# U18CO018

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# CNS

# Lab Assignment 6

Perform hill cipher

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#include <bits/stdc++.h>

using namespace std;

vector<vector<int>> subMatrix(vector<vector<int>> mat, int p, int q) {

    int n = mat.size();

    vector<vector<int>> temp(n-1, vector<int>(n-1));

    int i = 0;
    for(int x = 0; x<n;x++)
        for (int y = 0;y<n;y++)
            if(x!= p && y!=q) {
                temp[i/(n-1)][i%(n-1)] = mat[x][y];
                    i++;
            }

    return temp;
}

int det(vector<vector<int>> mat) {
    int ans = 0;

    int n = mat.size();

    if(n==1) {
        return mat[0][0];
    }

    int sign = 1;

    vector<vector<int>> temp;

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

```
        temp = subMatrix(mat, 0, i);

        ans += sign*mat[0][i]*det(temp);
        sign = -sign;
    }

    return ans;
}

vector<vector<int>> adj(vector<vector<int>> mat) {
    int n = mat.size();

    if(n==1) {
        return mat;
    }

    int sign = 1;
    vector<vector<int>> adj(n, vector<int>(n));

    for(int i = 0;i<n;i++)
        for(int j = 0;j<n;j++) {
            vector<vector<int>> temp = subMatrix(mat, i, j);
            adj[i][j] = sign*det(temp);
            sign = -sign;
        }

    return adj;
}

vector<int> multiply(vector<vector<int>> mat, vector<int> s) {
    int n = mat.size();
    vector<int> ans(n);

    for(int i = 0;i<n;i++) {
        int sum = 0;
        for(int j = 0;j<n;j++) {
            sum += mat[i][j]*s[j];
        }
        ans[i] = sum%26;
    }

    return ans;
}

vector<vector<int>> build(string key) {
    int n = key.size();

    int m = sqrt(n);
```

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    vector<vector<int>> ans(m, vector<int>(m));

    for(int i = 0;i<n;i++) {
        ans[i/m][i%m] = (key[i] - 'a');
    }

    return ans;
}

string encrypt(string plainText, string key) {
    int n = plainText.length();
    int m = sqrt(key.length());

    string cipherText = "";

    if(n%m != 0) {
        int p = m - n%m;
        for(;p<m;p++) {
            plainText += 'z';
        }
    }

    n = plainText.length();


    vector<vector<int>> mat = build(key);

    for(int p = 0; p < n/m;p+=m) {
        vector<int> temp(m);

        for(int i = p;i< p +m; i++)
            temp[i-p] = plainText[i] - 'a';

        vector<int> t2 = multiply(mat, temp);

        for(int k : t2) {
            cipherText += (k + 'a');
        }

    }

    return cipherText;
}



int main() {
```

```
    string p = "hello how are you";
    string key = "gybnqkurp";

    cout<<encrypt(p, key);

    return 0;
}
```

```
E:\Asem7\CNS\Assignment6>a.exe
Press 1 for encryption , 2 for decryption
1
String: this is hill cipher which use matrix to encrypt and decrypt the message
Enter key: GYBNQKURP
**********************************************************
Cipher Text: EXVA;>@1/LAS5<5CJL/8FCFU?>0P;2NIFFHPMP*6@:CSNTNYDEG/>>CSNTNYAJNQ2;UCQBCR
Press 1 for encryption , 2 for decryption
```

Plain Text

this is hill cipher which use matrix to encrypt and decrypt the message

Cipher Text

EXVA;>@1/LAS5<5CJL/8FCFU?>0P;2NIFFHPMP*6@:CSNTNYDEG/>>CSNTNYAJNQ2;UCQBCR