🎓 What is Playfair Cipher?

The **Playfair Cipher** is a classic encryption technique where:

- 🔡 Plain text is broken into pairs (digraphs)

- 🔁 Letters are replaced based on a special 5x5 grid

- 🚫 No letter is repeated in the grid

- 🫧 The letter **'J' is usually merged with 'I'**

1️⃣ Step 1: Create the Playfair Grid 🔲

🔑 Keyword: MONARCHY

We use the keyword to fill the grid first, followed by remaining alphabets (excluding 'J'):

M	O	N	A	R
C	H	Y	B	D
E	F	G	I	K
L	P	Q	S	T
U	V	W	X	Z

🧠 Notes:

- 'J' is not included.

- Letters in the keyword are not repeated.

2️⃣ Step 2: Prepare the Plaintext 📩

📝 Plaintext: HELLO

Split it into **pairs (digraphs)**:

🔡 Plaintext	➗ Pairs
HELLO	HE, LX, LO

📌 If letters repeat (like L and L), we insert X between them.

3️⃣ Step 3: Apply Playfair Rules 🧝‍♂️

🎯 Rule Summary Table

Rule Type	When It Applies	What to Do 🔧
🟥 Same Row	Both letters in the same row	Replace each with the letter to its **right**
🟦 Same Column	Both letters in the same column	Replace each with the letter **below**
🟨 Rectangle	Different row and column (most common)	Form rectangle, swap their **columns**

4️⃣ Step 4: Encrypt Each Pair 🔐

Let's go **pair-by-pair**, lookup positions, and apply the rules:

🅰 Pair 1: H and E

🔍 **Find Positions** in Grid:

Letter	Row 📍	Column 📍
H	2	2
E	3	1

🟨 Rectangle Rule applies

🧮 New Letters:

- H → (2,1) = **C**
- E → (3,2) = **F**

✅ Cipher = CF

🅱 Pair 2: L and X

Letter	Row 📍	Column 📍

L	4	1
X	5	4

🟨 Rectangle Rule applies

🧮 New Letters:

- L → (4,4) = **S**
- X → (5,1) = **U**

✅ Cipher = SU

🆎 **Pair 3: L and O**

Letter	Row 📍	Column 📍
L	4	1
O	1	2

🟨 Rectangle Rule applies

🧮 New Letters:

- L → (4,2) = **P**
- O → (1,1) = **M**

✅ Cipher = PM

📦 Final Encrypted Message:

Pair	Cipher
HE	CF
LX	SU
LO	PM

🟢 **Encrypted Text: CF SU PM**

📚 Full Table Summary

Step	Plaintext	Pair	Rule	Position 1	Position 2	Cipher
1️⃣	HELLO	HE	Rectangle	(2,2) H	(3,1) E	CF
2️⃣	HELLO	LX	Rectangle	(4,1) L	(5,4) X	SU
3️⃣	HELLO	LO	Rectangle	(4,1) L	(1,2) O	PM

💡 Why Use Playfair Cipher?

📝 Reason	🔍 Description
🔐 Stronger than Caesar Cipher	Uses digraphs (pairs), harder to crack
🧠 Easy to memorize	Only needs a keyword
🧩 Good practice	Teaches basic encryption logic