PRACTICAL 2

2. Practical Title : Playfair Cipher
Definition : Create a 5x5 matrix using a keyword and encrypt letter pairs (digraphs) using Playfair rules.

🧾 Objective

- To understand and implement the Playfair Cipher using digraph substitution.
- To learn how a 5x5 matrix is formed from a keyword.
- To encrypt/decrypt messages based on position rules (same row, same column, rectangle).

📈 Expected Learning Outcome

- Construct a Playfair matrix from a keyword.
- Split plaintext into letter pairs.
- Apply Playfair encryption and decryption rules.
- Understand digraph-based encryption vs monoalphabetic.

🛠️ Tools/Software

- Python (for implementation)
- Online Python Compiler (Programiz, Replit)
- CrypTool or Online Simulation

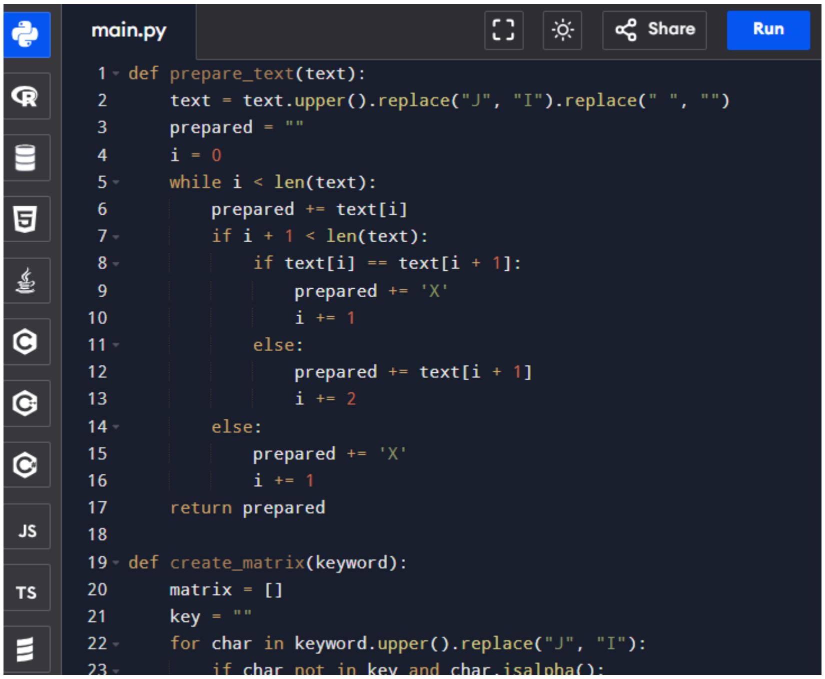
🧭 Steps to Perform Playfair Cipher Practical

🧩 Step 1: Open Online Python Compiler

- 🔗 Programiz Online Python Compiler
- 🔗 Replit - Python

🧩 Step 2: Copy & Paste the Code Below

```
def prepare_text(text):
    text = text.upper().replace("J", "I").replace(" ", "")
    prepared = ""
    i = 0
    while i < len(text):
        prepared += text[i]
        if i + 1 < len(text):
            if text[i] == text[i + 1]:
                prepared += 'X'
                i += 1
            else:
                prepared += text[i + 1]
                i += 2
        else:
            prepared += 'X'
            i += 1
    return prepared

def create_matrix(keyword):
    matrix = []
    key = ""
    for char in keyword.upper().replace("J", "I"):
        if char not in key and char.isalpha():
            key += char
    for char in "ABCDEFGHIKLMNOPQRSTUVWXYZ":
        if char not in key:
            key += char
    for i in range(0, 25, 5):
        matrix.append(list(key[i:i+5]))
    return matrix

def find_position(matrix, char):
    for row in range(5):
        for col in range(5):
            if matrix[row][col] == char:
                return row, col
    return None

def playfair_encrypt(plain_text, matrix):
    cipher_text = ""
    text = prepare_text(plain_text)
    for i in range(0, len(text), 2):
        a, b = text[i], text[i+1]
        row1, col1 = find_position(matrix, a)
        row2, col2 = find_position(matrix, b)
        if row1 == row2:
            cipher_text += matrix[row1][(col1 + 1) % 5]
            cipher_text += matrix[row2][(col2 + 1) % 5]
        elif col1 == col2:
            cipher_text += matrix[(row1 + 1) % 5][col1]
            cipher_text += matrix[(row2 + 1) % 5][col2]
        else:
            cipher_text += matrix[row1][col2]
            cipher_text += matrix[row2][col1]
    return cipher_text

# MAIN
keyword = input("Enter keyword: ")
plain_text = input("Enter plain text: ")

matrix = create_matrix(keyword)
encrypted = playfair_encrypt(plain_text, matrix)

print("Playfair Matrix:")
for row in matrix:
    print(row)

print("Encrypted Text:", encrypted)
```

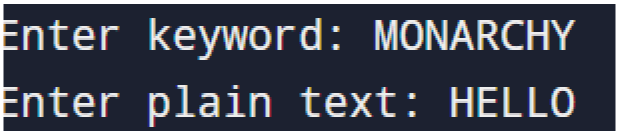


```python
def prepare_text(text):
    text = text.upper().replace("J", "I").replace(" ", "")
    prepared = ""
    i = 0
    while i < len(text):
        prepared += text[i]
        if i + 1 < len(text):
            if text[i] == text[i + 1]:
                prepared += 'X'
                i += 1
            else:
                prepared += text[i + 1]
                i += 2
        else:
            prepared += 'X'
            i += 1
    return prepared

def create_matrix(keyword):
    matrix = []
    key = ""
    for char in keyword.upper().replace("J", "I"):
        if char not in key and char.isalpha():
```

🖥️ Sample Input/Output

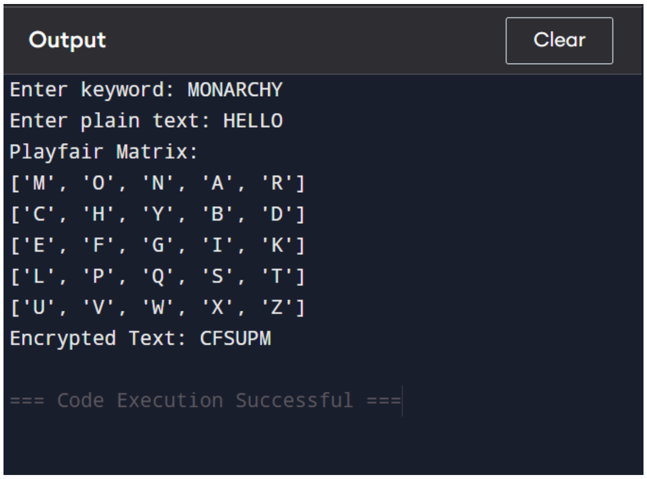
Input

Keyword: MONARCHY
Plain Text: HELLO



```
Enter keyword: MONARCHY
Enter plain text: HELLO
```

Output
Playfair Matrix: [['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']]



```
Enter keyword: MONARCHY
Enter plain text: HELLO
Playfair Matrix:
['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']
Encrypted Text: CFSUPM

=== Code Execution Successful ===
```

🌐 Visualize Playfair Cipher Online

- 🔗 GeeksforGeeks Playfair Cipher Explanation
- 🔗 CrypTool Playfair Simulation (CTO)

❗ Note: CrypTool simulation works better on desktop.