INFORMATION SECURITY (3170720)

VVP ENGINEERING COLLEGE

SUBMITTED BY: **DISHEN MAKWANA**

180470107035

G2

V. V. P. Engineering College, Rajkot

Department of Computer Engineering

Vision of the Institute

- To be an exemplary institute, transforming students into competent professionals with human values.

Mission of the Institute

- To provide a conducive academic environment for strengthening technical capabilities of the students.
- To strengthen linkage with industries, alumni and professional bodies.
- To organize various co-curricular and extra-curricular activities for overall development of the students.
- To practice good governance and conduct value- based activities for making students responsible citizens.

Vision of the Department

- Transforming students into globally efficient professionals with moral values.

Mission of the Department

- To provide a strong foundation of computer engineering through effective teaching learning process.
- To enhance industry linkage & alumni network for better placement and real-world exposure.
- To provide various opportunities & platforms for all round development of students &

encourage them for value-based practices.

Program Educational Objectives (PEOs)

Graduates will be able to

- Apply computer engineering theories, principles and skills to meet the challenges of the society.
- Communicate effectively, work collaboratively and manifest professionalism with ethics.
- Exhibit life-long learning attitude and adapt to rapid technological changes in industry.
- Advance their career in industry, pursue higher education or become an entrepreneur.

V.V.P. ENGINEERING COLLEGE

RAJKOT

Certificate

This is to certify that

Mr. DISHEN MAKWANA, Enrollment No: 180470107035, Branch: Computer Engineering, Semester: 7 has satisfactorily completed the course in the subject: **INFORMATION SECURITY (3170720)** within the four walls of V.V.P. Engineering College, Rajkot.

Date of Submission:

Prof. Komil Vora,
Staff In-Charge

Head of Department,
Department of Computer Engineering,
V.V.P. Engineering College

V. V. P. Engineering College
Department of Computer Engineering
Course Outcomes

Semester: 7th

Subject: Information Security

Subject Code: 3170720

After learning the course, the students will be able to:

CO Number	Course Outcomes	CL
C3170720.1	Explain the different attacks possible during data transmission and need of cryptography.	U
C3170720.2	Apply various symmetric and asymmetric algorithms.	Ap
C3170720.3	Assess the performance of Hash function, MAC function and Digital signature.	E
C3170720.4	Classify the different techniques of key distribution.	U
C3170720.5	Compare remote user authentication techniques and security protocols.	A

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EXP NO.	EXPERIMENT	LAB	Sign
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LAB 1

- # Shift Cipher

1. **Encrypt the following plaintext using key = 7:**
   Lord Rama was a good king.
   ABCDEFGHIJ KLMNOPQRST UVWXYZ
   0123456789 0123456789 012345
   L=11 O=14 R=17 D=3 R=17 A=0 M=12 A=0 W=22 A=0 S=18 A=0 G=6 O=14 O=14 D=3 K=10 I=8 N=13 G=6

   11 14 17 3 17 0 12 0 22 0 18 0 6 14 14 3 10 8 13 6
   Ans: +7

   18 21 24 10 24 7 19 7 29/4 7 25 7 13 21 21 10 17 15 20 13
   Ans: Svyk yhth dhz h nvvk rpun

2. **Given the plain text.**
   Plaintext: plain text and its corresponding cipher text, find out the key used for the encryption of abcdefghijklmnopqrstuvwxyz
   Ciphertext: TDNUCBZROHLGYVFPWIXSEKAMQJ
   Ans: Error

3. **How many different keys are possible with an n-letter alphabet?**
   Ans: 25

4. **Given a ciphertext, find out the corresponding plain text using brute force attack:**
   Ciphertext: HAAHJR HA KHDU
   Ans: 19 Attack at dawn

   Code :

```
#include <iostream>
using namespace std;

string encrypt(string text, int s)
{
    string result = "";
    for (int i=0;i<text.length();i++)
    {
            if (isupper(text[i]))
                    result += char(int(text[i]+s-65)%26 +65);

            else
                    result += char(int(text[i]+s-97)%26 +97);
    }
    return result;
}

int main()
```

```
{
    string text="ATTACKATONCE";
    int s = 4;
    cout << "Text : " << text;
    cout << "\nShift: " << s;
    cout << "\nCipher: " << encrypt(text, s);
    return 0;
}
```

Shift Cipher > C++ code.cpp > main()

```
#include <iostream>
using namespace std;

string encrypt(string text, int s)
{
    string result = "";
    for (int i = 0; i < text.length(); i++)
    {
        if (isupper(text[i]))
            result += char(int(text[i] + s - 65) % 26 + 65);

        else
            result += char(int(text[i] + s - 97) % 26 + 97);
    }
    return result;
}

int main()
{
    string text = "HAAHJRHAKHDU";
    int s = 4;
    cout << "Text : " << text;
    cout << "\nShift: " << s;
    cout << "\nCipher: " << encrypt(text, s);
    return 0;
```

PROBLEMS 1 OUTPUT TERMINAL DEBUG CONSOLE

```
https://aka.ms/powershell
Type 'help' to get help.

  A new PowerShell preview release is available: v7.2.0-preview.8
  Upgrade now, or check out the release page at:
    https://aka.ms/PowerShell-Release?tag=v7.2.0-preview.8

PS D:\INS> cd "d:\INS\Shift Cipher\" ; if ($?) { g++ code.cpp -o code } ; if ($?) { .\code }
Text : HAAHJRHAKHDU
Shift: 4
Cipher: LEELNVLEOLHY
PS D:\INS\Shift Cipher>
```

LAB 2

- # Monoalphabetic Cipher

Key:
Plain: a b c d e f g h Ijklmnopq r s t u v w x y z
Cipher: DKVQFIBJWPESCXHTMYAUOLRGZN
Plaintext: if we wish to replace letters
Ciphertext: WI RF RWAJ UH YFTSDVF SFUUFYA

Quiz:

1) Explain Monoalphabetic cipher.
Monoalphabetic cipher is an improvement over caesar cipher. In this cipher each letter has a defined alphabet and it is assigned to it in every occurrence. Like QWERTYUIOPASDFGHJKLZXCVBNM key is assigned to ABCDEFGHIJKLMNOPQRSTUVWXYZ

So Hello world becomes URAAF VFKAE

2) Justify why the Monoalphabetic cipher is more secure than the Caesar cipher.
In a Caesar cipher the possible number of guessing the key is only 25 but in a monoalphabetic cipher, It's 26!. So to avoid brute force attack, a monoalphabetic cipher is more secure than a caesar cipher.

3) Create your key and convert following sentence in to cipher text

A	Q	I	Z
B	A	W	C
C	Z	D	B
D	W	J	M
E	S	Q	N
F	X	P	V
G	E	E	X
H	D	U	A
I	C	F	D
J	R	H	G
K	F	R	J
L	V	Y	L

M	T	T	K
N	G	A	H
O	B	L	F
P	Y	Z	S
Q	H	C	Q
R	N	X	E
S	U	S	T
T	J	K	U
U	M	M	O
V	I	B	P
W	K	N	I
X	O	V	Y
Y	L	P	R
Z	P	F	W

a. A quick brown fox jump over the lazy dog
ANS: Q HMCZF ANBKG XBO RMTY BISN JDS VQPL WBE

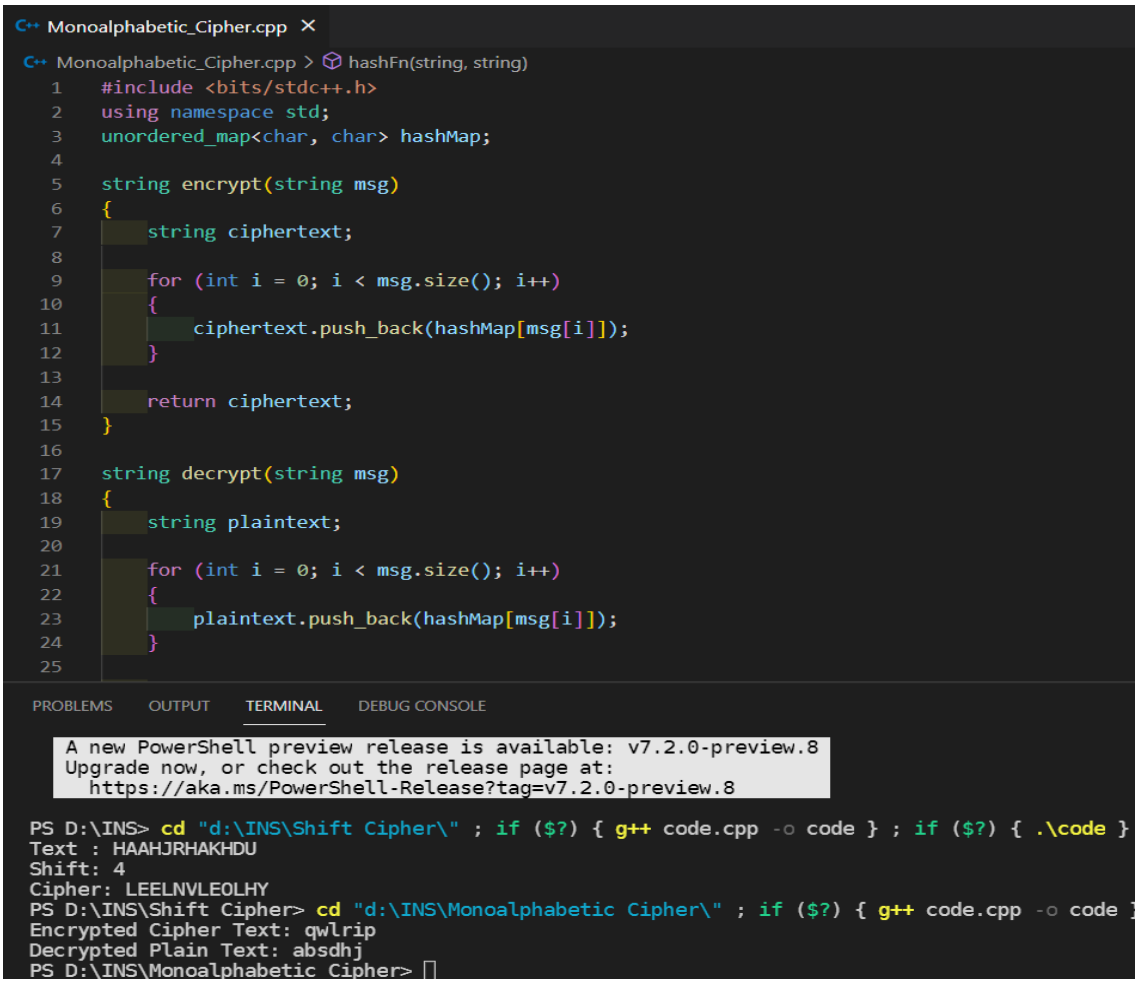
b. I am student of vvp engg college
ANS: F IT SKMJQAK LP BBZ QAEE DLYYQEQ

c. Gandhinagar is capital of gujarat
ANS: XZHMADHZXZE DT BZSDUZL FV XOGZEZU

Code:

```
#include <bits/stdc++.h>
using namespace std;
unordered_map<char,char> hashMap;

string encrypt(string msg)
{
  string ciphertext;
  for(int i=0; i<msg.size(); i++)
  {
    ciphertext.push_back(hashMap[msg[i]]);
  }

  return ciphertext;
```

```
}

string decrypt(string msg)
{
  string plaintext;
  for(int i=0; i<msg.size(); i++)
  {
    plaintext.push_back(hashMap[msg[i]]);
  }

  return plaintext;
}

void hashFn(string a, string b)
{
  hashMap.clear();
  for(int i=0; i<a.size(); i++)
  {
    hashMap.insert(make_pair(a[i],b[i]));
  }
}

int main()
{
    string alphabet = "abcdefghijklmnopqrstuvwxyz";
    string substitution = "qwertyuiopasdfghjklzxcvbnm";
    string msg = "absdhj";

    hashFn(alphabet, substitution);

    string cipher = encrypt(msg);
    cout<<"Encrypted Cipher Text: "<<cipher<<endl;

    hashFn(substitution, alphabet);
    string plain = decrypt(cipher);
    cout<<"Decrypted Plain Text: "<<plain<<endl;
}
```


Monoalphabetic_Cipher.cpp
Monoalphabetic_Cipher.cpp > hashFn(string, string)
#include <bits/stdc++.h>
using namespace std;
unordered_map<char, char> hashMap;
string encrypt(string msg)
{
string ciphertext;
for (int i = 0; i < msg.size(); i++)
{
ciphertext.push_back(hashMap[msg[i]]);
}
return ciphertext;
}
string decrypt(string msg)
{
string plaintext;
for (int i = 0; i < msg.size(); i++)
{
plaintext.push_back(hashMap[msg[i]]);
}
PROBLEMS
OUTPUT
TERMINAL
DEBUG CONSOLE
A new PowerShell preview release is available: v7.2.0-preview.8
Upgrade now, or check out the release page at:
https://aka.ms/PowerShell-Release?tag=v7.2.0-preview.8
PS D:\INS> cd "d:\INS\Shift Cipher\" ; if ($?) { g++ code.cpp -o code } ; if ($?) { .\code }
Text : HAAHJRHAKHDU
Shift: 4
Cipher: LEELNVLEOLHY
PS D:\INS\Shift Cipher> cd "d:\INS\Monoalphabetic Cipher\" ; if ($?) { g++ code.cpp -o code
Encrypted Cipher Text: qwlrip
Decrypted Plain Text: absdhj
PS D:\INS\Monoalphabetic Cipher>

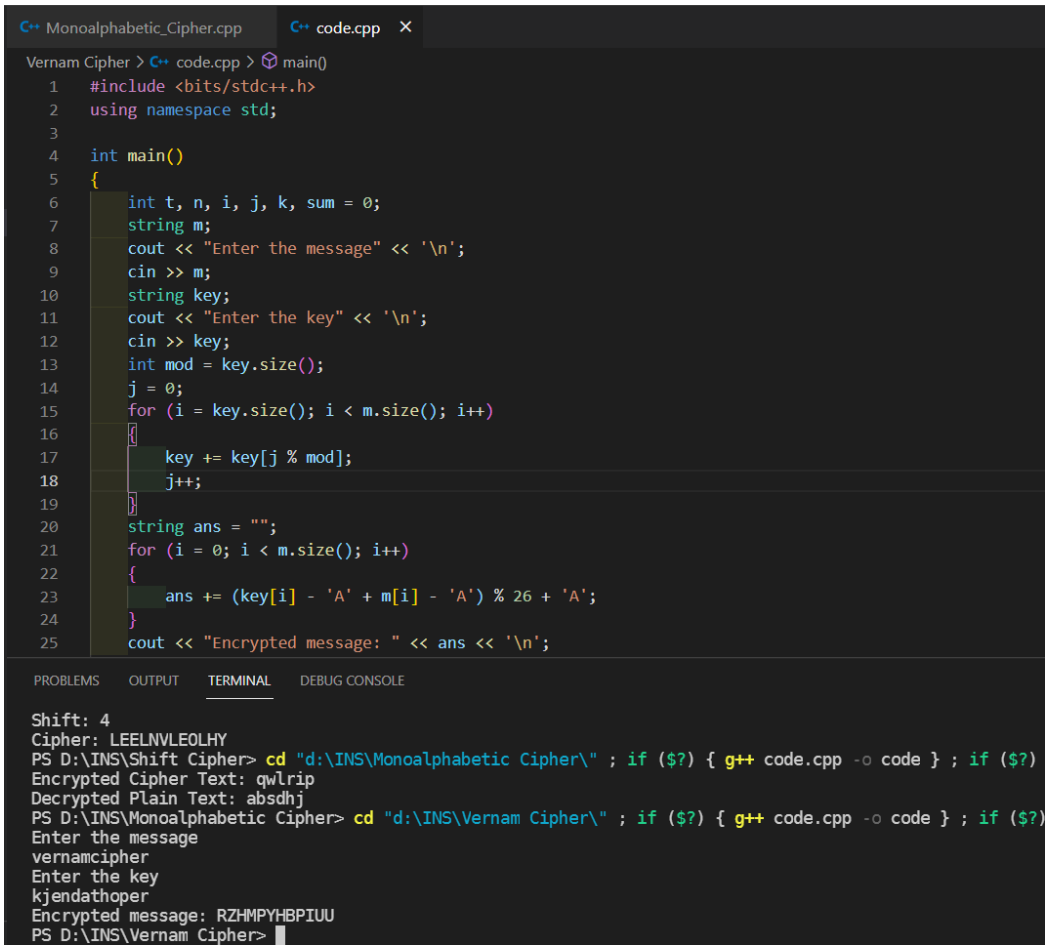
LAB 3

- # Vernam Cipher

1) Execute below vernam cipher

Code:

```
#include<bits/stdc++.h>
using namespace std;

int main(){
    int t,n,i,j,k,sum=0;
    string m;
    cout<<"Enter the message"<<'\n';
    cin>>m;
    string key;
    cout<<"Enter the key"<<'\n';
    cin>>key;
    int mod = key.size();
    j=0;
    for(i=key.size();i<m.size();i++){
        key+=key[j%mod];
        j++;
    }
    string ans="";
    for(i=0;i<m.size();i++){
        ans += (key[i]-'A'+m[i]-'A')%26+'A';
    }
    cout<<"Encrypted message: "<<ans<<'\n';

    return 0;
}
```



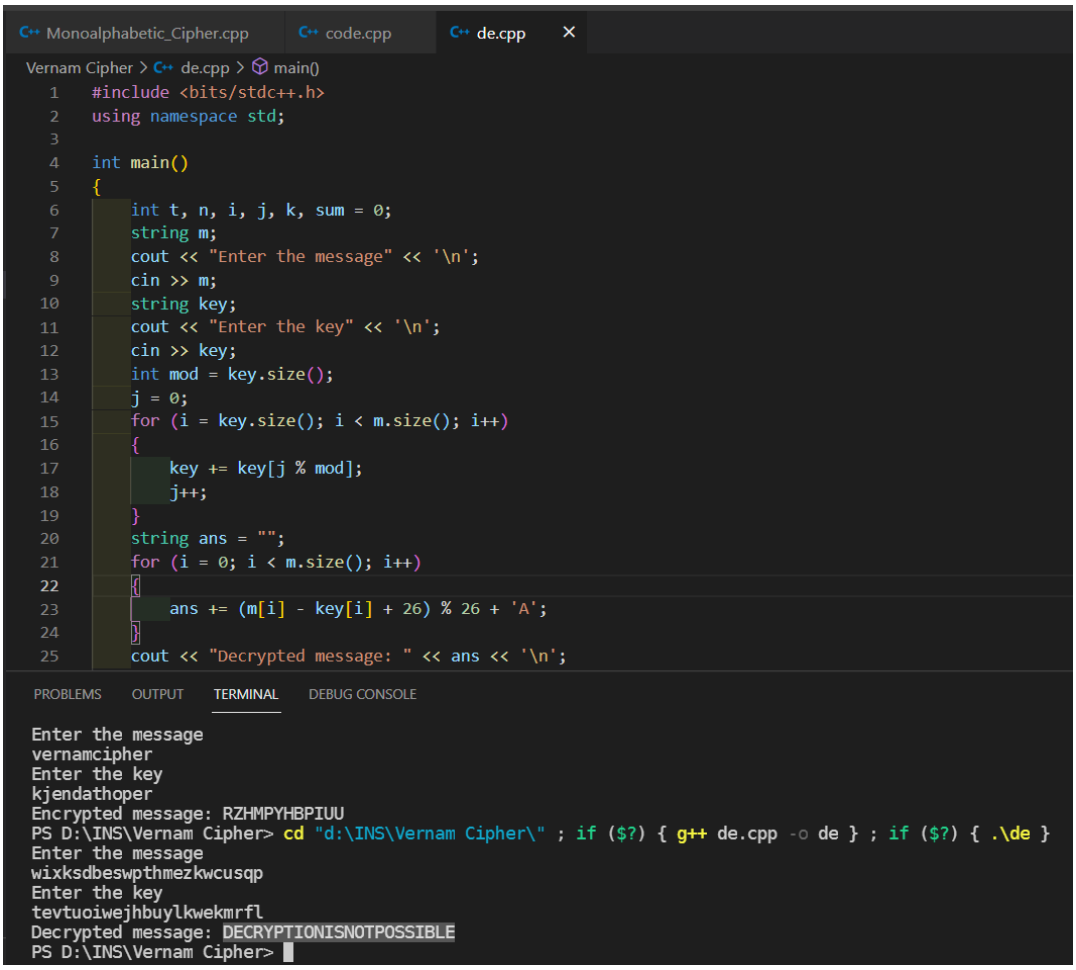
EX:
Plain Text : vernamcipher
Key : kjendathoper
Ans : RZHMPYHBPIUU

2) Decrypt below vernam cipher

Code:

```
#include<bits/stdc++.h>
using namespace std;

int main(){
   int t,n,i,j,k,sum=0;
   string m;
   cout<<"Enter the message"<<'\n';
   cin>>m;
   string key;
   cout<<"Enter the key"<<'\n';
   cin>>key;
   int mod = key.size();
   j=0;
   for(i=key.size();i<m.size();i++){
```

```
        key+=key[j%mod];
        j++;
    }
    string ans="";
    for(i=0;i<m.size();i++){
        ans += (m[i]-key[i]+26)%26+'A';
    }
    cout<<"Decrypted message: "<<ans<<'\n';

    return 0;
}
```



EX:
Cipher Text : wixksdbeswpthmezkwcusqp
Key : tevtuoiwejhbuylkwekmrfl
Ans : DECRYPTIONISNOTPOSSIBLE

LAB 4

- **Playfair Cipher**

Plain Text : jazz

Key : monarchy

I/J ARE TOGETHER

M	O	N	A	R
C	H	Y	B	D
E	F	G	I/J	K
L	P	Q	S	T
U	V	W	X	Z

Divide plain texts to two pairs:

jazz => ja zx zx

greet => gr ex et

off => of fx

ja => sb

In one column then immediate bottom

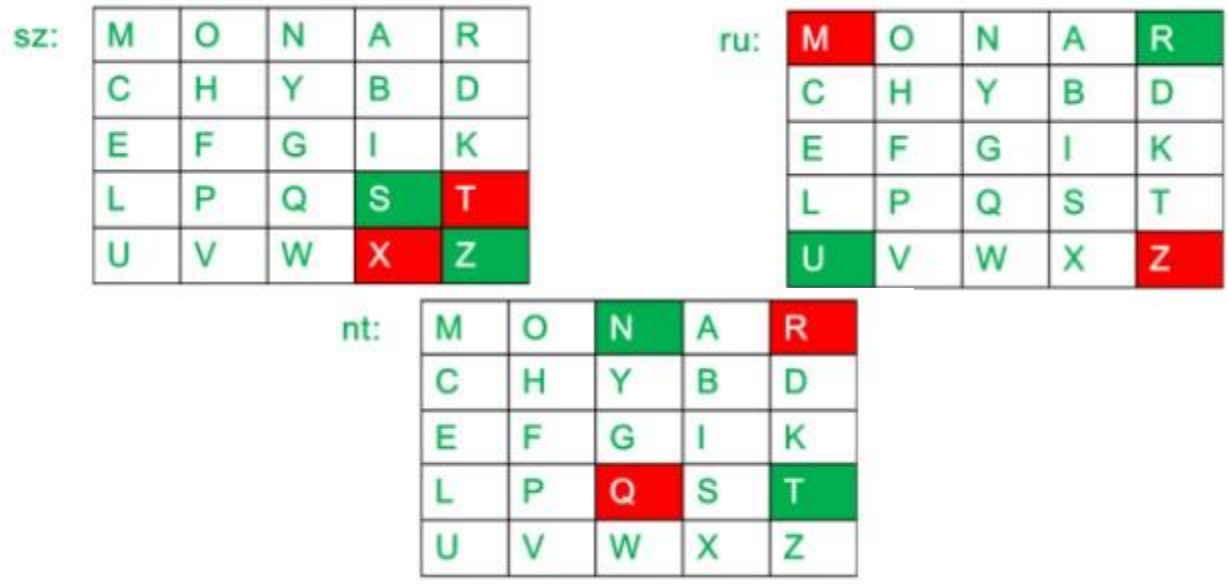
M	O	N	A	R
C	H	Y	B	D
E	F	G	I/J	K
L	P	Q	S	T
U	V	W	X	Z

xz => zu

In case of one row thake immediate right

All rows and columns are roundly connected.

M	O	N	A	R
C	H	Y	B	D
E	F	G	I/J	K
L	P	Q	S	T
U	V	W	X	Z



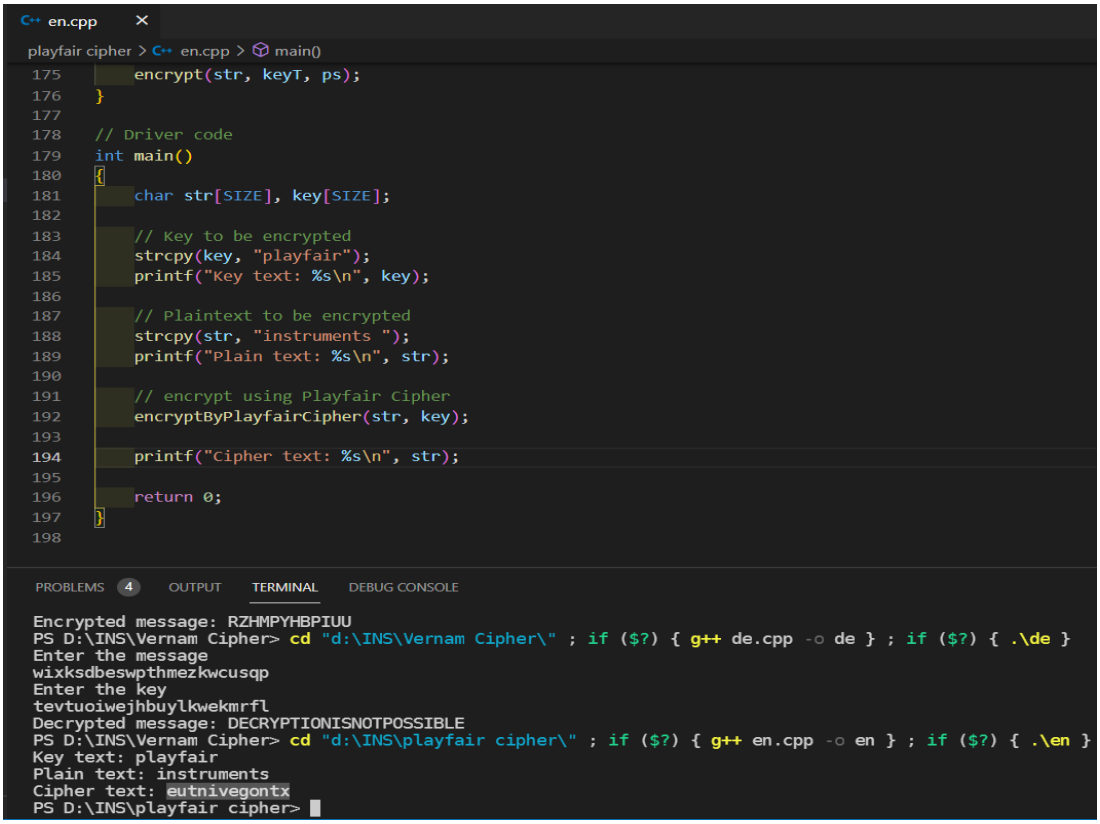
1) Encrypt following:

Code:

```
#include<iostream>
#include<string>
#include<vector>
#include<map>
using namespace std;
int main(){
    int i,j,k,n;
    cout<<"Enter the message"<<endl;
    string s,origin;
    getline(cin,origin);
    cout<<"Enter the key"<<endl;
    string key;
    cin>>key;
    for(i=0;i<origin.size();i++){
        if(origin[i]!=' ')
            s+= origin[i];
    }
    vector<vector<char> > a(5,vector<char>(5,' '));
```

```
n=5;
map<char,int> mp;
k=0;
int pi,pj;
for(i=0;i<n;i++){
   for(j=0;j<n;j++){
      while(mp[key[k]]>0&&k<key.size()){
         k++;
      }
      if(k<key.size()){
         a[i][j]=key[k];
         mp[key[k]]++;
         pi=i;
         pj=j;
      }
      if(k==key.size())
      break;
   }
   if(k==key.size())
      break;
}
k=0;
for(;i<n;i++){
   for(;j<n;j++){
      while(mp[char(k+'a')]>0&&k<26){
         k++;
      }
      if(char(k+'a')=='j'){
         j--;
         k++;
         continue;
      }
      if(k<26){
         a[i][j]=char(k+'a');
         mp[char(k+'a')]++;
      }
   }
   j=0;
}

string ans;
if(s.size()%2==1)
   s+="x";
for(i=0;i<s.size()-1;i++){
   if(s[i]==s[i+1])
      s[i+1]='x';
}

map<char,pair<int,int> > mp2;

for(i=0;i<n;i++){
```

```
    for(j=0;j<n;j++){
        mp2[a[i][j]] = make_pair(i,j);
    }
  }

  for(i=0;i<s.size()-1;i+=2){
    int y1 = mp2[s[i]].first;
    int x1 = mp2[s[i]].second;
    int y2 = mp2[s[i+1]].first;
    int x2 = mp2[s[i+1]].second;
    if(y1==y2){
      ans+=a[y1][(x1+1)%5];
      ans+=a[y1][(x2+1)%5];
    }
    else if(x1==x2){
      ans+=a[(y1+1)%5][x1];
      ans+=a[(y2+1)%5][x2];
    }
    else {
      ans+=a[y1][x2];
      ans+=a[y2][x1];
    }
  }
  cout<<ans<<'\n';
  return 0;
}
```



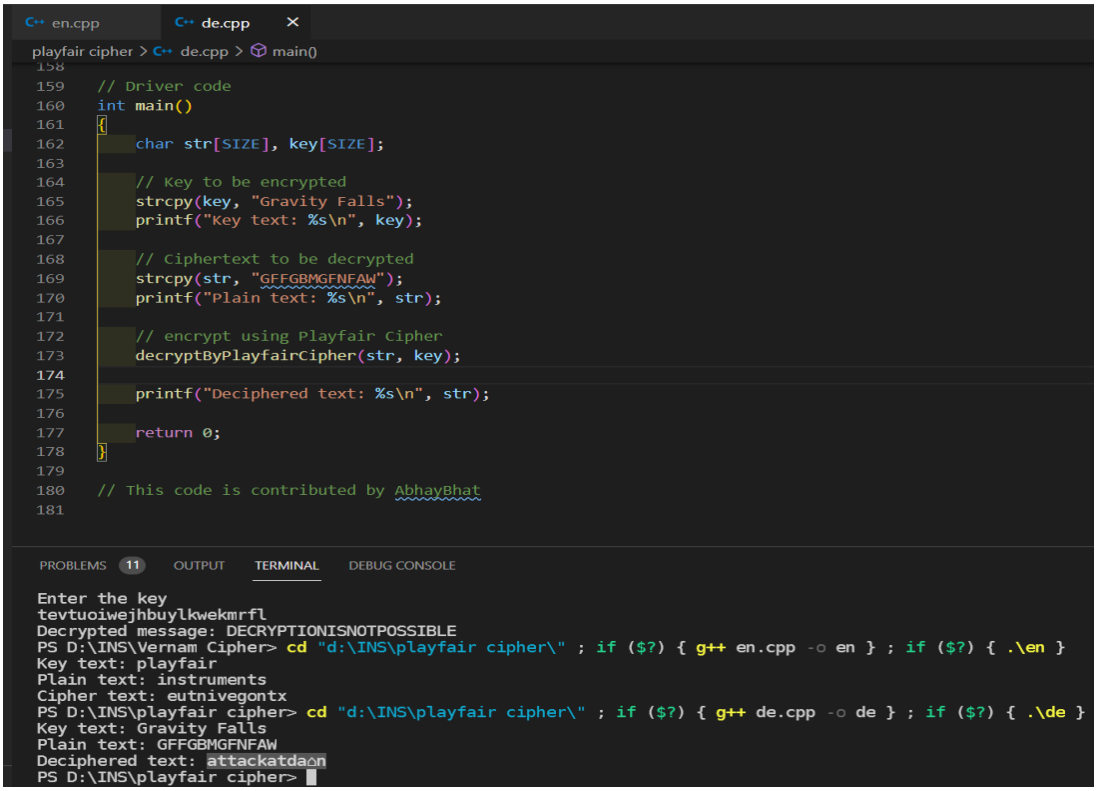
Message : instruments
Key : playfair
Ans : eutnivegontx

2. Decrypt following:

Code:

```
#include<iostream>
#include<string>
#include<vector>
#include<map>
using namespace std;
int main(){
   int i,j,k,n;
   cout<<"Enter the encrypted message\n";
   string s;
   cin>>s;
   cout<<"Enter the key\n";
   string key;
   cin>>key;
   vector<vector<char> > a(5,vector<char>(5,' '));
   n=5;
   map<char,int> mp;
   k=0;
   int pi,pj;
   for(i=0;i<n;i++){
      for(j=0;j<n;j++){
         while(mp[key[k]]>0&&k<key.size()){
            k++;
         }
         if(k<key.size()){
            a[i][j]=key[k];
            mp[key[k]]++;
            pi=i;
            pj=j;
         }
         if(k==key.size())
         break;
      }
      if(k==key.size())
         break;
   }
   k=0;
   for(;i<n;i++){
      for(;j<n;j++){
         while(mp[char(k+'a')]>0&&k<26){
            k++;
         }
         if(char(k+'a')=='j'){
            j--;
            k++;
```

```
            continue;
        }
        if(k<26){
            a[i][j]=char(k+'a');
            mp[char(k+'a')]++;
        }
    }
    j=0;
}

string ans;

map<char,pair<int,int> > mp2;

for(i=0;i<n;i++){
    for(j=0;j<n;j++){
        mp2[a[i][j]] = make_pair(i,j);
    }
}
for(i=0;i<s.size()-1;i+=2){
    int y1 = mp2[s[i]].first;
    int x1 = mp2[s[i]].second;
    int y2 = mp2[s[i+1]].first;
    int x2 = mp2[s[i+1]].second;
    if(y1==y2){
        ans+=a[y1][(x1-1)%5];
        ans+=a[y1][(x2-1)%5];
    }
    else if(x1==x2){
        ans+=a[(y1-1)%5][x1];
        ans+=a[(y2-1)%5][x2];
    }
    else {
        ans+=a[y1][x2];
        ans+=a[y2][x1];
    }
}
if(ans[ans.size()-1]=='x')
    ans[ans.size()-1]='\0';

for(i=1;i<ans.size();i++){
    if(ans[i]=='x')
        ans[i]=ans[i-1];
}

cout<<ans<<'\n';
return 0;
}
```



EX:
Cipher Text : GFFGBMGFNFAW
Key : Gravity Falls
Ans : attackatdawn

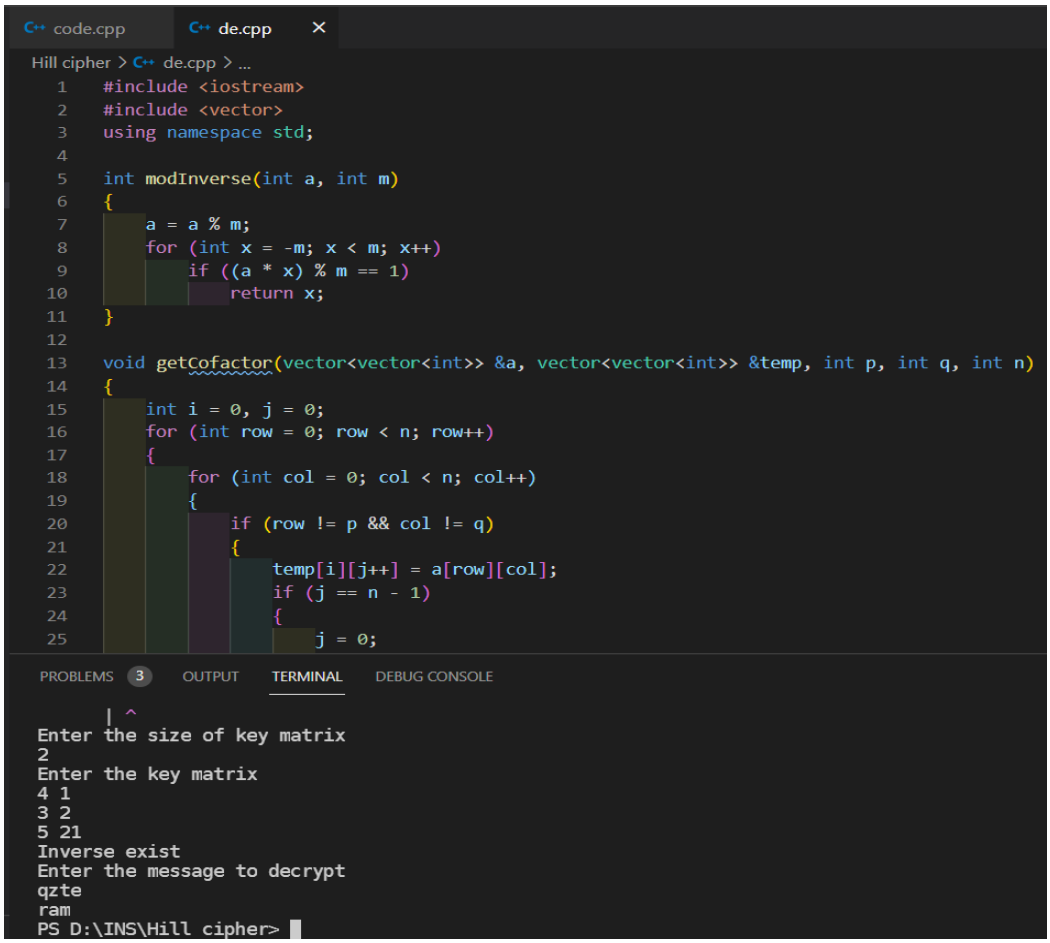
LAB 5

- ## Hill Cipher

1.Encrypt Following using Hill Cipher

Code:

```
#include<iostream>
#include<vector>
using namespace std;
int main(){
   int x,y,i,j,k,n;
   cout<<"Enter the size of key matrix\n";
   cin>>n;
   cout<<"Enter the key matrix\n";
   int a[n][n];
   for(i=0;i<n;i++){
      for(j=0;j<n;j++){
         cin>>a[i][j];
      }
   }
   cout<<"Enter the message to encrypt\n";
   string s;
   cin>>s;
   int temp = (n-s.size()%n)%n;
   for(i=0;i<temp;i++){
      s+='x';
   }
   k=0;
   string ans="";
   while(k<s.size()){
      for(i=0;i<n;i++){
         int sum = 0;
         int temp = k;
         for(j=0;j<n;j++){
            sum += (a[i][j]%26*(s[temp++]-'a')%26)%26;
            sum = sum%26;
         }
         ans+=(sum+'a');
      }
      k+=n;
   }
   cout<<ans<<'\n';

   return 0;
}
```



EX:
Plain Text : ram
Key : gybnqkcri
Ans : qzte

2. Decrypt following using Hill Cipher

Code:

```
#include<iostream>
#include<vector>
using namespace std;

int modInverse(int a, int m){
   a=a%m;
   for(int x=-m;x<m;x++)
     if((a*x)%m==1)
        return x;
}

void getCofactor(vector<vector<int> > &a, vector<vector<int> > &temp, int p, int q, int n){
   int i=0,j=0;
```

```
    for(int row=0;row<n;row++){
        for(int col=0;col<n;col++){
            if(row!=p&&col!=q){
                temp[i][j++] = a[row][col];
                if (j==n-1){
                    j=0;
                    i++;
                }
            }
        }
    }
}

int determinant(vector<vector<int> > &a, int n, int N){
    int D = 0;
    if(n==1)
        return a[0][0];
    vector<vector<int> > temp(N, vector<int>(N));
    int sign = 1;
    for(int f=0;f<n;f++){
        getCofactor(a, temp, 0, f, n);
        D += sign * a[0][f] * determinant(temp, n - 1, N);
        sign = -sign;
    }
    return D;
}

void adjoint(vector<vector<int> > &a,vector<vector<int> > &adj,int N){
    if(N == 1){
        adj[0][0] = 1;
        return;
    }
    int sign = 1;
    vector<vector<int> > temp(N, vector<int>(N));
    for(int i=0;i<N;i++){
        for(int j=0;j<N;j++){
            getCofactor(a, temp, i, j, N);
            sign = ((i+j)%2==0)? 1: -1;
            adj[j][i] = (sign)*(determinant(temp, N-1 , N));
        }
    }
}

bool inverse(vector<vector<int> > &a, vector<vector<int> > &inv, int N){
    int det = determinant(a, N, N);
    if(det == 0){
        cout << "Inverse does not exist";
        return false;
    }
    int invDet = modInverse(det,26);
    cout<<det%26<<' '<<invDet<<'\n';
```

```
    vector<vector<int> > adj(N, vector<int>(N));
    adjoint(a, adj, N);
    for(int i=0;i<N;i++)
        for(int j=0;j<N;j++)
            inv[i][j] = (adj[i][j]*invDet)%26;
    return true;
}

int main(){
    int x,y,i,j,k,n;
    cout<<"Enter the size of key matrix\n";
    cin>>n;
    cout<<"Enter the key matrix\n";
    vector<vector<int> > a(n, vector<int>(n));
    vector<vector<int> > adj(n, vector<int>(n));
    vector<vector<int> > inv(n, vector<int>(n));

    for(i=0;i<n;i++){
        for(j=0;j<n;j++){
            cin>>a[i][j];
        }
    }
    if(inverse(a,inv,n)){
        cout<<"Inverse exist\n";
    }

    cout<<"Enter the message to decrypt\n";
    string s;
    cin>>s;
    k=0;
    string ans;
    while(k<s.size()){
        for(i=0;i<n;i++){
            int sum = 0;
            int temp = k;
            for(j=0;j<n;j++){
                sum += ((inv[i][j] + 26)%26*(s[temp++]-'a')%26)%26;
                sum = sum%26;
            }
            ans+=(sum+'a');
        }
        k+=n;
    }
    //ans+='\0';
    int f=ans.size()-1;
    while(ans[f]=='x'){
        f--;
    }

    for(i=0;i<=f;i++){
        cout<<ans[i];
```

```
    }
    cout<<'\n';
    return 0;
}
```

code.cpp

```cpp
#include <iostream>
#include <vector>
using namespace std;
int main()
{
    int x, y, i, j, k, n;
    cout << "Enter the size of key matrix\n";
    cin >> n;
    cout << "Enter the key matrix\n";
    int a[n][n];
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < n; j++)
        {
            cin >> a[i][j];
        }
    }
    cout << "Enter the message to encrypt\n";
    string s;
    cin >> s;
    int temp = (n - s.size() % n) % n;
    for (i = 0; i < temp; i++)
    {
        s += 'x';
    }
```

```
   63 | }
      | ^
PS D:\INS\Hill cipher> cd "d:\INS\Hill cipher\" ; if ($?) { g++ code.cpp -o code } ; if ($?) { .\code }
Enter the size of key matrix
2
Enter the key matrix
4 1
3 2
Enter the message to encrypt
ram
qzte
PS D:\INS\Hill cipher> cd "d:\INS\Hill cipher\" ; if ($?) { g++ de.cpp -o de } ; if ($?) { .\de }
```

EX:
Cipher Text : sok
Key : cabgxrthn
Ans : qzte