//PART A HILL CIPHER

keyMatrix = [[0] \* 3 for i in range(2)]

messageVector = [[0] for i in range(2)]

cipherMatrix = [[0] for i in range(2)]

def getKeyMatrix(key):

    k = 0

    for i in range(2):

        for j in range(2):

            keyMatrix[i][j] = ord(key[k]) % 65

            k += 1

def encrypt(messageVector):

    for i in range(2):

        for j in range(1):

            cipherMatrix[i][j] = 0

            for x in range(2):

                cipherMatrix[i][j] += (keyMatrix[i][x] \*

                                       messageVector[x][j])

            cipherMatrix[i][j] = cipherMatrix[i][j] % 26

def HillCipher(message, key):

    getKeyMatrix(key)

    for i in range(2):

        messageVector[i][0] = ord(message[i]) % 65

    encrypt(messageVector)

    CipherText = []

    for i in range(2):

        CipherText.append(chr(cipherMatrix[i][0] + 65))

    print("Ciphertext: ", "".join(CipherText))

message = "CAKE"

key = "BAKE"

HillCipher(message, key)

//Part B Frequency Attack

def printString(S, N):

    plaintext = [None] \* 5

    freq = [0] \* 26

    freqSorted = [None] \* 26

    used = [0] \* 26

    for i in range(N):

        if S[i] != ' ':

            freq[ord(S[i]) - 65] += 1

    for i in range(26):

        freqSorted[i] = freq[i]

    T = "ETAOINSHRDLCUMWFGYPBVKJXQZ"

    freqSorted.sort(reverse=True)

    for i in range(5):

        ch = -1

        for j in range(26):

            if freqSorted[i] == freq[j] and used[j] == 0:

                used[j] = 1

                ch = j

                break

        if ch == -1:

            break

        x = ord(T[i]) - 65

        x = x - ch

        curr = ""

        for k in range(N):

            # Insert whitespaces as it is

            if S[k] == ' ':

                curr += " "

                continue

            y = ord(S[k]) - 65

            y += x

            if y < 0:

                y += 26

            if y > 25:

                y -= 26

            curr += chr(y + 65)

        plaintext[i] = curr

    for i in range(5):

        print(plaintext[i])

S = """UZQSOVUOHXMOPVGPOZPEVSGZWSZOPFPESXUDBMETSXAIZ

VUEPHZHMDZSHZOWSFPAPPDTSVPQUZWYMXUZUHSXEPYEPOPDZSZUFPOMBZ

WPFUPZHMDJUDTMOHMQ"""

N = len(S)

printString(S, N)