Chapter 13

Capital Budgeting Decisions

Solutions to Questions

**13-1** A capital budgeting screening decision is concerned with whether a proposed investment project passes a preset hurdle, such as a 15% rate of return. A capital budgeting preference decision is concerned with choosing from among two or more alternative investment projects, each of which has passed the hurdle.

**13-2** The “time value of money” refers to the fact that a dollar received today is more valuable than a dollar received in the future simply because a dollar received today can be invested to yield more than a dollar in the future.

**13-3** Discounting is the process of computing the present value of a future cash flow. Discounting gives recognition to the time value of money and makes it possible to meaningfully add together cash flows that occur at different times.

**13-4** Accounting net income is based on accruals rather than on cash flows. Both the net present value and internal rate of return methods focus on cash flows.

**13-5** Unlike other common capital budgeting methods, discounted cash flow methods recognize the time value of money and take into account all future cash flows.

**13-6** Net present value is the present value of cash inflows less the present value of the cash outflows. The net present value can be negative if the present value of the outflows is greater than the present value of the inflows.

**13-7** One assumption is that all cash flows occur at the end of a period. Another is that all cash inflows are immediately reinvested at a rate of return equal to the discount rate.

**13-8** No. The cost of capital is not simply the interest paid on long-term debt. The cost of capital is a weighted average of the costs of all sources of financing, both debt and equity.

**13-9** The internal rate of return is the rate of return on an investment project over its life. It is computed by finding the discount rate that results in a zero net present value for the project.

**13-10** The cost of capital is a hurdle that must be cleared before an investment project will be accepted. (a) In the case of the net present value method, the cost of capital is used as the discount rate. If the net present value of the project is positive, then the project is acceptable because its rate of return is greater than the cost of capital. (b) In the case of the internal rate of return method, the cost of capital is compared to a project’s internal rate of return. If the project’s internal rate of return is greater than the cost of capital, then the project is acceptable.

**13-11** No. As the discount rate increases, the present value of a given future cash flow decreases. For example, the present value factor for a discount rate of 12% for cash to be received ten years from now is 0.322, whereas the present value factor for a discount rate of 14% over the same period is 0.270. If the cash to be received in ten years is $10,000, the present value in the first case is $3,220, but only $2,700 in the second case. Thus, as the discount rate increases, the present value of a given future cash flow decreases.

**13-12** The internal rate of return is more than 14% because the net present value is positive. The internal rate of return would be 14% only if the net present value (evaluated using a 14% discount rate) is zero. The internal rate of return would be less than 14% if the net present value (evaluated using a 14% discount rate) is negative.

**13-13** The project profitability index is computed by dividing the net present value of the cash flows from an investment project by the required investment. The index measures the profit (in terms of net present value) provided by each dollar of investment in a project. The higher the project profitability index, the more desirable is the investment project.

**13-14** The payback period is the length of time for an investment to fully recover its initial cost out of the cash receipts that it generates. The payback method is used as a screening tool for investment proposals. The payback method is useful when a company has cash flow problems. The payback method is also used in industries where obsolescence is very rapid.

**13-15** Neither the payback method nor the simple rate of return method considers the time value of money. Under both methods, a dollar received in the future is weighed the same as a dollar received today. Furthermore, the payback method ignores all cash flows that occur after the initial investment has been recovered.

**The Foundational 15**

1. The depreciation expense of $595,000 is the only non-cash expense.

2. The annual net cash inflows are computed as follows:

|  |  |
| --- | --- |
| Net operating income | $  405,000 |
| Add: Noncash deduction for depreciation | 595,000 |
| Annual net cash inflow | $1,000,000 |

The present value of the annual net cash inflows is computed as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Year(s) | Cash Flow | 14% Factor | Present Value of Cash Flows |
| Annual net cash inflows | 1-5 | $1,000,000 | 3.433 | $3,433,000 |

**The Foundational 15** (continued)

3. The project’s net present value is computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | $(2,975,000) |  |  |  |  |  |
| Sales |  | $2,735,000 | $2,735,000 | $2,735,000 | $2,735,000 | $2,735,000 |
| Variable expenses |  | (1,000,000) | (1,000,000) | (1,000,000) | (1,000,000) | (1,000,000) |
| Out-of-pocket costs | \_\_\_\_\_\_\_\_\_\_ | (735,000) | (735,000) | (735,000) | (735,000) | (735,000) |
| Total cash flows (a) | $(2,975,000) | $1,000,000 | $1,000,000 | $1,000,000 | $1,000,000 | $1,000,000 |
| Discount factor (b) | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 |
| Present value (a)×(b) | $(2,975,000) | $877,000 | $769,000 | $675,000 | $592,000 | $519,000 |
| Net present value | $457,000 |  |  |  |  |  |

4. In question 2, the present value of the annual net cash inflows is $3,433,000. In question 3, the present value of the annual net cash inflows is $3,432,000. The $1,000 difference arises because the discount factors in Exhibits 13B-1 and 13B-2 are rounded to three decimal places. The discount factor used in question 2 was 3.433. The sum of the discount factors used in question 3 is 3.432 (0.877 + 0.769 + 0.675 + 0.592 + 0.519).

**The Foundational 15** (continued)

5. The project profitability index for the project is:

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Net Present Value (a) | Investment Required  (b) | Project  Profitability Index  (a) ÷ (b) |
| Project | $457,000 | $2,975,000 | 0.15\* |

\* The answer of 0.1536 was rounded to 0.15.

6. The project’s internal rate of return is:

|  |  |
| --- | --- |
|  |  |

Looking in Exhibit 13B-2, and scanning along the five-year line, we can see that the factor computed above, 2.975, is closest to 2.991, the factor for the 20% rate of return. Therefore, to the nearest whole percent, the internal rate of return is 20%.

7. The payback period is determined as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Investment | Cash  Inflow | Unrecovered Investment |
| 1 | $2,975,000 | $1,000,000 | $1,975,000 |
| 2 |  | $1,000,000 | $975,000 |
| 3 |  | $1,000,000 | $0 |
| 4 |  | $1,000,000 | $0 |
| 5 |  | $1,000,000 | $0 |

The investment in the project is fully recovered in the 3rd year. To be more exact, the payback period is approximately 2.98 years.

**The Foundational 15** (continued)

8. The simple rate of return is computed as follows:



9. If the discount rate was 16%, instead of 14%, the project’s net present value would be lower because the discount factors would be smaller.

10. The payback period would be the same because the initial investment was recovered at the end of three years. The salvage value at the end of five years is irrelevant to the payback calculation.

11. The net present value would be higher because a $300,000 salvage value translates into a larger cash inflow in the fifth year. Although the salvage value would need to be translated to its lesser present value, it would still increase the project’s net present value.

12. The simple rate of return would be higher. The salvage value would lower the annual depreciation expense by $60,000 ($300,000 ÷ 5 years), which in turn would raise the annual net operating income and the simple rate of return.

**The Foundational 15** (continued)

13. The new annual variable expense would be $1,230,750 ($2,735,000 × 45%). The project’s actual net present value would be computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | $(2,975,000) |  |  |  |  |  |
| Sales |  | $2,735,000 | $2,735,000 | $2,735,000 | $2,735,000 | $2,735,000 |
| Variable expenses |  | (1,230,750) | (1,230,750) | (1,230,750) | (1,230,750) | (1,230,750) |
| Out-of-pocket costs | \_\_\_\_\_\_\_\_\_\_ | (735,000) | (735,000) | (735,000) | (735,000) | (735,000) |
| Total cash flows (a) | $(2,975,000) | $  769,250 | $  769,250 | $  769,250 | $  769,250 | $  769,250 |
| Discount factor (b) | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 |
| Present value (a)×(b) | $(2,975,000) | $674,632 | $591,553 | $519,244 | $455,396 | $399,241 |
| Net present value | $(334,934) |  |  |  |  |  |

**The Foundational 15** (continued)

14. The payback period is computed as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Investment | Cash  Inflow | Unrecovered Investment |
| 1 | $2,975,000 | $769,250 | $2,205,750 |
| 2 |  | $769,250 | $1,436,500 |
| 3 |  | $769,250 | $667,250 |
| 4 |  | $769,250 | $0 |
| 5 |  | $769,250 | $0 |

The investment in the project is fully recovered in the 4th year. To be more exact, the payback period is approximately 3.87 years.

15. The simple rate of return is computed as follows:



**Exercise 13-1** (10 minutes)

1. The payback period is determined as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Year | Investment | Cash Inflow | Unrecovered Investment |
|  | 1 | $15,000 | $1,000 | $14,000 |
|  | 2 | $8,000 | $2,000 | $20,000 |
|  | 3 |  | $2,500 | $17,500 |
|  | 4 |  | $4,000 | $13,500 |
|  | 5 |  | $5,000 | $8,500 |
|  | 6 |  | $6,000 | $2,500 |
|  | 7 |  | $5,000 | $0 |
|  | 8 |  | $4,000 | $0 |
|  | 9 |  | $3,000 | $0 |
|  | 10 |  | $2,000 | $0 |

The investment in the project is fully recovered in the 7th year. To be more exact, the payback period is approximately 6.5 years.

2. Because the investment is recovered prior to the last year, the amount of the cash inflow in the last year has no effect on the payback period.

**Exercise 13-2** (10 minutes)

1.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | | 3 | | 4 | | 5 |
| Purchase of machine | $(27,000) | |  |  | |  | |  | |  |
| Reduced operating costs | \_\_\_\_\_\_\_\_ | | $7,000 | $7,000 | | $7,000 | | $7,000 | | $7,000 |
| Total cash flows (a) | $(27,000) | | $7,000 | $7,000 | | $7,000 | | $7,000 | | $7,000 |
| Discount factor (12%) (b) | 1.000 | | 0.893 | 0.797 | | 0.712 | | 0.636 | | 0.567 |
| Present value (a)×(b) | $(27,000) | | $6,251 | $5,579 | | $4,984 | | $4,452 | | $3,969 |
| Net present value |  | $(1,765) |  | |  | |  | |  | |

Note: The annual reduction in operating costs can also be converted to its present value using the discount factor of 3.605 as shown in Exhibit 13B-2 in Appendix 13B.

2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Item | Cash Flow | Years | Total Cash Flows |
|  | Annual cost savings | $7,000 | 5 | $ 35,000 |
|  | Initial investment | $(27,000) | 1 | (27,000) |
|  | Net cash flow |  |  | $  8,000 |

**Exercise 13-3** (30 minutes)

|  |  |  |
| --- | --- | --- |
| 1. | Annual savings in part-time help | $3,800 |
|  | Added contribution margin from expanded sales (1,000 dozen × $1.20 per dozen) | 1,200 |
|  | Annual cash inflows | $5,000 |

|  |  |
| --- | --- |
| 2. |  |

Looking in Exhibit 13B-2, a factor of 3.720 falls closest to the 16% rate of return.

3. The cash flows will not be even over the six-year life of the machine because of the extra $9,125 inflow in the sixth year. Therefore, the above approach cannot be used to compute the internal rate of return in this situation. Using trial-and-error or some other method, the internal rate of is 22%:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | | 1 | | 2 | 3 | | 4 | | 5 | | 6 | |
| Purchase of machine | | $(18,600) | |  | |  |  | |  | |  | |  | |
| Reduced part-time help | |  | | $3,800 | | $3,800 | $3,800 | | $3,800 | | $3,800 | | $3,800 | |
| Added contribution margin | |  | | 1,200 | | 1,200 | 1,200 | | 1,200 | | 1,200 | | 1,200 | |
| Salvage value of machine | | \_\_\_\_\_\_\_ | | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | | 9,125 | |
| Total cash flows (a) | | $(18,600) | | $5,000 | | $5,000 | $5,000 | | $5,000 | | $5,000 | | $14,125 | |
| Discount factor (22%) (b) | | 1.000 | | 0.820 | | 0.672 | 0.551 | | 0.451 | | 0.370 | | 0.303 | |
| Present value (a)×(b) | | $(18,600) | | $4,100 | | $3,360 | $2,755 | | $2,255 | | $1,850 | | $4,280 | |
| Net present value | |  | $0 | |  | | |  | |  | |  | |  | |

**Exercise 13-4** (15 minutes)

The equipment’s net present value without considering the intangible benefits would be:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Item | Year(s) | Amount of Cash Flows | 20% Factor | Present Value of Cash Flows |
|  | Cost of the equipment | Now | $(2,500,000) | 1.000 | $(2,500,000) |
|  | Annual cost savings | 1-15 | $400,000 | 4.675 | 1,870,000 |
|  | Net present value |  |  |  | $   (630,000) |

The annual value of the intangible benefits would have to be great enough to offset a $630,000 negative present value for the equipment. This annual value can be computed as follows:



**Exercise 13-5** (10 minutes)

1. The project profitability index for each proposal is:

|  |  |  |  |
| --- | --- | --- | --- |
| Proposal Number | Net Present Value  (a) | Investment Required (b) | Project Profitability Index  (a) ÷ (b) |
| A | $36,000 | $90,000 | 0.40 |
| B | $38,000 | $100,000 | 0.38 |
| C | $35,000 | $70,000 | 0.50 |
| D | $40,000 | $120,000 | 0.33 |

2. The ranking is:

|  |  |
| --- | --- |
| Proposal Number | Project Profitability Index |
| C | 0.50 |
| A | 0.40 |
| B | 0.38 |
| D | 0.33 |

Note that proposal D has the highest net present value, but it ranks lowest in terms of the project profitability index.

**Exercise 13-6** (10 minutes)

This is a cost reduction project, so the simple rate of return would be computed as follows:

|  |  |
| --- | --- |
|  |  |
| Operating cost of old machine | $ 30,000 |
| Less operating cost of new machine | 12,000 |
| Less annual depreciation on the new machine ($120,000 ÷ 10 years) | 12,000 |
| Annual incremental net operating income | $   6,000 |
|  |  |
| Cost of the new machine | $120,000 |
| Scrap value of old machine | 40,000 |
| Initial investment | $  80,000 |



**Exercise 13-7** (15 minutes)

Project A:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 | 6 |
| Purchase of equipment | | $(100,000) |  |  |  |  |  |  |
| Annual cash inflows | |  | $21,000 | $21,000 | $21,000 | $21,000 | $21,000 | $21,000 |
| Salvage value | | \_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 8,000 |
| Total cash flows (a) | | $(100,000) | $21,000 | $21,000 | $21,000 | $21,000 | $21,000 | $29,000 |
| Discount factor (14%) (b) | | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 | 0.456 |
| Present value (a)×(b) | | $(100,000) | $18,417 | $16,149 | $14,175 | $12,432 | $10,899 | $13,224 |
| Net present value | | $(14,704) |  |  |  |  |  |  |

Project B:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | | | | 1 | 2 | 3 | | 4 | | 5 | | 6 | |
| Working capital invested | | | $(100,000) | | |  |  |  | |  | |  | |  | |
| Annual cash inflows | | |  | | | $16,000 | $16,000 | $16,000 | | $16,000 | | $16,000 | | $  16,000 | |
| Working capital released | | | \_\_\_\_\_\_\_ | | | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | | 100,000 | |
| Total cash flows (a) | | | $(100,000) | | | $16,000 | $16,000 | $16,000 | | $16,000 | | $16,000 | | $116,000 | |
| Discount factor (14%) (b) | | | 1.000 | | | 0.877 | 0.769 | 0.675 | | 0.592 | | 0.519 | | 0.456 | |
| Present value (a)×(b) | | | $(100,000) | | | $14,032 | $12,304 | $10,800 | | $9,472 | | $8,304 | | $52,896 | |
| Net present value | |  | | $7,808 |  | | | |  | |  | |  | |  | |

The $100,000 should be invested in Project B rather than in Project A. Project B has a positive net present value whereas Project A has a negative net present value.

**Exercise 13-8** (15 minutes)

1. Computation of the annual cash inflow associated with the new electronic games:

|  |  |
| --- | --- |
| Net operating income | $40,000 |
| Add noncash deduction for depreciation | 35,000 |
| Annual net cash inflow | $75,000 |

The payback computation would be:



Yes, the games would be purchased. The payback period is less than the maximum 5 years required by the company.

2. The simple rate of return would be:



Yes, the games would be purchased. The 13.3% return exceeds 12%.

**Exercise 13-9** (20 minutes)

1. The net present value is computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | $(3,000,000) |  |  |  |  |  |
| Sales |  | $2,500,000 | $2,500,000 | $2,500,000 | $2,500,000 | $2,500,000 |
| Variable expenses |  | (1,000,000) | (1,000,000) | (1,000,000) | (1,000,000) | (1,000,000) |
| Out-of-pocket costs | \_\_\_\_\_\_\_\_\_\_ | (600,000) | (600,000) | (600,000) | (600,000) | (600,000) |
| Total cash flows (a) | $(3,000,000) | $  900,000 | $  900,000 | $  900,000 | $  900,000 | $  900,000 |
| Discount factor (b) | 1.000 | 0.870 | 0.756 | 0.658 | 0.572 | 0.497 |
| Present value (a)×(b) | $(3,000,000) | $783,000 | $680,400 | $592,200 | $514,800 | $447,300 |
| Net present value | $17,700 |  |  |  |  |  |

2. The simple rate of return would be:



3. The company would want Derrick to pursue the investment opportunity because it has a positive net present value of $17,700. However, Derrick might be inclined to reject the opportunity because its simple rate of return of 10% is well below his historical return on investment (ROI) of 20%. Derrick may be justifiably concerned that implementing this project would lower his ROI and his next pay raise.

**Exercise 13-10** (10 minutes)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | |
| Purchase of stock | | $(13,000) |  |  |  | |
| Annual cash dividend | |  | $420 | $420 | $    420 | |
| Sale of stock | | \_\_\_\_\_\_\_ | \_\_\_\_ | \_\_\_\_ | 16,000 | |
| Total cash flows (a) | | $(13,000) | $420 | $420 | $16,420 | |
| Discount factor (14%) (b) | | 1.000 | 0.877 | 0.769 | 0.675 | |
| Present value (a)×(b) | | $(13,000) | $368 | $323 | $11,084 | |
| Net present value | | $(1,225) |  |  | |  | |

No, Kathy did not earn a 14% return on the Malti Company stock. The negative net present value indicates that the rate of return on the investment is less than the minimum required rate of return of 14%.

**Problem 13-11** (30 minutes)

1. The project profitability index is computed as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Project* | *Net Present  Value (a)* | *Investment  Required (b)* | *Project  Profitability  Index (a) ÷ (b)* |
|  | A | $44,323 | $160,000 | 0.28 |
|  | B | $42,000 | $135,000 | 0.31 |
|  | C | $35,035 | $100,000 | 0.35 |
|  | D | $38,136 | $175,000 | 0.22 |

2. a., b., and c.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Net Present Value | Project Profitability Index | Internal Rate of Return |
| First preference | A | C | D |
| Second preference | B | B | C |
| Third preference | D | A | A |
| Fourth preference | C | D | B |

**Problem 13-11** (continued)

3. Oxford Company’s opportunities for reinvesting funds as they are released from a project will determine which ranking is best. The internal rate of return method assumes that any released funds are reinvested at the rate of return shown for a project. This means that funds released from project D would have to be reinvested in another project yielding a rate of return of 22%. Another project yielding such a high rate of return might be difficult to find.

The project profitability index approach also assumes that funds released from a project are reinvested in other projects. But the assumption is that the return earned by these other projects is equal to the discount rate, which in this case is only 10%. On balance, the project profitability index is generally regarded as being the most dependable method of ranking competing projects.

The net present value is inferior to the project profitability index as a ranking device, because it looks only at the total amount of net present value from a project and does not consider the amount of investment required. For example, it ranks project C as fourth because of its low net present value; yet this project is the best available in terms of the net present value generated for each dollar of investment (as shown by the project profitability index).

**Exercise 13-12** (10 minutes)

Note: All present value factors in the computation below have been taken from Exhibit 13B-1 in Appendix 13B, using a 12% discount rate.

|  |  |  |
| --- | --- | --- |
| Amount of the investment |  | $104,950 |
| Less present value of Year 1 and Year 2 cash inflows: |  |  |
| Year 1: $30,000 × 0.893 | $26,790 |  |
| Year 2: $40,000 × 0.797 | 31,880 | 58,670 |
| Present value of Year 3 cash inflow |  | $ 46,280 |

Therefore, the expected cash inflow for Year 3 is:

$46,280 ÷ 0.712 = $65,000.

**Exercise 13-13** (15 minutes)

1. The payback period is:



No, the equipment would not be purchased because the payback period (4.8 years) exceeds the company’s maximum payback time (4.0 years).

2. The simple rate of return would be computed as follows:

|  |  |
| --- | --- |
| Annual cost savings | $90,000 |
| Less annual depreciation ($432,000 ÷ 12 years) | 36,000 |
| Annual incremental net operating income | $54,000 |



No, the equipment would not be purchased because its 12.5% rate of return is less than the company’s 14% required rate of return.

**Exercise 13-14** (10 minutes)

Project X:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 | 6 |
| Initial investment | | $(35,000) |  |  |  |  |  |  |
| Annual cash inflows | | \_\_\_\_\_\_\_\_ | $12,000 | $12,000 | $12,000 | $12,000 | $12,000 | $12,000 |
| Total cash flows (a) | | $(35,000) | $12,000 | $12,000 | $12,000 | $12,000 | $12,000 | $12,000 |
| Discount factor (18%) (b) | | 1.000 | 0.847 | 0.718 | 0.609 | 0.516 | 0.437 | 0.370 |
| Present value (a)×(b) | | $(35,000) | $10,164 | $8,616 | $7,308 | $6,192 | $5,244 | $4,440 |
| Net present value | | $6,964 |  |  |  |  |  |  |

Project Y:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | | | 1 | 2 | 3 | | 4 | | 5 | | 6 | |
| Initial investment | | | $(35,000) | |  |  |  | |  | |  | |  | |
| Single cash inflow | | | \_\_\_\_\_\_\_ | | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | | \_\_\_\_\_\_ | | 90,000 | |
| Total cash flows (a) | | | $(35,000) | | $0 | $0 | $0 | | $0 | | $0 | | $90,000 | |
| Discount factor (18%) (b) | | | 1.000 | | 0.847 | 0.718 | 0.609 | | 0.516 | | 0.437 | | 0.370 | |
| Present value (a)×(b) | | | $(35,000) | | $0 | $0 | $0 | | $0 | | $0 | | $33,300 | |
| Net present value | |  | | $(1,700) |  | | |  | |  | |  | |  | |

Project X should be selected. Project Y does not provide the required 18% return, as shown by its negative net present value.

Note: The annual cash inflows related to Project X can also be discounted to their present value using the appropriate discount factor from Exhibit 13B-2 in Appendix 13B.

**Exercise 13-15** (30 minutes)

|  |  |
| --- | --- |
| 1. |  |

Looking in Exhibit 13B-2 and scanning along the 5-period line, a factor of 3.432 represents an internal rate of return of 14%.

2. The machine’s net present value is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Purchase of machine | | $(137,280) |  |  |  |  |  |
| Annual cash inflows | | \_\_\_\_\_\_\_\_\_\_ | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 |
| Total cash flows (a) | | $(137,280) | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 |
| Discount factor (b) | | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 |
| Present value (a)×(b) | | $(137,280) | $35,080 | $30,760 | $27,000 | $23,680 | $20,760 |
| Net present value | | $0 |  |  |  |  |  |

The reason for the zero net present value is that 14% (the discount rate we have used) represents the machine’s internal rate of return. The internal rate of return is the discount rate that results in a zero net present value.

**Exercise 13-15** (continued)

|  |  |
| --- | --- |
| 3. |  |

Looking in Exhibit 13B-2 and scanning along the 5-period line, a factor of 3.695 falls closest to the factor for 11%. Thus, to the nearest whole percent, the internal rate of return is 11%.

**Problem 13-16** (20 minutes)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 |
| Purchase of equipment | | $(275,000) |  |  |  |  |
| Working capital investment | | (100,000) |  |  |  |  |
| Annual net cash receipts | |  | $120,000 | $120,000 | $120,000 | $120,000 |
| Road construction | |  |  |  | (40,000) |  |
| Working capital released | |  |  |  |  | 100,000 |
| Salvage value of equipment | | \_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | 65,000 |
| Total cash flows (a) | | $(375,000) | $120,000 | $120,000 | $80,000 | $285,000 |
| Discount factor (20%) (b) | | 1.000 | 0.833 | 0.694 | 0.579 | 0.482 |
| Present value (a)×(b) | | $(375,000) | $99,960 | $83,280 | $46,320 | $137,370 |
| Net present value | | $(8,070) |  |  |  |  |

No, the project should not be accepted; it has a negative net present value at a 20% discount rate. This means that the rate of return on the investment is less than the company’s required rate of return of 20%.

**Problem 13-17** (20 minutes)

1. The net present value is computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | $(3,500,000) |  |  |  |  |  |
| Sales |  | $3,400,000 | $3,400,000 | $3,400,000 | $3,400,000 | $3,400,000 |
| Variable expenses |  | (1,600,000) | (1,600,000) | (1,600,000) | (1,600,000) | (1,600,000) |
| Out-of-pocket costs | \_\_\_\_\_\_\_\_\_\_ | (700,000) | (700,000) | (700,000) | (700,000) | (700,000) |
| Total cash flows (a) | $(3,500,000) | $1,100,000 | $1,100,000 | $1,100,000 | $1,100,000 | $1,100,000 |
| Discount factor (b) | 1.000 | 0.862 | 0.743 | 0.641 | 0.552 | 0.476 |
| Present value (a)×(b) | $(3,500,000) | $948,200 | $817,300 | $705,100 | $607,200 | $523,600 |
| Net present value | $101,400 |  |  |  |  |  |

**Problem 13-17** (continued)

2. The internal rate of return is computed as follows:

|  |  |
| --- | --- |
|  |  |

Looking in Exhibit 13B-2 and scanning along the 5-period line, a factor of 3.182 falls closest to the factor for 17%. Thus, to the nearest whole percent, the internal rate of return is 17%.

3. The simple rate of return is computed as follows:



4. The company would want Casey to invest in the project because it has a positive net present value of $101,400 and an internal rate of return of 17%. However, Casey might be inclined to reject the project because its simple rate of return of 11.4% is well below his historical return on investment (ROI) of 20%. Casey may be justifiably concerned that implementing this project would lower his ROI and his next pay raise.

**Problem 13-18** (20 minutes)

The net present value is computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 |
| Purchase of equipment | | $(130,000) |  |  |  |  |
| Working capital investment | | (60,000) |  |  |  |  |
| Sales | |  | $250,000 | $250,000 | $250,000 | $250,000 |
| Variable expenses | |  | (120,000) | (120,000) | (120,000) | (120,000) |
| Fixed out-of-pocket costs | |  | (70,000) | (70,000) | (70,000) | (70,000) |
| Overhaul of equipment | |  |  | (8,000) |  |  |
| Working capital released | |  |  |  |  | 60,000 |
| Salvage value of equipment | | \_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | 12,000 |
| Total cash flows (a) | | $(190,000) | $60,000 | $52,000 | $60,000 | $132,000 |
| Discount factor (15%) (b) | | 1.000 | 0.870 | 0.756 | 0.658 | 0.572 |
| Present value (a)×(b) | | $(190,000) | $52,200 | $39,312 | $39,480 | $75,504 |
| Net present value | | $16,496 |  |  |  |  |

**Problem 13-19** (30 minutes)

1. The income statement would be:

|  |  |  |
| --- | --- | --- |
| Sales |  | $300,000 |
| Variable expenses: |  |  |
| Cost of ingredients (20% × $300,000) | $60,000 |  |
| Commissions (12.5% × $300,000) | 37,500 | 97,500 |
| Contribution margin |  | 202,500 |
| Selling and administrative expenses: |  |  |
| Salaries | 70,000 |  |
| Rent ($3,500 × 12) | 42,000 |  |
| Depreciation\* | 16,800 |  |
| Insurance | 3,500 |  |
| Utilities | 27,000 | 159,300 |
| Net operating income |  | $  43,200 |

|  |  |
| --- | --- |
| \* | $270,000 – $18,000 = $252,000  $252,000 ÷ 15 years = $16,800 per year. |

2. The formula for the simple rate of return is:



Yes, the franchise would be acquired because it promises a rate of return in excess of 12%.

**Problem 13-19** (continued)

3. The formula for the payback period is:



\*Net operating income + Depreciation = Annual net cash inflow

$43,200 + $16,800 = $60,000

According to the payback computation, the franchise would not be acquired. The 4.5 years payback is greater than the maximum 4 years allowed. Payback and simple rate of return can give conflicting signals as in this example.

**Problem 13-20** (30 minutes)

1. The annual net cost savings would be:

|  |  |
| --- | --- |
| Reduction in labor costs | $108,000 |
| Reduction in material waste | 6,500 |
| Total | 114,500 |
| Less increased maintenance costs ($3,000 × 12) | 36,000 |
| Annual net cost savings | $ 78,500 |

2. Using this cost savings figure, and other data from the text, the net present value analysis would be:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 | 6 |
| Cost of machine | | $(250,000) |  |  |  |  |  |  |
| Software and installation | | (80,000) |  |  |  |  |  |  |
| Salvage value of old equipment | | 12,000 |  |  |  |  |  |  |
| Annual net cost savings | |  | $78,500 | $78,500 | $78,500 | $78,500 | $78,500 | $78,500 |
| Replacement of parts | |  |  |  | (45,000) |  |  |  |
| Salvage value of new machine | | \_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 20,000 |
| Total cash flows (a) | | $(318,000) | $78,500 | $78,500 | $33,500 | $78,500 | $78,500 | $98,500 |
| Discount factor (16%) (b) | | 1.000 | 0.862 | 0.743 | 0.641 | 0.552 | 0.476 | 0.410 |
| Present value (a)×(b) | | $(318,000) | $67,667 | $58,326 | $21,474 | $43,332 | $37,366 | $40,385 |
| Net present value | | $(49,450) |  |  |  |  |  |  |

No, the automated welding machine should not be purchased. Its net present value is negative.

**Problem 13-20** (continued)

3. The dollar value per year that would be required for the intangible benefits is:



Thus, the automated welding machine should be purchased if management believes that the intangible benefits are worth at least $13,419 per year.

**Problem 13-21** (30 minutes)

1. The formula for the project profitability index is:



The indexes for the projects under consideration would be:

|  |  |  |
| --- | --- | --- |
|  | Project 1: | $66,140 ÷ $270,000 = 0.24 |
|  | Project 2: | $72,970 ÷ $450,000 = 0.16 |
|  | Project 3: | $73,400 ÷ $360,000 = 0.20 |
|  | Project 4: | $87,270 ÷ $480,000 = 0.18 |

2. a., b., and c.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Net Present Value | Project Profitability Index | Internal Rate of Return |
| First preference | 4 | 1 | 2 |
| Second preference | 3 | 3 | 1 |
| Third preference | 2 | 4 | 4 |
| Fourth preference | 1 | 2 | 3 |

**Problem 13-21** (continued)

3. Which ranking is best will depend on Revco Products’ opportunities for reinvesting funds as they are released from the project. The internal rate of return method assumes that any released funds are reinvested at the internal rate of return. This means that funds released from project #2 would have to be reinvested in another project yielding a rate of return of 19%. Another project yielding such a high rate of return might be difficult to find.

The project profitability index approach assumes that funds released from a project are reinvested in other projects at a rate of return equal to the discount rate, which in this case is only 10%. On balance, the project profitability index is the most dependable method of ranking competing projects.

The net present value is inferior to the project profitability index as a ranking device because it looks only at the total amount of net present value from a project and does not consider the amount of investment required. For example, it ranks project #1 as fourth in terms of preference because of its low net present value; yet this project is the best available in terms of the amount of cash inflow generated for each dollar of investment (as shown by the project profitability index).

**Problem 13-22** (20 minutes)

1. The annual net cash inflows would be:

|  |  |
| --- | --- |
| Reduction in annual operating costs: |  |
| Operating costs, present hand method | $30,000 |
| Operating costs, new machine | 7,000 |
| Annual savings in operating costs | 23,000 |
| Increased annual contribution margin: |  |
| 6,000 boxes × $1.50 per box | 9,000 |
| Total annual net cash inflows | $32,000 |

2. The net present value is computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | 1 | 2 | 3 | 4 | 5 |
| Purchase of machine | $(120,000) |  |  |  |  |  |
| Annual net cash inflows |  | $32,000 | $32,000 | $32,000 | $32,000 | $32,000 |
| Replacement parts |  |  |  | (9,000) |  |  |
| Salvage value of machine | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_ | 7,500 |
| Total cash flows (a) | $(120,000) | $32,000 | $32,000 | $23,000 | $32,000 | $39,500 |
| Discount factor (20%) (b) | 1.000 | 0.833 | 0.694 | 0.579 | 0.482 | 0.402 |
| Present value (a)×(b) | $(120,000) | $26,656 | $22,208 | $13,317 | $15,424 | $15,879 |
| Net present value | (26,516) |  |  |  |  |  |

**Problem 13-23** (45 minutes)

1. The payback periods for Products A and B are calculated using a two-step process. First, the annual net cash inflows are calculated as follows:

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Sales revenues | $250,000 | $350,000 |
| Variable expenses | (120,000) | (170,000) |
| Fixed out-of-pocket operating costs | (70,000) | (50,000) |
| Annual net cash inflows | $  60,000 | $130,000 |

The second step is to compute each product’s payback period as follows:

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Investment required (a) | $170,000 | $380,000 |
| Annual net cash inflow (b) | $60,000 | $130,000 |
| Payback period (a) ÷ (b) | 2.83 years | 2.92 years |

**Problem 13-23** (continued)

2. The net present values for Products A and B are computed as follows:

Product A:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | | $(170,000) |  |  |  |  |  |
| Sales | |  | $250,000 | $250,000 | $250,000 | $250,000 | $250,000 |
| Variable expenses | |  | (120,000) | (120,000) | (120,000) | (120,000) | (120,000) |
| Fixed out-of-pocket costs | |  | (70,000) | (70,000) | (70,000) | (70,000) | (70,000) |
| Total cash flows (a) | | $(170,000) | $60,000 | $60,000 | $60,000 | $60,000 | $60,000 |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 | 0.552 | 0.476 |
| Present value (a)×(b) | | $(170,000) | $51,720 | $44,580 | $38,460 | $33,120 | $28,560 |
| Net present value | | $26,440 |  |  |  |  |  |

Product B:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | | $(380,000) |  |  |  |  |  |
| Sales | |  | $350,000 | $350,000 | $350,000 | $350,000 | $350,000 |
| Variable expenses | |  | (170,000) | (170,000) | (170,000) | (170,000) | (170,000) |
| Fixed out-of-pocket costs | |  | (50,000) | (50,000) | (50,000) | (50,000) | (50,000) |
| Total cash flows (a) | | $(380,000) | $130,000 | $130,000 | $130,000 | $130,000 | $130,000 |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 | 0.552 | 0.476 |
| Present value (a)×(b) | | $(380,000) | $112,060 | $96,590 | $83,330 | $71,760 | $61,880 |
| Net present value | | $45,620 |  |  |  |  |  |

**Problem 13-23** (continued)

3. The internal rate of return for each product is calculated as follows:

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Investment required (a) | $170,000 | $380,000 |
| Annual net cash inflow (b) | $60,000 | $130,000 |
| Factor of the internal rate of return (a) ÷ (b) | 2.833 | 2.923 |

Looking in Exhibit 13B-2 and scanning along the 5-period line, a factor of 2.833 falls right between 22% and 23%, so we’ll estimate an internal rate of return for Product A of 22.5%. A factor of 2.923 is closest to 21%, so we’ll estimate an internal rate of return for Product B of 21%.

4. The project profitability index for each product is computed as follows:

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Net present value (a) | $26,440 | $45,620 |
| Investment required (b) | $170,000 | $380,000 |
| Project profitability index (a) ÷ (b) | 0.16 | 0.12 |

5. The simple rate of return for each product is computed as follows:

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Annual net cash inflow | $60,000 | $130,000 |
| Depreciation expense | 34,000 | 76,000 |
| Annual incremental net operating income | $26,000 | $54,000 |

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Annual incremental net operating income (a) | $26,000 | $54,000 |
| Initial investment (b) | $170,000 | $380,000 |
| Simple rate of return (a) ÷ (b) | 15.3% | 14.2% |

6. The net present value calculations suggest that Product B is preferable to Product A. However, the project profitability index reveals that Product A is the preferred choice. The payback period, internal rate of return, and simple rate of return all favor Product A over Product B. However, it bears emphasizing that Lou Barlow may be inclined to reject both products because the simple rate of return for each product is lower than his division’s historical return on investment of 18%.

**Problem 13-24** (45 minutes)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | Present cost of transient workers |  | | $40,000 |
|  | Less out-of-pocket costs to operate the cherry picker: | |  |  |
|  | Cost of an operator and assistant | $14,000 | |  |
|  | Insurance | 200 | |  |
|  | Fuel | 1,800 | |  |
|  | Maintenance contract | 3,000 | | 19,000 |
|  | Annual savings in cash operating costs |  | | $21,000 |

2. The first step is to determine the annual incremental net operating income:

|  |  |  |
| --- | --- | --- |
|  | Annual savings in cash operating costs | $21,000 |
|  | Less annual depreciation ($90,000 ÷ 12 years) | 7,500 |
|  | Annual incremental net operating income | $13,500 |



No, the cherry picker would not be purchased. The expected return is less than the 16% return required by the farm.

3. The formula for the payback period is:



|  |  |
| --- | --- |
| \* | In this case, the cash inflow is measured by the annual savings in cash operating costs. |

Yes, the cherry picker would be purchased. The payback period is less than 5 years. Note that this answer conflicts with the answer in Part 2.

**Problem 13-24** (continued)

4. The formula for the internal rate of return is:



Looking in Exhibit 13B-2, and reading along the 12-period line, a factor of 4.500 represents an internal rate of return of approximately 20%.

No, the simple rate of return is not an accurate guide in investment decisions. It ignores the time value of money.

**Problem 13-25** (30 minutes)

1. The present value of each alternative’s cash flows is computed as follows:

Purchase Alternative:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 |
| Purchase of cars | | $(170,000) |  |  |  |
| Annual servicing costs | |  | $(3,000) | $(3,000) | $(3,000) |
| Repairs | |  | (1,500) | (4,000) | (6,000) |
| Resale value of cars | | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 85,000 |
| Total cash flows (a) | | $(170,000) | $(4,500) | $(7,000) | $76,000 |
| Discount factor (b) | | 1.000 | 0.847 | 0.718 | 0.609 |
| Present value (a)×(b) | | $(170,000) | $(3,812) | $(5,026) | $46,284 |
| Present value | | $(132,554) |  |  |  |

Lease Alternative:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 |
| Security deposit | | $(10,000) |  |  |  |
| Annual lease payments | |  | $(55,000) | $(55,000) | $(55,000) |
| Refund of deposit | | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | 10,000 |
| Total cash flows (a) | | $(10,000) | $(55,000) | $(55,000) | $(45,000) |
| Discount factor (b) | | 1.000 | 0.847 | 0.718 | 0.609 |
| Present value (a)×(b) | | $(10,000) | $(46,585) | $(39,490) | $(27,405) |
| Net present value | | $(123,480) |  |  |  |

2. The company should lease the cars because this alternative has the lowest present value of total costs.

**Problem 13-26** (30 minutes)

1. The annual incremental net operating income can be determined as follows:

|  |  |  |
| --- | --- | --- |
| Ticket revenue (50,000 × $3.60) |  | $180,000 |
| Selling and administrative expenses: |  |  |
| Salaries | $85,000 |  |
| Insurance | 4,200 |  |
| Utilities | 13,000 |  |
| Depreciation\* | 27,500 |  |
| Maintenance | 9,800 |  |
| Total selling and administrative expenses |  | 139,500 |
| Net operating income |  | $ 40,500 |

\*$330,000 ÷ 12 years = $27,500 per year.

2. The simple rate of return is:



Yes, the water slide would be constructed. Its return is greater than the specified hurdle rate of 14%.

3. The payback period is:



\*Net operating income + Depreciation = Annual net cash flow  
 $40,500 + $27,500 = $68,000.

Yes, the water slide would be constructed. The payback period is within the 5 year payback required by Mr. Sharkey.

**Problem 13-27** (30 minutes)

1. Average weekly use of the auto wash and the vacuum will be:



The expected annual net cash flow from operations would be:

|  |  |  |
| --- | --- | --- |
| Auto wash cash receipts ($1,350 × 52) |  | $70,200 |
| Vacuum cash receipts (405 × $1.00 × 52) |  | 21,060 |
| Total cash receipts |  | 91,260 |
| Less cash disbursements: |  |  |
| Water (675 × $0.20 × 52) | $ 7,020 |  |
| Electricity (405 × $0.10 × 52) | 2,106 |  |
| Rent ($1,700 × 12) | 20,400 |  |
| Cleaning ($450 × 12) | 5,400 |  |
| Insurance ($75 × 12) | 900 |  |
| Maintenance ($500 × 12) | 6,000 |  |
| Total cash disbursements |  | 41,826 |
| Annual net cash flow from operations |  | $49,434 |

**Problem 13-27** (continued)

2. The net present value is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | | $(200,000) |  |  |  |  |  |
| Working capital | | (2,000) |  |  |  |  |  |
| Annual net cash flows | |  | $49,434 | $49,434 | $49,434 | $49,434 | $49,434 |
| Working capital released | |  |  |  |  |  | 2,000 |
| Salvage value | | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 20,000 |
| Total cash flows (a) | | $(202,000) | $49,434 | $49,434 | $49,434 | $49,434 | $71,434 |
| Discount factor (b) | | 1.000 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| Present value (a)×(b) | | $(202,000) | $44,936 | $40,832 | $37,125 | $33,763 | $44,361 |
| Net present value | | $(983) |  |  |  |  |  |

No, Mr. Duncan should not open the auto wash. The negative net present value indicates that the rate of return on this investment is slightly less than the 10% required rate of return.

**Problem 13-28** (20 minutes)

The net present value of each alternative is computed as follows:

Keep the old truck:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Overhaul needed now | | $(7,000) |  |  |  |  |  |
| Annual operating costs | |  | (10,000) | (10,000) | (10,000) | (10,000) | (10,000) |
| Salvage value (old) | | \_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | 1,000 |
| Total cash flows (a) | | $(7,000) | $(10,000) | $(10,000) | $(10,000) | $(10,000) | $(9,000) |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 | 0.552 | 0.476 |
| Present value (a)×(b) | | $(7,000) | $(8,620) | $(7,430) | $(6,410) | $(5,520) | $(4,284) |
| Present value | | $(39,264) |  |  |  |  |  |

Purchase the new truck:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Purchase new truck | | $(30,000) |  |  |  |  |  |
| Salvage value (old) | | 9,000 |  |  |  |  |  |
| Annual operating costs | |  | (6,500) | (6,500) | (6,500) | (6,500) | (6,500) |
| Salvage value (new) | | \_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 4,000 |
| Total cash flows (a) | | $(21,000) | $(6,500) | $(6,500) | $(6,500) | $(6,500) | $(2,500) |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 | 0.552 | 0.476 |
| Present value (a)×(b) | | $(21,000) | $(5,603) | $(4,830) | $(4,167) | $(3,588) | $(1,190) |
| Present value | | $(40,378) |  |  |  |  |  |

The company should keep the old truck because the present value of the net cash outflows is lower for that alternative.

**Problem 13-29** (45 minutes)

1. A net present value computation for each investment follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Common stock: | Now | | 1 | 2 | 3 |
| Purchase of the stock | | $(95,000) |  |  |  |
| Sales of the stock | | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 160,000 |
| Total cash flows (a) | | $(95,000) | $0 | $0 | $160,000 |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 |
| Present value (a)×(b) | | $(95,000) | $0 | $0 | $102,560 |
| Net present value | | $7,560 |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Preferred stock: | Now | | 1 | 2 | 3 |
| Purchase of the stock | | $(30,000) |  |  |  |
| Annual cash dividend | |  | $1,800 | $1,800 | $1,800 |
| Sales of the stock | | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 27,000 |
| Total cash flows (a) | | $(30,000) | $1,800 | $1,800 | $28,800 |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 |
| Present value (a)×(b) | | $(30,000) | $1,552 | $1,337 | $18,461 |
| Net present value | | $(8,650) |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bonds: | Now | | 1 | 2 | 3 |
| Purchase of the bonds | | $(50,000) |  |  |  |
| Annual interest income | |  | $6,000 | $6,000 | $6,000 |
| Sales of the bonds | | \_\_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 52,700 |
| Total cash flows (a) | | $(50,000) | $6,000 | $6,000 | $58,700 |
| Discount factor (b) | | 1.000 | 0.862 | 0.743 | 0.641 |
| Present value (a)×(b) | | $(50,000) | $5,172 | $4,458 | $37,627 |
| Net present value | | $(2,743) |  |  |  |

Linda earned a 16% rate of return on the common stock, but not on the preferred stock or the bonds.

**Problem 13-29** (continued)

2. Considering all three investments together, Linda did not earn a 16% rate of return. The computation is:

|  |  |
| --- | --- |
|  | Net Present Value |
| Common stock | $ 7,560 |
| Preferred stock | (8,650) |
| Bonds | (2,743) |
| Overall net present value | $(3,833) |

The defect in the broker’s computation is that it does not consider the time value of money and therefore has overstated the rate of return earned.

|  |  |
| --- | --- |
| 3. |  |

Substituting the $239,700 investment and the factor for 14% for 12 periods into this formula, we get:



Therefore, the required annual net cash inflow is: $239,700 ÷ 5.660 = $42,350.

**Problem 13-30** (60 minutes)

1. Computation of the annual net cost savings:

|  |  |
| --- | --- |
| Savings in labor costs (25,000 hours × $16 per hour) | $400,000 |
| Savings in inventory carrying costs | 210,000 |
| Total | 610,000 |
| Less increased power and maintenance cost  ($2,500 per month × 12 months) | 30,000 |
| Annual net cost savings | $580,000 |

2. The net present value is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Cost of the robot | | $(1,600,000) |  |  |  |  |  |
| Installation & software | | (450,000) |  |  |  |  |  |
| Annual net cost savings | |  | $580,000 | $580,000 | $580,000 | $580,000 | $580,000 |
| Inventory reduction | |  | 400,000 |  |  |  |  |
| Salvage value (old) | | \_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | 70,000 |
| Total cash flows (a) | | $(2,050,000) | $980,000 | $580,000 | $580,000 | $580,000 | $650,000 |
| Discount factor (b) | | 1.000 | 0.833 | 0.694 | 0.579 | 0.482 | 0.402 |
| Present value (a)×(b) | | $(2,050,000) | $816,340 | $402,520 | $335,820 | $279,560 | $261,300 |
| Present value | | $45,540 |  |  |  |  |  |

Yes, the robot should be purchased. It has a positive net present value at a 20% discount rate.

**Problem 13-30** (continued)

3. Recomputation of the annual net cost savings:

|  |  |
| --- | --- |
| Savings in labor costs (22,500 hours × $16 per hour) | $360,000 |
| Savings in inventory carrying costs | 210,000 |
| Total | 570,000 |
| Less increased power and maintenance cost  ($2,500 per month × 12 months) | 30,000 |
| Annual net cost savings | $540,000 |

The revised present value computations are follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| Cost of the robot | | $(1,600,000) |  |  |  |  |  |
| Installation & software | | (525,000) |  |  |  |  |  |
| Annual net cost savings | |  | $540,000 | $540,000 | $540,000 | $540,000 | $540,000 |
| Inventory reduction | |  | 400,000 |  |  |  |  |
| Salvage value (old) | | \_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | 70,000 |
| Total cash flows (a) | | $(2,125,000) | $940,000 | $540,000 | $540,000 | $540,000 | $610,000 |
| Discount factor (b) | | 1.000 | 0.833 | 0.694 | 0.579 | 0.482 | 0.402 |
| Present value (a)×(b) | | $(2,125,000) | $783,020 | $374,760 | $312,660 | $260,280 | $245,220 |
| Present value | | $(149,060) |  |  |  |  |  |

It appears the rate of return that will be earned by the new equipment is less than 20%.

**Problem 13-30** (continued)

4. a. Several intangible benefits are usually associated with investments in automated equipment. These intangible benefits include:

* Greater throughput.
* Greater variety of products.
* Higher quality.
* Reduction in inventories.

The value of these benefits can equal or exceed any savings that may come from reduced labor cost. However, these benefits are hard to quantify.

|  |  |
| --- | --- |
| b. |  |

Thus, the intangible benefits in (a) would have to generate a cash inflow of $35,558 per year in order for the robot to yield a 20% rate of return.

**Case 13-31** (45 minutes)

1. Rachel Arnett’s revision of her first proposal can be considered a violation of the IMA’s Statement of Ethical Professional Practice. She discarded her reasonable projections and estimates after she was questioned by William Earle. She used figures that had a remote chance of occurring. By doing this, she violated the requirements to “Communicate information fairly and objectively” and “disclose all relevant information that could reasonably be expected to influence an intended user’s understanding of the reports, analyses, or recommendations.” By altering her analysis, she also violated the Integrity standard. She engaged in an activity that would prejudice her ability to carry out her duties ethically. In addition, she violated the Competence standard—“Provide decision support information and recommendations that are accurate, clear, concise, and timely.”

2. Earle was clearly in violation of the Standards of Ethical Conduct for Management Accountants because he tried to persuade a subordinate to prepare a proposal with data that was false and misleading. Earle has violated the standards of Competence (Provide decision support information and recommendations that are accurate, clear, concise, and timely.), Integrity (Mitigate actual conflicts of interest. Regularly communicate with business associates to avoid apparent conflicts of interest.), and Credibility (Communicate information fairly and objectively. Disclose all relevant information that could reasonably be expected to influence an intended user’s understanding of the reports, analyses, or recommendations.).

**Case 13-31** (continued)

3. The internal controls Fore Corporation could implement to prevent unethical behavior include:

 approval of all formal capital expenditure proposals by the Controller and/or the Board of Directors.

 designating a non-accounting/finance manager to coordinate capital expenditure requests and/or segregating duties during the preparation and approval of capital expenditure requests.

 requiring that all capital expenditure proposals be reviewed by senior operating management, which includes the Controller, before the proposals are submitted for approval.

 requiring the internal audit staff to review all capital expenditure proposals or contracting external auditors to review the proposal if the corporation lacks manpower.

(Unofficial CMA Solution, adapted)

**Problem 13-32** (45 minutes)

1. The net cash inflow from sales of the device for each year would be:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Year | | | |
|  | 1 | 2 | 3 | 4-6 |
| Sales in units | 9,000 | 15,000 | 18,000 | 22,000 |
| Sales in dollars  (@ $35 each) | $315,000 | $525,000 | $630,000 | $770,000 |
| Variable expenses  (@ $15 each) | 135,000 | 225,000 | 270,000 | 330,000 |
| Contribution margin | 180,000 | 300,000 | 360,000 | 440,000 |
| Fixed expenses: |  |  |  |  |
| Salaries and other\* | 85,000 | 85,000 | 85,000 | 85,000 |
| Advertising | 180,000 | 180,000 | 150,000 | 120,000 |
| Total fixed expenses | 265,000 | 265,000 | 235,000 | 205,000 |
| Net cash inflow (outflow) | $(85,000) | $  35,000 | $125,000 | $235,000 |

|  |  |
| --- | --- |
| \* | Depreciation is not a cash expense and therefore must be eliminated from this computation. The analysis is: |
|  |  |
|  | ($315,000 – $15,000 = $300,000) ÷ 6 years = $50,000 depreciation; |
|  | $135,000 total expense – $50,000 depreciation = $85,000. |

**Problem 13-32** (continued)

2. The net present value of the proposed investment would be:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 | 6 |
| Cost of equipment | | $(315,000) |  |  |  |  |  |  |
| Working capital | | (60,000) |  |  |  |  |  |  |
| Yearly net cash flows | |  | $(85,000) | $35,000 | $125,000 | $235,000 | $235,000 | $235,000 |
| Release of working capital | |  |  |  |  |  |  | 60,000 |
| Salvage value of equipment | | \_\_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | \_\_\_\_\_\_ | 15,000 |
| Total cash flows (a) | | $(375,000) | $(85,000) | $35,000 | $125,000 | $235,000 | $235,000 | $310,000 |
| Discount factor (14%) (b) | | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 | 0.456 |
| Present value (a)×(b) | | $(375,000) | $(74,545) | $26,915 | $84,375 | $139,120 | $121,965 | $141,360 |
| Net present value | | $64,190 |  |  |  |  |  |  |

Since the net present value is positive, the company should pursue the new product.

Appendix 13A

The Concept of Present Value

**Exercise 13A-1** (10 minutes)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Amount of Cash Flows | | 18% | Present Value of Cash Flows | |
| Year | Investment A | Investment B | Factor | Investment A | Investment B |
| 1 | $3,000 | $12,000 | 0.847 | $ 2,541 | $10,164 |
| 2 | $6,000 | $9,000 | 0.718 | 4,308 | 6,462 |
| 3 | $9,000 | $6,000 | 0.609 | 5,481 | 3,654 |
| 4 | $12,000 | $3,000 | 0.516 | 6,192 | 1,548 |
|  |  |  |  | $18,522 | $21,828 |

Investment project B is best.

**Exercise 13A-2** (10 minutes)

The present value of the first option is $150,000, since the entire amount would be received immediately.

The present value of the second option is:

|  |  |
| --- | --- |
| Annual annuity: $14,000 × 7.469 (Exhibit 13B-2) | $104,566 |
| Lump-sum payment: $60,000 × 0.104 (Exhibit 13B-1) | 6,240 |
| Total present value | $110,806 |

Thus, Julie should accept the first option, which has a much higher present value.

On the surface, the second option appears to be a better choice because it promises a total cash inflow of $340,000 over the 20-year period ($14,000 × 20 = $280,000; $280,000 + $60,000 = $340,000), whereas the first option promises a cash inflow of only $150,000. However, the cash inflows under the second option are spread out over 20 years, causing the present value to be far less.

**Exercise 13A-3** (10 minutes)

1. From Exhibit 13B-1, the factor for 10% for 3 periods is 0.751. Therefore, the present value of the required investment is:

$8,000 × 0.751 = $6,008

2. From Exhibit 13B-1, the factor for 14% for 3 periods is 0.675. Therefore, the present value of the required investment is:

$8,000 × 0.675 = $5,400

**Exercise 13A-4** (10 minutes)

1. From Exhibit 13B-1, the factor for 10% for 5 periods is 0.621. Therefore, the company must invest:

$500,000 × 0.621 = $310,500

2. From Exhibit 13B-1, the factor for 14% for 5 periods is 0.519. Therefore, the company must invest:

$500,000 × 0.519 = $259,500

**Exercise 13A-5** (10 minutes)

1. From Exhibit 13B-2, the factor for 16% for 8 periods is 4.344. The computer system should be purchased only if its net present value is positive. This will occur only if the purchase price is less:

$7,000 × 4.344 = $30,408

2. From Exhibit 13B-2, the factor for 20% for 8 periods is 3.837. Therefore, the maximum purchase price would be:

$7,000 × 3.837 = $26,859

**Exercise 13A-6** (10 minutes)

1. From Exhibit 13B-2, the factor for 12% for 20 periods is 7.469. Thus, the present value of Mr. Ormsby’s winnings is:

$80,000 × 7.469 = $597,520

2. Whether or not it is correct to say that Mr. Ormsby is the state’s newest millionaire depends on your point of view. He will receive more than a million dollars over the next 20 years; however, he is not a millionaire as shown by the present value computation above, nor will he ever be a millionaire if he spends his winnings rather than investing them.

Appendix 13C

Income Taxes and Net Present Value Analysis

**Exercise 13C-1** (10 minutes)

The project’s net present value is computed as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Now | 1 | 2 | 3 | 4 | 5 |
| Purchase of equipment | $(2,000,000) |  |  |  |  |  |
| Sales |  | $2,800,000 | $2,800,000 | $2,800,000 | $2,800,000 | $2,800,000 |
| Variable expenses |  | (1,600,000) | (1,600,000) | (1,600,000) | (1,600,000) | (1,600,000) |
| Out-of-pocket costs |  | (500,000) | (500,000) | (500,000) | (500,000) | (500,000) |
| Income tax expense ($300,000 × 30%) | \_\_\_\_\_\_\_\_\_\_ | (90,000) | (90,000) | (90,000) | (90,000) | (90,000) |
| Total cash flows (a) | $(2,000,000) | $610,000 | $610,000 | $610,000 | $610,000 | $610,000 |
| Discount factor (b) | 1.000 | 0.885 | 0.783 | 0.693 | 0.613 | 0.543 |
| Present value (a)×(b) | $(2,000,000) | $539,850 | $477,630 | $422,730 | $373,930 | $331,230 |
| Net present value | $145,370 |  |  |  |  |  |

Note: The present value of the net cash inflows from years 1 through 5 can also be computed using the appropriate discount factor from Exhibit 13B-2 in Appendix 13B ($610,000 × 3.517 = $2,145,370).

**Exercise 13C-2** (20 minutes)

The net present value of the new product is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| *Annual tax expense*: | |  |  |  |  |  |  |
| Sales | |  | $250,000 | $250,000 | $250,000 | $250,000 | $250,000 |
| Variable expenses | |  | (120,000) | (120,000) | (120,000) | (120,000) | (120,000) |
| Out-of-pocket costs | |  | (70,000) | (70,000) | (70,000) | (70,000) | (70,000) |
| Depreciation expense | |  | (26,000) | (26,000) | (26,000) | (26,000) | (26,000) |
| Incremental net income | |  | $  34,000 | $  34,000 | $  34,000 | $  34,000 | $  34,000 |
| Tax rate | |  | 30% | 30% | 30% | 30% | 30% |
| Income tax expense | |  | $(10,200) | $(10,200) | $(10,200) | $(10,200) | $(10,200) |
|  | |  |  |  |  |  |  |
| *Net present value*: | |  |  |  |  |  |  |
| Purchase equipment | | $(130,000) |  |  |  |  |  |
| Sales | |  | $250,000 | $250,000 | $250,000 | $250,000 | $250,000 |
| Variable expenses | |  | (120,000) | (120,000) | (120,000) | (120,000) | (120,000) |
| Out-of-pocket costs | |  | (70,000) | (70,000) | (70,000) | (70,000) | (70,000) |
| Income tax expense | | \_\_\_\_\_\_\_\_ | (10,200) | (10,200) | (10,200) | (10,200) | (10,200) |
| Total cash flows (a) | | $(130,000) | $  49,800 | $  49,800 | $  49,800 | $  49,800 | $  49,800 |
| Discount factor (b) | | 1.000 | 0.870 | 0.756 | 0.658 | 0.572 | 0.497 |
| Present value (a) × (b) | | $(130,000) | $43,326 | $37,649 | $32,768 | $28,486 | $24,751 |
| Net present value | | $36,980 |  |  |  |  |  |

**Problem 13C-3** (30 minutes)

The net present value of the project is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| *Annual tax expense*: | |  |  |  |  |  |  |
| Sales | |  | $350,000 | $350,000 | $350,000 | $350,000 | $350,000 |
| Variable expenses | |  | (180,000) | (180,000) | (180,000) | (180,000) | (180,000) |
| Out-of-pocket costs | |  | (80,000) | (80,000) | (80,000) | (80,000) | (80,000) |
| Overhaul of equipment | |  |  | (18,000) |  |  |  |
| Depreciation expense | |  | (50,000) | (50,000) | (50,000) | (50,000) | (50,000) |
| Incremental net income | |  | $  40,000 | $  22,000 | $  40,000 | $  40,000 | $  40,000 |
| Tax rate | |  | 30% | 30% | 30% | 30% | 30% |
| Income tax expense | |  | $(12,000) | $(6,600) | $(12,000) | $(12,000) | $(12,000) |
| *Net present value*: | |  |  |  |  |  |  |
| Purchase equipment | | $(250,000) |  |  |  |  |  |
| Working capital | | (60,000) |  |  |  |  |  |
| Sales | |  | $350,000 | $350,000 | $350,000 | $350,000 | $350,000 |
| Variable expenses | |  | (180,000) | (180,000) | (180,000) | (180,000) | (180,000) |
| Out-of-pocket costs | |  | (80,000) | (80,000) | (80,000) | (80,000) | (80,000) |
| Overhaul of equipment | |  |  | (18,000) |  |  |  |
| Release working capital | |  |  |  |  |  | 60,000 |
| Income tax expense | | \_\_\_\_\_\_\_\_ | (12,000) | (6,600) | (12,000) | (12,000) | (12,000) |
| Total cash flows (a) | | $(310,000) | $  78,000 | $  65,400 | $  78,000 | $  78,000 | $  138,000 |
| Discount factor (b) | | 1.000 | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 |
| Present value (a) × (b) | | $(310,000) | $69,654 | $52,124 | $55,536 | $49,608 | $78,246 |
| Net present value | | $(4,832) |  |  |  |  |  |

**Problem 13C-4** (30 minutes)

The net present value of the project is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| *Annual tax expense*: | |  |  |  |  |  |  |
| Sales | |  | $410,000 | $410,000 | $410,000 | $410,000 | $410,000 |
| Variable expenses | |  | (175,000) | (175,000) | (175,000) | (175,000) | (175,000) |
| Out-of-pocket costs | |  | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) |
| Equipment maintenance | |  |  |  | (20,000) | (20,000) |  |
| Depreciation expense | |  | (84,000) | (84,000) | (84,000) | (84,000) | (84,000) |
| Incremental net income | |  | $  51,000 | $  51,000 | $  31,000 | $  31,000 | $  51,000 |
| Tax rate | |  | 30% | 30% | 30% | 30% | 30% |
| Income tax expense | |  | $(15,300) | $(15,300) | $(9,300) | $(9,300) | $(15,300) |
| *Net present value*: | |  |  |  |  |  |  |
| Purchase equipment | | $(420,000) |  |  |  |  |  |
| Working capital | | (65,000) |  |  |  |  |  |
| Sale of old equipment | | $80,000 |  |  |  |  |  |
| Sales | |  | $410,000 | $410,000 | $410,000 | $410,000 | $410,000 |
| Variable expenses | |  | (175,000) | (175,000) | (175,000) | (175,000) | (175,000) |
| Out-of-pocket costs | |  | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) |
| Equipment maintenance | |  |  |  | (20,000) | (20,000) |  |
| Release working capital | |  |  |  |  |  | 65,000 |
| Income tax expense | | \_\_\_\_\_\_\_\_ | (15,300) | (15,300) | (9,300) | (9,300) | (15,300) |
| Total cash flows (a) | | $(405,000) | $119,700 | $119,700 | $105,700 | $105,700 | $184,700 |
| Discount factor (b) | | 1.000 | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 |
| Present value (a) × (b) | | $(405,000) | $106,892 | $95,401 | $75,258 | $67,225 | $104,725 |
| Net present value | | $44,501 |  |  |  |  |  |

**Problem 13C-5** (45 minutes)

1. The net present value of the Product A is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| *Annual tax expense*: | |  |  |  |  |  |  |
| Sales | |  | $370,000 | $370,000 | $370,000 | $370,000 | $370,000 |
| Operating expenses | |  | (200,000) | (200,000) | (200,000) | (200,000) | (200,000) |
| Repairs | |  |  |  | (45,000) |  |  |
| Depreciation expense | |  | (80,000) | (80,000) | (80,000) | (80,000) | (80,000) |
| Incremental net income | |  | $90,000 | $90,000 | $  45,000 | $90,000 | $90,000 |
| Tax rate | |  | 30% | 30% | 30% | 30% | 30% |
| Income tax expense | |  | $(27,000) | $(27,000) | $(13,500) | $(27,000) | $(27,000) |
| *Net present value*: | |  |  |  |  |  |  |
| Purchase equipment | | $(400,000) |  |  |  |  |  |
| Working capital | | (85,000) |  |  |  |  |  |
| Sales | |  | $370,000 | $370,000 | $370,000 | $370,000 | $370,000 |
| Operating expenses | |  | (200,000) | (200,000) | (200,000) | (200,000) | (200,000) |
| Repairs | |  |  |  | (45,000) |  |  |
| Release working capital | |  |  |  |  |  | 85,000 |
| Income tax expense | | \_\_\_\_\_\_\_\_ | (27,000) | (27,000) | (13,500) | (27,000) | (27,000) |
| Total cash flows (a) | | $(485,000) | $143,000 | $143,000 | $111,500 | $143,000 | $228,000 |
| Discount factor (b) | | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 |
| Present value (a) × (b) | | $(485,000) | $125,411 | $109,967 | $75,263 | $84,656 | $118,332 |
| Net present value | | $28,629 |  |  |  |  |  |

**Problem 13C-5** (continued)

The net present value of the Product B is computed as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Now | | 1 | 2 | 3 | 4 | 5 |
| *Annual tax expense*: | |  |  |  |  |  |  |
| Sales | |  | $390,000 | $390,000 | $390,000 | $390,000 | $390,000 |
| Operating expenses | |  | (170,000) | (170,000) | (170,000) | (170,000) | (170,000) |
| Repairs | |  |  |  | (70,000) |  |  |
| Depreciation expense | |  | (110,000) | (110,000) | (110,000) | (110,000) | (110,000) |
| Incremental net income | |  | $110,000 | $110,000 | $  40,000 | $110,000 | $110,000 |
| Tax rate | |  | 30% | 30% | 30% | 30% | 30% |
| Income tax expense | |  | $(33,000) | $(33,000) | $(12,000) | $(33,000) | $(33,000) |
| *Net present value*: | |  |  |  |  |  |  |
| Purchase equipment | | $(550,000) |  |  |  |  |  |
| Working capital | | (60,000) |  |  |  |  |  |
| Sales | |  | $390,000 | $390,000 | $390,000 | $390,000 | $390,000 |
| Operating expenses | |  | (170,000) | (170,000) | (170,000) | (170,000) | (170,000) |
| Repairs | |  |  |  | (70,000) |  |  |
| Release working capital | |  |  |  |  |  | 60,000 |
| Income tax expense | | \_\_\_\_\_\_\_\_ | (33,000) | (33,000) | (12,000) | (33,000) | (33,000) |
| Total cash flows (a) | | $(610,000) | $187,000 | $187,000 | $138,000 | $187,000 | $247,000 |
| Discount factor (b) | | 1.000 | 0.877 | 0.769 | 0.675 | 0.592 | 0.519 |
| Present value (a) × (b) | | $(610,000) | $163,999 | $143,803 | $93,150 | $110,704 | $128,193 |
| Net present value | | $29,849 |  |  |  |  |  |

**Problem 13C-5** (continued)

2. Students should use the project profitability index to answer this question as follows:

|  |  |  |
| --- | --- | --- |
|  | Product A | Product B |
| Net present value (a) | $28,629 | $29,849 |
| Investment required (b) | $485,000 | $610,000 |
| Project profitability index (a) ÷ (b) | 0.059 | 0.049 |

Although Product A has the lower net present value, it has the higher project profitability index; therefore, it should be chosen over Product B.