – $831,765

Since the project has a negative *NPV* at a discount rate of 7%, the rate of return on

the investment will be below 7% and Jasper should not proceed with the project.

**CF**

**2nd CLR Work**

375000 **+ / –** **ENTER**

75000 **ENTER**

2 **ENTER**

25000 **ENTER**

75000 **ENTER**

5000 **ENTER**

55000 **ENTER**

75000 **ENTER**

**NPV**

8 **ENTER**

**CPT**

*Ans*: –84,458

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 9. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *profit* | *cash flow* |
|  | 0 | –$375,000 |  | –$375,000 |
|  | 1 to 2 |  | $75,000 | 75,000 |
|  | 3 | –50,000 | 75,000 | 25,000 |
|  | 4 |  | 75,000 | 75,000 |
|  | 5 | –50,000 | 55,000 | 5,000 |
|  | 6 |  | 55,000 | 55,000 |
|  | 7 | 20,000 | 55,000 | 75,000 |

*NPV* = $75,000 +  + 

+  +  +  – $375,000

= $133,745 + $19,846 + $55,127 + $3403

+ $34,659 + $43,762 – $375,000

= – $84,458

The product should not be manufactured since

the investment has a negative *NPV*.

**CF**

**2nd CLR Work**

14000000 **+ / –** **ENTER**

2000000 **ENTER**

2200000 **ENTER**

2420000 **ENTER**

2662000 **ENTER**

2928200 **ENTER**

3221020 **ENTER**

5543122 **ENTER**

**NPV**

8 **ENTER**

**CPT**

*Ans*: 872,752

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 11. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *profit* | *cash flow* |
|  | 0 | –$14,000,000 |  | –$14,000,000 |
|  | 1 |  | $2,000,000 | 2,000,000 |
|  | 2 |  | 2,200,000 | 2,200,000 |
|  | 3 |  | 2,420,000 | 2,420,000 |
|  | 4 |  | 2,662,000 | 2,662,000 |
|  | 5 |  | 2,928,200 | 2,928,200 |
|  | 6 |  | 3,221,020 | 3,221,020 |
|  | 7 | 2,000,000 | 3,543,122 | 5,543,122 |

Since the *NPV* ($872,752) is positive, Wildcat

Drilling should acquire the new drilling rig.

**Exercise 17.3**

1. Rank the projects in descending order of *NPV* per invested dollar.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Initial* | *Project* | *NPV per* | *Cumulative* |
|  | *Project* | *investment* | *NPV* | *invested dollar* | *investment* |
|  | B | $60,000 | $40,000 | $0.67 | $60,000 |
|  | D | 200,000 | 110,000 | 0.55 | 260,000 |
|  | C | 130,000 | 60,000 | 0.46 | 390,000 |
|  | A | 100,000 | 25,000 | 0.25 | 490,000 |

Now find the combination of projects having the largest aggregate *NPV* subject

to the $300,000 constraint on total investment.

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Combination* | *Combined* | *Total* |
|  | *of projects* | *NPV* | *investment* |
|  | B, D | $150,000 | $260,000 |
|  | B, C, A | 125,000 | 290,000 |

Projects B and D have the highest *NPV* subject to the capital budgeting constraint.

3. Calculate each project's *NPV* and rank the projects in descending order of *NPV*

per invested dollar.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Initial* | *Project* | *NPV per* | *Cumulative* |
|  | *Project* | *investment* | *NPV* | *invested dollar* | *investment* |
|  | F  C | $20,000  18,000 | $7581  5960 | $0.38  0.33 | $20,000  38,000 |
|  | A | 30,000 | 9878 | 0.33 | 68,000 |
|  | E | 28,000 | 8570 | 0.31 | 96,000 |
|  | B | 36,000 | 7503 | 0.21 | 132,000 |
|  | D | 22,000 | 3502 | 0.16 | 154,000 |

Projects F, C, A and D should be selected(requiring a combined investment of $90,000).

5. *NPV*(Massey) = $77,000 +  – $190,000 = $210,341

*NPV*(Deere) = $70,000 +  – $156,000 = $216,411

Carl should purchase the Deere combine. In current dollars, its *NPV* is

$216,411 – $210,341 = $6070

larger than the *NPV* for the purchase of the Massey combine.

7. We will use the Equivalent Annual Cash Flow Method.

*NPV*(H, 3 years) = $55,000 – $119,000 = $29,386

H's equivalent annual cash flow is the value of *PMT* in

$29,386 = *PMT*

*PMT* = $10,892

*NPV*(J, 4 years) = $58,000 – $160,000 = $43,299

J's equivalent annual cash flow is the value of *PMT* in

$43,299 = *PMT*

*PMT* = $12,353

Model J should be purchased because it has the larger equivalent annual cash flow.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 9. | *Investment* C | | | *Investment* D | | |
|  | *Time* | *Capital* | *Operating* | *Time* | *Capital* | *Operating* |
|  | *(years)* | *cash flow* | *profit* | *(years)* | *cash flow* | *profit* |
|  | 0 | –$50,000 |  | 0 | –$25,000 |  |
|  | 1 |  | $16,000 | 1 to 3 | –25,000 |  |
|  | 2 | –30,000 | 16,000 | 4 to 9 |  | $35,000 |
|  | 3 to 9 |  | 16,000 | 10 | 20,000 | 35,000 |
|  | 10 | 30,000 | 16,000 |  |  |  |

*NPV*(C) = $16,000 +  –  – $50,000 = $40,104

*NPV*(D) =  +  – $25,000 – $25,000

= $136,023 + $8,448 – $63,282 – $25,000

= $56,189

The company should choose investment D whose current economic

value is $16,085 more than C's economic value.

11. The truck that generates the larger equivalent annual cash flow (EACF) should

be purchased.

*NPV*(15-ton, 7 years) = $35,000 +  – $150,000 = $42,564

This truck's EACF is the value of *PMT* in

$42,564 = *PMT*

*PMT* = $8457

*NPV*(25-ton, 6 years) = $48,000 +  – $200,000 = $39,175

The 25-ton truck's EACF is the value of *PMT* in

$39,175 = *PMT*

*PMT* = $8733

The 25-ton truck should be purchased. It will generate a

$8733 – $8457 = $276 larger

annual economic benefit to the owner than the 15-ton truck.

13. *NPV*(Hawk, 5 years) =  – $60,000 – $240,000

= $43,792.9 – $249,340.8 – $240,000

= – $445,548

The equivalent annual cost (EAC) is the value of *PMT* in

– $445,548 = *PMT*

*PMT* = – $107,214

(The negative sign is interpreted as a cash outflow or cost.)

*NPV*(Falcon, 7 years) =  – $80,000 – $190,000

= $51,480.5 – $438,761.6 – $190,000

= – $577,281

The Falcon's EAC is the value of *PMT* in

– $577,281 = *PMT*

*PMT* = – $105,256

The Falcon has a lower (by $1958) equivalent annual cost.

15. The present value of the costs for 8 years with the Caterpillar is

 –  –  –  – $160,000

= $12,548.2 – $21,148.8 – $23,762.8 – $26,699.9 – $160,000

= – $219,063

The equivalent annual cost (EAC) of the Caterpillar is the value of *PMT* in

– $219,063 = *PMT* 

*PMT* = – $35,277

The present value of the costs for 12 years with the International is

 –  –  –  – $210,000

= $9939.4 – $11,838.0 – $14,099.2 – $16,792.4 – $210,000

= – $242,790

The EAC of the International is the value of *PMT* in

– $242,790 = *PMT* 

*PMT* = – $28,959

The International model should be purchased since its equivalent annual cost is

$35,277 – $28,959 = $6318 lower.

**Exercise 17.4**

**P/Y** 1 **ENTER**

(making *C/Y* = *P/Y* = 1)

10 **N**

66000 **+ / –**  **PV**

10000 **PMT**

0  **FV**

**CPT** **I/Y**

*Ans*: 8.37

1. The *NPV* of the license at the discount rate *i* is

*NPV* = $10,000 – $66,000

The IRR is the value for *i* that makes the *NPV* = 0.

The value is *i* = 8.4% (to the nearest 0.1%).

The investment's *IRR* is 8.4%.

**P/Y** 1 **ENTER**

(making *C/Y* = *P/Y* = 1)

10 **N**

80000 **+ / –**  **PV**

20000 **PMT**

0  **FV**

**CPT** **I/Y**

*Ans*: 21.4

3. For the first stage, the *IRR* is the value of *i* satisfying

$20,000 – $80,000 = 0

The solution is *i* = 21.4% = *IRR* for Stage 1.

Similarly, for Stage 2, solve for *i* in

Same *P/Y, C/Y*

Same *PV, FV*

9 **N**

17000 **PMT**

**CPT** **I/Y**

*Ans*: 15.4

$17,000 – $80,000 = 0

The solution is *i* = 15.4% = *IRR* for Stage 2.

For Stage 3, solve for *i* in

Same *P/Y, C/Y*

Same *PV, FV*

8 **N**

13000 **PMT**

**CPT** **I/Y**

*Ans*: 6.2

$13,000 – $80,000 = 0

The solution is *i* = 6.2% = *IRR* for Stage 3.

For Stage 4, solve for *i* in

Same *P/Y, C/Y*

Same *PV, FV*

7 **N**

15000 **PMT**

**CPT** **I/Y**

*Ans*: 7.3

$15,000 – $80,000 = 0

The solution is *i* = 7.3% = *IRR* for Stage 4.

Stages 1 and 2 should be approved since their

*IRR*'s exceed the cost of capital (8%).

5. The investment's *IRR* is the value of *i* satisfying

**P/Y** 1 **ENTER**

(making *C/Y* = *P/Y* = 1)

10 **N**

100000 **+ / –**  **PV**

12000 **PMT**

15000  **FV**

**CPT** **I/Y**

*Ans*: 5.4

*NPV* = 0

= $12,000 +  – $100,000

The solution is *i* = 5.4% = *IRR* of the investment.

The investment should not be made since the

*IRR* (5.4%) is less than the cost of capital (6%).

7. The investment's *IRR* is the value of *i* satisfying

**CF**

**2nd CLR Work**

80000 **+ / –** **ENTER**

15000 **ENTER**

5 **ENTER**

10000 **ENTER**

5 **ENTER**

**IRR**

**CPT**

*Ans*: 10.13

*NPV* = 0 = $15,000

+  – $80,000

The solution is *i* = 10.1% = *IRR* of the investment.

The investment should be undertaken since its

*IRR* exceeds the cost of capital (8.5%).

9. The investment's *IRR* is the value of *i* satisfying

**CF**

**2nd CLR Work**

120000 **+ / –** **ENTER**

15000 **ENTER**

60000 **ENTER**

40000 **ENTER**

35000 **ENTER**

**IRR**

**CPT**

*Ans*: 8.98

*NPV* = 0 =  + 

+  +  – $120,000

The solution is *i* = 9.0% = *IRR* of the

investment. The investment just meets the

minimum requirement for acceptance since

its *IRR* equals the firm's cost of capital (9%).

The product should, therefore, be introduced.

11. Note that the Year 11 operating profit will be

**CF**

**2nd CLR Work**

3000000 **+ / –** **ENTER**

3000000 **+ / –** **ENTER**

1000000 **ENTER**

9 **ENTER**

**IRR**

**CPT**

*Ans*: 8.024

exactly offset by the $1,000,000 expenditure

for environmental restoration. The project's

*IRR* is the value of *i* satisfying

*NPV* = 0 = 

–  – $3,000,000

The solution is *i* = 8.0% = *IRR* of the project.

The mine should not be developed because the

*IRR* is less than the company's cost of capital.

**CF**

**2nd CLR Work**

1900000 **+ / –** **ENTER**

5800000 **+ / –** **ENTER**

600000 **ENTER**

4 **ENTER**

1000000 **ENTER**

7 **ENTER**

1800000 **ENTER**

**IRR**

**CPT**

*Ans*: 5.18

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 13. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *profit* | *cash flow* |
|  | 0 | –$ 1,900,000 |  | –$1,900,000 |
|  | 1 | –5,800,000 |  | –5,800,000 |
|  | 2 to 5 |  | $600,000 | 600,000 |
|  | 6 to 12 |  | 1,000,000 | 1,000,000 |
|  | 13 | 800,000 | 1,000,000 | 1,800,000 |

The project’s *IRR* is 5.2%. Since the *IRR* is

less than the required rate of return (7%),

Jasper should not undertake the

expansion.

**Exercise 17.5**

1 *a.* The *IRR* on project C is the value *i* satisfying

*NPV* = 0 = $43,000 – $200,000

The solution is *i* = 7.8% = *IRR* of project C.

The *IRR* on project D is the value of *i* satisfying

*NPV* = 0 = $30,000 – $135,000

The solution is *i* = 8.9% = *IRR* of project D.

Project D should be selected on the basis of having the larger *IRR*.

*b*. *NPV*(C) = $43,000 – $200,000 = $4961

*NPV*(D) = $30,000 – $135,000 = $7996

Project D has the larger *NPV* if the firm's cost of capital is 7%.

*c.* *NPV*(C) = $43,000 – $200,000 = $18,255

*NPV*(D) = $30,000 – $135,000 = $17,271

Project C has the higher *NPV* if the firm's cost of capital is 5%.

3. *a.* The *IRR* on Project X is the value of *i* satisfying

*NPV* = 0 =  +  +  – $800,000

The solution is *i* = 10.0% = *IRR* on Project X.

The *IRR* on Project Y is the value of *i* satisfying

*NPV* = 0 =  – $800,000

The solution is *i* = 9.5% = *IRR* on Project Y.

Based on an *IRR* ranking, Project X should be selected.

*b.* *NPV*(X) =  +  +  – $800,000 = $12,522

*NPV*(Y) =  – $800,000 = $10,793

At a cost of capital of 9%, Project X has the larger *NPV* and should be selected.

*c.* *NPV*(X) =  +  +  – $800,000 = $39,938

*NPV*(Y) =  – $800,00 = $57,113

At a cost of capital of 7%, Project Y has the larger *NPV* and should be selected.

5. *a.* The *IRR* on Project X is the value of *i* satisfying

*NPV* = 0 =  – $100,000

The solution is *i* = 4.7% = *IRR* on project X.

The *IRR* on Project Y is the value of *i* satisfying

*NPV* = 0 =  –  – $50,000

The solution is *i* = 6.3% = *IRR* on Project Y.

Project Y is preferred on an *IRR* basis.

*b.* *NPV*(Project X) =  – $100,000 = $2629

*NPV*(Project Y) =  –  – $50,000 = $6632

At a cost of capital of 4%, Project Y has the larger *NPV* and should be selected.

*c.* Similarly, at a cost of capital of 3%,

*NPV*(Project X) = $6649

*NPV*(Project Y) = $9721

Project Y has the higher *NPV* and should be selected.

**Exercise 17.6**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | *a.* |  | *Cumulative* | Payback period = 4 + years  = 4.67 years |
|  |  | *Year* | *profit* |
|  |  | 1 | $ 8000 |
|  |  | 2 | 20,000 |
|  |  | 3 | 32,000 |
|  |  | 4 | 44,000 |
|  |  | 5 | 56,000 |

*b.* Since it will take longer than 4 years to recover the initial investment from

profits, the firm would not make the investment.

|  |  |  |  |
| --- | --- | --- | --- |
| 3. |  | Cumulative profit | |
|  | *Year* | *Project X* | Project Y |
|  | 1 | $25,000 | 0 |
| Payback period(Project X) = 4 years  Payback period(Project Y) = 5 years | 2 | 50,000 | $25,000 |
|  | 3 | 75,000 | 50,000 |
|  | 4 | 100,000 | 75,000 |
|  | 5 | 125,000 | 100,000 |
|  | 6 | 150,000 | 125,000 |
|  | 7 |  | 150,000 |
|  | 8 |  | 175,000 |

*NPV*(Project X) = $25,000 – $100,000 = $15,572

*NPV*(Project Y) =  – $100,000 = $20,518

Project X would be preferred on the basis of its shorter payback but

Project Y would be preferred on the basis of its larger *NPV*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 5. |  | *Proposal A* | | *Proposal B* | |
|  |  |  | *Cumulative* |  | *Cumulative* |
|  | *Year* | *Profit* | *profit* | *Profit* | *profit* |
|  | 1 | $16,250 | $16,250 | $12,500 | $12,500 |
|  | 2 | 17,500 | 33,750 | 12,500 | 25,000 |
|  | 3 | 17,500 | 51,250 | 15,000 | 40,000 |
|  | 4 | 17,500 | 68,750 | 15,000 | 55,000 |

*a.* *NPV*(A) =  +  – $45,000 =$13,108

*NPV*(B) = $12,500 +  – $35,000 = $11,288

Proposal A is preferred on the basis of its larger *NPV*.

*b.* The *IRR* on Proposal A is the value of *i* satisfying

*NPV* = 0 =  +  – $45,000

The solution is *i* = 19.1% = *IRR* on proposal A.

The *IRR* on proposal B is the value of *i* satisfying

*NPV* = 0 = $12,500 +  – $35,000

The solution *i* = 20.0% = *IRR* on proposal B.

Proposal B is preferred on the basis of its larger *IRR*.

*c.* Payback period(A) = 2 +  = 2.64 years

Payback period(B) = 2 +  = 2.67 years

There is a weak preference for proposal A based on its slightly

shorter payback period.

# Review Problems

1. *a.* Cumulative profit after 4 years = $75,000

Cumulative profit after 5 years = $95,000

The machine's payback period is 4 +  = 4.25 years.

*b.* No because the machine's payback period exceeds the required payback of 4 years.

*c.* *NPV* =  +  – $80,000 = $19,498

Yes. Since the *NPV* is positive, the firm will make the investment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *Profit* | *cash flow* |
|  | 0 | –$3,000,000 |  | –$3,000,000 |
|  | 1 | –1,000,000 |  | –1,000,000 |
|  | 2 to 8 |  | $750,000 | 750,000 |
|  | 9 | –1,000,000 | 750,000 | –250,000 |

*NPV* =  – $3,000,000 –  –

= $ 4,040,024 – $3,000,000 – $947,867 - $154,407

= – $62,250

Since the *NPV* is negative when the cash flows are discounted at 5.5%, the

project will not provide the company with a rate of return exceeding 5.5%.

5. If the plane is leased,

*PMT* = $5600, *n* = 60, *i* =  = 0.625%

*PV*(Iease) = *PV*(due) = $5600(1.00625) = $281,216

If the plane is purchased,

*PV*(purchase) = $360,000 –  = $263,667

Rainbow Aviation should purchase the plane and thereby gain an economic

advantage (in current dollars) of

$281,216 – $263,667 = $17,549

7. Rank the projects in descending order of *NPV* per invested dollar.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Initial* | *Project* | *NPV per* | *Cumulative* |
|  | *Project* | *investment* | *NPV* | *invested dollar* | *investment* |
|  | A | $200,000 | $63,000 | $0.32 | $200,000 |
|  | D | 250,000 | 75,000 | 0.30 | 450,000 |
|  | C | 350,000 | 90,000 | 0.26 | 800,000 |
|  | B | 400,000 | 100,000 | 0.25 | 1,200,000 |
|  | E | 100,000 | 20,000 | 0.20 | 1,300,000 |

Projects A, D, and C give the highest aggregate *NPV* within the $800,000

capital budget constraint.

9. *a.* For the lease alternative,

*PMT* = $385, *n* = 60, *i* = 0.75%

*PV*(Iease) = *PV*(due) = $385(1.0075) = $18,686

*PV*(purchase) = $22,500 –  = $19,307

The car should be leased because the economic value of the net cash

outflows is $621 lower.

*b.* If the trade-in value after 5 years is $7000,

*PV*(purchase) = $22,500 –  = $18,029

In this case, the car should be purchased (a $657 advantage over leasing).

11. Choose the machine having the larger equivalent annual cash flow (EACF).

*NPV*(X, 5 years) = $16,000 +  – $50,000 = $20,689

X's EACF is the value of *PMT* satisfying

$20,689 = *PMT*  giving *PMT* = $5182

*NPV*(Y, 10 years) = $16,000 +  – $72,000 = $39,993

Y's EACF is the value of *PMT* satisfying

$39,993 = *PMT*  giving *PMT* = $5960

Machine Y should be selected because its equivalent annual cash flow is $778 larger.

13. Choose the alternative having the lower equivalent annual cost. The present

value of the net costs of a Songster for 5 years is

 – $10,000 – $90,000 = – $116,959

The Songster’s equivalent annual cost (EAC) is the value of *PMT* in

$116,959 = *PMT*  giving *PMT* = $28,144

The present value of the net costs of a Boston Wailer for 7 years is

 – $8000 – $110,000 = – $128,136

The Boston Wailer’s EAC is the value of *PMT* in

$128,136 = *PMT*  giving *PMT* = $23,363

The Boston Wailer’s equivalent annual cost is $28,144 – $23,363 = $4781 lower.

15. Since the investment’s *NPV* is $20,850, the initial investment is the value of C satisfying

$20,850 =  +  +  +  – C

= $66,071.4 + $66,964.3 + $68,330.9 + $44,486.3 – C

C = $225,003

Cumulative profit after 2 years = $158,000

Cumulative profit after 3 years = $254,000

Payback period = 2 +  = 2.7 years

17. The investment's *IRR* is the value of *i* satisfying

*NPV* = 0 = $90,000 +  – $600,000

The solution is *i* = 7.6% = *IRR* of the investment.

The investment should be undertaken since its *IRR* is greater than the cost

of capital (7%).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 19. | *Time* | *Capital* | *Operating* | *Net* |
|  | *(years)* | *cash flow* | *profit* | *cash flow* |
|  | 0 | –$80,000 |  | –$80,000 |
|  | 1 to 4 |  | $16,500 | 16,500 |
|  | 5 to 7 |  | 15,500 | 15,500 |
|  | 8 | 10,000 | 15,500 | 25,500 |

*NPV* = $16,500 +  +  – $80,000

= $54,650 + $29,361 + $13,777 – $80,000

= $17,788

The machine should be acquired since the investment has a positive *NPV*.

21. *a.* The *IRR* on Investment A is the value of *i* satisfying

*NPV* = 0 =  +  – $92,000

The solution is *i* = 11.0% = *IRR* on Investment A.

The *IRR* on Investment B is the value of *i* satisfying

*NPV* = 0 =  +  – $85,000

The solution is *i* = 11.6% = *IRR* on Investment B.

Investment B would be selected on the basis on an *IRR* ranking.

*b.* *NPV*(Investment A) =  +  – $92,000 = $1388

*NPV*(Investment B) =  +  – $85,000 = $1777

With the cost of capital at 10%, Investment B has the larger *NPV* and

should be chosen.

*c*. Similarly, at a cost of capital of 7%,

*NPV*(Investment A) = $5912

*NPV*(Investment B) = $5401

Investment A now has the higher *NPV* and should be chosen.

23. Choose the alternative possessing the larger equivalent annual cash flow (EACF).

*NPV*(C, 3 years) = $30,000 +  – $55,000 = $28,661

C's EACF is the value of *PMT* satisfying

$28,661 = *PMT*  giving *PMT* = $11,323

*NPV*(D, 5 years) = $35,000 +  – $90,000 = $59,136

D's EACF is the value of *PMT* satisfying

$59,136 = *PMT*  giving *PMT* = $15,203

The firm should purchase Machine D because it has a $3880 larger annual

economic advantage.