Exercise 15-1 (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 15B-2 in Appendix 15B.

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 15-2 (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. $$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Annual cash inflow}}$$

$$= \frac{\$18,600}{\$5,000} = 3.720$$

Looking in Exhibit 15B-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 15-3 (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:

$$\frac{\text{Required increase in present value}}{\text{Factor for 15 years}} = \frac{\$630,000}{4.675} = \$134,759$$

Exercise 15-4 (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.

Problem 15-11 (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 15-11 (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).

Problem 15-23 (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 15-23 (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 15B-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%.

Appendix 15C
Income Taxes and Net Present Value Analysis

Exercise 15C-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 15B-2 in Appendix 15B ($610,000 × 3.517 = $2,145,370).

Exercise 15C-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					