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 x_1 and x_2 in part **a**),and into two part y_1 and y_2 in part **b**). Then x_1, x_2, y_1, y_2 satisfies following equations

$$x_1 + x_2 = 30000 \tag{2.0.1}$$
$$0.05x_1 + 0.07x_2 = 1800 \tag{2.0.2}$$
$$y_1 + y_2 = 30000 \tag{2.0.3}$$
$$0.05y_1 + 0.07y_2 = 2000 \tag{2.0.4}$$

From (2.0.1) and (2.0.2) we get

$$\begin{pmatrix} 1 & 1 \\ 0.05 & 0.07 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 30000 \\ 1800 \end{pmatrix} \tag{2.0.5}$$

and from (2.0.3) and (2.0.4) we get

$$\begin{pmatrix} 1 & 1 \\ 0.05 & 0.07 \end{pmatrix}\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{pmatrix} 30000 \\ 2000 \end{pmatrix} \tag{2.0.6}$$

Combining the two we get

$$\begin{pmatrix} 1 & 1 \\ 0.05 & 0.07 \end{pmatrix}\begin{pmatrix} x_1 & y_1 \\ x_2 & y_2 \end{pmatrix} = \begin{pmatrix} 30000 & 30000 \\ 1800 & 2000 \end{pmatrix}$$
$$\xleftrightarrow{R_2=R_2-0.05R_1} \begin{pmatrix} 1 & 1 \\ 0 & 0.02 \end{pmatrix}\begin{pmatrix} x_1 & y_1 \\ x_2 & y_2 \end{pmatrix} = \begin{pmatrix} 30000 & 30000 \\ 300 & 500 \end{pmatrix}$$
$$\xleftrightarrow{R_2=50R_2} \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x_1 & y_1 \\ x_2 & y_2 \end{pmatrix} = \begin{pmatrix} 30000 & 30000 \\ 15000 & 25000 \end{pmatrix}$$
$$\xleftrightarrow{R_1=R_1-R_2} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x_1 & y_1 \\ x_2 & y_2 \end{pmatrix} = \begin{pmatrix} 15000 & 5000 \\ 15000 & 25000 \end{pmatrix} \tag{2.0.7}$$

From (2.0.7) we get x_1=₹15000, x_2=₹15000, y_1=₹5000 and y_2=₹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.