Financial Mathematics

Principal component analysis

0035-1.

Let e_1, e_2, e_3 be the standard basis of $\mathbb{R}^{1\times 3}$,

viz., $$e_1 := [1 \quad 0 \quad 0],$$
$$e_2 := [0 \quad 1 \quad 0],$$
$$e_3 := [0 \quad 0 \quad 1].$$

a. Let $v_1 := [2 \quad 4 \quad -2]$,

Let $v_2 := [1 \quad -1 \quad -1]$.

Find a rotation matrix R

and scalars $c_1, c_2 \in \mathbb{R}$

such that $c_1 e_1 R = v_1$ and $c_2 e_2 R = v_2$.

b. Find a rotation matrix L

such that $v_1 L \in \mathbb{R}e_1$ and $v_2 L \in \mathbb{R}e_2$.

0035-2. Let $M := \begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 2 \end{bmatrix}$.

Find rotation matrices

$$K \in \mathbb{R}^{2\times 2} \quad \text{and} \quad L \in \mathbb{R}^{3\times 3}$$

s.t. KML is "diagonal".