ENGR 3703 Computational Methods of Engineering

Matrix Operations

Special Problems (SP):

<u>Vectors:</u>

SP1:

Find the sums **A+B** and **C+D**, and the differences **A-B** and **C-D** if the vectors **A, B, C,** and **D** are given as follows:

$$A=[7.2 \quad -4.3 \quad 0.6 \quad 1.7] \qquad B=[-11.0 \quad 11.8 \quad 2.4 \quad -1.9]$$

$$C=\begin{bmatrix} 1.7 \\ 1.0 \\ -1.0 \\ 4.3 \end{bmatrix} \qquad D=\begin{bmatrix} -2.4 \\ -0.7 \\ -6.8 \\ 3.0 \end{bmatrix}$$

SP2:

Given the vectors specified in SP1, find the following:

$R_1=3A-2B \qquad R_2=5C+2D$

SP3:

$E=[7 \quad -1 \quad 4 \quad 2 \quad -8] \qquad F=[1 \quad 2 \quad 9 \quad 0 \quad -4]$

Find $\mathbf{R_3}$ so that

$2E-3F+R_3=0$

SP4:

Find the vector **R** from this expression (using vectors in SP1):

$R=(A \cdot B)(2A+B)$

SP5:

Find the component of the vector G in the direction of the vector H and the angle, α, between the two vectors for:

$G=[2 \quad -3 \quad 5] \qquad H=[1 \quad 4 \quad -2]$

<u>Matrices</u>

SP6:

Determine the matrix **C** given by:

$C=3A-2B$ Note A and B are

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

SP7:
Find the product **CD**:

$$C=\begin{bmatrix} 4 & 0 & -2 & 1 \\ 3 & -2 & 4 & 3 \end{bmatrix} \qquad D=\begin{bmatrix} 3 \\ -2 \\ 1 \\ 4 \end{bmatrix}$$

SP8:
Find the product **CED**, where **E** is defined as:

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

SP9:
Find the products **FG** and **GF** for the matrices below:

$$F=\begin{bmatrix} -1 & 2 & 2 & 6 \\ 7 & -3 & -4 & 0 \end{bmatrix} \qquad G=\begin{bmatrix} 6 & 3 \\ -1 & 0 \\ 0 & -4 \\ 2 & 1 \end{bmatrix}$$

SP10:
Find the products HJ and JH for the following:

$$H=\begin{bmatrix} 1 & 3 & 0 \\ 2 & -1 & 0 \\ 3 & 2 & 0 \end{bmatrix} \qquad J=\begin{bmatrix} 0 & 0 & 0 \\ 0 & -0 & 0 \\ 2 & 5 & 7 \end{bmatrix}$$

SP11:
Use the matrices **B_1**, **B_2, B_3** to show that the following is satisfied:

$$(B_1 B_2 B_3)^T = B_3^T B_2^T B_1^T$$

$$B_1=\begin{bmatrix} -4 & 1 \\ 2 & 3 \end{bmatrix} \qquad B_2=\begin{bmatrix} 2 & 1 \\ 0 & -3 \end{bmatrix} \qquad B_3=\begin{bmatrix} 3 & -2 \\ -1 & 4 \end{bmatrix}$$

SP12:
Solve the following set of equations for *x, y,* and *z* using Cramer's Rule:

$$\begin{aligned} x+2y+3z&=-5 \\ 3x+y-3z&=4 \\ -3x+4y+7z&=-7 \end{aligned}$$