MATLAB: University of California, Davis

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MATH 22AL   LAB # 6

12   Background, Reading Part : How to use MATLAB to find a basis Null space of A

Enter your matrix A in MATLAB.
1. Enter the following matrix:

$$A1 = \begin{bmatrix} 1 & 3 & 0 & 2 & 6 & 3 & 1 \\ -2 & -6 & 0 & -2 & -8 & 3 & 1 \\ 3 & 9 & 0 & 0 & 6 & 6 & 2 \\ -1 & -3 & 0 & 1 & 0 & 9 & 3 \end{bmatrix}$$

2. Find $rref(A1)$ by typing $RRA1 = rref(A1)$ you will get

$$RRA1 = \begin{bmatrix} 1 & 3 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & \frac{1}{3} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

3. Solve for leading variables:

$$\begin{array}{rl} x_1 = & -3x_2 \quad -2x_5 \\ x_4 = & -2x_5 \\ x_6 = & -\frac{1}{3}x_7 \end{array}$$

Set $x_2 = r, x_3 = s, x_5 = t$ and $x_7 = w$ we obtain

$$\begin{bmatrix} x_1 = & -3r & -2t \\ x_4 = & & -2t \\ x_6 = & & -\frac{1}{3}w \end{bmatrix}$$

In matrix form we can write this as

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{bmatrix} = \begin{bmatrix} -3r-2t \\ r \\ s \\ -2t \\ t \\ \frac{1}{3}w \\ w \end{bmatrix} = r\begin{bmatrix} -3 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + s\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + t\begin{bmatrix} -2 \\ 0 \\ 0 \\ -2 \\ 1 \\ 0 \\ 0 \end{bmatrix} + w\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -\frac{1}{3} \\ 1 \end{bmatrix}$$

So the vectors

$$\mathbf{v_1} = \begin{bmatrix} -3 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \mathbf{v_2} = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \mathbf{v_3} = \begin{bmatrix} -2 \\ 0 \\ 0 \\ -2 \\ 1 \\ 0 \\ 0 \end{bmatrix} \mathbf{v_4} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -\frac{1}{3} \\ 1 \end{bmatrix}$$

form a basis for the solution space of $AX = 0$.