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PRACTICAL:-1

AIM: Implement Caeser Cipher with Variable Key.

PROGRAM:

```
def encrypt(text,s):
    result = ""
     # traverse text
    for i in range(len(text)):
        char = text[i]
        # Encrypt uppercase characters
        if (char.isupper()):
            result += chr((ord(char) + s-65) % 26 + 65)
      # Encrypt lowercase characters
        else:
            result += chr((ord(char) + s - 97) % 26 + 97)

    return result
 #check the above function
text = "ATTACKATONCE"
s = 4
print ("Text  : " + text)
print ("Shift : " + str(s))
print ("Cipher: " + encrypt(text,s))
```

OUTPUT:

Text : ATTACKATONCE

Shift: 4

Cipher: EXXEGOEXSRGI

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<u>PRACTICAL:- 2</u>

AIM: Implement the Brute Force Attack on Caeser Cipher.

PROGRAM:

```
message = 'GIEWIVrGMTLIVrHIQS' #encrypted message
LETTERS = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
for key in range(len(LETTERS)):
  translated = ''
  for symbol in message:
    if symbol in LETTERS:
      num = LETTERS.find(symbol)
      num = num - key
      if num < 0:
        num = num + len(LETTERS)
      translated = translated + LETTERS[num]
    else:
      translated = translated + symbolprint('Hacking key #%s: %s' % (key, translated))
```

<u>OUTPUT:</u>

```
Key #25: HJFXJWrHNUMJWrIJRT

E:\Cryptography- Python>python caesarHacker.py
Key #0: GIEWIVrGMTLIVrHIQS
Key #1: FHDVHUrFLSKHUrGHPR
Key #2: EGCUGTrEKRJGTrFGOQ
Key #3: DFBTFSrDJQIFSrEFNP
Key #4: CEASERrCIPHERrDEMO
Key #5: BDZRDQrBHOGDQrCDLN
Key #6: ACYQCPrAGNFCPrBCKM
Key #7: ZBXPBOrZFMEBOrABJL
Key #8: YAWOANrYELDANrZAIK
Key #9: XZVNZMrXDKCZMrYZHJ
Key #10: WYUMYLrWCJBYLrXYGI
Key #11: VXTLXKrVBIAXKrWXFH
Key #12: UWSKWJrUAHZWJrVWEG
Key #13: TVRJVIrTZGYVIrUVDF
Key #14: SUQIUHrSYFXUHrTUCE
Key #15: RTPHTGrRXEWTGrSTBD
Key #16: QSOGSFrQWDVSFrRSAC
Key #17: PRNFRErPVCURErQRZB
Key #18: OQMEQDrOUBTQDrPQYA
Key #19: NPLDPCrNTASPCrOPXZ
Key #20: MOKCOBrMSZROBrNOWY
Key #21: LNJBNArLRYQNArMNVX
Key #22: KMIAMZrKQXPMZrLMUW
Key #23: JLHZLYrJPWOLYrKLTV
Key #24: IKGYKXrIOVNKXrJKSU
Key #25: HJFXJWrHNUMJWrIJRT

E:\Cryptography- Python>
```

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PRACTICAL:-3

AIM: Implement Simple Transposition Technique.

PROGRAM:

```
def split_len(seq, length):
   return [seq[i:i + length] for i in range(0, len(seq), length)]def encode(key, plaintext):
   order = {
      int(val): num for num, val in enumerate(key)
   }
ciphertext = ''
for index in sorted(order.keys()):
   for part in split_len(plaintext, len(key)):
      try:ciphertext += part[order[index]]
         except IndexError:
            continue
   return ciphertextprint(encode('3214', 'HELLO'))
```

Output:

```
E:\Cryptography- Python>python columnarTransposition.py
LARPT HUONTSINCQCM NSOEIURAOITNE

E:\Cryptography- Python>
```

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PRACTICAL:-4

AIM: Implement Simple Permutation Technique.

Program:

```
import math

loop = "Y"
while loop == "Y" or loop == "y":
    print("1. Encrypt The Plain Text")
    print("2. Decrypt The Cipher Text", end="\n\n")
    choice = input("Enter Your Choice:")
    if choice == "1":
        key = input("Please Enter The Key:")
        key = str.upper(key)
        plain_text = input("Please Enter The Plain Text:")
        cipher_text = ""
        k_indx = 0
        plain_text_len = float(len(plain_text))
        plain_text_lst = list(plain_text)
        key_lst = sorted(list(key))
        col = len(key)
        row = int(math.ceil(plain_text_len / col))
        fill_null = int((row * col) - plain_text_len)
        plain_text_lst.extend('_' * fill_null)
        matrix = [plain_text_lst[i: i + col] for i in range(0, len(plain_text_lst), col)]

        for _ in range(col):
            curr_idx = key.index(key_lst[k_indx])
            cipher_text += ''.join([row[curr_idx] for row in matrix])
            k_indx += 1
            print(f" Plain Text: {plain_text}")
            print(f" Cipher Text: {cipher_text}")
            print()
    elif choice == "2" :
        key = input("Please Enter The Key:")
        cipher_text = input("Please Enter The Cipher Text:")
        plain_text = ""
        k_indx = 0
        plain_text_indx = 0
```

```
        plain_text_len = float(len(cipher_text))
        plain_text_lst = list(cipher_text)
        col = len(key)
        row = int(math.ceil(plain_text_len / col))
        key_lst = sorted(list(key))
        dec_cipher = []

        for _ in range(row):
            dec_cipher += [[None] * col]

        for _ in range(col):
            curr_idx = key.index(key_lst[k_indx])
            for j in range(row):
                dec_cipher[j][curr_idx] = plain_text_lst[plain_text_indx]
                plain_text_indx += 1
            k_indx += 1

        try:
            plain_text = ''.join(sum(dec_cipher, []))
        except TypeError:
            raise TypeError("This Program Cannot Handle Repeating Words.")
        null_count = plain_text.count('_')
        if null_count > 0:
            plain_text = plain_text[: -null_count]
        print(f"Cipher text: {cipher_text}")
        print(f"Plain text:{plain_text}")
        print()
    else:
        print("Invalid choice")
        print()
    loop = input("Do you want to continue(y/n):")
    print()

else:
    print(" Program is terminated.")
```

OUTPUT:

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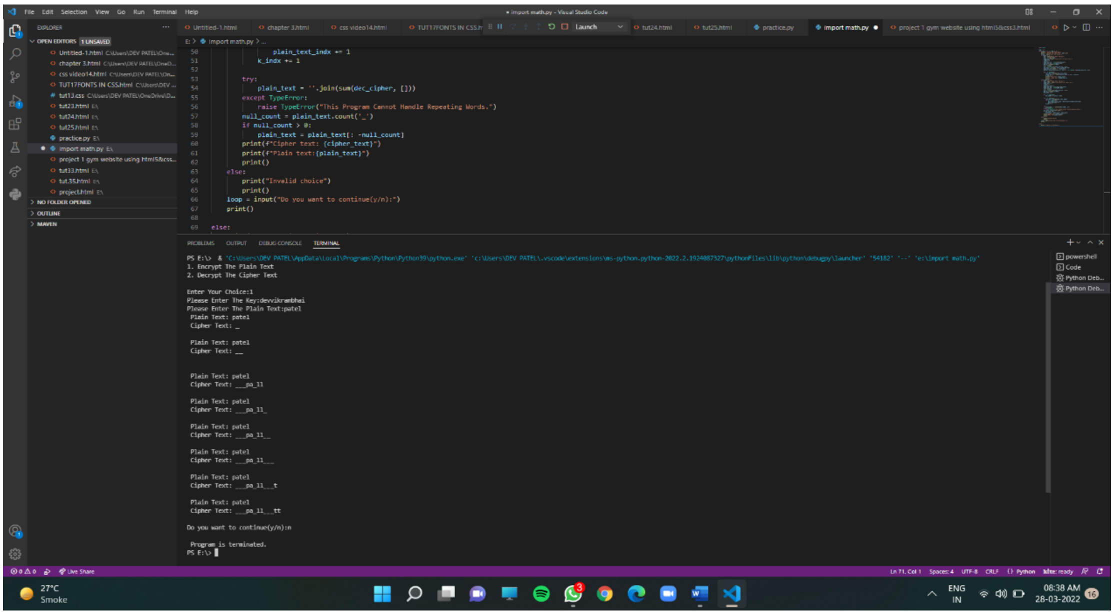

PRACTICAL:-5

AIM: Implement the rail fence cipher with variable fence.

PROGRAM:

```
def encryptRailFence(text, key):
        rail = [['\n' for i in range(len(text))]
                        for j in range(key)]
        # to find the direction
        dir_down = False
        row, col = 0, 0
```

```
    for i in range(len(text)):
        if (row == 0) or (row == key - 1):
            dir_down = not dir_down
        rail[row][col] = text[i]
        col += 1
        if dir_down:
            row += 1
        else:
            row -= 1
    result = []
    for i in range(key):
        for j in range(len(text)):
            if rail[i][j] != '\n':
                result.append(rail[i][j])
    return("" . join(result))
def decryptRailFence(cipher, key):
    rail = [['\n' for i in range(len(cipher))]
                for j in range(key)]
    dir_down = None
    row, col = 0, 0
    for i in range(len(cipher)):
        if row == 0:
            dir_down = True
        if row == key - 1:
            dir_down = False
        rail[row][col] = '*'
        col += 1

        if dir_down:
            row += 1
        else:
            row -= 1
    index = 0
    for i in range(key):
        for j in range(len(cipher)):
            if ((rail[i][j] == '*') and
            (index < len(cipher))):
```

```
                rail[i][j] = cipher[index]
                index += 1
    result = []
    row, col = 0, 0
    for i in range(len(cipher)):

        # check the direction of flow
        if row == 0:
            dir_down = True
        if row == key-1:
            dir_down = False

        # place the marker
        if (rail[row][col] != '*'):
            result.append(rail[row][col])
            col += 1
        if dir_down:
            row += 1
        else:
            row -= 1
    return("".join(result))
if _name_ == "_main_":
    print(encryptRailFence("attack at once", 2))
    print(encryptRailFence("GeeksforGeeks ", 3))
    print(encryptRailFence("defend the east wall", 3))

    print(decryptRailFence("GsGsekfrek eoe", 3))
    print(decryptRailFence("atc toctaka ne", 2))
    print(decryptRailFence("dnhaweedtees alf tl", 3))
```

Output:

```
atc toctaka ne
GsGsekfrek eoe
dnhaweedtees alf  tl
GeeksforGeeks
attack at once
delendfthe east wal
```

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PRACTICAL:-6

AIM: Implement 6 x 6 Playfair Matrix

PROGRAM:

```
loop = "Y"

def matrix(x,y,initial):
    return [[initial for i in range(x)] for j in range(y)]


def createMatrix(key):
```

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```
    result=list()
    for c in key:
        if c not in result:
            result.append(c)

    for i in range(65,91):
        if chr(i) not in result:
            result.append(chr(i))

    for i in range(0,10):
        if i not in result:
            result.append(i)

    k=0
    my_matrix=matrix(6,6,0)
    for i in range(0,6):
        for j in range(0,6):
            my_matrix[i][j]=result[k]
            k+=1
    return my_matrix

def displayMatrix(matrix):
    for i in range(len(matrix)):
        for j in range(len(matrix[i])):
            print(matrix[i][j], end="\t")
        print()

def locindex(c):
    loc=list()
    for i ,j in enumerate(my_matrix):
        for k,l in enumerate(j):
            if str(c)==str(l):
                loc.append(i)
                loc.append(k)
                return loc

while loop == "Y" or loop == "y":
    print(" 1. Encrypt The Plain Text")
    print(" 2. Decrypt The Cipher Text")
    choice = input(" Enter Your Choice : ")
    if choice == "1":
        key = input("Please Enter the Key : ")
        key = key.upper()
        key=key.replace(" ","")
        plain_text = str(input(" Please Enter The Plain Text : "))
        plain_text = plain_text.upper()
        plain_text = plain_text.replace(" ","")
        my_matrix = createMatrix(key)
        print(" Playfair Matrix is as follows : \n")
        displayMatrix(my_matrix)
        i=0
        for s in range(0,len(plain_text)+1,2):
            if s<len(plain_text)-1:
                if plain_text[s]==plain_text[s+1]:
                    plain_text=plain_text[:s+1]+'X'+plain_text[s+1:]

        if len(plain_text)%2!=0:
```

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```
            plain_text=plain_text[:]+'X'

        print(f" Plain Text : {plain_text}")
        print(f" Cipher Text : ",end="")
        while i<len(plain_text):
            loc1=list()
            loc1=locindex(plain_text[i])
            loc2=list()
            loc2=locindex(plain_text[i+1])
            if loc1[1]==loc2[1]:
                print(f"{my_matrix[(loc1[0]+1)%6][loc1[1]]}{my_matrix[(loc2[0]+1)%6][loc2[1]]}",end='')
            elif loc1[0]==loc2[0]:
                print(f"{my_matrix[loc1[0]][(loc1[1]+1)%6]}{my_matrix[loc2[0]][(loc2[1]+1)%6]}",end='')
            else:
                print(f"{my_matrix[loc1[0]][loc2[1]]}{my_matrix[loc2[0]][loc1[1]]}",end='')
            i=i+2

    elif choice =="2":
        key = input("Please Enter The Key : ")
        key = key.upper()
        key=key.replace(" ","")
        cipher_text = str(input(" Please Enter The Cipher Text : "))
        cipher_text=cipher_text.upper()
        cipher_text=cipher_text.replace(" ", "")
        my_matrix = createMatrix(key)
        print(" Playfair Matrix is as follows :")
        displayMatrix(my_matrix)
        print(f"Cipher Text : {cipher_text}")
        print(" Plain Text : ")
        i=0
        while i<len(cipher_text):
            loc1=list()
            loc1=locindex(cipher_text[i])
            loc2=list()
            loc2=locindex(cipher_text[i+1])
            if loc1[1]==loc2[1]:
                print(f"{my_matrix[(loc1[0]-1)%5][loc1[1]]}{my_matrix[(loc2[0]-1)%5][loc2[1]]}",end='')
            elif loc1[0]==loc2[0]:
                print(f"{my_matrix[loc1[0]][(loc1[1]-1)%5]}{my_matrix[loc2[0]][(loc2[1]-1)%5]}",end='')
            else:
                print(f"{my_matrix[loc1[0]][loc2[1]]}{my_matrix[loc2[0]][loc1[1]]}",end='')
            i=i+2
    else:
        print("Invalid Choice")
    print()
    loop = input("Do you want to continue(y/n) : ")
else :
 print(" Program is Terminating.")
```

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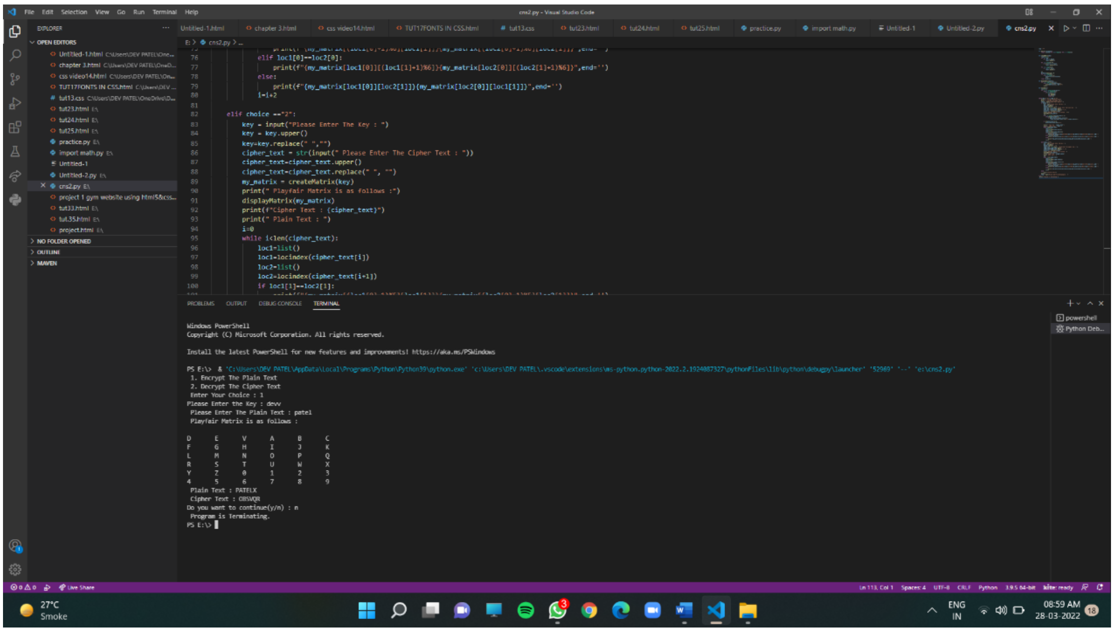

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PRACTICAL:-7

AIM: Implement n x n Hill Cipher

Program:

```
    encrypt(messageVector)
    CipherText = []
    for i in range(3):
        CipherText.append(chr(cipherMatrix[i][0] + 65))
    print("Ciphertext: ", "".join(CipherText))
def main():
    message = "ACT"
    key = "GYBNQKURP"

    HillCipher(message, key)

if _name_ == "_main_":
    main()
```

OUTPUT:

Ciphertext: POH

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PRACTICAL:-8

AIM: Implement Vigenere Cipher.

Program:

```
def generateKey(string, key):
key = list(key)
if len(string) == len(key):
return(key)
else:
for i in range(len(string) -len(key)):
key.append(key[i % len(key)])
return("" . join(key))
def encryption(string, key):
encrypt_text = []
for i in range(len(string)):
x = (ord(string[i]) +ord(key[i])) % 26
x += ord('A')
encrypt_text.append(chr(x))
return("" . join(encrypt_text))
def decryption(encrypt_text, key):
orig_text = []
for i in range(len(encrypt_text)):
x = (ord(encrypt_text[i]) -ord(key[i]) + 26) % 26
x += ord('A')
orig_text.append(chr(x))
return("" . join(orig_text))
if __name__ == "__main__":
string = input("Enter the message: ")
keyword = input("Enter the keyword: ")
key = generateKey(string, keyword)
encrypt_text = encryption(string,key)
print("Encrypted message:", encrypt_text)
print("Decrypted message:", decryption(encrypt_text, key))
```

OUTPUT:

```
Enter the message: CODESPEEDY
Enter the keyword: TIME
Encrypted message: BCVORDWOCM
```

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Decrypted message: CODESPEEDY

PRACTICAL:-9

AIM: Implement the auto-key cipher.

Program:

```
dict1 = {'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4,'F': 5, 'G': 6, 'H': 7, 'I': 8, 'J': 9,
        'K': 10, 'L': 11, 'M': 12, 'N': 13, 'O': 14,'P': 15, 'Q': 16, 'R': 17, 'S': 18, 'T': 19,
        'U': 20, 'V': 21, 'W': 22, 'X': 23, 'Y': 24, 'Z': 25}

dict2 = {0: 'A', 1: 'B', 2: 'C', 3: 'D', 4: 'E', 5: 'F', 6: 'G', 7: 'H', 8: 'I', 9: 'J',
        10: 'K', 11: 'L', 12: 'M', 13: 'N', 14: 'O',15: 'P', 16: 'Q', 17: 'R', 18: 'S', 19: 'T',
        20: 'U', 21: 'V', 22: 'W', 23: 'X', 24: 'Y', 25: 'Z'}

def generate_key(message, key):
    i = 0
    while True:
        if len(key) == len(message):
            break
        if message[i] == ' ':
            i += 1
        else:
            key += message[i]
            i += 1
    return key

def cipherText(message, key_new):
    cipher_text = ''
    i = 0
    for letter in message:
        if letter == ' ':
            cipher_text += ' '
 else:
            x = (dict1[letter]+dict1[key_new[i]]) % 26
            i += 1
            cipher_text += dict2[x]
    return cipher_text

def originalText(cipher_text, key_new):
    or_txt = ''
    i = 0
    for letter in cipher_text:
        if letter == ' ':
            or_txt += ' '
        else:
            x = (dict1[letter]-dict1[key_new[i]]+26) % 26
            i += 1
            or_txt += dict2[x]
    return or_txt

message = 'DROP BOMB ON LDRP'
key = 'FAST'
key_new = generate_key(message, key)
cipher_text = cipherText(message, key_new)
original_text = originalText(cipher_text, key_new)
print("Encrypted Text =", cipher_text)
```

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```
print("Original Text =", original_text)
```

OUTPUT:

```
Encrypted Text = IRGI EFAQ PB XEFC
Original Text = DROP BOMB ON LDRP
```

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PRACTICAL:-10

AIM: Implement Vernam Cipher.

PROGRAM:

```
loop = "Y"
while loop == "Y" or loop == "y":
    print("1. Encrypt The Plain Text")
    print("2. Decrypt The Cipher Text")
    print()
    choice = input("Enter Your Choice:")
    if choice == "1":
        key = input("Please Enter The Key: ")
        plain_text = input("Please Enter The Plain Text: ")
        cipher_text = ''
        flag = 0
        for char in plain_text:
            cipher_text += chr(ord(char) ^ ord(key[flag]))
            flag += 1
            if flag == len(key):
                flag = 0
        print(f" Plain text : {plain_text}")
        print(f" Cipher text : {cipher_text}")
        print()

    elif choice == "2":
        key = input("Please Enter The Key: ")
        cipher_text = input("Please Enter The Cipher Text: ")
        plain_text = ''
        flag = 0
        for char in cipher_text:
            plain_text += chr(ord(char) ^ ord(key[flag]))
            flag += 1
            if flag == len(key):
                flag = 0
        print(f"Cipher text : {cipher_text}")
        print(f"Plain text : {plain_text}")
    else:
        print("Invalid choice")
```

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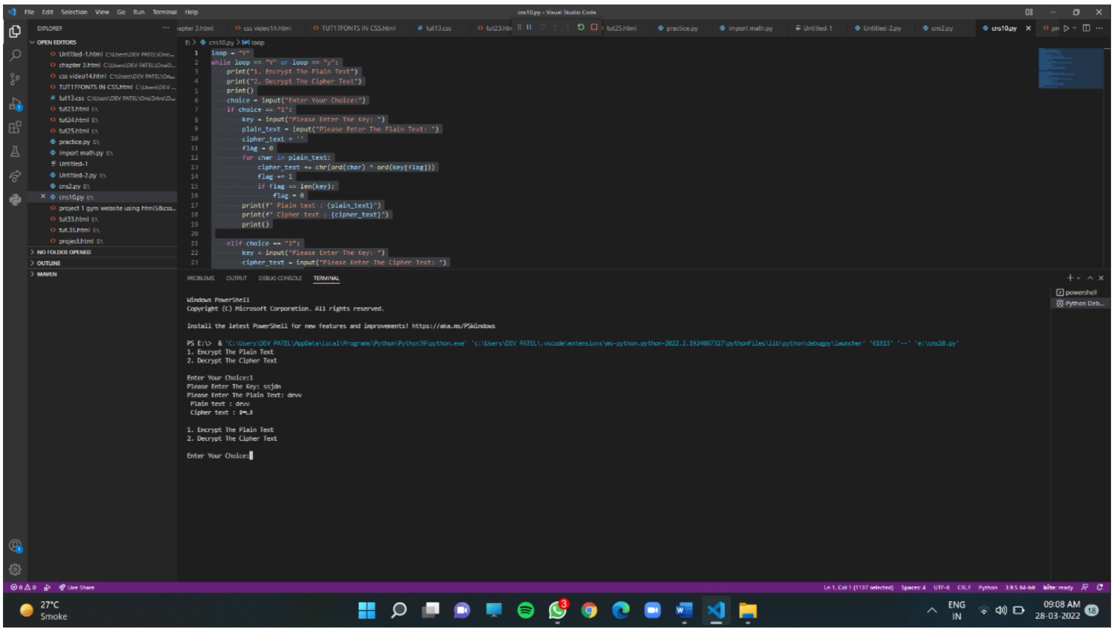
```
    loop = input("Do you want to continue(y/n): ")
    print()
else:
    print("\n Program is terminating...")
```

OUTPUT:



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PRACTICAL:11

AIM: Implement the One Time Pad Cipher.

PROGRAM:

```
import string
import random

loop = "Y"
key=""

while loop == "Y" or loop == "y":
    print("1. Encrypt The Plain Text")
    print("2. Decrypt The Cipher Text")
    choice = input(" Enter Your Choice: ")
    if choice == "1":
        plain_text = input(" Please Enter The Plain Text: ")
        key = ".join(random.choices(string.ascii_uppercase, k = len(plain_text)))
        cipher_text = []
        for i in range(len(plain_text)):
            x = (ord(plain_text[i]) + ord(key[i])) % 26
            x += ord('A')
            cipher_text.append(chr(x))
        cipher_text = "".join(cipher_text)
        print(f" Plain text : {plain_text}")
        print(f" Cipher text : {cipher_text}")
        print()

    elif choice =="2":
        plain_text=[]
        cipher_text = input(" Please Enter The Cipher Text: ")
  for i in range(len(cipher_text)):
            x = (ord(cipher_text[i]) - ord(key[i]) + 26) % 26
            x += ord('A')
            plain_text.append(chr(x))
        plain_text = "".join(plain_text)
        print(f" Cipher text : {cipher_text}")
        print(f" Plain text: {plain_text}")
        print()

    else:
        print("Invalid Choice")
        print()
    loop = input(" Do you want to continue(y/n):")

else :
 print(" Program is terminating.")
```

OUTPUT:

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```
1. Encrypt The Plain Text
2. Decrypt The Cipher Text
 Enter Your Choice: 1
 Please Enter The Plain Text: ATTACK
 Plain text : ATTACK
 Cipher text : RDJSMG
```

PRACTICAL:-12

AIM: Implement the Cryptanalysis using Frequency analysis.

PROGRAM:

```
def printString(S, N):
    plain_text = [None] * 5
    freq = [0] * 26
    freq_sorted = [None] * 26
    used = [0] * 26
    for i in range(N):
        if S[i] != ' ':
            freq[ord(S[i]) - 65] += 1

    for i in range(26):
        freq_sorted[i] = freq[i]

    T = "ETAOINSHRDLCUMWFGYPBVKJXQZ"
    freq_sorted.sort(reverse = True)

    for i in range(5):
        ch = -1
        for j in range(26):
            if freq_sorted[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):
            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)
        plain_text[i] = curr

    for i in range(5):
        print(plain_text[i])
```

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```
S = "B TJNQMF NFTTBHF"
N = len(S)
printString(S, N)
```

OUTPUT:

```
A SIMPLE MESSAGE
B TJNQMF NFTTBHF
A SIMPLE MESSAGE
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PRACTICAL:-13

AIM: Implement Euclidean Algorithm and Extended Euclidean Algorithm.

PROGRAM:

```
def calculate(x, y, q):
    return (x - (q*y))

def euclideanAlgorithm(a, b, s1, s2, t1, t2):
    if b == 0 :
        print(f" {a} {b} {s1} {s2} {t1} {t2} ")
        return a,s1,t1

    elif a == 0:
        print(f"0 {a} {b} 0 {s1} {s2} 1 {t1} {t2} 0")
        return b,s1,t1
    else:
        q=a//b
        r=a%b
        t=calculate(t1,t2,q)
        s=calculate(s1,s2,q)
        print(f"{q} {a} {b} {r} {s1} {s2} {s} {t1} {t2} {t}")
        a=b
        b=r
        s1=s2
        s2=s
        t1=t2
        t2=t
 x,y,z=euclideanAlgorithm(a,b,s1,s2,t1,t2)
        return x,y,z


a = int(input("Enter The First Number:"))
b = int(input("Enter The Second Number:"))
print("q r1 r2 r s1 s2 s t1 t2 t")
print("-------------------------------------------------------")
gcdValue, s, t = euclideanAlgorithm(a, b, 1, 0, 0, 1)
print(f" Using Extended Euclidean Algorithm : \n GCD({a},{b}) = {gcdValue}")
print(f" s = {s}, t = {t} [a*s + b*t = GCD(a,b)]")
```

OUTPUT:

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```
Enter The First Number:70
Enter The Second Number:50
q r1 r2 r s1 s2 s t1 t2 t
-------------------------------------------
1 70 50 20 1 0 1 0 1 -1
2 50 20 10 0 1 -2 1 -1 3
2 20 10 0 1 -2 5 -1 3 -7
 10 0 -2 5 3 -7
 Using Extended Euclidean Algorithm :
 GCD(70,50) = 10
 s = -2, t = 3 [a*s + b*t = GCD(a,b)]
```

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PRACTICAL:-14

AIM: Implement Diffie-Hellman Algorithm for Key Exchange with Small Number

PROGRAM:

```
q = int(input("Enter the value of 'q'(Prime Number): "))
alpha = int(input("Enter the value of α(primitive root of 'q' and α<q'): "))

print(f"\n q={q}")
print(f" α(Primitive Root of \'q\")={alpha}")
Xa = int(input("Enter the private key of Sender(Xa): "))
print(f"\n The Private Key Xa for Sender : {Xa}")
Ya = int(pow(alpha,Xa,q))
print(f" The Public Key Ya for Sender : {Ya} ")
Xb = int(input("Enter The Private Key Of The Receiver(Xb): "))
print(f"\n The Private Key Xb For Receiver : {Xb}")
Yb = int(pow(alpha,Xb,q))
print(f" The Private Key Yb For Sender : {Yb}")
Ka = int(pow(Yb,Xa,q))
Kb = int(pow(Ya,Xb,q))
print(f"\n The Public Key Ka For Sender : {Ka} ")
print(f" The Public Key Kb For Sender : {Kb} ")
print(" Secret Key of Both parties are Same.")
print(" Key Exchange is Successful.")
```

OUTPUT:

```
Enter the value of 'q'(Prime Number): 7
Enter the value of α(primitive root of 'q' and α<q'): 5

 q=7
 α(Primitive Root of 'q'')=5
Enter the private key of Sender(Xa): 3

 The Private Key Xa for Sender : 3
 The Public Key Ya for Sender : 6
Enter The Private Key Of The Receiver(Xb): 6

 The Private Key Xb For Receiver : 6
 The Private Key Yb For Sender : 1

 The Public Key Ka For Sender : 1
 The Public Key Kb For Sender : 1
 Secret Key of Both parties are Same.
 Key Exchange is Successful.
```

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PRACTICAL:15

AIM: Implement RSA Algorithm with Small Number

PROGRAM:

```
def GCD(a, b):
    if b == 0 :
        return a

    elif a == 0:
        return b

    else:
        r=a%b
        a=b
        b=r
        x=GCD(a,b)
        return x

def modInverse(a, m):
    for x in range(1, m):
        if (((a%m) * (x%m)) % m == 1):
            return x
    return -1

p = int(input(" Enter The 'p'(Prime): "))
q = int(input(" Enter The 'q'(Prime): "))

n = p*q
phi_n =( p-1)*(q-1)
e = int(input(f" Enter The 'e'(GCD(e,{phi_n})=1 and 1<e<{phi_n})): "))
while e < phi_n:
    if (GCD(e, phi_n)==1):
        break
    else:
        e+=1

k = 2
d = modInverse(e,phi_n)

print(f" 'd' is {d}")

privateKey = set([d,n])
publicKey = set([e,n])

print(f"\n The Private Key is {privateKey}")
print(f" The Public Key is {publicKey}")

M = int(input(f" Enter The Message To Be Encrypted(M<{n}): "))

print("\n\n\n\n Encryption:")

C = int(pow(M,e,n))

print(f" Plain Text = {M}")
print(f" Cipher Text = {C}")
```

```
print("\n DECRYPTION:")

M1 = pow(C,d,n)

print(f" Cipher Text = {C}")
print(f" Plain Text = {M1}")
```

OUTPUT:

```
Enter The 'p'(Prime): 3
Enter The 'q'(Prime): 11
Enter The 'e'(GCD(e,20)=1 and 1<e<20)): 7
'd' is 3

The Private Key is {33, 3}
The Public Key is {33, 7}
Enter The Message To Be Encrypted(M<33): 17
```

```
Encryption:
Plain Text = 17
Cipher Text = 8

DECRYPTION:
Cipher Text = 8
Plain Text = 17
```

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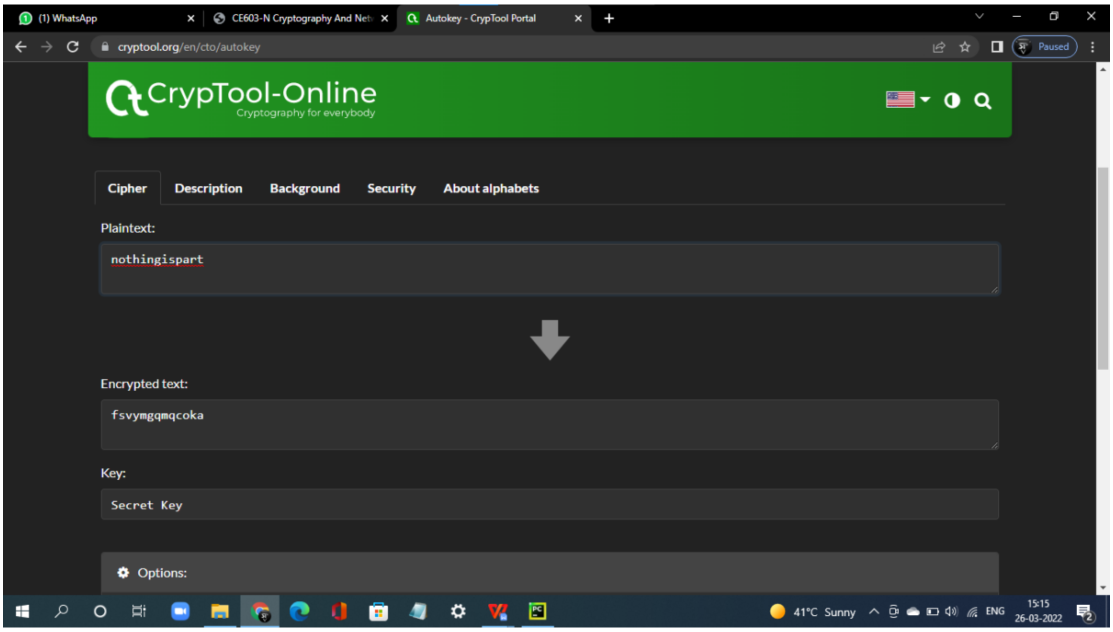
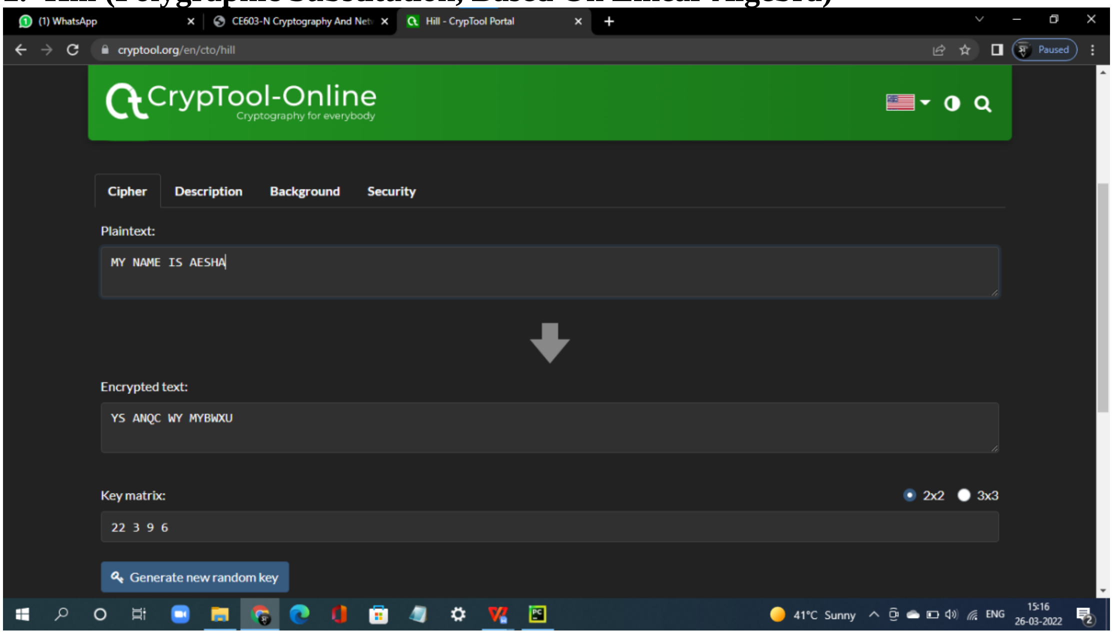
PRACTICAL:-16

AIM: STUDY VARIOUS ENCRYPTION/DECRYPTION TOOLS AVAILABLE ONLINE (EG. ‘www.cryptool.org’).

1. **Autokey (Variant Of Vigenère, Which Also Uses Plain Text)**



2. **Hill (Polygraphic Substitution, Based On Linear Algebra)**



3. **Caesar/Rot13 (Shifting Cipher, Which Was Used By Julius Caesar)**

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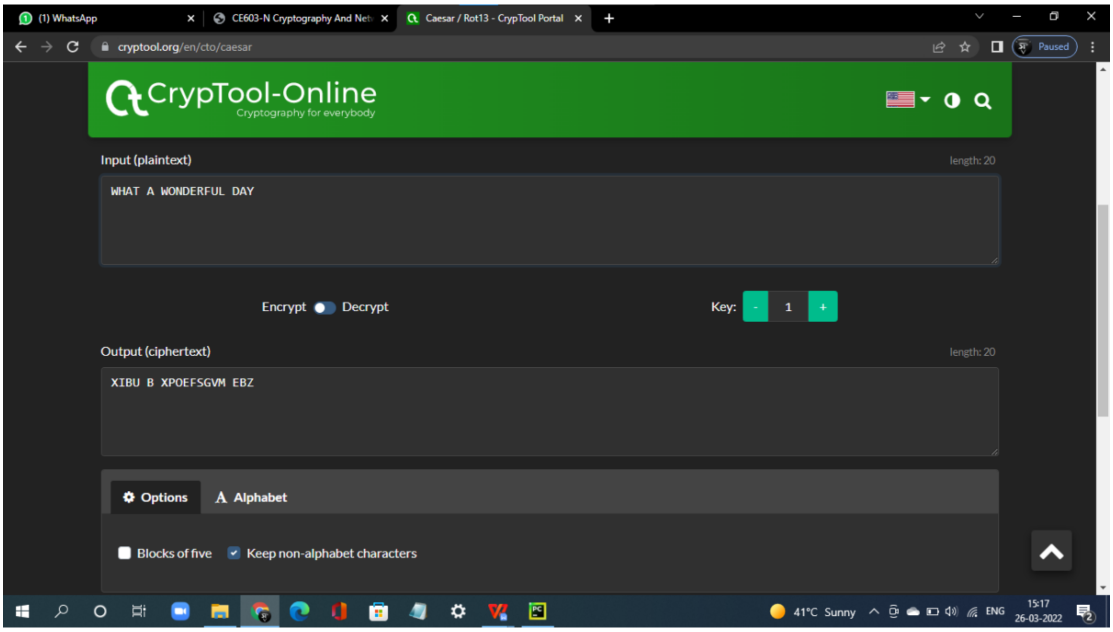
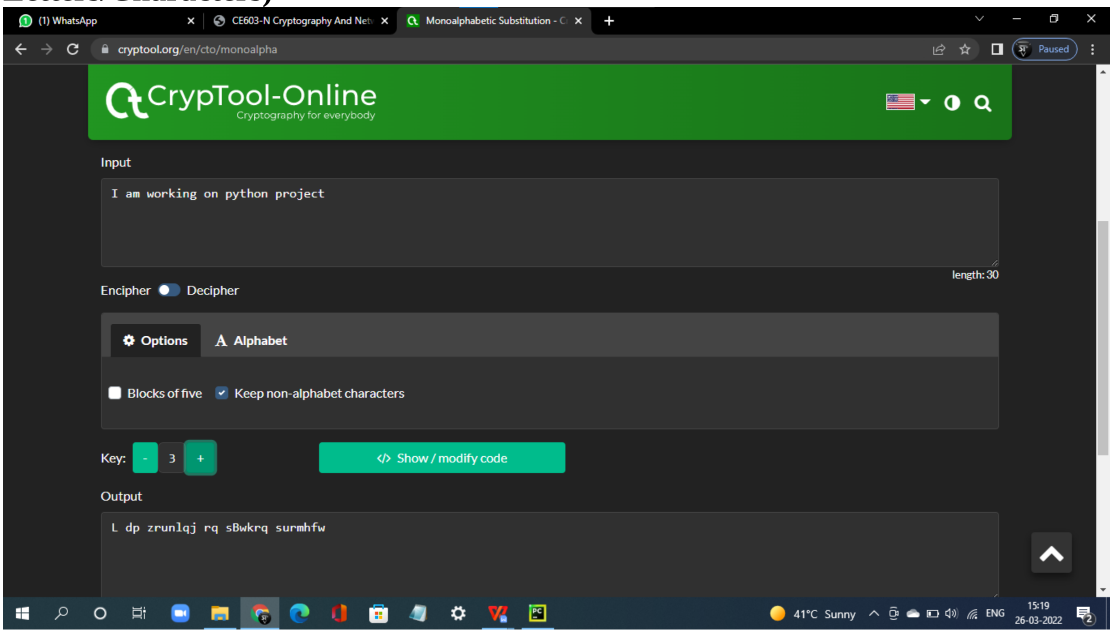


4.Monoalphabetic Substitution (Cipher That Replaces Letters With Letters/Characters)



5.Rail Fence (Transposition Cipher That Uses A Railfence Pattern)

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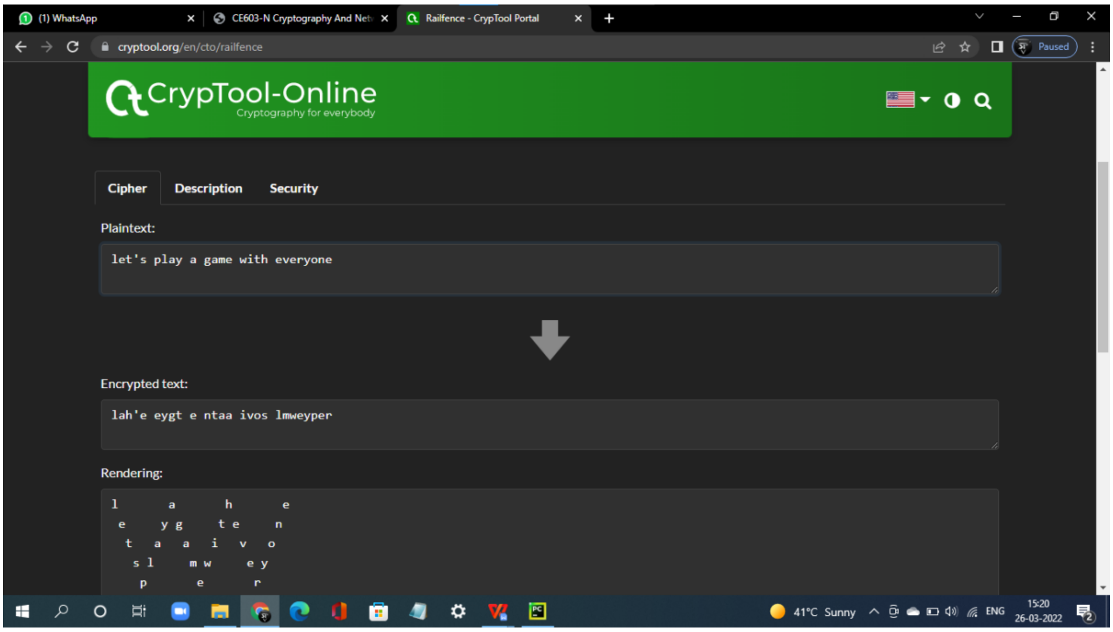
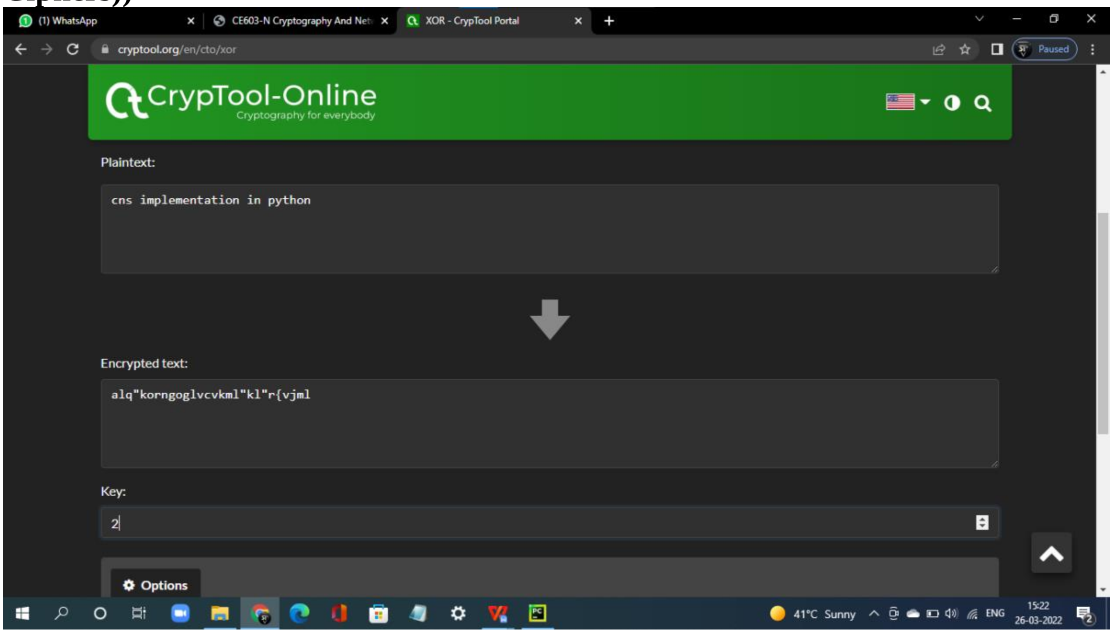


6. XOR (Single Bits Are XORed (Typical Component Of More Complex Ciphers))



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