Matrix Theory(EE5609) Assignment 2

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***Abstract*—This Assignment finds investment to be made in two different bonds to get the desired interest.**

Download all python codes from

https://github.com/anshum0302/EE5609/blob/master/assignment2/solu2.py

and latex-tikz codes from

https://github.com/anshum0302/EE5609/blob/master/assignment2/assign2.tex

1 PROBLEM STATEMENT

A trust fund has ₹30000 that must be invested in two different types of bonds.The first bond pays 5% interest per year, and the second bond pays 7% interest per year.Using matrix multiplication, determine how to divide ₹30000 among the two types of bonds.If the trust fund must obtain an annual total interest of : a) ₹1800 b) ₹2000.

2 Solution

Let ₹30000 be divided into two part $xa1$ and $xa2$ in part **a**),and into two part $xb1$ and $xb2$ in part **b**). Then $xa1, xa2, xb1, xb2$ satisfies following equations

$$xa1 + xa2 = 30000 \tag{2.0.1}$$
$$0.05xa1 + 0.07xa2 = 1800 \tag{2.0.2}$$
$$xb1 + xb2 = 30000 \tag{2.0.3}$$
$$0.05xb1 + 0.07xb2 = 2000 \tag{2.0.4}$$

From (2.0.1) and (2.0.2) we get

$$\begin{bmatrix} 1 & 1 \\ 0.05 & 0.07 \end{bmatrix} \begin{bmatrix} xa1 \\ xa2 \end{bmatrix} = \begin{bmatrix} 30000 \\ 1800 \end{bmatrix} \tag{2.0.5}$$

and from (2.0.3) and (2.0.4) we get

$$\begin{bmatrix} 1 & 1 \\ 0.05 & 0.07 \end{bmatrix} \begin{bmatrix} xb1 \\ xb2 \end{bmatrix} = \begin{bmatrix} 30000 \\ 2000 \end{bmatrix} \tag{2.0.6}$$

Combining the two we get

$$\begin{bmatrix} 1 & 1 \\ 0.05 & 0.07 \end{bmatrix} \begin{bmatrix} xa1 & xb1 \\ xa2 & xb2 \end{bmatrix} = \begin{bmatrix} 30000 & 30000 \\ 1800 & 2000 \end{bmatrix}$$
$$\xleftrightarrow{R_2=R_2-0.05R_1} \begin{bmatrix} 1 & 1 \\ 0 & 0.02 \end{bmatrix} \begin{bmatrix} xa1 & xb1 \\ xa2 & xb2 \end{bmatrix} = \begin{bmatrix} 30000 & 30000 \\ 300 & 500 \end{bmatrix}$$
$$\xleftrightarrow{R_2=50R_2} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} xa1 & xb1 \\ xa2 & xb2 \end{bmatrix} = \begin{bmatrix} 30000 & 30000 \\ 15000 & 25000 \end{bmatrix}$$
$$\xleftrightarrow{R_1=R_1-R_2} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} xa1 & xb1 \\ xa2 & xb2 \end{bmatrix} = \begin{bmatrix} 15000 & 5000 \\ 15000 & 25000 \end{bmatrix} \tag{2.0.7}$$

From (2.0.7) we get $xa1$=₹15000, $xa2$=₹15000, $xb1$=₹5000 and $xb2$=₹25000.Therefore to get an annual total interest of ₹1800 trust must invest ₹15000 in first bond and ₹15000 in second bond and to get an annual interest of ₹2000 trust must invest ₹5000 in first bond and ₹25000 in second bond.