

# Some Matrix Exercises in R

I have written these exercises for a fixed dimension. Try to write your solutions where the dimension could be easily changed.

1. Create the matrix

$$\mathbf{X} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 4 \\ 1 & 3 & 9 \\ 1 & 4 & 16 \\ 1 & 5 & 25 \\ 1 & 6 & 36 \end{bmatrix}$$

and compute  $\text{diff}(\text{diff}(\mathbf{X}))$ .

2. Create the matrix

$$\mathbf{A} = \begin{bmatrix} 1 & -2 & 1 & 0 & 0 & 0 \\ 0 & 1 & -2 & 1 & 0 & 0 \\ 0 & 0 & 1 & -2 & 1 & 0 \\ 0 & 0 & 0 & 1 & -2 & 1 \end{bmatrix}$$

and compute  $\mathbf{A}\mathbf{X}$ .

3. Create the matrix  $\mathbf{V}$  so that  $(\mathbf{V})_{ij} = \rho^{|i-j|}$  for  $\rho = (\sqrt{5} - 1)/2$ .
4. Create the matrix  $\mathbf{V}$  so that  $(\mathbf{V})_{ij} = \min(i, j)$  for  $i, j = 1, \dots, n$ .
5. Create the matrix  $\mathbf{J}$  so that  $(\mathbf{J})_{ij} = 1$  where  $i + j = n + 1$  and zero otherwise, as

$$\mathbf{J} = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

6. Create the matrix  $\mathbf{K}$  so that  $(\mathbf{K})_{ij} = 1$  where  $i \geq j$  and zero otherwise.

jfm, 26 August 2008