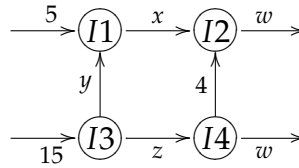


1. Reduce each of the following matrices to row echelon form. In each case, state whether the corresponding system of linear equations is consistent or not.

(a) $\left[\begin{array}{cc|c} 1 & 2 & b_1 \\ 3 & 4 & b_2 \end{array} \right]$

(b) $\left[\begin{array}{cc|c} a & b & 3 \\ 2a & 2b & 1 \end{array} \right]$

2. Suppose that the volume of traffic in the neighborhood of intersections $I1 - I4$ is known to match the following diagram.



In the diagram, the arrows denote one-way streets and the units are hundreds of cars per day.

- (a) Set up a system of linear equations which models the given traffic flow

- (b) Reduce the corresponding augmented matrix to row echelon form.

- (c) What are the values of x, y, z, w ?

3. Consider the linear transformations

$$S(x, y, z, w) = (3x + 4y + w, -x - y + 3z + 4w, x + z - w)$$

$$T(x, y, z) = (-2x + 3y - z, x + y + z)$$

(a) Write the matrix A that corresponds to S .

(b) Write the matrix B that corresponds to T .

(c) Write the matrix which corresponds to the composite transformation $T \circ S$.

(d) What is the domain of $T \circ S$ and where does it take its values?

4. Consider the matrix

$$A = \begin{bmatrix} 1 & -3 & 1 \\ 2 & -2 & 0 \\ 1 & 1 & -1 \\ 5 & -11 & 3 \end{bmatrix}$$

(a) Without any computation, explain why the columns of A cannot form a spanning set for \mathbb{R}^4 .

(b) Determine whether the particular vector

$$\mathbf{y} = \begin{bmatrix} 0 \\ 2 \\ 2 \\ 2 \end{bmatrix}$$

is in the range of A , and if it is, then tell me *how many* \mathbf{x} satisfy $A\mathbf{x} = \mathbf{y}$.