Name - Yash Lakhtariya
Enrollment number - 21162101012
Branch - CBA Batch - 61
INS Practical 5

<u>Aim</u> : Alice wants to send some confidential information to Bob over a secure network. Provide encryption through Hill Cipher Method for message Palladium Mall" and Key is "SAVE" (A=1,B=2...). Also decrypt using same.

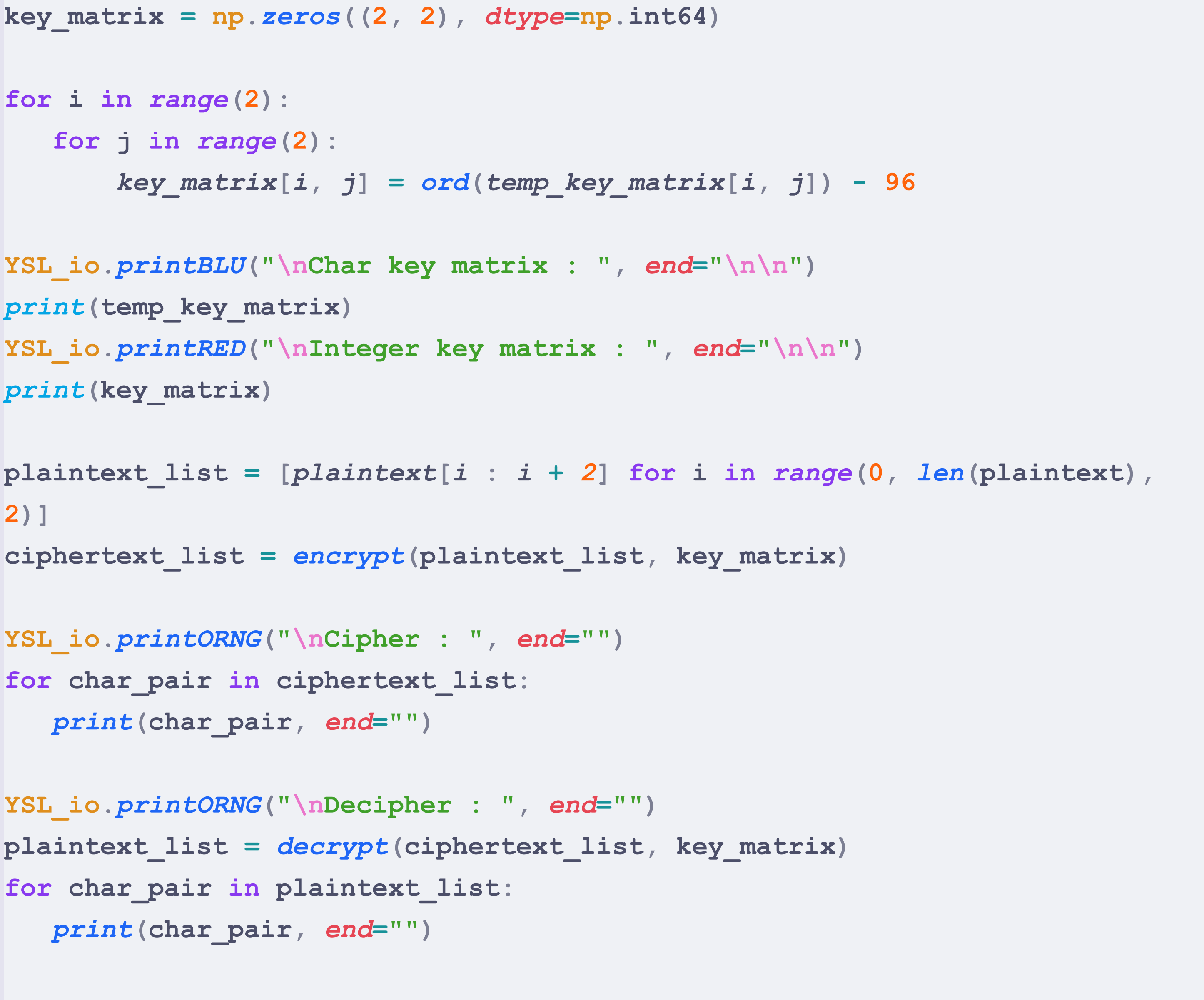
Code :

```
import numpy as np
import YSL_io


def transpose(matrix):
   matrix[0, 0], matrix[1, 1] = matrix[1, 1], matrix[0, 0]
   matrix[0, 1] *= -1
   matrix[1, 0] *= -1
   return matrix


def inverse_modulo(det_mod, mod=26):
   k_inv = 1
   while (det_mod * k_inv) % mod != 1:
       k_inv += 1
   return k_inv


def encrypt(plaintext, key_matrix):
   ciphertext_list = []

   for char_pair in plaintext:
       t = np.zeros((2, 1), dtype=np.int64)
       t[0, 0] = ord(char_pair[0]) - 96
       t[1, 0] = ord(char_pair[1]) - 96
       cipher = np.dot(key_matrix, t) % 26
       ciphertext_list.append(chr(cipher[0, 0] + 96) + chr(cipher[1, 0] +
```

Name - Yash Lakhtariya
Enrollment number - 21162101012
Branch - CBA   Batch - 61
INS Practical 5

```
96))

    return ciphertext_list


def decrypt(ciphertext_list, key_matrix):
    det_mod = (
        key_matrix[0, 0] * key_matrix[1, 1] - key_matrix[1, 0] *
key_matrix[0, 1]
    ) % 26
    k_inv = inverse_modulo(det_mod)
    adj_key_matrix = transpose(key_matrix.copy())
    k_inv_matrix = (adj_key_matrix % 26) * k_inv % 26

    plaintext_list = []
    for char_pair in ciphertext_list:
        t = np.zeros((2, 1), dtype=np.int64)
        t[0, 0] = ord(char_pair[0]) - 96
        t[1, 0] = ord(char_pair[1]) - 96
        decipher = np.dot(k_inv_matrix, t) % 26
        plaintext_list.append(chr(decipher[0, 0] + 96) + chr(decipher[1, 0]
+ 96))

    return plaintext_list


plaintext = YSL_io.inputGRN("\nEnter the plain text : ")
key = YSL_io.inputMGNTA("\nEnter the key : ")

if len(plaintext) % 2 != 0:
    plaintext += "x"

temp_key_matrix = np.array(list(key)).reshape((2, 2))
```

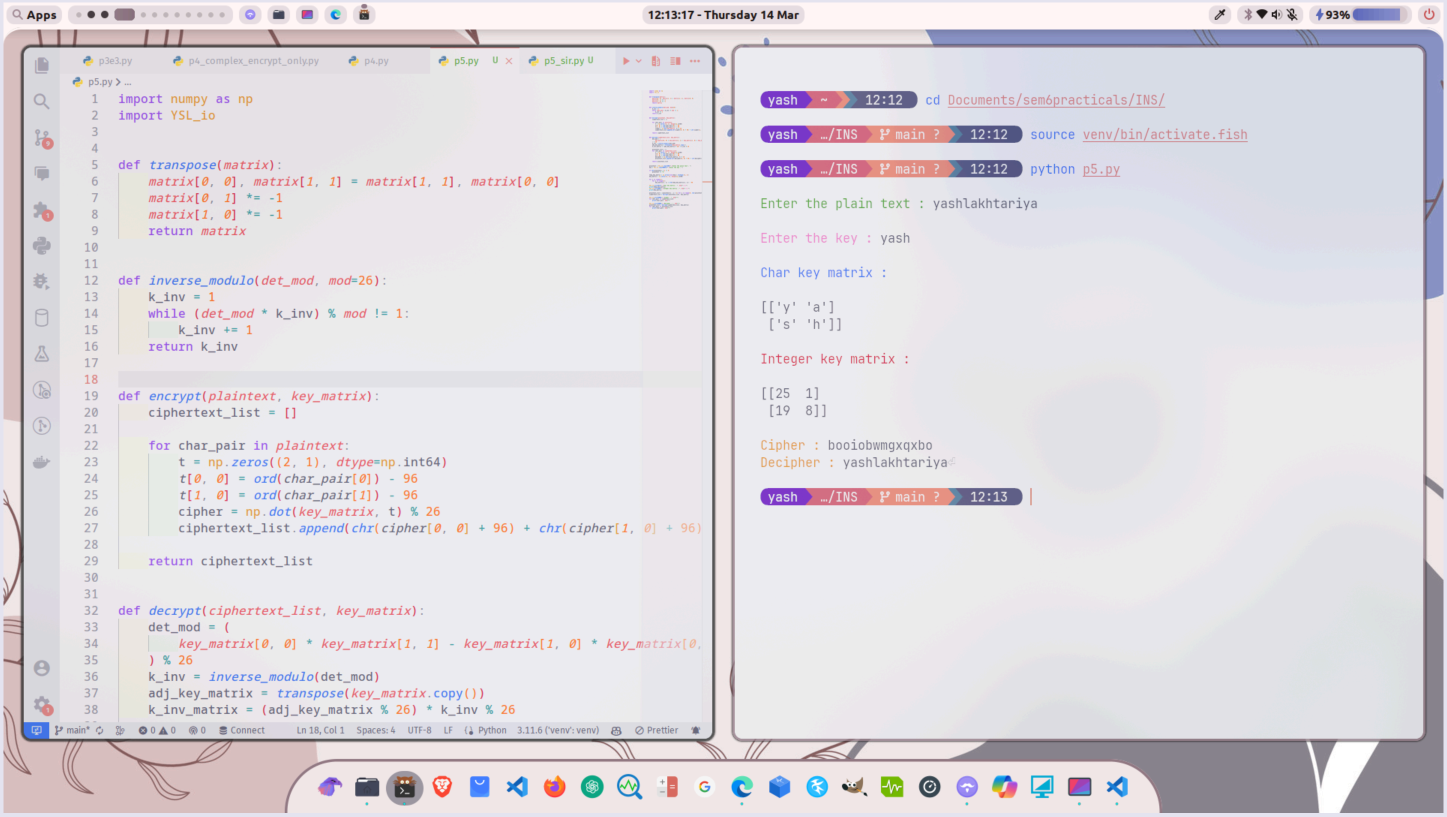
Name - Yash Lakhtariya
Enrollment number - 21162101012
Branch - CBA   Batch - 61
INS Practical 5



```
key_matrix = np.zeros((2, 2), dtype=np.int64)

for i in range(2):
   for j in range(2):
       key_matrix[i, j] = ord(temp_key_matrix[i, j]) - 96

YSL_io.printBLU("\nChar key matrix : ", end="\n\n")
print(temp_key_matrix)
YSL_io.printRED("\nInteger key matrix : ", end="\n\n")
print(key_matrix)

plaintext_list = [plaintext[i : i + 2] for i in range(0, len(plaintext),
2)]
ciphertext_list = encrypt(plaintext_list, key_matrix)

YSL_io.printORNG("\nCipher : ", end="")
for char_pair in ciphertext_list:
   print(char_pair, end="")

YSL_io.printORNG("\nDecipher : ", end="")
plaintext_list = decrypt(ciphertext_list, key_matrix)
for char_pair in plaintext_list:
   print(char_pair, end="")
```

Name - Yash Lakhtariya
Enrollment number - 21162101012
Branch - CBA   Batch - 61
INS Practical 5

Output :



```python
import numpy as np
import YSL_io


def transpose(matrix):
    matrix[0, 0], matrix[1, 1] = matrix[1, 1], matrix[0, 0]
    matrix[0, 1] *= -1
    matrix[1, 0] *= -1
    return matrix


def inverse_modulo(det_mod, mod=26):
    k_inv = 1
    while (det_mod * k_inv) % mod != 1:
        k_inv += 1
    return k_inv


def encrypt(plaintext, key_matrix):
    ciphertext_list = []

    for char_pair in plaintext:
        t = np.zeros((2, 1), dtype=np.int64)
        t[0, 0] = ord(char_pair[0]) - 96
        t[1, 0] = ord(char_pair[1]) - 96
        cipher = np.dot(key_matrix, t) % 26
        ciphertext_list.append(chr(cipher[0, 0] + 96) + chr(cipher[1, 0] + 96)

    return ciphertext_list


def decrypt(ciphertext_list, key_matrix):
    det_mod = (
        key_matrix[0, 0] * key_matrix[1, 1] - key_matrix[1, 0] * key_matrix[0,
    ) % 26
    k_inv = inverse_modulo(det_mod)
    adj_key_matrix = transpose(key_matrix.copy())
    k_inv_matrix = (adj_key_matrix % 26) * k_inv % 26
```

```
yash  ~  12:12  cd Documents/sem6practicals/INS/

yash  …/INS  main ?  12:12  source venv/bin/activate.fish

yash  …/INS  main ?  12:12  python p5.py

Enter the plain text : yashlakhtariya

Enter the key : yash

Char key matrix :

[['y' 'a']
 ['s' 'h']]

Integer key matrix :

[[25  1]
 [19  8]]

Cipher : booiobwmgxqxbo
Decipher : yashlakhtariya

yash  …/INS  main ?  12:13
```