

## **The No Solution Case**

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## No Solution Case

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A **signal equation** is a nonzero equation having no variables. It is typically encountered in frame sequences as the equation  $\mathbf{0} = \mathbf{1}$ .

When a signal equation occurs in a frame sequence, then we report **no solution**, because a signal equation is a false equation, implying that the system of equations cannot have a solution.

## An Example

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$$\begin{array}{rcl} x + 2y + 3z & = & 4, \\ -y - 3z & = & -1, \\ 0 & = & 1. \end{array}$$

Signal Equation  $0 = 1$ .

## An Illustration of the No Solution Case

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$$\begin{array}{rcl} & y + 3z & = 2, \\ x + & y & = 3, \\ x + 2y + 3z & = & 4. \end{array}$$

Frame 1. Original system.

$$\begin{array}{rcl} x + 2y + 3z & = & 4, \\ x + & y & = 3, \\ & y + 3z & = 2. \end{array}$$

Frame 2.

swap (1, 3)

$$\begin{array}{rcl} x + 2y + 3z & = & 4, \\ - & y - 3z & = -1, \\ & y + 3z & = 2. \end{array}$$

Frame 3.

combo (1, 2, -1)

$$\begin{array}{rcl} x + 2y + 3z & = & 4, \\ - & y - 3z & = -1, \\ & 0 & = 1. \end{array}$$

Frame 4.

Signal Equation  $0 = 1$ .

combo (2, 3, 1)

The signal equation  $0 = 1$  is a false equation, therefore the last frame has no solution. Because the toolkit neither creates nor destroys solutions, then the first frame, which is the original system, has **no solution**.

## Perplexing Frames

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Values cannot be assigned to any variables in the case of no solution. This can be perplexing, especially in a final frame like

$$\begin{array}{l} x = 4, \\ z = -1, \\ 0 = 1. \end{array}$$

While it is true that  $x$  and  $z$  were assigned values, the final signal equation  $0 = 1$  is false, meaning any answer is impossible.

There is no possibility to write equations for all variables. There is **no solution**. It is a **tragic error** to claim  $x = 4, z = -1$  is a solution.