

Financial Decisions in Engineering Project Management

Practice Problems

**All questions are from Blank, L. and A. Tarquin. Engineering Economy, 6th edition. McGraw-Hill, 2005.*

Topic 1

1.1 (B&T 1.25)

Companies frequently borrow money under an arrangement that requires them to make periodic payment of only interest and then pay the principal of the loan all at once. A company that manufactures odor control chemicals borrowed \$400,000 for 3 years at 10% per year compound interest under such an arrangement. What is the difference in the total amount paid between this arrangement (identified as plan 1) and plan 2, in which the company makes no interest payments until the loan is due and then pays it off in one lump sum? **(\$12,400)**

Topic 2

2.1 (B&T 2.12)

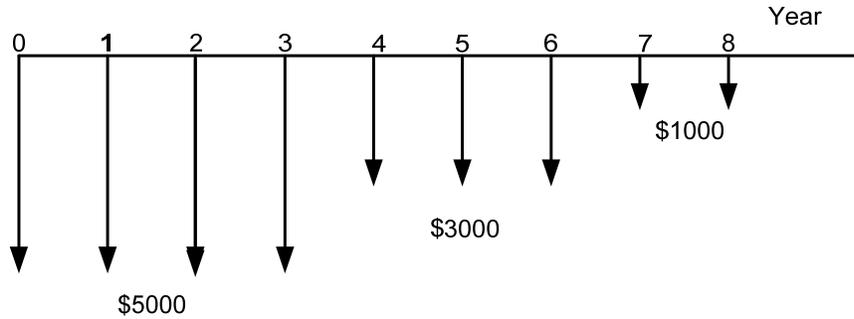
V-Tek Systems is a manufacturer of vertical compactors, and it is examining its cash flow requirements for the next 5 years. The company expects to replace office machines and computer equipment at various times over the 5-year planning period. Specifically, the company expects to spend \$9000 two years from now, \$8000 three years from now, and \$5000 five years from now. What is the present value of the planned expenditures at an interest rate of 10% per year? **(\$16,553)**

2.2 (B&T 2.23)

Southwestern Moving and Storage wants to have enough money to purchase a new tractor-trailer in 3 years. If the unit will cost \$250,000, how much should the company set aside each year if the account earns 9% per year? **(\$76,263)**

2.3 (B&T 3.28)

In attempting to obtain a swing loan from a local bank, a general contractor was asked to provide an estimate of annual expenses. One component of the expenses is shown in the cash flow diagram below. Convert the amounts shown into an equivalent uniform annual amount in years 1 through 8, using an interest rate of 12% per year. **(\$4628.69)**



Topic 3

3.1 (B&T 4.21)

A company that specializes in online security software development wants to have \$85 million available in 3 years to pay stock dividends. How much money must the company set aside now in an account that earns interest at a rate of 8% per year, compounded quarterly? (**\$67.02 million**)

3.2 (B&T 4.32)

Northwest Iron and Steel is considering getting involved in electronic commerce. A modest e-commerce package is available for \$20,000. If the company wants to recover the cost in 2 years, what is the equivalent amount of new income that must be realized every 6 months, if the interest rate is 3% per quarter? (**\$5784**)

Topic 4

4.1 (B&T 5.16)

Three different plans were presented to the GAO by a high-technology facilities manager for operating a small weapons production facility. Plan A would involve renewable 1-year contracts with payments of \$1 million at the beginning of each year. Plan B would be a 2-year contract, and it would require four payments of \$600,000 each, with the first one to be made now and the other three at 6-month intervals. Plan C would be a 3-year contract, and it would entail a payment of \$1.5 million now and another payment of \$0.5 million 2 years from now. Assuming that the GAO could renew any of the plans under the same conditions if it wants to do so, which plan is better on the basis of a present value analysis at an interest rate of 6% per year, compounded semiannually? (**Plan C**)

4.2 (B&T 5.25)

A city that is attempting to attract a professional football team is planning to build a new stadium costing \$250 million. Annual upkeep is expected to amount to \$800,000 per year. The artificial turf

will have to be replaced every 10 years at a cost of \$950,000. Painting every 5 years will cost \$75,000. If the city expects to maintain the facility indefinitely, what will be its capitalized cost at an interest rate of 8% per year? (**\$-260979538**)

4.3 (B&T 5.39)

A new process for manufacturing laser levels will have a first cost of \$35,000 with annual costs of \$17,000. Extra income associated with the new process is expected to be \$22,000 per year. What is the payback period at (a) $i = 0\%$ and (b) $i = 10\%$ per year? (**7 years, 13 years**)

Topic 5

5.1 (B&T 6.5)

A chemical engineer is considering two styles of pipes for moving distillate from a refinery to the tank farm. A small pipeline will cost less to purchase (including valves and other appurtenances) but will have a high head loss and, therefore, a higher pumping cost. The small pipeline will cost \$1.7 million installed and will have an operating cost of \$12,000 per month. A larger-diameter pipeline will cost \$2.1 million installed, but its operating cost will be only \$8,000 per month. Which pipe size is more economical at an interest rate of 1% per month on the basis of an annual value analysis? Assume the salvage value is 10% of the first cost for each pipeline at the end of the 10-year project period. (**Small Pipeline**)

Topic 6

6.1 (B&T 7.13)

The University of California at San Diego is considering a plan to build an 8-megawatt cogeneration plant to provide for part of its power needs. The cost of the plant is expected to be \$41 million. The university consumes 55,000 megawatt-hours per year at a cost of \$120 per megawatt-hours. (a) If the university will be able to produce power at one-half the cost that it now pays, what rate of return will it make on its investment if the power plant lasts 30 years? (b) If the university can sell an average of 12,000 megawatt-hours per year back to the utility at \$90 per megawatt-hour, what rate of return will it make? (**7.0% per year, 10.1% per year**)

6.2 (B&T 7.36)

A \$10,000 mortgage bond with a bond interest rate of 8% per year, payable quarterly, was purchased for \$9,200. The bond was kept until it was due, a total of 7 years. What rate of return was made by the purchaser per 3 months and per year (nominal)? (**9.6% per year**)

6.3 (B&T 5.50)

What is the present value of a \$50,000 municipal bond that has an interest rate of 4% per year, payable quarterly? The bond matures in 15 years, and the market interest rate is 8% per year, compounded quarterly. **(\$32,620)**

Topic 7

7.1 (B&T 8.2)

What is the overall rate of return on a \$100,000 investment that returns 20% on the first \$30,000 and 14% on the remaining \$70,000? **(15.8%)**

7.2 (B&T 8.16)

The manager of a canned food processing plant is trying to decide between two labeling machines. Determine which should be selected on the basis of rate of return with MARR of 20% per year.

(Machine B)

	Machine A	Machine B
First cost, \$	-15,000	-25,000
Annual operating cost, \$/year	-1,600	-400
Salvage value, \$	3,000	4,000
Life, years	2	4

7.3 (B&T 8.33)

The four alternatives described below are being evaluated.

Alternative	Initial Investment, \$	Rate of Return, %	Incremental Rate of Return, %, When Compared with Alternative		
			A	B	C
A	-40,000	29			
B	-75,000	15	1		
C	-100,000	16	7	20	
D	-200,000	14	10	13	12

(a) If the proposals are independent, which should be selected when the MARR is 16% per year?

(Select A and C)

(b) If the proposals are mutually exclusive, which one should be selected when the MARR is 9% per year? **(Proposal D)**

(c) If the proposals are mutually exclusive, which one should be selected when the MARR is 12% per year? **(Proposal A)**

Topic 8

8.1 (B&T 13.1)

The fixed costs at Harley Motors are \$1 million annually. The main product has revenue of \$8.50 per unit and \$4.25 variable cost. Determine the following.

(a) Breakeven quantity per year. **(235,294 units)**

(b) Annual profit if 200,000 units are sold and if 350,000 units are sold. Use both an equation and a plot of the revenue and total cost relations to answer. **(-\$150,000, \$487,500)**

8.2 (B&T 13.12)

A Yellow Pages directory company must decide whether it should compose the ads for its clients in-house or pay a production company to compose them. To develop the ads in-house, the company will have to purchase computers, printers, and other peripherals at a cost of \$12,000. The equipment will have a useful life of 3 years, after which it will be sold for \$2,000. The employee who creates the ads will be paid \$45,000 per year. In addition, each ad will have an average cost of \$8 to prepare for delivery to the printer. A total of 4000 ads are anticipated for the next few years. Alternatively, the company can outsource ad development at a fee of \$20 per ad regardless of the quantity. The current interest rate is 8% per year. What is the breakeven amount, and which alternative is economically better? **(4087 ads per year; select outsource)**

Topic 9

9.1 (B&T 18.31)

A large decision tree has an outcome branch that is detailed for this problem. If decisions D1, D2, and D3 are all options in a 1-year time period, find the decision path which maximizes the outcome value. There are specific dollar investments necessary for decision nodes D1, D2, and D3 as indicated on each branch. **(Select D2 path and choose top branch (\$25 investment))**

