(*b*) If Frank thinks the rate of return in (*a*) is too low, which alternative should he select?

7-81 A bulldozer can be bought for $380,000 and used for six years, when its salvage value is 15% of the first cost. Or it can be leased for $60,000 a year. (Remember that lease payments occur at the start of the year.) The firm's interest rate is 12%.

(*a*) What is the interest rate for buying versus leasing? Which is the better choice?

(*b*) If the firm will receive $65,000 more each year than it spends on operating and maintenance costs, should the firm obtain the bulldozer? What is the rate of return for the bulldozer using the best financing plan?

7-82 A diesel generator for electrical power can be purchased by a remote community for $480,000 and used for 10 years, when its salvage value is $50,000. Or it can be leased for $70,000 a year. (Remember that lease payments occur at the start of the year.) The community's interest rate is 8%.

(*a*) What is the interest rate for buying versus leasing? Which is the better choice?

(*b*) The community will spend $80,000 less each year for fuel and maintenance than it currently spends on buying power. Should it obtain the generator? What is the rate of return for the generator using the best financing plan?

ANALYSIS PERIOD

7-83 Two alternatives are being considered:

	A	B
First cost	$9,200	$5,000
Uniform annual benefit	$1,850	$1,750
Useful life, in years	8	4

If the minimum attractive rate of return is 7%, which alternative should be selected?

7-84 Jean has decided it is time to buy a new battery for her car. Her choices are the following:

	Zappo	Kicko
First cost	$56	$90
Guarantee period, in months	12	24

Jean believes the batteries can be expected to last only for the guarantee period. She does not want to invest extra money in a battery unless she can expect a 50% rate of return. If she plans to keep her present car another two years, which battery should she buy?

7-85 Two alternatives are being considered:

	A	B
Initial cost	$9,200	$5,000
Uniform annual benefit	$1,850	$1,750
Useful life, in years	8	4

Base your computations on a MARR of 7% and an eight-year analysis period. If identical replacement is assumed, which alternative should be chosen?

7-86 Two investment opportunities are as follows:

	A	B
First cost	$150	$100
Uniform annual benefit	$25	$22.25
End-of-useful-life salvage value	$20	$0
Useful life, in years	15	10

At the end of 10 years, Alternative B is not replaced. Thus, the comparison is 15 years of A versus 10 years of B. If the MARR is 10%, which alternative should be selected?

SPREADSHEETS

7-87 The Southern Guru Copper Company operates a large mine in a South American country. A legislator said in the National Assembly that most of the capital for the mining operation was provided by loans from the World Bank; in fact, Southern Guru has only $500,000 of its own money actually invested in the property. The cash flow for the mine is as follows:

Year	Cash Flow
0	$0.5 million investment
1	3.5 million profit
2	0.9 million profit
3	3.9 million profit
4	8.6 million profit
5	4.3 million profit
6	3.1 million profit
7	6.1 million profit

The legislator divided the $30.4 million total profit by the $0.5 million investment. This produced, he said, a 6,080% rate of return on the investment. Southern Guru claims the actual rate of return is much lower. They ask you to compute their rate of return. Use a spreadsheet.

7-88 A young engineer's starting salary is $52,000. She expects annual raises of 3%. She will deposit 10% of the annual salary at the end of each year in a savings account that earns 4%. How much will the engineer have saved for starting a business after 15 years? We suggest that the spreadsheet include at least columns for the year, the year's salary, the year's deposit, and the year's cumulative savings.

7-89 A young engineer's starting salary is $55,000. He expects annual raises of 2%. He will deposit 10% of the annual salary at the end of each year in a savings account that earns 5%. How much will the engineer have saved for his retirement after 40 years? Use a spreadsheet.

7-90 A young engineer's starting salary is $55,000. The engineer expects annual raises of 2%. She will deposit a constant percentage of the annual salary at the end of each year in a savings account that earns 5%. What percentage must be saved so that there will be $1 million in savings for her retirement after 40 years? (*Hint*: Use GOAL SEEK: see last section of Chapter 8.) Use a spreadsheet.

7-91 Find the average starting engineer's salary for your discipline. Find and reference a source for the average annual raise you can expect. If you deposit 10% of your annual salary at the end of each year in a savings account that earns 4%, how much will you have saved for retirement after 40 years? Use a spreadsheet.

MINI-CASES

7-92 Some lenders charge an up-front fee on a loan, which is subtracted from what the borrower receives. This is described as x points (where one point equals 1% of the loan amount). The US federal government requires that this be included in the APR that discloses the loan's cost.

(a) A five-year auto loan for $18,000 has monthly payments at a 9% nominal annual rate. If the borrower must pay a loan origination fee of 2%, what is the true effective cost of the loan? What would the APR be?

(b) If the car is sold after two years and the loan is paid off, what are the effective interest rate and the APR?

(c) Graph the effective interest rate as the time to sell the car and pay off the loan varies from one to five years.

7-93 Some lenders charge an up-front fee on a loan, which is added to what the borrower owes. This is described as x points (where one point equals 1% of the loan amount). The US federal government requires that this be included in the APR that discloses the cost of the loan.

(a) A 30-year mortgage for $220,000 has monthly payments at a 6% nominal annual rate. If a borrower's loan origination fee is 3% and it is added to the initial balance, what is the true effective cost of the loan? What would the APR be?

(b) If the house is sold after six years and the loan is paid off, what is the effective interest rate and the APR?

(c) Graph the effective interest rate as the time to sell the house and pay off the loan varies from one to 15 years.

8-4 A firm is considering two alternatives:

	A	B
Initial cost	$10,700	$5,500
Uniform annual benefits	$2,100	$1,800
Salvage value at end of useful life	$0	$0
Useful life, in years	8	4

At the end of four years, another B may be purchased with the same cost, benefits, and so forth.

(a) Construct a choice table for interest rates from 0% to 100%.

(b) If the MARR is 10%, which alternative should be chosen?

8-5 Your cat's summer kitty-cottage needs a new roof. You are considering the following two proposals and you think a 15-year analysis period is in line with your cat's remaining lives. (There is no salvage value for old roofs.)

	Thatch	Slate
First cost	$20	$40
Annual upkeep	$5	$2
Service life, in years	3	5

(a) Construct a choice table for interest rates from 0% to 100%.

(b) Which roof should you choose if your MARR is 12%? What is the actual value of the IRR on the incremental cost?

8-6 Don Garlits is a landscaper. He is considering the purchase of a new commercial lawn mower, either the Atlas or the Zippy. Construct a choice table for interest rates from 0% to 100%.

	Atlas	Zippy
Initial cost	$6,700	$16,900
Annual operation and maintenance cost	$1,500	$1,200
Annual benefit	$4,000	$4,500
Salvage value	$1,000	$3,500
Useful life, in years	3	6

8-7 The South End bookstore has an annual profit of $170,000. The owner is considering opening a second bookstore on the north side of the campus. He can rent an existing building for five years with an option to continue the lease for a second five-year period. If he opens the second bookstore, he expects the existing store will lose some business, which will be gained by The North End, the new bookstore. It will take $500,000 of store fixtures and inventory to open The North End. He believes that the two stores will have a combined profit of $260,000 a year after all the expenses of both stores have been paid.

The owner's economic analysis is based on a five-year period. He will be able to recover his $500,000 investment at the end of five years by selling the store fixtures and inventory.

(a) Construct a choice table for interest rates from 0% to 100%.

(b) The owner will not open The North End unless he can expect a 15% rate of return. What should he do? Show computations to justify your decision.

8-8 A paper mill is considering two types of pollution-control equipment.

	Neutralization	Precipitation
Initial cost	$700,000	$500,000
Annual chemical cost	$40,000	$110,000
Salvage value	$175,000	$125,000
Useful life, in years	5	5

(a) Construct a choice table for interest rates from 0% to 100%.

(b) The firm wants a 12% rate of return on any avoidable increments of investment. Which equipment should be purchased?

8-9 A stockbroker has proposed two investments in low-rated corporate bonds paying high interest rates and selling below their stated value (in other words, junk bonds). The two bonds are rated as equally risky.

8-15 Consider four mutually exclusive alternatives, each having an eight-year useful life:

	A	B	C	D
First cost	$1,000	$800	$600	$500
Uniform annual benefit	122	120	97	122
Salvage value	750	500	500	0

(a) Construct a choice table for interest rates from 0% to 100%.
(b) If the minimum attractive rate of return is 8%, which alternative should be selected?

8-16 Three mutually exclusive projects are being considered:

	A	B	C
First cost	$1,000	$2,000	$3,000
Uniform annual benefit	$150	$150	$0
Salvage value	$1,000	$2,700	$5,600
Useful life, in years	5	6	7

When each project reaches the end of its useful life, it would be sold for its salvage value and there would be no replacement.
(a) Construct a choice table for interest rates from 0% to 100%.
(b) If 8% is the desired rate of return, which project should be chosen?

8-17 Consider four mutually exclusive alternatives:

	A	B	C	D
Initial cost	$770.00	$1406.30	$2563.30	0
Uniform annual benefit	$420.00	$420.00	$420.00	0
Useful life, in years	2	4	8	0
Computed rate of return	6.0%	7.5%	6.4%	0

The analysis period is eight years. At the end of two, four, and six years, Alternative A will have an identical replacement. Alternative B will have a single identical replacement at the end of four years. Over what range of values of MARR is Alternative B the preferred alternative?

8-18 Consider the three alternatives:

	A	B	C
Initial cost	$1,500	$1,000	$2,035
Annual benefit in each of first 5 years	250	250	650
Annual benefit in each of subsequent 5 years	450	250	145

Each alternative has a 10-year useful life and no salvage value. Construct a choice table for interest rates from 0% to 100%.

8-19 Three mutually exclusive alternatives are being considered.

	A	B	C
Initial investment	$50,000	$22,000	$15,000
Annual net income	$5,093	$2,077	$1,643
Computed rate of return	8%	7%	9%

Each alternative has a 20-year useful life with no salvage value.
(a) Construct a choice table for interest rates from 0% to 100%.
(b) If the MARR is 7%, which alternative should be chosen?

8-20 A business magazine is available for $58 for one year, $108 for two years, $153 for three years, or $230 for five years. Assume you will read the magazine for at least the next five years. For what interest rates do you prefer each payment plan?

8-21 Three office furniture firms that offer different payment plans have responded to a request for bids from a government department.

8-31 In a particular situation, four mutually exclusive alternatives are being considered. Each of the alternatives costs $1,300 and has no salvage value after a 10-year life.

Alternative	Annual Benefit	Calculated Rate of Return
A	$100 at end of first year; increasing by $30 per year thereafter	10.0%
B	$10 at end of first year; increasing by $50 per year thereafter	8.8%
C	Annual end-of-year benefit = $260	15.0%
D	$450 at end of first year; declining by $50 per year thereafter	18.1%

(a) Construct a choice table for interest rates from 0% to 100%.
(b) If MARR is 8%, which alternative should be selected?

8-32 A more detailed examination of the situation in Problem 8-31 reveals that there are two additional mutually exclusive alternatives to be considered. Both cost more than the $1,300 for the four original alternatives. Neither has any salvage value after a useful life of 10 years.

Alternative	Cost	Annual End-of-Years Benefit	Calculated Rate of Return
E	$3,000	$488	10.0%
F	5,850	1,000	11.2%

(a) Construct a choice table for interest rates from 0% to 100%.
(b) If the MARR remains at 8%, which one of the six alternatives should be chosen?

8-33 The owner of a downtown parking lot has employed a civil engineering consulting firm to advise him on the economic feasibility of constructing an office building on the site. Marie Tremblay, a newly hired civil engineer, has been assigned to make the analysis. She has assembled the following data:

Alternative	Total Investment*	Total Net Annual Revenue from Property
Sell parking lot	$0	$0
Keep parking lot	200,000	22,000
Build 1-storey building	400,000	60,000
Build 2-storey building	555,000	72,000
Build 3-storey building	750,000	100,000
Build 4-storey building	875,000	105,000
Build 5-storey building	1,000,000	120,000

*Includes the value of the land.

The analysis period is to be 15 years. For all the alternatives, the property has an estimated resale (salvage) value at the end of 15 years equal to the present total investment.
(a) Construct a choice table for interest rates from 0% to 100%.
(b) If the MARR is 10%, what recommendation should Marie make?

8-34 A firm is considering moving its manufacturing plant from Red Deer to a new location. The industrial engineering department was asked to identify the various alternatives together with the costs to relocate the plant, and the benefits. The engineers examined six likely sites, together with the do-nothing alternative of keeping the plant at its present location. Their findings are summarized as follows:

Plant Location	First Cost ($000s)	Uniform Annual Benefit ($000s)
Halifax	$300	$52
Edmonton	550	137
Toronto	450	117
Vancouver	750	167
Calgary	150	18
Regina	200	49
Red Deer	0	0

The annual benefits are expected to be constant over the eight-year analysis period. If the firm uses 10% annual interest in its economic analysis, where should the manufacturing plant be located?

8-35 An oil company plans to buy a piece of vacant land on the corner of two busy streets for $70,000. On properties of this type, the company installs businesses of four different types.

Plan	Cost*	Type of Business
A	$75,000	Conventional gas station with service facilities for lubrication, oil changes, etc.
B	230,000	Automatic carwash facility with gasoline pump island in front
C	30,000	Discount gas station (no service bays)
D	130,000	Gas station with low-cost, quick-carwash facility

*Improvements do not include the $70,000 cost of the land.

In each case, the estimated useful life of the improvements is 15 years. The salvage value for each is estimated to be the $70,000 cost of the land. The net annual income, after all operating expenses are paid for, is projected as follows:

Plan	Net Annual Income
A	$23,300
B	44,300
C	10,000
D	27,500

(a) Construct a choice table for interest rates from 0% to 100%.
(b) If the oil company expects a 10% rate of return on its investments, which plan (if any) should it choose?

8-36 "The Financial Adviser" is a weekly column in the local newspaper. Assume you must answer the following question: "I recently retired at age 65, and I have a tax-free retirement annuity coming due soon. I have three options. I can receive (A) $30,976 now, (B) $359.60 a month for the rest of my life (assume 20 years), or (C) $513.80 a month for the next 10 years. What should I do?" Ignore the timing of the monthly cash flows and assume that the payments are received at the end of the year.

(a) Construct a choice table for interest rates from 0% to 50%. (You do not know what the reader's interest rate is.)
(b) If $i = 9\%$, use an incremental rate of return analysis to recommend which option should be chosen.

8-37 A firm must decide which of three alternatives to adopt to expand its capacity. The firm wants a minimum annual profit of 20% of the initial cost of each separable increment of investment. Any money not invested in capacity expansion can be invested elsewhere for an annual yield of 20% of initial cost.

Alt.	Initial Cost	Annual Profit	Profit Rate
A	$100,000	$30,000	30%
B	300,000	66,000	22%
C	500,000	80,000	16%

Which alternative should be selected?

8-38 The Pure White Soap Company is considering adding some processing equipment to the plant to aid in the removal of impurities from certain raw materials. By adding the processing equipment, the firm can purchase lower-grade raw material at reduced cost and upgrade it for use in its products.

Four different pieces of processing equipment are being considered:

	A	B	C	D
Initial investment	$10,000	$18,000	$25,000	$30,000
Annual saving in materials costs	4,000	6,000	7,500	9,000
Annual operating cost	2,000	3,000	3,000	4,000