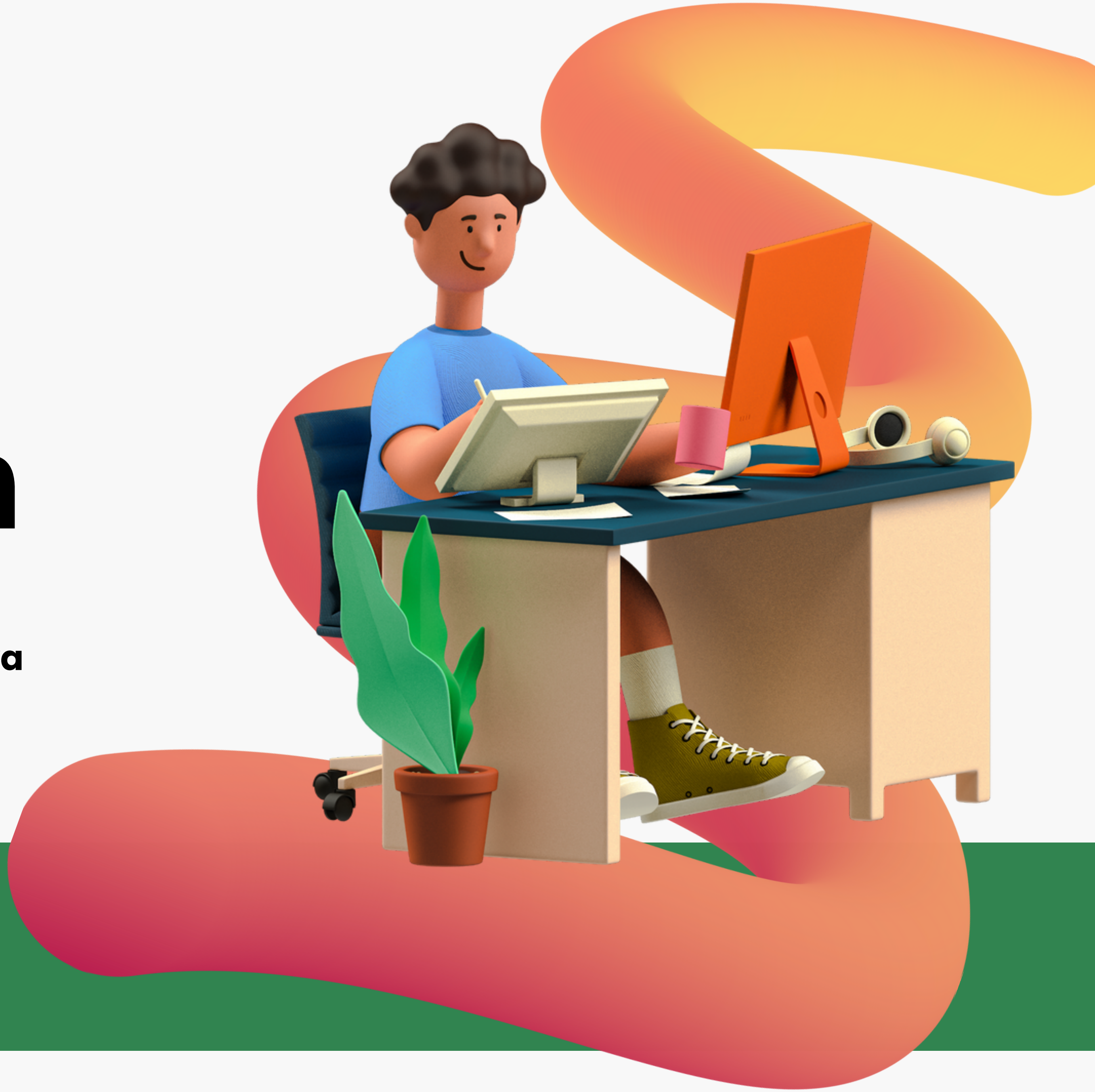
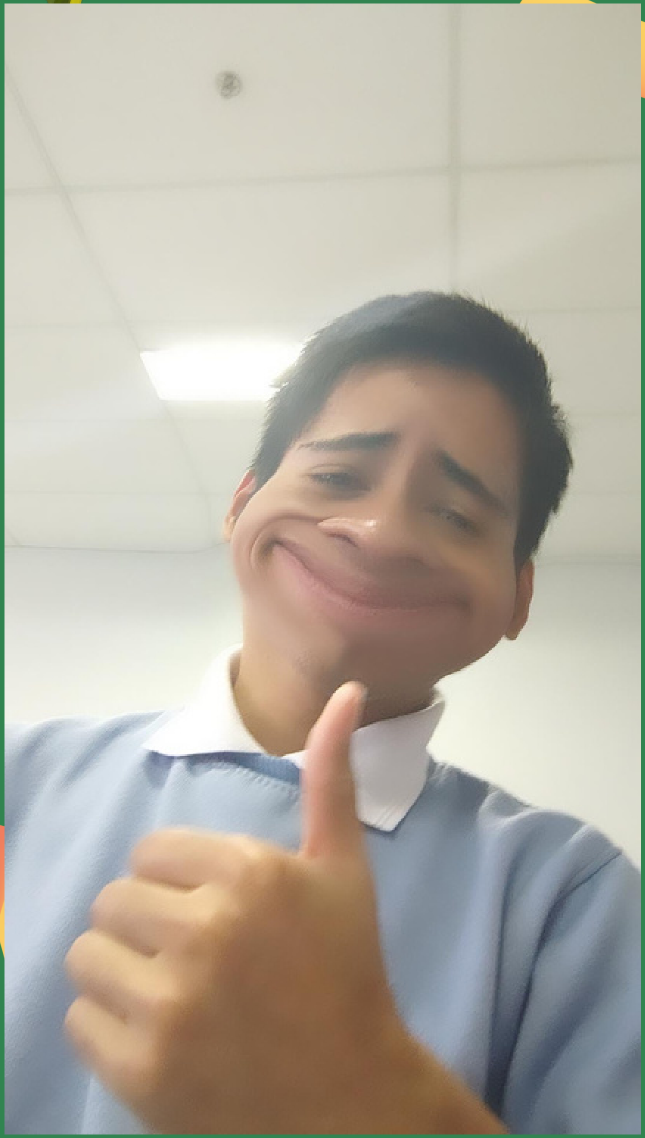
Gauss Jordan

- Renathan A. A. W.
- Sri Kresna Maha Dewa



DUO GAUSS JORDAN



Background

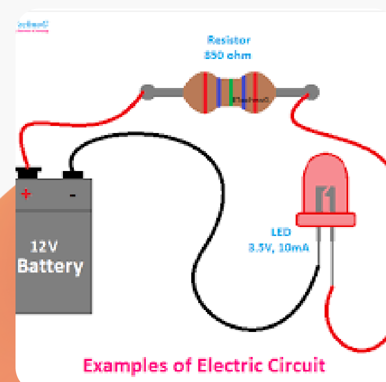
Carl Friedrich Gauss is a German mathematician who has the nickname 'Prince of Mathematics'. He was the person who discovered the Gauss elimination which was later developed and perfected by Camille Jordan, a French mathematician, into the Gauss-Jordan elimination.

USAGE

1. **Gauss elimination application in gold investment information system.**
2. **The application of Jordan Gauss elimination for traffic light calculations.**
3. **The application of the Jordan Gauss elimination for the calculation of the electric current strength of each electric circuit.**

Gold Invesment

Traffic light calculation

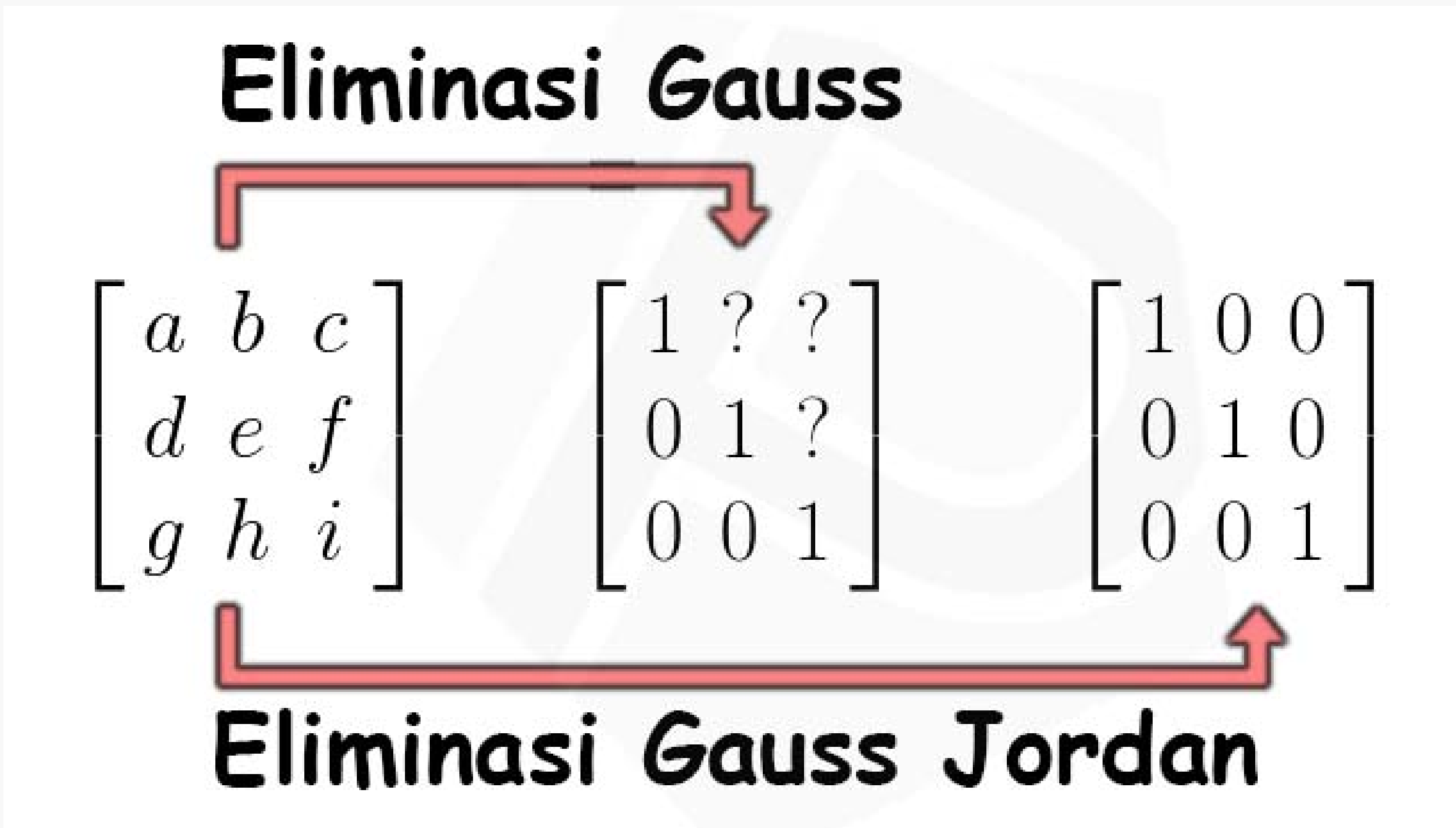


Electric Circuit

WHAT IS

Gauss-Jordan elimination is a procedure for solving systems of linear equations by converting them into reduced row echelon matrix form with elementary row operations. Gauss Jordan elimination will change a matrix into a diagonal matrix, more specifically Gauss Jordan elimination will change the matrix into a singular matrix (unit matrix)

WHAT IS



Picture of the difference between Gauss and Gauss Jordan

what is a reduced row echelon matrix?

The reduced row echelon matrix is a simplified form of the row echelon matrix which aims to make it easier to solve the solution of a system of equations

Reduced Row Echelon Matrix R

$$A = \begin{bmatrix} 1 & 0 & * & * & 0 & * & 0 \\ 0 & 1 & * & * & 0 & * & 0 \\ 0 & 0 & 0 & 0 & 1 & * & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Free variables

Properties of reduced row echelon matrix

1. If it contains non-zero rows, the leftmost non-zero entry is 1, then this element (number 1) can be referred to as the pivot element.
2. For two consecutive rows where all elements do not consist of zeros, the pivot in the lower row is placed farther to the right than the main pivot in the higher row
3. If it contains zero rows then they are all located at the bottom of the matrix
4. This 4th property is a special property, that is, every column containing 1 main must have a zero element elsewhere.

Reduced Row Echelon Matrix R

1

2

$$A = \begin{bmatrix} 1 & 0 & * & * & 0 & * & 0 \\ 0 & 1 & * & * & 0 & * & 0 \\ 0 & 0 & 0 & 0 & 1 & * & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

4

0 0 0 0 0 0 0 0

Free variables

3

minigame time!

is this reduced row echelon matrix??

$$B = \begin{bmatrix} 1 & 1 & 0 & 4 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$


YES!

is this reduced row echelon matrix??

$$E = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 2 \end{bmatrix}$$

```java
public class minigame {
  public static void main(String[] args) {
    System.out.print("NO");
  }
}
```

is this reduced row echelon matrix??

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


Yass

How do we do the elimination of Gauss Jordan?

Example 1

1	3	2
2	5	0
2	7	1

Example 1

1	3	2
2	5	0
2	7	1

R2-2*R1

R3-2*R1

1	3	2
0	-1	-4
0	1	-3

1	3	2
0	-1	-4
0	1	-3

-R2

R3+R2

1	3	2
0	1	4
0	0	-7

1	3	2
0	1	4
0	0	-7

$-\frac{R3}{7}$

1	3	2
0	1	4
0	0	1

Example 1

1	3	2
0	1	4
0	0	1

R1-R2

R2-4*R3

1	2	-2
0	1	0
0	0	1

1	2	-2
0	1	0
0	0	1

R1-2*R2

1	0	-2
0	1	0
0	0	1

1	0	-2
0	1	0
0	0	1

R1-2*R3

1	0	0
0	1	0
0	0	1

Example 2

$$\begin{pmatrix} -3 & 0 & -4 \\ -6 & 0 & 3 \\ -3 & -7 & 4 \end{pmatrix}$$

Swap row 1 with row 2

$$\begin{pmatrix} -3 & 0 & -4 \\ -6 & 0 & 3 \\ -3 & -7 & 4 \end{pmatrix}$$

cale row 1 (divide by pivot value -6)

$$\begin{pmatrix} \underline{-6} & 0 & 3 \\ -3 & 0 & -4 \\ -3 & -7 & 4 \end{pmatrix}$$

Subtract -3 times row 1 from row 2

$$\begin{pmatrix} 1 & 0 & -1/2 \\ -3 & 0 & -4 \\ -3 & -7 & 4 \end{pmatrix}$$

Subtract -3 times row 1 from row 3

$$\begin{pmatrix} 1 & 0 & -1/2 \\ 0 & 0 & -11/2 \\ -3 & -7 & 4 \end{pmatrix}$$

Swap row 2 with row 3

$$\begin{pmatrix} 1 & 0 & -1/2 \\ 0 & 0 & -11/2 \\ 0 & -7 & 5/2 \end{pmatrix}$$

Scale row 2 (divide by pivot value -7)

$$\begin{pmatrix} 1 & 0 & -1/2 \\ 0 & \underline{-7} & 5/2 \\ 0 & 0 & -11/2 \end{pmatrix}$$

Scale row 3 (divide by pivot value -11/2)

$$\begin{pmatrix} 1 & 0 & -1/2 \\ 0 & 1 & -5/14 \\ 0 & 0 & \underline{-11/2} \end{pmatrix}$$

Subtract -1/2 times row 3 from row 1

$$\begin{pmatrix} 1 & 0 & -1/2 \\ 0 & 1 & -5/14 \\ 0 & 0 & 1 \end{pmatrix}$$

Subtract -5/14 times row 3 from row 2

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & -5/14 \\ 0 & 0 & 1 \end{pmatrix}$$

Reduced Row Echelon Form:

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Exercise

2	4	-1	2
4	2	3	-1
6	-3	4	4
-2	1	-2	-1

Thank You