**Practical-5**

**Aim:- 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

def adjoint(matrix):

    matrix[0,0],matrix[1,1]=matrix[1,1],matrix[0,0]

    matrix[0,1]\*=-1

    matrix[1,0]\*=-1

    return matrix

pt=input("Please enter the plain text : ")

key=input("Please enter the key : ")

if len(pt)%2 != 0:

    pt+='x'

tempKeyMatrix=np.zeros((2,2), dtype=np.str\_)

k=0

for i in range(2):

    for j in range(2):

        tempKeyMatrix[i,j]=key[k]

        k+=1

keyMatrix=np.matrix(tempKeyMatrix)

print('Char key matrix\n',tempKeyMatrix)

keyMatrix=np.zeros((2,2),dtype=np.int64)

for i in range(2):

    for j in range(2):

        keyMatrix[i,j]=ord(tempKeyMatrix[i,j])-96

print('Integer key matrix\n',keyMatrix)

ptList=[pt[i:i+2] for i in range(0,len(pt),2)]

ctList=[]

print()

print('Cipher')

print(ptList)

for i in ptList:

    # print('For',i)

    t=np.zeros((2,1),dtype=np.int64)

    t[0,0]=ord(i[0])-96

    t[1,0]=ord(i[1])-96

    cipher=np.dot(keyMatrix,t)%26

    # print(cipher)

    ctList+=[chr(cipher[0,0]+96)+chr(cipher[1,0]+96)]

    del t

del ptList

print(ctList)

print()

print('Decipher')

mod=(keyMatrix[0,0]\*keyMatrix[1,1])-(keyMatrix[1,0]\*keyMatrix[0,1])

print('Determinant of key matrix',mod)

mod%=26

print('Modulus By 26 of Determinant of key matrix',mod)

kInverse=1

while (mod\*kInverse)%26!=1:

    kInverse+=1

print()

print('kInverse',kInverse)

print('Adjoint of Key Matrix\n', adjoint(keyMatrix.copy()))

kInverseMatrix=((adjoint(keyMatrix.copy())%26)\*kInverse)%26

print()

print('kInverseMatrix\n',kInverseMatrix)

print()

print(ctList)

ptList=[]

for i in ctList:

    # print('For',i)

    t=np.zeros((2,1),dtype=np.int64)

    t[0,0]=ord(i[0])-96

    t[1,0]=ord(i[1])-96

    decipher=np.dot(kInverseMatrix,t)%26

    # print(cipher)

    ptList+=[chr(decipher[0,0]+96)+chr(decipher[1,0]+96)]

    del t

print(ptList)

**output: -**

**A screenshot of a computer program

Description automatically generated**