

## Chapter 3

### Bob's Builders

The government wants to commission a large infrastructure project to a contractor. Contractors are asked to bid on the project to let the government know for what price they are willing to do the job. Naturally they will give the job to the lowest bidder. Bob's Builders are thinking about bidding. They have made the following estimates:

- The project will take 4 years to complete.
- The cost is \$ 125,000 per year.

The government proposes two payment schemes to pay the selected contractor. The first would be one total payment at the end of the project. The other is two equal payments, one at the end of year 2, the second at the end of year 4.

Assuming a cost of capital of 10%, what is the lowest bid that Bob can submit to the government under each of the payment schedules?

### Solutions Bob's Builders

Payment schedule 1:

$$\text{PV of cost} = \$125,000 * [1 - 1/(1.1)^4]/0.1 = \$396,233.$$

$$\text{Bid} = \$396,233 * (1.1)^4 = \$580,125.$$

$$\text{Alternative calculation: } \$125,000 * [(1.1)^4 - 1]/0.1 = \$580,125.$$

Payment schedule 2:

Bob will receive 2 equal payments (P), one at moment 2, the other in 4 years.

$$P/(1.1)^2 + P/(1.1)^4 = \$396,233.$$

$$P * (1/(1.1)^2 + 1/(1.1)^4) = \$396,233.$$

$$P = \$262,493. \text{ Total bid} = \$262,493 * 2 = \$524,986.$$

### Savings account

A savings account earning 5% interest holds \$160,000. For the next 15 years, a \$15,000 withdrawal is made at the end of each year.

A. How much does the account hold immediately after the last withdrawal?

B. How much interest has been earned in these 15 years?

### Solutions savings account

$$\text{A. PV of withdrawals} = \$15,000 * [1 - 1/(1.05)^{15}]/0.05 = \$155,694.87.$$

$$\$160,000 - \$155,694.87 = \$4,305.13.$$

$$\$4,305.13 * (1.05)^{15} = \$8,950.05.$$

$$\text{B. Total withdrawals} = 15 * \$15,000 = \$225,000. \text{ Total interest earned} = \$225,000 - \$160,000 + \$8,950.05 = \$73,950.05.$$