University of Diyala

Engineering Economy

Lecture 5

3rd Stage

Communication department / Engineering collage

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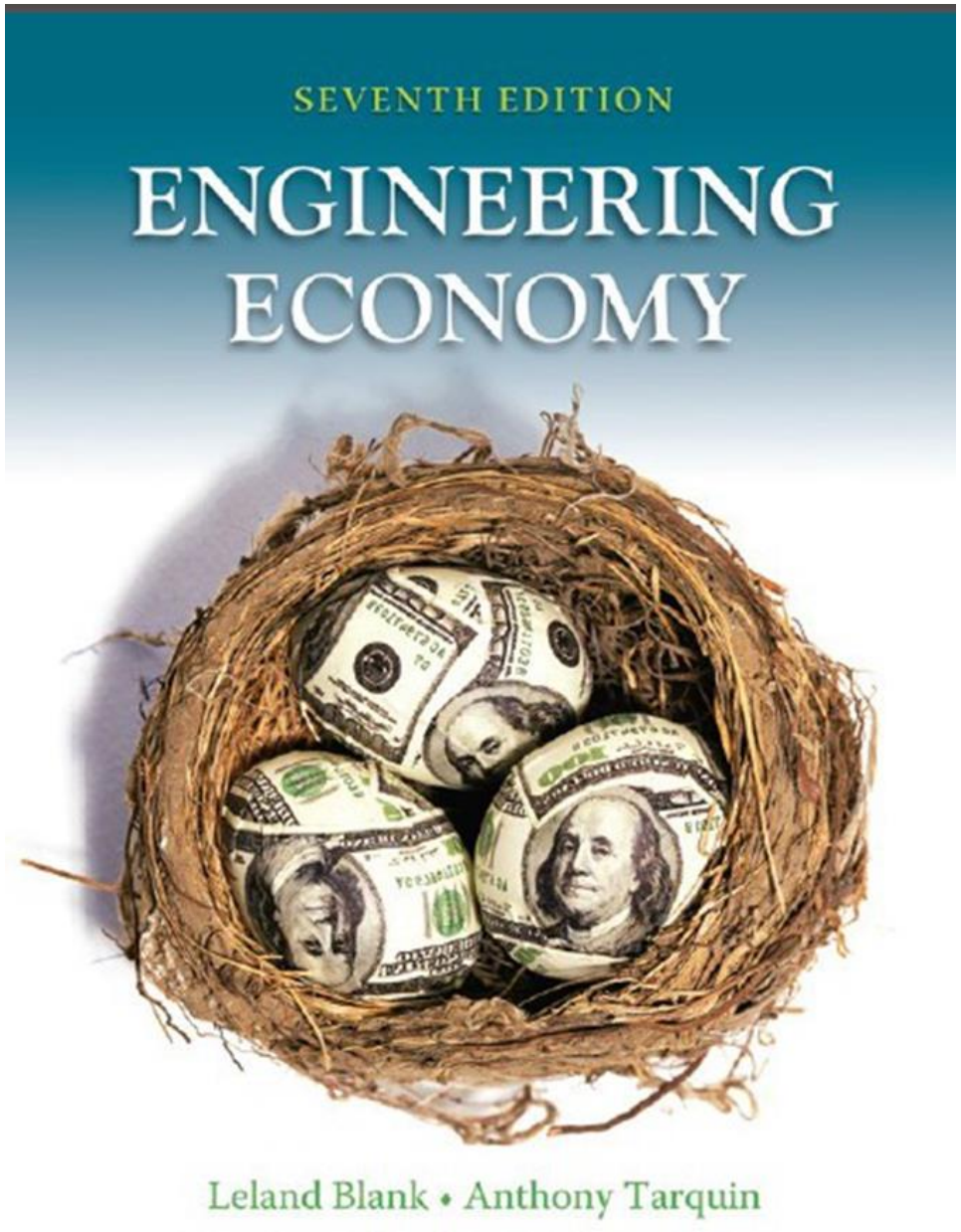

Chapter 1

Foundation of Engineering Economy

Interest

1. Simple interest

- Simple interest is computed only on original sum (principal), not on prior interest earned and left in the account.

- A bank account, for example, may have its simple interest every year: in this case, an account with $1000 initial principal and 20% interest per year would have a balance of $1200 at the end of the first year, $1400 at the end of the second year, and so on.

- **Simple interest** is calculated using the principal only.

Simple interest = (principal)(number of periods)(interest rate) [4]

$$I = Pni$$

Example:

Green Tree Financing lent an engineering company $100,000 to retrofit an environmentally unfriendly building. The loan is for 3 years at 10% per year simple interest. How much money will the firm repay at the end of 3 years?

Solution:

Total interest = $100,000(3)(0.10) = $30,000

Total due= 100,000 + 30,000 = 130,000$

Interest

2. Compound Interest

- Compound interest arises when interest is added to the principal of a deposit or loan, so that, from that moment on, the interest that has be ended also earns interest. This addition of interest to the principal is called compounding.

- A bank account, for example, may have its interest compounded every year: in this case, an account with $1000 initial principal and 20% interest per year would have a balance of $1200 at the end of the first year, $1440 at the end of the second year, and so on.

- **Compound interest** is the interest accrued for each interest period is calculated on the principal plus the total amount of interest accumulated in all previous periods.

Compound interest = (principal + all accrued interest)(interest rate)

The interest It for time period t may be calculated using the relation

$$I_t = \left(P + \sum_{j=1}^{j=t-1} I_J \right)(i) \qquad [5]$$

Example

Assume an engineering company borrows $100,000 at 10% per year compound interest and will pay the principal and all the interest after 3 years. Compute the annual interest and total amount due after 3 years. Graph the interest and total owed for each year, and compare with the previous example that involved simple interest.

Solution

To include compounding of interest, the annual interest and total owed each year are calculated by Equation [1.8].

Interest, year 1:	$100{,}000(0.10) = \$10{,}000$
Total due, year 1:	$100{,}000 + 10{,}000 = \$110{,}000$
Interest, year 2:	$110{,}000(0.10) = \$11{,}000$
Total due, year 2:	$110{,}000 + 11{,}000 = \$121{,}000$
Interest, year 3:	$121{,}000(0.10) = \$12{,}100$
Total due, year 3:	$121{,}000 + 12{,}100 = \$133{,}100$

The repayment plan requires no payment until year 3 when all interest and the principal, a total of $133,100, are due. Figure 1–11 uses a cash flow diagram format to compare end-of-year (*a*) simple and (*b*) compound interest and total amounts owed. The differences due to compounding are clear. An extra $133,100 – 130,000 = $3100 in interest is due for the compounded interest loan.

Note that while simple interest due each year is constant, the compounded interest due grows geometrically. Due to this geometric growth of compound interest, the difference between simple and compound interest accumulation increases rapidly as the time frame increases. For example, if the loan is for 10 years, not 3, the extra paid for compounding interest may be calculated to be $59,374.

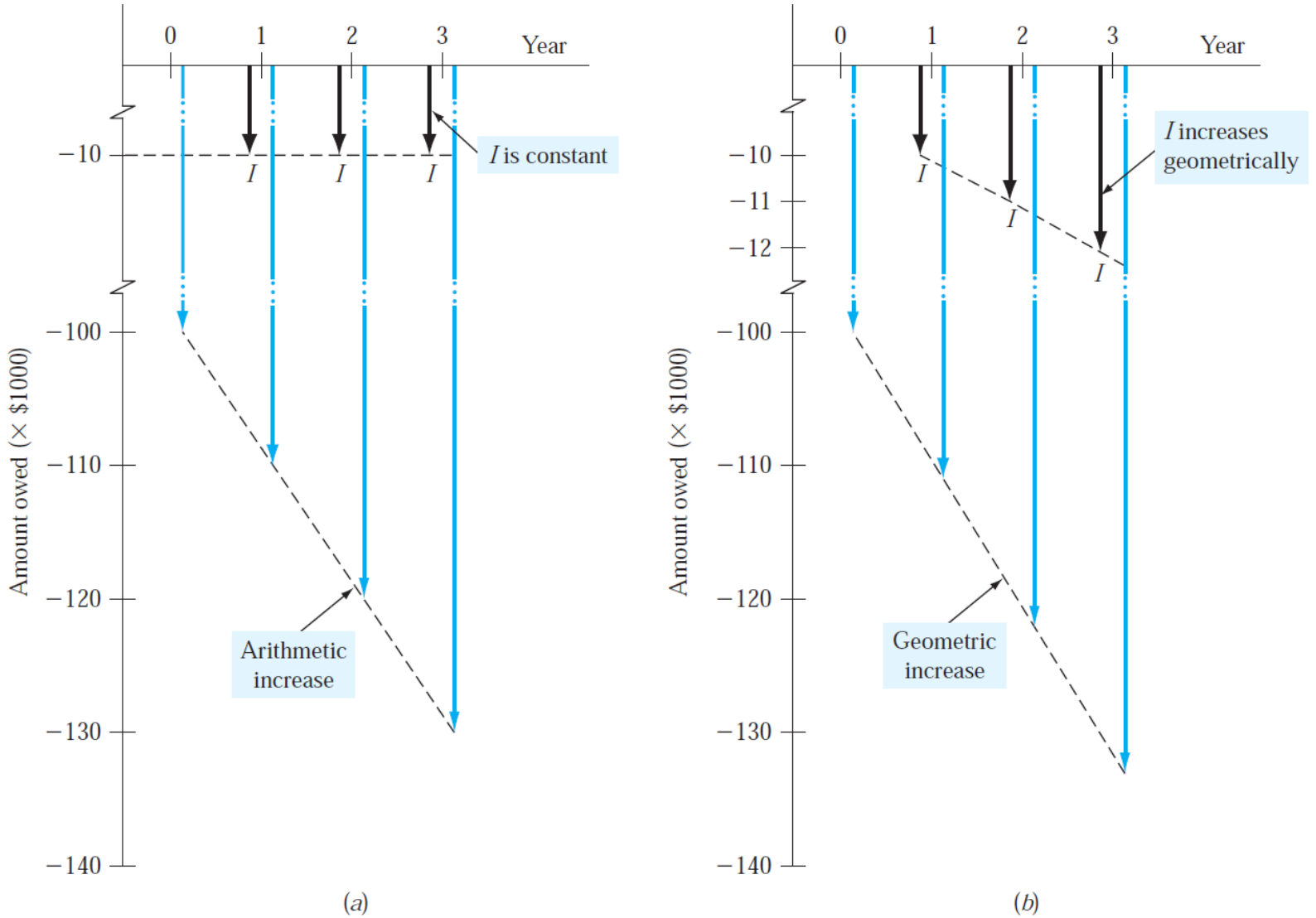

Figure 1–11
Interest I owed and total amount owed for (*a*) simple interest (Example 1.14) and (*b*) compound interest (Example 1.15).