Your name:

(first)	(last)	

All the output for the assignment should be printed and attached to this sheet.

Question 1. Let

$$\mathbf{a}_{1} = \begin{bmatrix} 2\\1\\3\\1 \end{bmatrix}, \quad \mathbf{a}_{2} = \begin{bmatrix} 6\\3\\9\\3 \end{bmatrix}, \quad \mathbf{a}_{3} = \begin{bmatrix} 1\\0\\0\\1 \end{bmatrix}, \quad \text{and} \quad \mathbf{a}_{4} = \begin{bmatrix} 5\\2\\6\\3 \end{bmatrix},$$

and let V be the subspace of  $\mathbb{R}^4$  spanned by  $\mathbf{a}_1$ ,  $\mathbf{a}_2$ ,  $\mathbf{a}_3$ , and  $\mathbf{a}_4$ .

(a) Define the matrix A in Matlab/Octave so that V = colA.
A =
(b) Find the reduced echelon form for A.

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(c) Find a basis for V, and find dim V.

(d) Express  $\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3, \mathbf{a}_4$  as a linear combination of the basis you found in the previous question.

Question 2. Let

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

(a) Find general solutions in a parametric vector form for the homogeneous equation  $A\mathbf{x} = \mathbf{0}$ .

(b) Find a basis for nullA, and find dim nullA.

(c) Find a basis for row A, and find dim row A.

(d) Let  $\mathbf{b}_1, \mathbf{b}_2, \mathbf{b}_3, \mathbf{b}_4$  be the row vectors forming the matrix A. Express  $\mathbf{b}_1^T, \mathbf{b}_2^T, \mathbf{b}_3^T, \mathbf{b}_4^T$  as a linear combination of the basis for row A.

(e) (Bonus question) Does any of  $\mathbf{b}_1^T, \mathbf{b}_2^T, \mathbf{b}_3^T, \mathbf{b}_4^T$  belong to null A? Justify your answer.