

Lab 11

Stat 427

Fall 2020

Instructions

Complete all questions. To prepare for the randomly collected lab, follow the instructions on the class website to prepare the work for submission. These submission rules will apply to all labs throughout the semester.

Matrix algebra

(1) Find the dot products of the following pairs of vectors

(a) $\mathbf{x} = (\mathbf{3}, \mathbf{12}, \mathbf{7}, -\mathbf{4}, -\mathbf{9})$, $\mathbf{y} = (-\mathbf{2}, \mathbf{0}, \mathbf{4}, \mathbf{8}, -\mathbf{3})$

(b) $\mathbf{x} = (\mathbf{0.3}, \mathbf{0.5}, \mathbf{0.2}, \mathbf{0.4})$, $\mathbf{y} = (\mathbf{127}, \mathbf{48}, \mathbf{205}, \mathbf{76})$

(c) $\mathbf{x} = (\mathbf{1}, \mathbf{1}, \mathbf{1}, \mathbf{1}, \mathbf{1})$, $\mathbf{y} = (\mathbf{2}, \mathbf{4}, \mathbf{3}, \mathbf{5}, \mathbf{4}, \mathbf{6})$

(2) Find the matrix product \mathbf{AB} of the following matrices

(a)

$$\mathbf{A} = \begin{bmatrix} 2 & 3 & 0 \\ 4 & 1 & -5 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 7 & 6 \\ 2 & 4 \\ -8 & 1 \end{bmatrix}$$

(b)

$$\mathbf{A} = \begin{bmatrix} 14 & 20 & 12 \\ 7 & 19 & 32 \\ 10 & 22 & 17 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 0.23 & 0.32 \\ 0.14 & 0.19 \\ 0.04 & 0.22 \end{bmatrix}$$

(c)

$$\mathbf{A} = \begin{bmatrix} 1 & 1 & 1 \\ 6 & 4 & 8 \\ 5 & 12 & 4 \\ 2 & 1 & 9 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 1 & 6 & 5 & 2 \\ 1 & 4 & 12 & 1 \\ 1 & 8 & 4 & 9 \end{bmatrix}$$

(d)

$$\mathbf{A} = \begin{bmatrix} 3 & 1 \\ 4 & 4 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 1 & -0.5 \\ -2 & 1.5 \end{bmatrix}$$

- (3) Usher (1972) presented the survival and the fecundity values listed in the table for age classes of the blue whale. The blue whale lifespan was divided into seven age classes. Each time period, a fraction of the animals in each age class survive and enter the next age class. Animals in the last age class that survive each time period simply remain in the last age class. The blue whales start reproducing upon attaining the third age class, and so on, each time period, several older age classes contribute newborns to the first age class. The initial stage abundancies for age classes 1 – 7 respectively are: 200, 150, 120, 90, 80, 60, 100. Calculate the abundancies of the age classes through twenty years.

Age Class	1	2	3	4	5	6	7
Fraction surviving	0.87	0.87	0.87	0.87	0.87	0.87	0.80
Fecundity	–	–	0.19	0.44	0.5	0.5	0.45