Quiz on Matrix Operations

1. Use Python code, to multiply the following tensors

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

2. Given that

$$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(a) Use the dot product to demonstrate any two columns of I are orthogonal to each other.

(b) Similarly, use handwriting to demonstrate that each of the columns of I has a unit vector

(c) Repeat Q. a. and b. by using code.

3.

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

Repeat Questions a). through c). to asses whether K is orthogonal using code.

4. Given that

$$\mathbf{u} = \begin{bmatrix} 2 \\ 5 \\ -3 \end{bmatrix} \qquad \mathbf{u}_2 = \begin{bmatrix} 0 \\ -4 \\ 6 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 2 & 0 & -1 \\ -2 & 3 & 1 \\ 0 & 4 & -1 \end{bmatrix}$$

(a) Apply the identity matrix I_3 to the vector $\mathbf{u}$

(b) Apply the matrix $\mathbf{B}$ to the vector $\mathbf{u}$.

(c) Concatenate vector $\mathbf{u}$ with vector $\mathbf{u}_2$ to form a matrix $\mathbf{U}$, then apply the matrix $\mathbf{B}$ to the matrix $\mathbf{U}$