Chapter 14
Capital Budgeting Decisions

Solutions to Questions

14-1 Capital budgeting screening decisions concern whether a proposed investment project meets some preset standard for acceptance, such as a 15% rate of return. Capital budgeting preference decisions are concerned with choosing from among two or more alternative investment projects.

14-2 The term "time value of money" means that a dollar received today is more valuable than a dollar received in the future. A dollar received today can be invested to yield more than a dollar in the future.

14-3 Discounting is the process of computing the present value of a future cash flow. The concept gives specific recognition to the time value of money and makes it possible to meaningfully add together cash flows that occur at different times.

14-4 Accounting net income includes accruals that ignore the timing of cash flows into and out of an organization. Both the net present value and internal rate of return methods focus on cash flows.

14-5 Discounted cash flow methods are superior to other methods of making capital budgeting decisions because they give specific recognition to the time value of money.

14-6 Net present value is the present value of cash inflows promised by an investment project less the present value of the cash outflows associated with the project. The net present value can be negative if the present value of the outflows is greater than the present value of the inflows.

14-7 One simplifying assumption is that all cash flows occur at the end of a period. Another is that all cash flows generated by an investment project are immediately reinvested in another project, bearing a rate of return equal to the discount rate.

14-8 No. Cost of capital is not simply the interest paid on long-term debt. Cost of capital involves a weighted average of the individual costs of all sources of financing, both debt and equity.

14-9 The internal rate of return is the rate of return of an investment project over its life. It is computed by finding that discount rate that equates the present value of a project's cash inflows with the present value of its cash outflows.

14-10 In both situations the cost of capital is a hurdle that must be cleared before an investment project will be accepted. 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, since its rate of return will be greater than the cost of capital. 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.

14-11 No. As the discount rate increases, the present value of a given future cash flow decreases. For example, the factor for a discount rate of 12% for cash to be received ten years from now is 0.322, whereas the 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 would be $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.

14-12 The return is more than 14% since the net present value is positive. In order for the rate of return to be exactly 14%, the net present value would have to be zero. The return would less than 14% only if the net present value (evaluated using a 14% discount rate) is negative.

14-13 The profitability index is computed by dividing the present value of the cash inflows from an investment project by the present value of the investment required. The index measures the amount of cash inflow provided by each dollar of investment in a project. The higher the profitability index, the more desirable the investment project.

14-14 No. If the profitability index is less than 1.00, then the net present value of the project is negative, indicating that it does not provide the required minimum rate of return.

14-15 The payback period is the length of time that it takes for an investment to fully recover its own initial cost out of the cash receipts that it generates.

The payback method can help the manager by acting as a screening tool in weeding out investment proposals. If a proposal doesn't provide a payback within some specified period, there may be no need to consider it further. Also, the payback method is often very useful to firms that are experiencing difficulties in maintaining a strong cash position. It can help the manager to identify projects that will return the initial investment very quickly, thus helping in the management of short-term cash flow problems. The payback method is also used in industries where products become obsolete very rapidly.

14-16 Neither method considers the time value of money. Under both the payback method and the simple rate of return method, a dollar received today is weighed equally with a dollar received in the future. Furthermore, the payback method ignores all cash flows that occur after the initial investment has been recovered.

14-17 An outlay that is tax deductible results in some savings in taxes. The after-tax cost of an item is the amount of the outlay less the tax savings. In capital budgeting decisions, all tax-deductible cash expenses should be included on an after-tax cost basis, since the after-tax amount represents the actual *net* cash outflow.

14-18 The depreciation tax shield refers to the tax deductibility of depreciation, which is not a cash outflow. From a capital budgeting point of view, the depreciation tax shield triggers a cash inflow (tax reduction) equal to the depreciation deduction taken multiplied by the tax rate.

14-19 An increase in the tax rate would tend to make the new investment less attractive, since net after-tax cash inflows would be reduced.

14-20 One cash inflow would be the proceeds from the sale of the piece of equipment. The other cash inflow would be the income tax reduction that results from the loss on the equipment.

14-21 The purchase of the equipment should be shown as a cash outflow of $40,000. The initial cost of an asset is not immediately deductible for tax purposes. Rather, the cost is deducted in later periods in the form of depreciation.

Exercise 14-1 (30 minutes)

1.

	Amount of Cash Flows			*Present Value of Cash Flows*	
Year(s)	*X*	*Y*	*20% Factor*	*X*	*Y*
1	$1,000	$4,000	0.833	$ 833	$3,332
2	2,000	3,000	0.694	1,388	2,082
3	3,000	2,000	0.579	1,737	1,158
4	4,000	1,000	0.482	1,928	482
				$5,886	$7,054

2. a. From Table 14C-3, the factor for 6% for 3 periods is 0.840. Therefore, the present value of the investment required is:

$$\$12,000 \times 0.840 = \$10,080.$$

b. From Table 14C-3, the factor for 10% for 3 periods is 0.751. Therefore, the present value of the investment required is:

$$\$12,000 \times 0.751 = \$9,012.$$

3.

Option	*Year(s)*	*Amount of Cash Flows*	*10% Factor*	*Present Value of Cash Flows*
A	Now	$500,000	1.000	$500,000
B	1-8	$ 60,000	5.335	$320,100
	8	200,000	0.467	93,400
				$413,500

Mark should accept option A. On the surface, option B appears to be a better choice since it promises a total cash inflow of $680,000 ($60,000 × 8 = $480,000; $480,000 + $200,000 = $680,000), whereas option A promises a cash inflow of only $500,000. However, the cash inflows under option B are spread out over eight years, whereas the cash flow under option A is received immediately. Since the $500,000 under option A can be invested at 10%, it would actually accumulate to more than $680,000 at the end of eight years. Consequently, the present value of option A is higher than the present value of option B.

Exercise 14-1 (continued)

4. You should prefer option a:

   Option a: $50,000 × 1.000 = $50,000.
   Option b: $75,000 × 0.507 = $38,025. (From Table 14C-3)
   Option c: $12,000 × 4.111 = $49,332. (From Table 14C-4)

Exercise 14-2 (15 minutes)

	Year(s)	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Purchase of the stock.....	Now	$(18,000)	1.000	$(18,000)
Annual dividends*.....	1-4	720	3.037	2,187
Sale of the stock.....	4	22,500	0.636	14,310
Net present value				$(1,503)

*900 shares × $0.80 per share per year = $720 per year.

No, Mr. Critchfield did not earn a 12% return on the stock. The negative net present value indicates that the rate of return on the investment is less than the discount rate of 12%.

Exercise 14-3 (30 minutes)

1. Annual savings over present method of delivery $5,400
   Added contribution margin from expanded deliveries
   (1,800 pizzas × $2 per pizza) 3,600
   Annual cash inflows $9,000

2. $$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Annual cash inflow}}$$

$$= \frac{\$45{,}000}{\$9{,}000} = 5.000$$

   Looking in Table 14C-4, and scanning along the six-year line, we can see that the factor computed above, 5.000, is closest to 5.076, the factor for the 5% rate of return. Therefore, to the nearest whole percent, the internal rate of return is 5%.

3. The cash flows are not even over the six-year life of the truck because of the extra $13,000 cash inflow that occurs in the sixth year. Therefore, the approach used above cannot be used to compute the internal rate of return. Using trial-and-error or some other method, the internal rate of return turns out to be about 11%:

	Year(s)	*Amount of Cash Flows*	*11% Factor*	*Present Value of Cash Flows*
Initial investment	Now	$(45,000)	1.000	$(45,000)
Annual cash inflows...	1-6	9,000	4.231	38,079
Salvage value.....	6	13,000	0.535	6,955
Net present value.....				$ 34

   As expected, the extra cash inflow in the sixth year increases the internal rate of return.

Exercise 14-4 (30 minutes)

1. Note: All present value factors have been taken from Table 14C-3 in Appendix 14C, using a 16% discount rate.

Investment in the equipment		$134,650
Less present value of Year 1 and Year 2 cash inflows:		
Year 1: $45,000 × 0.862	$38,790	
Year 2: $60,000 × 0.743.....	44,580	83,370
Present value of Year 3 cash inflow		$ 51,280

   Therefore, the expected cash inflow for Year 3 would be:

   $51,280 ÷ 0.641 = $80,000.

2. The equipment's net present value without considering the intangible benefits would be:

Item	*Year(s)*	*Amount of Cash Flows*	*15% Factor*	*Present Value of Cash Flows*
Cost of the equipment	Now	$(750,000)	1.000	$(750,000)
Annual cash savings	1-10	100,000	5.019	501,900
Net present value				$(248,100)

   The annual value of the intangible benefits would have to be large enough to offset the $248,100 negative present value for the equipment. This annual value can be computed as follows:

$$\frac{\text{Required increase in present value}}{\text{Factor for 10 years}} = \frac{\$248,100}{5.019} = \$49,432$$

Exercise 14-4 (continued)

3. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

$$= \frac{\$307,100}{\$50,000} = 6.142$$

Looking in Table 14C-4, and scanning *down* the 14% column, we find that a factor of 6.142 equals 15 years. Thus, the equipment will have to be used for 15 years to yield a return of 14%.

Exercise 14-5 (15 minutes)

1. The profitability index for each proposal would be:

Proposal	*Present Value of Cash Inflows (a)*	*Investment Required (b)*	*Profitability Index (a) ÷ (b)*
A	$119,000	$ 85,000	1.40
B	184,000	200,000	0.92
C	135,000	90,000	1.50
D	221,000	170,000	1.30

2. The ranking would be:

Proposal	*Profitability Index*
C	1.50
A	1.40
D	1.30
B	0.92

Two points should be noted about the ranking. First, proposal B is not an acceptable proposal at all, since it has a profitability index of less than 1.0 (negative net present value). Second, proposal D has the highest net present value, but it ranks lowest of the three acceptable proposals in terms of the profitability index.

Exercise 14-6 (15 minutes)

1. The payback period would be:

$$\text{Payback Period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{\$180{,}000}{\$37{,}500 \text{ per year}} = 4.8 \text{ years}$$

No, the equipment would not be purchased, since the 4.8-year payback period exceeds the company's maximum 4.0-year payback.

2. The simple rate of return would be:

$$\text{Simple rate of return} = \frac{\text{Cost savings - Depreciation}}{\text{Initial Investment}}$$

$$= \frac{\$37{,}500 - \$15{,}000^*}{\$180{,}000} = 12.5\%$$

*180,000 ÷ 12 years = $15,000 per year.

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

Exercise 14-7 (15 minutes)

1. a. $400,000 × 0.794 (Table 14C-3) = $317,600.
   b. $400,000 × 0.712 (Table 14C-3) = $284,800.

2. a. $5,000 × 4.355 (Table 14C-4) = $21,775.
   b. $5,000 × 3.685 (Table 14C-4) = $18,425.

3. Looking in Table 14C-4, the factor for 10% for 20 years is 8.514. Thus, the present value of Sally's winnings would be:

   $50,000 × 8.514 = $425,700.

   Whether or not Sally really won a million dollars depends on your point of view. She will receive a million dollars over the next 20 years; however, in terms of its value *right now* she won much less than a million dollars as shown by the present value computation above.

Exercise 14-8 (15 minutes)

a.	Management consulting fee.....	$100,000
	Multiply by 1 – 0.30	× 0.70
	After-tax cost.....	$ 70,000
b.	Increased revenues.....	$40,000
	Multiply by 1 – 0.30	× 0.70
	After-tax cash flow (benefit).....	$28,000

c. The depreciation deduction is $210,000 ÷ 7 years = $30,000 per year, which has the effect of reducing taxes by 30% of that amount, or $9,000 per year.

Exercise 14-9 (15 minutes)

Item	*Year(s)*	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Project A:				
Cost of the equipment	Now	$(300,000)	1.000	$(300,000)
Annual cash inflows	1-7	80,000	3.605	288,400
Salvage value of the equipment	7	20,000	0.279	5,580
Net present value				$ (6,020)
Project B:				
Working capital investment	Now	$(300,000)	1.000	$(300,000)
Annual cash inflows	1-7	60,000	3.605	216,300
Working capital released	7	300,000	0.279	83,700
Net present value				$ 0

The $300,000 should be invested in Project B rather than in Project A. Project B has a zero net present value, which means that it promises exactly a 20% rate of return. Project A is not acceptable at all, since it has a negative net present value.

Exercise 14-10 (20 minutes)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*10% Factor*	*Present Value of Cash Flows*
Project A:						
Investment in photocopier	Now	$(50,000)	—	$(50,000)	1.000	$(50,000)
Net annual cash inflows	1-8	9,000	1 – 0.30	6,300	5.335	33,610
Depreciation deductions*	1-8	6,250	0.30	1,875	5.335	10,003
Salvage value of the photocopier	8	5,000	1 – 0.30	3,500	0.467	1,634
Net present value						$ (4,753)
Project B:						
Investment in working capital	Now	$(50,000)	—	$(50,000)	1.000	$(50,000)
Net annual cash inflows	1-8	9,000	1 – 0.30	6,300	5.335	33,610
Release of working capital	8	50,000	—	50,000	0.467	23,350
Net present value						$ 6,960

* $50,000 ÷ 8 years = $6,250 per year

Exercise 14-11 (15 minutes)

Item	*Year(s)*	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Project A:				
Investment required....	Now	$(15,000)	1.000	$(15,000)
Annual cash inflows.....	1-10	4,000	4.833	19,332
Net present value.....				$ 4,332
Project B:				
Investment.....	Now	$(15,000)	1.000	$(15,000)
Cash inflow.....	10	60,000	0.227	13,620
Net present value.....				$ (1,380)

Project A should be selected. Project B does not provide the required 16% return, as shown by its negative net present value.

Alternatively, the profitability indexes of the projects can be computed.

$$\text{Profitability index} = \frac{\text{Present value of cash inflows}}{\text{Investment required}}$$

Project A:

$$\text{Profitability index} = \frac{\$19,332}{\$15,000} = 1.289$$

Project B:

$$\text{Profitability index} = \frac{\$13,620}{\$15,000} = 0.908$$

Project A is preferred since its profitability index is higher.

Exercise 14-12 (30 minutes)

1.

Item	*Year(s)*	*Amount of Cash Flows*	*15% Factor*	*Present Value of Cash Flows*
Initial investment	Now	$(40,350)	1.000	$(40,350)
Annual cash inflows....	1-4	15,000	2.855	42,825
Net present value.....				$ 2,475

Yes, this is an acceptable investment. Its net present value is positive, which indicates that its rate of return exceeds the minimum 15% rate of return required by the company.

2. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

$$= \frac{\text{Machine cost}}{\text{Annual cost savings}}$$

$$= \frac{\$111,500}{\$20,000} = 5.575$$

Looking in Table 14C-4, and reading along the 15-year line, we find that a factor of 5.575 represents an internal rate of return of 16%.

3. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

$$= \frac{\text{Machine cost}}{\text{Annual cost savings}}$$

$$= \frac{\$14,125}{\$2,500} = 5.650$$

Looking in Table 14C-4, and reading along the 10-year line, a factor of 5.650 represents an internal rate of return of 12%. If the company's cost of capital is 16%, then it did not make a wise investment, since the return promised by the machine is less than the cost of capital.

Exercise 14-13 (30 minutes)

1. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

$$= \frac{\$136,700}{\$25,000} = 5.468$$

Looking in Table 14C-4 and scanning along the 14-period line, a factor of 5.468 represents an internal rate of return of 16%.

2.

Item	*Year(s)*	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Initial investment	Now	$(136,700)	1.000	$(136,700)
Net annual cash inflows	1-14	25,000	5.468	136,700
Net present value				$ 0

The reason for the zero net present value is that 16% (the discount rate we have used) represents the machine's internal rate of return. The internal rate of return is the rate that causes the present value of a project's cash inflows to just equal the present value of the investment required.

3. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

$$= \frac{\$136,700}{\$20,000} = 6.835$$

Looking in Table 14C-4 and scanning along the 14-period line, the 6.835 factor is closest to 6.982, the factor for the 11% rate of return. Thus, to the nearest whole percent, the internal rate of return is 11%.

Exercise 14-14 (20 minutes)

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

Net operating income	$63,000
Add: Noncash deduction for depreciation	27,000
Net annual cash inflow	$90,000

The payback computation would be:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{\$450{,}000}{\$90{,}000 \text{ per year}} = 5 \text{ years}$$

Yes, the new ride meets the requirement. The payback period is less than the maximum 6 years required by the Park.

2. The simple rate of return would be:

$$\text{Simple rate of return} = \frac{\text{Incremental revenues} - \text{Incremental expenses, including depreciation}}{\text{Initial investment}}$$

$$= \frac{\$63{,}000}{\$450{,}000} = 14\%$$

Yes, the new ride satisfies the criterion. Its 14% return exceeds the Park's requirement of a 12% return.

Exercise 14-15 (20 minutes)

1. Annual cost of student help in collating		$60,000
Annual cost of the new collating machine:		
Operator	$18,000	
Maintenance	7,000	25,000
Net annual cost savings (cash inflow)		$35,000

2. The net present value analysis follows:

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*14% Factor*	*Present Value of Cash Flows*
Cost of the new collating machine	Now	$(140,000)		$(140,000)	1.000	$(140,000)
Net annual cost savings (above)	1-10	35,000	1 – 0.30	24,500	5.216	127,792
Depreciation deductions*	1-10	14,000	0.30	4,200	5.216	21,907
Cost of the new roller pads.....	5	(20,000)	1 – 0.30	(14,000)	0.519	(7,266)
Salvage value of the new machine	10	40,000	1 – 0.30	28,000	0.270	7,560
Net present value						$ 9,993

* $140,000 ÷ 10 years = $14,000 per year

Yes, the new collating machine should be purchased.

Problem 14-16 (20 minutes)

1. The annual cash inflows would be:

Reduction in annual operating costs:	
Operating costs, present hand method	$35,000
Operating costs, new machine	14,000
Annual savings in operating costs	21,000
Increased annual contribution margin:	
5,000 packages × $0.60 per package	3,000
Total annual cash inflows	$24,000

2.

Item	*Year(s)*	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Cost of the machine	Now	$(90,000)	1.000	$(90,000)
Overhaul required	5	(7,500)	0.476	(3,570)
Annual cash inflows	1-8	24,000	4.344	104,256
Salvage value	8	6,000	0.305	1,830
Net present value				$ 12,516

Problem 14-17 (30 minutes)

1. The net annual cost savings is computed as follows:

Reduction in labor costs	$240,000
Reduction in material costs	96,000
Total cost reductions	336,000
Less increased maintenance costs ($4,250 × 12)	51,000
Net annual cost savings	$285,000

2. Using this cost savings figure, and other data provided in the text, the net present value analysis is:

	Year(s)	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Cost of the machine	Now	$(900,000)	1.000	$ (900,000)
Installation and software	Now	(650,000)	1.000	(650,000)
Salvage of the old machine	Now	70,000	1.000	70,000
Annual cost savings	1-10	285,000	4.494	1,280,790
Overhaul required	6	(90,000)	0.370	(33,300)
Salvage of the new machine	10	210,000	0.191	40,110
Net present value				$ (192,400)

   No, the etching machine should not be purchased. It has a negative net present value at an 18% discount rate.

3. The intangible benefits would have to be worth at least $42,813 per year as shown below:

$$\frac{\text{Required increase in net present value}}{\text{Factor for 10 years}} = \frac{\$192,400}{4.494} = \$42,813$$

   Thus, the new etching machine should be purchased if management believes that the intangible benefits are worth at least $42,813 per year to the company.

Problem 14-18 (30 minutes)

1. The income statement would be:

Sales revenue (72,000 loaves × $1.25 per loaf)		$90,000
Less cost of ingredients ($90,000 × 40%)		36,000
Contribution margin		54,000
Less operating expenses:		
Utilities	$ 9,000	
Salaries	18,000	
Insurance	3,000	
Depreciation	7,200 *	
Total operating expenses		37,200
Net operating income		$16,800

* $120,000 × 90% = $108,000
$108,000 ÷ 15 years = $7,200 per year.

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

$$\text{Simple rate of return} = \frac{\text{Net Income}}{\text{Initial Investment}}$$

$$= \frac{\$16{,}800}{\$120{,}000} = 14\%$$

Yes, the oven and equipment would be purchased since their return exceeds Mr. Lugano's 12% requirement.

Problem 14-18 (continued)

3. The formula for the payback period is:

$$\text{Payback period} = \frac{\text{Initial investment}}{\text{Net annual cash inflow}}$$

$$= \frac{\$120{,}000}{\$24{,}000 \text{ per year}^*} = 5 \text{ years}$$

*$16,800 net operating income + $7,200 depreciation = $24,000.

Yes, the oven and equipment would be purchased. The payback period is less than the 6-year period Mr. Lugano requires.

Problem 14-19 (20 minutes)

Item	*Year(s)*	*Amount of Cash Flows*	*14% Factor*	*Present Value of Cash Flows*
Cost of equipment required	Now	$(850,000)	1.000	$(850,000)
Working capital required	Now	(100,000)	1.000	(100,000)
Net annual cash receipts	1-5	230,000	3.433	789,590
Cost of road repairs	3	(60,000)	0.675	(40,500)
Salvage value of equipment	5	200,000	0.519	103,800
Working capital released	5	100,000	0.519	51,900
Net present value				$ (45,210)

No, the project should not be accepted; it has a negative net present value. This means that the rate of return on the investment is less than the company's required rate of return of 14%.

Problem 14-20 (30 minutes)

1. The formula for the profitability index is:

$$\text{Profitability index} = \frac{\text{Present value of cash inflows}}{\text{Investment required}}$$

The index for the projects under consideration would be:

Project 1: $567,270 ÷ $480,000 = 1.18
Project 2: $433,400 ÷ $360,000 = 1.20
Project 3: $336,140 ÷ $270,000 = 1.24
Project 4: $522,970 ÷ $450,000 = 1.16
Project 5: $379,760 ÷ $400,000 = 0.95

2. a., b., and c.

	Net Present Value	*Profitability Index*	*Internal Rate of Return*
First preference.....	1	3	4
Second preference.....	2	2	3
Third preference.....	4	1	1
Fourth preference.....	3	4	2
Fifth preference.....	5	5	5

Problem 14-20 (continued)

3. Which ranking is best will depend on Austin Company's opportunities for reinvesting funds as they are released from a project. 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 #4 would have to be reinvested in another project yielding an internal rate of return of 19%. Another project yielding such a high rate of return might be difficult to find.

   The 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 profitability index is generally regarded as being the most dependable method of ranking competing projects.

   The net present value is inferior to the profitability index as a ranking device, since 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 #3 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 profitability index).

Problem 14-21 (20 minutes)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Investment in new trucks	Now	$(450,000)		$(450,000)	1.000	$(450,000)
Salvage from sale of the old trucks	Now	30,000	1 – 0.30	21,000	1.000	21,000
Net annual cash receipts	1-8	108,000	1 – 0.30	75,600	4.968	375,581
Depreciation deductions*	1-8	56,250	0.30	16,875	4.968	83,835
Overhaul of motors	5	(45,000)	1 – 0.30	(31,500)	0.567	(17,861)
Salvage from the new trucks	8	20,000	1 – 0.30	14,000	0.404	5,656
Net present value						$ 18,211

* $450,000 ÷ 8 years = $56,250 per year

Since the project has a positive net present value, the contract should be accepted.

Problem 14-22 (30 minutes)

1. Average weekly use of the washers and dryers would be:

$$\text{Washers: } \frac{\$1{,}800}{\$1.50 \text{ per use}} = 1{,}200 \text{ uses}$$

$$\text{Dryers: } \frac{\$1{,}125}{\$0.75 \text{ per use}} = 1{,}500 \text{ uses}$$

The expected net annual cash receipts will be:

Washer cash receipts ($1,800 × 52)		$ 93,600
Dryer cash receipts ($1,125 × 52)		58,500
Total cash receipts		152,100
Less cash disbursements:		
Washer: Water and electricity ($0.075 × 1,200 × 52)	$ 4,680	
Dryer: Gas and electricity ($0.09 × 1,500 × 52)	7,020	
Rent ($3,000 × 12)	36,000	
Cleaning ($1,500 × 12)	18,000	
Maintenance and other ($1,875 × 12)	22,500	88,200
Net annual cash receipts		$ 63,900

2.

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Cost of equipment	Now	$(194,000)	1.000	$(194,000)
Working capital invested	Now	(6,000)	1.000	(6,000)
Net annual cash receipts	1-6	63,900	4.111	262,693
Salvage of equipment	6	19,400	0.507	9,836
Working capital released	6	6,000	0.507	3,042
Net present value				$ 75,571

Yes, Mr. White should be advised to invest in the laundromat. The positive net present value indicates that the rate of return on this investment would exceed the 12% rate of return he could earn elsewhere.

Problem 14-23 (90 minutes)

1. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

$$= \frac{\$142,950}{\$37,500} = 3.812$$

From Table 14C-4 in Appendix 14C, reading along the 7-period line, a factor of 3.812 equals an 18% rate of return.

Verification of the 18% rate of return:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Investment in equipment	Now	$(142,950)	1.000	$(142,950)
Annual cash inflows	1-7	37,500	3.812	142,950
Net present value				$ 0

2. $$\text{Factor of the internal rate of return} = \frac{\text{Investment in the project}}{\text{Annual cash inflow}}$$

We know that the investment is $142,950, and we can determine the factor for an internal rate of return of 14% by looking in Table 14C-4 along the 7-period line. This factor is 4.288. Using these figures in the formula, we get:

$$\frac{\$142,950}{\text{Annual cash inflow}} = 4.288$$

Therefore, the annual cash inflow would have to be:

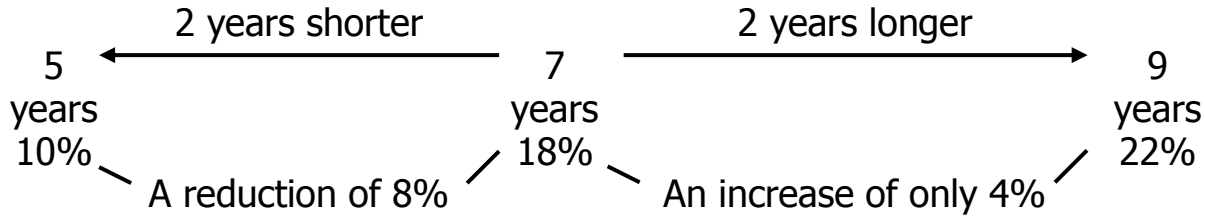
$142,950 ÷ 4.288 = $33,337.

Problem 14-23 (continued)

3. a. 5-year life for the equipment:
   The factor for the internal rate of return would still be 3.812 [as computed in (1) above]. From Table 14C-4, reading this time along the 5-period line, a factor of 3.812 is closest to 3.791, the factor for 10%. Thus, to the nearest whole percent, the internal rate of return is 10%.

   b. 9-year life for the equipment:
   The factor of the internal rate of return would again be 3.812. From Table 14C-4, reading along the 9-period line, a factor of 3.812 is closest to 3.786, the factor for 22%. Thus, to the nearest whole percent, the internal rate of return is 22%.

   The 10% return in part (a) is less than the 14% minimum return that Dr. Black wants to earn on the project. Of equal or even greater importance, the following diagram should be pointed out to Dr. Black:



   As this illustration shows, a *decrease* in years has a much greater impact on the rate of return than an *increase* in years. This is because of the time value of money; added cash inflows far into the future do little to enhance the rate of return, but loss of cash inflows in the near term can do much to reduce it. Therefore, Dr. Black should be *very* concerned about any potential decrease in the life of the equipment, while at the same time realizing that any increase in the life of the equipment will do little to enhance her rate of return.

Problem 14-23 (continued)

4. a. The expected annual cash inflow would be:

$$\$37{,}500 \times 120\% = \$45{,}000$$

$$\frac{\$142{,}950}{\$45{,}000} = 3.177$$

From Table 14C-4 in Appendix 14C, reading along the 7-period line, a factor of 3.177 is closest to 3.161, the factor for 25%, and is between that factor and the factor for 24%. Thus, to the nearest whole percent, the internal rate of return is 25%.

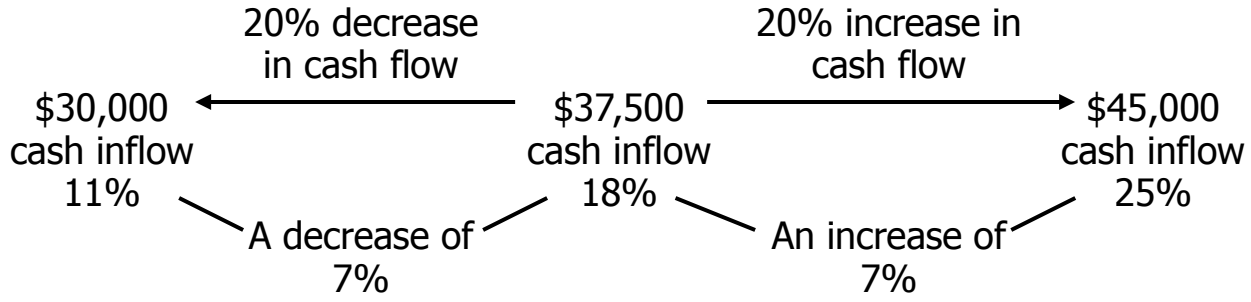
b. The expected annual cash inflow would be:

$$\$37{,}500 \times 80\% = \$30{,}000$$

$$\frac{\$142{,}950}{\$30{,}000} = 4.765$$

From Table 14C-4 in Appendix 14C, reading along the 7-period line, a factor of 4.765 is closest to 4.712, the factor for 11%. Thus, to the nearest whole percent, the internal rate of return is 11%.

Unlike changes in time, increases and decreases in cash flows at a given point in time have basically the same impact on the rate of return, as shown below:



Problem 14-23 (continued)

5. Since the cash flows are not even over the five-year period (there is an extra $61,375 cash inflow from sale of the equipment at the end of the fifth year), some other method must be used to compute the internal rate of return. Using trial-and-error or more sophisticated methods, it turns out that the actual internal rate of return will be 12%:

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Investment in the equipment ...	Now	$(142,950)	1.000	$(142,950)
Annual cash inflow	1-5	30,000	3.605	108,150
Sale of the equipment	5	61,375	0.567	34,800
Net present value				$ 0

Problem 14-24 (30 minutes)

1. The formula for the profitability index is:

$$\text{Profitability index} = \frac{\text{Present value of cash inflows}}{\text{Investment required}}$$

The profitability index for each project would be:

Project A: $800,000 + $221,615 = $1,021,615;
$1,021,615 ÷ $800,000 = 1.28
Project B: $675,000 + $210,000 = $885,000;
$885,000 ÷ $675,000 = 1.31
Project C: $500,000 + $175,175 = $675,175;
$675,175 ÷ $500,000 = 1.35
Project D: $700,000 + $152,544 = $852,544;
$852,544 ÷ $700,000 = 1.22
Project E: $900,000 + $(52,176) = $847,824;
$847,824 ÷ $900,000 = 0.94

2. a., b., and c.

	Net Present Value	*Profitability Index*	*Internal Rate of Return*
First preference.....	A	C	D
Second preference.....	B	B	C
Third preference.....	C	A	A
Fourth preference.....	D	D	B
Fifth preference.....	E	E	E

Problem 14-24 (continued)

3. Which ranking is best will depend on Yancey Company's opportunities for reinvesting funds as they are released from a project. 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 an internal rate of return of 22%. Another project yielding such a high rate of return might be difficult to find.

   The 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 profitability index is generally regarded as being the most dependable method of ranking competing projects.

   The net present value is inferior to the profitability index as a ranking device, since 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 third 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 profitability index).

Problem 14-25 (30 minutes)

1. The income statement would be:

Sales revenue		¥200,000
Less commissions (40% × ¥200,000)		80,000
Contribution margin		120,000
Less fixed expenses:		
Maintenance	¥50,000	
Insurance	10,000	
Depreciation*	36,000	
Total fixed expenses		96,000
Net operating income		¥ 24,000

*¥180,000 ÷ 5 years = ¥36,000 per year

2. The simple rate of return would be:

$$\text{Simple rate of return} = \frac{\text{Net operating income}}{\text{Initial investment - Salvage from old equipment}}$$

$$= \frac{¥24,000}{¥180,000\text{-}¥30,000} = \frac{¥24,000}{¥150,000} = 16\%$$

Yes, the games would be purchased. The return exceeds the 14% threshold set by the company.

3. The payback period would be:

$$\text{Payback period} = \frac{\text{Initial investment - Salvage from old equipment}}{\text{Net annual cash inflow}}$$

$$= \frac{¥180,000\text{-}¥30,000}{¥60,000*} = \frac{¥150,000}{¥60,000} = 2.5 \text{ years}$$

*Net operating income, ¥24,000 + Depreciation, ¥36,000 = ¥60,000.

Yes, the games would be purchased. The payback period is less than the 3 years.

Problem 14-26 (30 minutes)

1. The total-cost approach:

	Year(s)	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Purchase the new generator:				
Cost of the new generator.....	Now	$(20,000)	1.000	$(20,000)
Salvage of the old generator.....	Now	4,000	1.000	4,000
Annual cash operating costs	1-8	(7,500)	4.344	(32,580)
Salvage of the new generator....	8	6,000	0.305	1,830
Present value of the net cash outflows				$(46,750)
Keep the old generator:				
Overhaul needed now	Now	$ (8,000)	1.000	$ (8,000)
Annual cash operating costs	1-8	(12,500)	4.344	(54,300)
Salvage of the old generator.....	8	3,000	0.305	915
Present value of the net cash outflows				$(61,385)
Net present value in favor of purchasing the new generator....				$ 14,635

The hospital should purchase the new generator, since it has the lowest present value of total cost.

Problem 14-26 (continued)

2. The incremental-cost approach:

	Year(s)	*Amount of Cash Flows*	*16% Factor*	*Present Value of Cash Flows*
Incremental investment—new generator*	Now	$(12,000)	1.000	$(12,000)
Salvage of the old generator	Now	4,000	1.000	4,000
Savings in annual cash operating costs	1-8	5,000	4.344	21,720
Difference in salvage value in 8 years	8	3,000	0.305	915
Net present value in favor of purchasing the new generator				$ 14,635

*$20,000 – $8,000 = $12,000.

Problem 14-27 (45 minutes)

1. Labor savings €190,000
   Ground mulch savings 10,000 €200,000
   Less out-of-pocket costs:
   Operator 70,000
   Insurance 1,000
   Fuel 9,000
   Maintenance contract 12,000 92,000
   Annual savings in cash operating costs €108,000

2. The formula for the simple rate of return when a cost reduction project is involved is as follows:

$$\text{Simple rate of return} = \frac{\text{Cost savings-Depreciation on new equipment}}{\text{Initial investment}}$$

$$= \frac{€108{,}000 - €40{,}000^*}{€480{,}000} = 14.2\% \text{ (rounded)}$$

*Depreciation is calculated as follows: $\frac{€480{,}000}{12 \text{ years}} = €40{,}000$ per year

3. The formula for the payback period is:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{€480{,}000}{108{,}000^*} = 4.4 \text{ years (rounded)}$$

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

The harvester meets Mr. Despinoy's payback criterion since its payback period is less than 5 years.

Problem 14-27 (continued)

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

$$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$= \frac{€480{,}000}{€108{,}000} = 4.4 \text{ (rounded)}$$

Looking at Table 14C-4 in Appendix 14C, and reading along the 12-period line, a factor of 4.4 would represent an internal rate of return of approximately 20%.

Note that the payback and internal rate of return methods would indicate that the investment should be made. The simple rate of return method indicates the opposite since the simple rate of return is less than 16%. The simple rate of return method generally is not an accurate guide in investment decisions.

Problem 14-28 (30 minutes)

1. The net present value analysis would be:

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*10% Factor*	*Present Value of Cash Flows*
Investment in equipment	Now	$(600,000)		$(600,000)	1.000	$(600,000)
Working capital needed	Now	(85,000)		(85,000)	1.000	(85,000)
Net annual cash receipts	1-10	110,000	1 – 0.30	77,000	6.145	473,165
Depreciation deductions	1-10	60,000	0.30	18,000	6.145	110,610
Cost of restoring land	10	(70,000)	1 – 0.30	(49,000)	0.386	(18,914)
Salvage value of the equipment*	10	90,000	1 – 0.30	63,000	0.386	24,318
Working capital released	10	85,000		85,000	0.386	32,810
Net present value						$ (63,011)

*$600,000 × 15% = $90,000.

2. No, the investment project should not be undertaken. It has a negative net present value when the company's cost of capital is used as the discount rate.

Problem 14-29 (30 minutes)

1. The present value of cash flows would be:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Purchase alternative:				
Purchase cost of the plane	Now	$(850,000)	1.000	$(850,000)
Annual cost of servicing, etc...	1-5	(9,000)	3.127	(28,143)
Repairs:				
First three years.....	1-3	(3,000)	2.174	(6,522)
Fourth year.....	4	(5,000)	0.516	(2,580)
Fifth year.....	5	(10,000)	0.437	(4,370)
Resale value of the plane	5	425,000	0.437	185,725
Present value of cash flows				$(705,890)
Lease alternative:				
Damage deposit	Now	$ (50,000)	1.000	$ (50,000)
Annual lease payments	1-5	(200,000)	3.127	(625,400)
Refund of deposit	5	50,000	0.437	21,850
Present value of cash flows				$(653,550)
Net present value in favor of leasing the plane				$ 52,340

2. The company should accept the leasing alternative, since it has the lowest present value of total cost. When a company has a high cost of capital, such as the company in this problem, it is usually better to avoid tying up funds in equipment and facilities. Although the purchase of equipment and facilities allows a company to claim a resale value at the end of useful life, this resale value frequently has a very low present value if the company's cost of capital is high, as can be seen by the purchase alternative above. Moreover, leased equipment and facilities are often owned by pension funds and similar organizations that require a fairly low rate of return and thus can pass a savings on to the lessee. "You should lease whenever money is worth more to you than it is to the other person."

Problem 14-30 (60 minutes)

1. Computation of the net annual cost savings:

Savings in labor costs ($16 per hour × 20,000 hours)	$320,000
Savings in inventory carrying costs	190,000
Total	510,000
Less increased power and maintenance cost ($2,500 per month × 12 months)	30,000
Net annual cost savings	$480,000

2.

	Year(s)	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Cost of the robot	Now	$(1,600,000)	1.000	$(1,600,000)
Software and installation	Now	(700,000)	1.000	(700,000)
Cash released from inventory	1	300,000	0.833	249,900
Net annual cost savings	1-12	480,000	4.439	2,130,720
Salvage value	12	90,000	0.112	10,080
Net present value				$ 90,700

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

3. Recomputation of the annual cost savings:

Savings in labor costs ($16 per hour × 17,500 hours)	$280,000
Savings in inventory carrying costs	190,000
Total	470,000
Less increased power and maintenance cost ($2,500 per month × 12 months)	30,000
Net annual cost savings	$440,000

Problem 14-30 (continued)

Recomputation of the net present value of the project:

	Year(s)	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Cost of the robot.....	Now	$(1,600,000)	1.000	$(1,600,000)
Software and installation....	Now	(825,000)	1.000	(825,000)
Cash released from inventory.....	1	300,000	0.833	249,900
Net annual cost savings.....	1-12	440,000	4.439	1,953,160
Salvage value.....	12	90,000	0.112	10,080
Net present value.....				$ (211,860)

Given the cost data at hand, it appears that the company did not make a wise investment, since the rate of return that will be earned by the robot is less than 20%. However, see part 4 below. This problem shows the difficulty often encountered in estimating data going into capital budgeting analyses, and also shows what a heavy impact even seemingly small changes in the data can have on overall net present value. To mitigate these problems, some companies analyze several scenarios—one showing the "most likely" results, one showing the "best case" results, and one showing the "worst case" results. Probability analysis is also used when probabilities can be attached to the various possible outcomes.

Problem 14-30 (continued)

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

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

   The president should understand that 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. $$\frac{\text{Additional present value required}}{\text{Factor for 12 years}} = \frac{\$211,860}{4.439} = \$47,727$$

   Thus, the intangible benefits in part (a) will have to be worth at least $47,727 per year in order for the robot to yield a 20% rate of return.

Problem 14-31 (45 minutes)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*8% Factor*	*Present Value of Cash Flows*
Alternative 1:						
Investment in the bonds.....	Now	$(200,000)		$(200,000)	1.000	$(200,000)
Interest on the bonds (8% × $200,000)	1-24*	8,000 *		8,000	15.247 **	121,976
Maturity of the bonds	24	200,000		200,000	0.390 **	78,000
Net present value.....						$ (24)***

* 24 six-month interest periods; $8,000 received each interest period.

** Factor for 4% for 24 periods.

*** This amount should be zero; the difference is due to rounding of the discount factors. (Since the bonds yield 8% after taxes, they would have a zero net present value at an 8% discount rate.)

Problem 14-31 (continued)

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*8% Factor*	*Present Value of Cash Flows*
Alternative 2:						
Investment in the business	Now	$(200,000)	—	$(200,000)	1.000	$(200,000)
Net annual cash receipts ($400,000 – $370,000 = $30,000)	1-12	30,000	1 – 0.40	18,000	7.536	135,648
Depreciation deductions:						
Year 1: 14.3% of $80,000	1	11,440	0.40	4,576	0.926	4,237
Year 2: 24.5% of $80,000	2	19,600	0.40	7,840	0.857	6,719
Year 3: 17.5% of $80,000	3	14,000	0.40	5,600	0.794	4,446
Year 4: 12.5% of $80,000	4	10,000	0.40	4,000	0.735	2,940
Year 5: 8.9% of $80,000	5	7,120	0.40	2,848	0.681	1,939
Year 6: 8.9% of $80,000	6	7,120	0.40	2,848	0.630	1,794
Year 7: 8.9% of $80,000	7	7,120	0.40	2,848	0.583	1,660
Year 8: 4.5% of $80,000	8	3,600	0.40	1,440	0.540	778
Recovery of working capital ($200,000 – $80,000 = $120,000)	12	120,000	—	120,000	0.397	47,640
Net present value						$ 7,801

The net present value of Alternative 2 is higher than the net present value of Alternative 1. That certainly gives the edge to Alternative 2. However, the additional net present value is so small that it may be outweighed by the higher risk of Alternative 2 and the potential hassles of owning a store.

Problem 14-32 (60 minutes)

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

	Year			
	1	*2*	*3*	*4-12*
Sales in units	4,000	7,000	10,000	12,000
Sales in dollars (@ $45 each)	$ 180,000	$ 315,000	$450,000	$540,000
Less variable expenses (@ $25 each)	100,000	175,000	250,000	300,000
Contribution margin.....	80,000	140,000	200,000	240,000
Less fixed expenses:				
Advertising	70,000	70,000	50,000	40,000
Other fixed expenses*	120,000	120,000	120,000	120,000
Total fixed expenses.....	190,000	190,000	170,000	160,000
Net cash inflow (outflow)...	$(110,000)	$ (50,000)	$ 30,000	$ 80,000

* Depreciation is not a cash outflow and therefore must be eliminated when determining the net cash flow. The analysis is:

Cost of the equipment.....	$100,000
Less salvage value (10%).....	10,000
Net depreciable cost.....	$ 90,000

$ 90,000 ÷ 12 years = $7,500 per year depreciation
$127,500 – $7,500 depreciation = $120,000 cash fixed expenses

Problem 14-32 (continued)

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

Item	*Year(s)*	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Investment in equipment	Now	$(100,000)	1.000	$(100,000)
Working capital investment	Now	(40,000)	1.000	(40,000)
Yearly cash flows	1	(110,000)	0.833	(91,630)
" " "	2	(50,000)	0.694	(34,700)
" " "	3	30,000	0.579	17,370
" " "	4-12	80,000	2.333 *	186,640
Salvage value of equipment	12	10,000	0.112	1,120
Release of working capital	12	40,000	0.112	4,480
Net present value				$ (56,720)

* Present value factor for 12 periods	4.439
Present value factor for 3 periods	2.106
Present value factor for 9 periods, starting 4 periods in the future	2.333

Since the net present value is negative, the company should not accept the smoke detector as a new product.

Case 14-33 (45 minutes)

1. As a member of the division budget committee that is conducting the postaudit review, Amy Kimbell will be implicitly lending her credibility to any report that is forwarded to the board of directors. If she were to implicitly accept the review by failing to call attention to its shortcomings, she would be violating several of the standards of ethical conduct adopted by the Institute of Management Accountants including:

   - Competence. Prepare complete and clear reports and recommendations after appropriate analysis of relevant and reliable information. The current postaudit review is incomplete—incremental service department costs have been excluded.
   - Integrity. Communicate unfavorable as well as favorable information and professional judgments or opinions. The current postaudit review suppresses unfavorable information.
   - Objectivity. Communicate information fairly and objectively. Disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations presented. The intent of the current postaudit review is clearly to justify the earlier decision to invest in the high-tech operation, rather than to present a fair and balanced view. Unfavorable information has been suppressed.

   Amy is in a delicate situation if the other members of the budget committee are unwilling to heed her concerns. On the one hand, she cannot let the flawed postaudit review go to the board of directors. On the other hand, she needs to maintain good working relations with the other members of the budget committee. And her actions on this committee will likely become known throughout the company and influence her relations with just about everyone she comes into contact with. We suggest that, as diplomatically as she can, she should firmly state that she feels the postaudit review is an important document, but the current version is deeply flawed, and that she respects the opinions of the other members of the committee, but will feel obligated to file a minority report if the current version is sent to the board of directors. Quite often, the threat of such a report is enough to bring the other members of the committee to their senses. If it does not have this effect, then she should file the minority report.

Case 14-33 (continued)

2. Unfortunately, the situation that Amy faces is all too common. Rather than acknowledge mistakes and cut losses, managers (and people in general) too often remain committed to their failing courses of action. This commitment leads people into self-delusion, self-justification, and cover-ups—all of which sap time and energy as well as perpetuating the results of bad decisions. Postaudits, if conducted properly, provide an escape route from this self-defeating behavior.

   The review process is flawed from the very beginning if the postaudit review is prepared by the same people who approved the original proposal. The people who approved the original proposal are probably going to be interested in justifying their original decision rather than in conducting an objective review. Therefore, the postaudit review should be conducted by an independent group—perhaps the company's internal audit office—rather than by the division budget committees.

Case 14-34 (45 minutes)

1. Some students will have difficulty organizing the data into a coherent format. Perhaps the clearest approach is as follows:

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Purchase of facilities:				
Initial payment	Now	$(6,000,000)	1.000	$ (6,000,000)
Annual payments	1-4	(2,000,000)	3.037	(6,074,000)
Annual cash operating costs	1-20	(200,000)	7.469	(1,493,800)
Resale value of facilities	20	5,000,000	0.104	520,000
Present value of cash flows				$(13,047,800)
Lease of facilities:				
Initial deposit	Now	$ (400,000)	1.000	$ (400,000)
First lease payment	Now	(1,000,000)	1.000	(1,000,000)
Remaining lease payments	1-19	(1,000,000)	7.366	(7,366,000)
Annual repair and maintenance	1-20	(50,000)	7.469	(373,450)
Return of deposit	20	400,000	0.104	41,600
Present value of cash flows				$ (9,097,850)
Net present value in favor of leasing the facilities				$ 3,949,950

This is a least-cost decision. In this particular case, the simplest way to handle the data is the total-cost approach as shown above. The problem with Harry Wilson's approach, in which he simply added up the payments, is that it ignores the time value of money. The purchase option ties up large amounts of funds that could be earning a return elsewhere.

Case 14-34 (continued)

The incremental-cost approach is another way to organize the data, although it is harder to follow and would not be as clear in a presentation to the executive committee. The data could be arranged as follows (students are likely to have many variations):

Lease rather than buy:

Item	*Year(s)*	*Amount of Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Initial payment avoided[1]	Now	$5,000,000	1.000	$ 5,000,000
Deposit	Now	(400,000)	1.000	(400,000)
Annual purchase payments avoided	1-4	2,000,000	3.037	6,074,000
Annual lease payments	1-19	(1,000,000)	7.366	(7,366,000)
Cash operating cost savings[2]	1-20	150,000	7.469	1,120,350
Forgone resale value of facilities, net of the return of deposit[3]	20	(4,600,000)	0.104	(478,400)
Net present value in favor of leasing the facilities				$ 3,949,950

[1] $6,000,000 – $1,000,000 = $5,000,000
[2] $200,000 – $50,000 = $150,000
[3] $5,000,000 – $400,000 = $4,600,000

2. The present value of $5 million in 20 years is only $520,000 if the company can invest its funds at 12%. Money to be received far into the future is worth very little in terms of present value when the discount rate is high. The facility's future value would have to be more than $37,980,000 (= $3,949,950 ÷ 0.104) higher than Harry Wilson has assumed to overturn the conclusion that leasing is the more attractive alternative.

Case 14-35 (60 minutes)

1. This is a least-cost problem; it can be worked either by the total-cost approach or by the incremental-cost approach. Regardless of which approach is used, we must first compute the annual production costs that would result from each of the machines. The computations are:

	Year			
	1	*2*	*3*	*4-10*
Units produced	20,000	30,000	40,000	45,000
Model 2600: Total cost at $0.90 per unit	$18,000	$27,000	$36,000	$40,500
Model 5200: Total cost at $0.70 per unit	$14,000	$21,000	$28,000	$31,500

Using these data, the solution by the total-cost approach would be:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Alternative 1: Purchase the model 2600 machine:				
Cost of new machine	Now	$(180,000)	1.000	$(180,000)
Cost of new machine	6	(200,000)	0.370	(74,000)
Market value of replacement machine	10	100,000	0.191	19,100
Production costs (above)	1	(18,000)	0.847	(15,246)
" "	2	(27,000)	0.718	(19,386)
" "	3	(36,000)	0.609	(21,924)
" "	4-10	(40,500)	2.320 *	(93,960)
Repairs and maintenance	1-10	(6,000)	4.494	(26,964)
Present value of cash outflows				$(412,380)

Case 14-35 (continued)

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Alternative 2: Purchase the model 5200 machine:				
Cost of new machine	Now	$(250,000)	1.000	$(250,000)
Production costs (above)	1	(14,000)	0.847	(11,858)
" "	2	(21,000)	0.718	(15,078)
" "	3	(28,000)	0.609	(17,052)
" "	4-10	(31,500)	2.320 *	(73,080)
Repairs and maintenance	1-10	(4,600)	4.494	(20,672)
Present value of cash outflows				$(387,740)
Net present value in favor of Alternative 2				$ 24,640

* Present value factor for 10 periods 4.494
Present value factor for 3 periods 2.174
Present value factor for 7 periods starting 4 periods in the future 2.320

Case 14-35 (continued)

The solution by the incremental-cost approach would be:

Item	*Year(s)*	*Amount of Cash Flows*	*18% Factor*	*Present Value of Cash Flows*
Incremental cost of the model 5200 machine.....	Now	$ (70,000)	1.000	$ (70,000)
Cost avoided on a replacement model 2600 machine....	6	200,000	0.370	74,000
Salvage value forgone on the replacement machine.....	10	(100,000)	0.191	(19,100)
Savings in production costs.....	1	4,000	0.847	3,388
" " "	2	6,000	0.718	4,308
" " "	3	8,000	0.609	4,872
" " "	4-10	9,000	2.320	20,880
Savings on repairs, etc.	1-10	1,400	4.494	6,292
Net present value.....				$ 24,640

Thus, the company should purchase the model 5200 machine and keep the presently owned model 2600 machine on standby.

2. An increase in materials cost would make the model 5200 machine less desirable. The reason is that it uses more material per unit than does the model 2600 machine, as evidenced by the greater material cost per unit.

3. An increase in labor cost would make the model 5200 machine more desirable. The reason is that it uses less labor time per unit than does the model 2600 machine, as evidenced by the lower labor cost per unit.

Case 14-36 (60 minutes)

1. The net present value analysis would be:

Items and Computations	*Year(s)*	*(1) Amount*	*(2) Tax Effect*	*(1) × (2) After-Tax Cash Flows*	*12% Factor*	*Present Value of Cash Flows*
Investment in equipment	Now	$(3,000,000)		$(3,000,000)	1.000	$(3,000,000)
Investment in working capital	Now	(200,000)		(200,000)	1.000	(200,000)
Additional revenue (300 pounds × $5,600 per pound)	1-10	1,680,000	1 – 0.30	1,176,000	5.650	6,644,400
Variable processing costs (300 pounds × $1,400 per pound)	1-10	(420,000)	1 – 0.30	(294,000)	5.650	(1,661,100)
Salaries and fringe benefits	1-10	(110,000)	1 – 0.30	(77,000)	5.650	(435,050)
Periodic maintenance	1-10	(50,000)	1 – 0.30	(35,000)	5.650	(197,750)
Depreciation deductions:						
Year 1 (14.3% of $3,000,000)	1	429,000	0.30	128,700	0.893	114,929
Year 2 (24.5% of $3,000,000)	2	735,000	0.30	220,500	0.797	175,739
Year 3 (17.5% of $3,000,000)	3	525,000	0.30	157,500	0.712	112,140
Year 4 (12.5% of $3,000,000)	4	375,000	0.30	112,500	0.636	71,550
Year 5 (8.9% of $3,000,000)	5	267,000	0.30	80,100	0.567	45,417
Year 6 (8.9% of $3,000,000)	6	267,000	0.30	80,100	0.507	40,611
Year 7 (8.9% of $3,000,000)	7	267,000	0.30	80,100	0.452	36,205
Year 8 (4.5% of $3,000,000)	8	135,000	0.30	40,500	0.404	16,362
Release of working capital	10	200,000	—	200,000	0.322	64,400
Restoration of mine site	10	(4,000,000)	1 – 0.30	(2,800,000)	0.322	(901,600)
Net present value						$ 926,253

Case 14-36 (continued)

2. Net present value of the project	$ 926,253	
Less: net present value of the additional revenue	6,644,400	
Net present value of cash flows other than revenue	$(5,718,147)	
Net present value of revenue required to break even	$ 5,718,147	
Present value factor for a ten-year annuity at 12%	÷ 5.650	
Required annual after-tax revenue	1,012,061	
Tax effect	÷ [1 – 0.30]	
Required annual before-tax revenue	1,445,801	
Annual production in pounds	÷ 300	pounds
Required market price to break even	$ 4,819	per pound

Group Exercise 14-37

Students' answers will depend on the specific project they investigate at your local university or college.