Q: Write a program to encrypt and decrypt Plain text using Hill Cipher

Ans:

Source Code:

```
#include<iostream>

#include<math.h>

using namespace std;

float encmatrix[3][1], decmatrix[3][1], a[3][3], b[3][3], msg[3][1], m[3][3];

void KeyMatrix() {

  int i, j;

  char mes[3];

  cout<<"\nEnter plain text of length 3(use A through Z): ";

  cin>>mes;

  for(i = 0; i < 3; i++)

  msg[i][0] = mes[i] - 65;

  cout<<"Enter 3x3 matrix key:\n";

  for(i = 0; i < 3; i++)

  for(j = 0; j < 3; j++) {

    cin>>a[i][j];

    m[i][j] = a[i][j];

  }

}

void Encrypt() { //encrypts the message

  int i, j, k;

  for(i = 0; i < 3; i++)

  for(j = 0; j < 1; j++)
```

```
   for(k = 0; k < 3; k++)

   encmatrix[i][j] = encmatrix[i][j] + a[i][k] * msg[k][j];

   cout<<"\nEncrypted text: ";

   for(i = 0; i < 3; i++)

   cout<<(char)(fmod(encmatrix[i][0], 26) + 65); //modulo 26 is taken for each element of the matrix obtained by multiplic
ation

}

void inversematrix() { //find inverse of key matrix

   int i, j, k;

   float p, q;

   for(i = 0; i < 3; i++)

   for(j = 0; j < 3; j++) {

     if(i == j)

       b[i][j]=1;

     else

       b[i][j]=0;

   }

   for(k = 0; k < 3; k++) {

     for(i = 0; i < 3; i++) {

       p = m[i][k];

       q = m[k][k];

       for(j = 0; j < 3; j++) {

         if(i != k) {

           m[i][j] = m[i][j]*q - p*m[k][j];

           b[i][j] = b[i][j]*q - p*b[k][j];

         }

       }

     }
```

```
    }
    for(i = 0; i < 3; i++)
    for(j = 0; j < 3; j++)
    b[i][j] = b[i][j] / m[i][i];
    cout<<"\n\nInverse Matrix:\n";
    for(i = 0; i < 3; i++) {
      for(j = 0; j < 3; j++)
      cout<<b[i][j]<<" ";
      cout<<"\n";
    }
}
void Decrypt() { //decrypt the message
    int i, j, k;
    inversematrix();
    for(i = 0; i < 3; i++)
    for(j = 0; j < 1; j++)
    for(k = 0; k < 3; k++)
    decmatrix[i][j] = decmatrix[i][j] + b[i][k] * encmatrix[k][j];
    cout<<"\nDecrypted text: ";
    for(i = 0; i < 3; i++)
    cout<<(char)(fmod(decmatrix[i][0], 26) + 65); //modulo 26 is taken to get the original message
    cout<<"\n";
}
int main() {
    KeyMatrix();
    int n;
    Encrypt();
```

```
    cout<<"\nEnter 1 to Decrypt and 0 to exit.\t";
    cin>>n;
    if(n){
        Decrypt();
    }
    return 0;
}
```

Output:

```
PS D:\sem-5\CN lab> cd "d:\sem-5\CN lab\" ; if ($?) { g++ t.c
pp -o t } ; if ($?) { .\t }

Enter plain text of length 3(use A through Z): TAN
Enter 3x3 matrix key:
3 10 20
20 9 17
9 4 17

Encrypted text: FDC
Enter 1 to Decrypt and 0 to exit.       1


Inverse Matrix:
-0.0519878 0.0550459 0.00611621
0.114373 0.0788991 -0.213456
0.000611621 -0.0477064 0.10581

Decrypted text: TAN
```