

Example 3. You are a portfolio manager in charge of a bank portfolio with \$10 million to invest. There are 5 different securities available:

Bond name	Bond type	Years to maturity	Rate of return at maturity
1	Municipal	9	4.3%
2	Agency	15	2.7
3	Government	4	2.5
4	Government	3	2.2

The bank has some policies that limit how you can construct your portfolio:

1. Municipal and agency bonds must total at least \$4 million
2. The average years to maturity of the portfolio must not exceed 5 years
3. Bonds cannot be "shorted" (cannot buy negative amounts of bonds)

Write a linear program that determines a portfolio of the above securities that maximizes earnings.

DVs: $x_1 = \text{amt. invested in bond 1, in millions}$
 Define x_2, x_3, x_4 similarly

$$\max \quad 0.043x_1 + 0.027x_2 + 0.025x_3 + 0.022x_4 \quad (\text{total earnings})$$

$$\text{s.t.} \quad x_1 + x_2 + x_3 + x_4 \leq 10 \quad (\text{budget})$$

$$x_1 + x_2 \geq 4 \quad (\text{M+A requirement})$$

$$9x_1 + 15x_2 + 4x_3 + 3x_4 \geq 5(x_1 + x_2 + x_3 + x_4) \quad (\text{avg. YTM req.})$$

$$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, x_4 \geq 0 \quad (\text{no shorting})$$