

Gauss-Jordan Elimination

Finite Math

20 March 2017

Quiz

Is the following matrix in reduced form?

$$\left[\begin{array}{ccc|c} 1 & 2 & 0 & 6 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 8 \end{array} \right]$$

Now You Try It!

Example

Solve by Gauss-Jordan elimination:

(a)

$$\begin{array}{rrcrcl} 3x_1 & + & 5x_2 & - & x_3 & = & -7 \\ x_1 & + & x_2 & + & x_3 & = & -1 \\ 2x_1 & & & + & 11x_3 & = & 7 \end{array}$$

(b)

$$\begin{array}{rrcrcl} 3x_1 & - & 4x_2 & - & x_3 & = & 1 \\ 2x_1 & - & 3x_2 & + & x_3 & = & 1 \\ x_1 & - & 2x_2 & + & 3x_3 & = & 2 \end{array}$$

(c)

$$\begin{array}{rrcrcl} 3x_1 & - & 4x_2 & - & x_3 & = & 0 \\ 2x_1 & - & 3x_2 & + & x_3 & = & 1 \\ x_1 & - & 2x_2 & + & 3x_3 & = & 2 \end{array}$$

Now You Try It!

Example

Solve by Gauss-Jordan elimination:

(a)

$$\begin{array}{rrcrcl} 3x_1 & + & 5x_2 & - & x_3 & = & -7 \\ x_1 & + & x_2 & + & x_3 & = & -1 \\ 2x_1 & & & + & 11x_3 & = & 7 \end{array}$$

(b)

$$\begin{array}{rrcrcl} 3x_1 & - & 4x_2 & - & x_3 & = & 1 \\ 2x_1 & - & 3x_2 & + & x_3 & = & 1 \\ x_1 & - & 2x_2 & + & 3x_3 & = & 2 \end{array}$$

(c)

$$\begin{array}{rrcrcl} 3x_1 & - & 4x_2 & - & x_3 & = & 0 \\ 2x_1 & - & 3x_2 & + & x_3 & = & 1 \\ x_1 & - & 2x_2 & + & 3x_3 & = & 2 \end{array}$$

Solution

(a) $x_1 = -2, x_2 = 0, x_3 = 1$, (b) *No solution*, (c) $x_1 = 7t - 4, x_2 = 5t - 3, x_3 = t$

Gauss-Jordan Elimination

Example

Solve by Gauss-Jordan elimination:

$$\begin{array}{rrcr} 2x & - & y & - 3z & = & 8 \\ x & - & 2y & & = & 7 \end{array}$$

Now You Try It!

Example

Solve by Gauss-Jordan elimination:

$$\begin{array}{rclclcl} 2x_1 & + & 4x_2 & - & 6x_3 & = & 10 \\ 3x_1 & + & 3x_2 & - & 3x_3 & = & 6 \end{array}$$

Now You Try It!

Example

Solve by Gauss-Jordan elimination:

$$\begin{array}{rrcrcl} 2x_1 & + & 4x_2 & - & 6x_3 & = & 10 \\ 3x_1 & + & 3x_2 & - & 3x_3 & = & 6 \end{array}$$

Solution

$$x_1 = -t - 1, x_2 = 2t + 3, x_3 = t$$

Application

Example

A company that rents small moving trucks wants to purchase 16 trucks with a combined capacity of 19,200 cubic feet. Three different types of trucks are available: a cargo van with a capacity of 300 cubic feet, a 15-foot truck with a capacity of 900 cubic feet, and a 24-foot truck with a capacity of 1,500-cubic feet. How many of each type should the company purchase?