Quantitative Genetics 610

Homework 1: Exercises with Matrices

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1.

$$\begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix} + \begin{bmatrix} 0 & -2 \\ -1 & -3 \\ 1 & -4 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 1 & 2 \\ 4 & 2 \end{bmatrix}$$

2.

$$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} - \begin{bmatrix} -1 & 0 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 2 \\ 1 & 2 \end{bmatrix}$$

3.

$$3 * \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & -2 \end{bmatrix} = \begin{bmatrix} 3 & 6 & 0 \\ 9 & -3 & -6 \end{bmatrix}$$

4.

$$\begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix} \begin{bmatrix} 0 & -2 \\ -1 & -3 \\ 1 & -4 \end{bmatrix} = \text{not compatible.}$$

5.

$$\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

6.

$$\begin{bmatrix} 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = 3$$

7.

$$\begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} = \begin{bmatrix} 7 & 8 & 9 \\ 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

8.

$$\begin{bmatrix} 1 & 5 \\ 2 & 0 \\ 3 & 1 \end{bmatrix}^\top = \begin{bmatrix} 1 & 2 & 3 \\ 5 & 0 & 1 \end{bmatrix}$$

9.

$$A = \begin{bmatrix} 1 & -1 \\ 0 & 2 \\ 3 & 2 \end{bmatrix}; \quad a_{31} - a_{22} = 3 - 2 = 1$$

10.

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \pi & 3 & -1 \\ 2 & 0 & 0 \\ 5 & 3^{-1} & 0.5 \end{bmatrix} = \begin{bmatrix} \pi & 3 & -1 \\ 2 & 0 & 0 \\ 5 & \frac{1}{3} & 0.5 \end{bmatrix}$$

11.

Solve for x and y: $\begin{bmatrix} 1 & y \\ 2 & 3 \\ x & 6 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ 0 & 6 \end{bmatrix}$ \qquad Thus, $x = 0$, $y = 2$.

12.

$$\begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}^{-1} = \begin{bmatrix} 0.5 & -0.5 \\ 0.0 & 1.0 \end{bmatrix}$$

13.

$$B = \begin{bmatrix} 3 & 1 \\ 3 & 2 \end{bmatrix}; \qquad \det(B) = 5$$

14.

$$[1, 1, 1, 1] \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix} = \sum_{i=1}^{4} y_i$$

15.

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix}; \qquad Y^\top Y = \sum_{i=1}^{4} y_i^2$$

16.

$$
\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \begin{bmatrix} y_1 & y_2 & y_3 \end{bmatrix} = \begin{bmatrix} x_1y_1 & x_1y_2 & x_1y_3 \\ x_2y_1 & x_2y_2 & x_3y_3 \\ x_3y_1 & x_2y_2 & x_3y_3 \end{bmatrix}
$$

17.

$$
\begin{bmatrix} 1 & -1 & 0 & 0 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & -1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix} = \begin{bmatrix} y_1 - y_2 \\ y_2 - y_3 \\ y_3 - y_4 \end{bmatrix}
$$

18.

$$
\begin{bmatrix} 1 & 2 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} -7 & 7 \\ -1 & 2 \end{bmatrix}
$$

Solve the following linear systems of equations:

19.

$$
\begin{cases} x_1 + x_2 + x_3 = 3 \\ x_1 - x_2 + x_3 = 3 \\ x_1 - x_2 - x_3 = -1 \end{cases} \qquad x_1 = 1, x_2 = 0, x_3 = 2
$$

20.

$$
\begin{cases} y_1 + 2y_2 - y_3 - y_4 = -2 \\ 2y_1 - y_2 - y_3 + y_4 = 6 \\ 2y_1 + y_2 + 3y_3 - y_4 = -4 \\ 3y_1 + 3y_2 + y_3 + y_4 = 1 \end{cases} \qquad y_1 = 1, y_2 = -1, y_3 = -1, y_4 = 2
$$