

PROBLEM SET 9 - HANDOUT

Problem 7-1

What funds will be available 10 years from now if \$10,000 is deposited at a nominal interest rate of 6% compounded semiannually?

Problem 7-2

The original cost for a distillation tower is \$50,000, and the useful life of the tower is estimated to be 10 years. How much must be placed annually in an annuity at an interest rate of 6% to obtain sufficient funds to replace the tower at the end of 10 years? If the scrap value of the distillation tower is \$5,000, determine the asset value (i.e., the total book value of the tower) at the end of 5 years based on straight line depreciation.

Problem 7-4

Derive an expression for capitalized cost based on annual discrete interest compounding. *Capitalized cost* is defined as the sum of the original cost C_v of the equipment or asset plus the amount P that must be invested when the original equipment or asset is purchased so that when the original equipment or asset is replaced in N years at a cost C_R , the value of the investment equals P plus C_R .

Problem 7-5

A heat exchanger is to be used in a heating process. A standard type of heat exchanger with a negligible scrap value costs \$20,000 and will have a useful life of 6 years. Another type of heat exchanger with equivalent design capacity is priced at \$34,000 but has a useful life of 10 years and a scrap value of \$4000. Assume an effective compound interest rate of 6% per year, and that the replacement cost of each heat exchanger is the same as that of the original exchanger. Determine which heat exchanger is cheaper by comparing the capitalized cost of each. See Problem 7-4 for a definition of capitalized cost.

Problem 7-9

The fixed capital investment for an existing chemical plant is \$20 million. Annual property taxes amount to 1% of the fixed-capital investment, and state income taxes are 5% of the gross earnings. The net income after all taxes is \$2 million, and the federal income taxes amount to 35% of gross earnings. If the same plant had been constructed for the same fixed capital investment but at a location where property taxes were 4% of the fixed capital investment and the state income taxes were 2% of the gross earnings, what would be the net income per year after taxes, assuming all other cost factors were unchanged?

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Problem 7-17

A laboratory piece of equipment was purchased for \$35,000 and is estimated to be used for 5 years with a salvage value of \$5,000. (a) Tabulate the annual depreciation allowances and year-end book values for the 5 years by using the (1) straight-line depreciation method, (2) the MACRS 5-yr recovery period depreciation method, and (3) the sum of digits depreciation method. (b) Compare the net present worth of each of the three depreciation methods assuming an interest rate of 6%.

Problem 7-18

A piece of equipment with an original cost of \$10,000 and no salvage value has a depreciation allowance of \$2381 during its second year of service when depreciated by the sum-of-the-digits method. What recovery period has been used?

Problem 8-1

What total amount of funds before taxes will be available 10 years from now if \$10,000 is placed in a savings account earning an interest rate of 6 percent compounded monthly? How many years will be required for this amount to double at the same interest rate compounded semiannually? What is the shortest time in years for the doubling to occur if continuous compounding is available?

Problem 8-2

A proposed chemical plant will require a fixed-capital investment of \$10 million. It is estimated that the working capital will be 25 percent of the total investment. Annual depreciation costs are estimated to be 10 percent of the fixed-capital investment. If the annual profit will be \$3 million, determine the percent return on the total investment and the payout period.

Problem 8-4

Two pumps are being considered for pumping water from a reservoir. Installed cost and salvage value for the two pumps are given below:

	Pump A	Pump B
Installed cost	\$20,000	\$25,000
Salvage value	\$2,000	\$4,000

Pump A has a service life of 4 years. Determine the service life of pump B at which the two pumps are competitive if the annual effective interest rate is 15%. Competitiveness refers to the requirement that the installed cost of the two pumps plus the amount that must be invested at the time of installation so that sufficient interest will be earned over the service life (when added to the salvage value) to replace the pumps at the original cost [be the same] (Capitalized cost must be the same).

(Problems continue on the next page.)

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Problem 8-6

A design engineer is evaluating two pumps for handling a corrosive solution. The information on the pumps is the following:

	Pump A	Pump B
Installed cost	\$15,000	\$22,000
Service life, years	2	5

Determine the annual interest rate at which the two pumps are considered competitive. Neglect salvage value. See Problem 8-4 for the definition of competitiveness. Which pump would you recommend?