PROGRAM:

```
import java.util.*;
import java.io.*;
public class Caesercipher {
    public static final String ALPHABET = "abcdefghijklmnopqrstuvwxyz";
    public static String encrypt(String ptext, int cserkey) {
        String ctext = "";
        for (int i = 0; i < ptext.length(); i++) {
            int plainnumeric = ALPHABET.indexOf(ptext.charAt(i));
            int ciphernumeric = (plainnumeric + cserkey) % 26;
            char cipherchar = ALPHABET.charAt(ciphernumeric);
            ctext += cipherchar;
        } return ctext;
    }
    public static String decrypt(String ctext, int cserkey) {
        String ptext = "";
        for (int i = 0; i < ctext.length(); i++) {
            int ciphernumeric = ALPHABET.indexOf(ctext.charAt(i));
            int plainnumeric = (ciphernumeric - cserkey) % 26;
            if (plainnumeric < 0) {
                plainnumeric = ALPHABET.length() + plainnumeric;
            }
            char plainchar = ALPHABET.charAt(plainnumeric);
            ptext += plainchar;
        } return ptext;
    }
    public static void main(String[] args) throws IOException {
        BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
        System.out.print("Enter the PLAIN TEXT for Encryption: ");
        String plaintext = br.readLine();
        System.out.print("Enter the CAESERKEY between 0 and 25:");
        int cserkey = Integer.parseInt(br.readLine());
        System.out.println("ENCRYPTION");
        String ciphertext = encrypt(plaintext, cserkey);
        System.out.println("CIPHER TEXT : " + ciphertext);
        System.out.println("DECRYPTION");
        plaintext = decrypt(ciphertext, cserkey);
        System.out.println("PLAIN TEXT : " + plaintext);
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java Caesercipher.java
Enter the PLAIN TEXT for Encryption:  hello
Enter the CAESERKEY between 0 and 25: 3
ENCRYPTION
CIPHER TEXT : khoor
DECRYPTION
PLAIN TEXT : hello
```

PROGRAM:

```
import java.util.*;
import java.io.*;
public class Playfairs {
    private char pfmatrix[][] = new char[5][5];
    public String ALPHABET = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
    String plain, cipher;
    int jflg = 0, xpad = 0;
    int row, col;
    public void matrixgen(String key) {
        key = key.toUpperCase().replaceAll("[^A-Z]", "").replace("J", "I");
        boolean[] used = new boolean[26];
        int i = 0, j = 0;
        for (int k = 0; k < key.length(); k++) {
            char ch = key.charAt(k);
            if (!used[ch - 'A']) {
                pfmatrix[i][j] = ch;
                used[ch - 'A'] = true;
                j++;
                if (j == 5) {
                    j = 0;
                    i++;
                }
            }
        }
        for (char ch = 'A'; ch <= 'Z'; ch++) {
            if (ch == 'J') continue;
            if (!used[ch - 'A']) {
                pfmatrix[i][j] = ch;
                used[ch - 'A'] = true;
                j++;
                if (j == 5) {
                    j = 0;
                    i++;
                }
            }
        }
    }
    public void matrixdisplay() {
        for (int i = 0; i < 5; i++) {
            for (int j = 0; j < 5; j++)
                System.out.print(pfmatrix[i][j] + " ");
            System.out.println();
        }
    }
    public String pfencryption(String txt) {
```

```
int ch1row, ch2row, ch1col, ch2col;
char ch1, ch2, tmp1, tmp2;
String nutext = "", text = "";
int i = 0;
txt = txt.toUpperCase().replace("J", "I").replaceAll("[^A-Z]", "");
while (i < txt.length()) {
    text += txt.charAt(i);
    if (i + 1 < txt.length()) {
        if (txt.charAt(i) == txt.charAt(i + 1)) {
            text += 'X';
            xpad++;
        } else {
            text += txt.charAt(i + 1);
            i++;
        }
    } else {
        text += 'X';
        xpad++;
    }
    i++;
}
System.out.println("TEXT : " + text);
for (int k = 0; k < text.length(); k += 2) {
    ch1 = text.charAt(k);
    ch2 = text.charAt(k + 1);
    System.out.println("CHARACTER PAIR : " + ch1 + " " + ch2);
    matsearch(ch1);
    ch1row = row;
    ch1col = col;
    matsearch(ch2);
    ch2row = row;
    ch2col = col;
    //System.out.println("ch1row: " + ch1row + " ch1col: " + ch1col);
    //System.out.println("ch2row: " + ch2row + " ch2col: " + ch2col);
    if (ch1row == ch2row) {
        tmp1 = pfmatrix[ch1row][(ch1col + 1) % 5];
        tmp2 = pfmatrix[ch2row][(ch2col + 1) % 5];
    } else if (ch1col == ch2col) {
        tmp1 = pfmatrix[(ch1row + 1) % 5][ch1col];
        tmp2 = pfmatrix[(ch2row + 1) % 5][ch2col];
    } else {
        tmp1 = pfmatrix[ch1row][ch2col];
        tmp2 = pfmatrix[ch2row][ch1col];
    }
    nutext += tmp1;
    nutext += tmp2;
    System.out.println("TRANSLATED TEXT : " + tmp1 + " " + tmp2);
}
```

```
        return nutext;
    }
    public String pfdecryption(String text) {
        int ch1row, ch2row, ch1col, ch2col;
        char ch1, ch2, tmp1, tmp2;
        String nutext = "", txt = "";
        for (int k = 0; k < text.length(); k += 2) {
            ch1 = text.charAt(k);
            ch2 = text.charAt(k + 1);
            System.out.println("CHARACTER PAIR : " + ch1 + " " + ch2);
            matsearch(ch1);
            ch1row = row;
            ch1col = col;
            matsearch(ch2);
            ch2row = row;
            ch2col = col;
            //System.out.println("ch1row: " + ch1row + " ch1col: " + ch1col);
            //System.out.println("ch2row: " + ch2row + " ch2col: " + ch2col);
            if (ch1row == ch2row) {
                int c1 = ch1col - 1;
                if (c1 < 0) c1 += 5;
                int c2 = ch2col - 1;
                if (c2 < 0) c2 += 5;
                tmp1 = pfmatrix[ch1row][c1];
                tmp2 = pfmatrix[ch2row][c2];
            } else if (ch1col == ch2col) {
                int r1 = ch1row - 1;
                int r2 = ch2row - 1;
                if (r1 < 0) r1 += 5;
                if (r2 < 0) r2 += 5;
                tmp1 = pfmatrix[r1][ch1col];
                tmp2 = pfmatrix[r2][ch2col];
            } else {
                tmp1 = pfmatrix[ch1row][ch2col];
                tmp2 = pfmatrix[ch2row][ch1col];
            }
            nutext += tmp1;
            nutext += tmp2;
            System.out.println("TRANSLATED TEXT : " + tmp1 + " " + tmp2);
        }
        if (xpad != 0) {
            int i = 0;
            while (i < nutext.length()) {
                if (nutext.charAt(i) == 'X') {
                    i++;
                    continue;
                }
                txt += nutext.charAt(i);
            i++;
        }
        System.out.println("TEXT : " + txt);
        return txt;
    } else {
        System.out.println("TEXT : " + nutext);
        return nutext;
    }
}
public void matsearch(char ch) {
    if (ch == 'J') ch = 'I';

    for (int i = 0; i < 5; i++) {
        for (int j = 0; j < 5; j++) {
            if (pfmatrix[i][j] == ch) {
                row = i;
                col = j;
                return;
            }
        }
    }
}
public static void main(String[] args) {
    Playfairs pf = new Playfairs();
    Scanner sc = new Scanner(System.in);
    System.out.println("Enter the PLAYFAIR KEY: ");
    String pfkey = sc.nextLine();
    System.out.println("PLAYFAIR MATRIX");
    pf.matrixgen(pfkey);
    pf.matrixdisplay();
    System.out.println("Enter PLAIN TEXT");
    String ptext = sc.nextLine();
    String ctext = pf.pfencryption(ptext);
    System.out.println("\nCIPHER TEXT :" + ctext);
    String plaintext = pf.pfdecryption(ctext);
    System.out.println("\nPLAIN TEXT :" + plaintext);
    sc.close();
}
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java Playfairs.java
Enter the PLAYFAIR KEY:
MONARCHY
PLAYFAIR MATRIX
M O N A R
C H Y B D
E F G I K
L P Q S T
U V W X Z
Enter PLAIN TEXT
INSTRUMENTS
TEXT : INSTRUMENTSX
CHARACTER PAIR : I N
TRANSLATED TEXT : G A
CHARACTER PAIR : S T
TRANSLATED TEXT : T L
CHARACTER PAIR : R U
TRANSLATED TEXT : M Z
CHARACTER PAIR : M E
TRANSLATED TEXT : C L
CHARACTER PAIR : N T
TRANSLATED TEXT : R Q
CHARACTER PAIR : S X
TRANSLATED TEXT : X A

CIPHER TEXT :GATLMZCLRQXA
CHARACTER PAIR : G A
TRANSLATED TEXT : I N
CHARACTER PAIR : T L
TRANSLATED TEXT : S T
CHARACTER PAIR : M Z
TRANSLATED TEXT : R U
CHARACTER PAIR : C L
TRANSLATED TEXT : M E
CHARACTER PAIR : R Q
TRANSLATED TEXT : N T
CHARACTER PAIR : X A
TRANSLATED TEXT : S X
TEXT : INSTRUMENTS

PLAIN TEXT :INSTRUMENTS
```

PROGRAM:

```
import java.util.*;
import java.io.*
public class Hillcipher {
    public int keyinverse[][] = new int[3][3];
    public int key[][] = { {17, 17, 5}, {21, 18, 21}, {2, 2, 19} };
    public int plainmat[][] = new int[8][3];
    public int ciphermat[][] = new int[8][3];
    public String ALPHABET = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
    String plain, cipher;
    int row, flag = 0, decrypt = 0;

    public void matdisplay(int mat[][]) {
        for (int i = 0; i < row; i++) {
            for (int j = 0; j < 3; j++)
                System.out.print(mat[i][j] + " ");
            System.out.println();
        }
    }
    public void keydisplay(int mat[][]) {
        for (int i = 0; i < 3; i++) {
            for (int j = 0; j < 3; j++)
                System.out.print(mat[i][j] + " ");
            System.out.println();
        }
    }
    public void inverse() {
        int dtrmnt = 0, mulinvdtrmnt = 0, x, y, z, i, j, a, tmp, p, q;
        int transkey[][] = new int[3][3];
        int minormat[][] = new int[3][3];
        int temp[][] = new int[2][2];
        System.out.println("HILL CIPHER KEY");
        keydisplay(key);
        x = key[0][0] * ((key[1][1] * key[2][2]) - (key[1][2] * key[2][1]));
        y = key[0][1] * ((key[1][0] * key[2][2]) - (key[1][2] * key[2][0]));
        z = key[0][2] * ((key[1][0] * key[2][1]) - (key[1][1] * key[2][0]));
        dtrmnt = (x - y + z) % 26;
        if (dtrmnt < 0) dtrmnt += 26;
        System.out.println("DETERMINANT :" + dtrmnt);
        a = dtrmnt;
        for (i = 0; i < 26; i++) {
            tmp = (a * i) % 26;
            if (tmp == 1) {
                mulinvdtrmnt = i;
                break;
            }
        }
        System.out.println("MULTIPLICATIVE INVERSE OF DETERMINANT:" + mulinvdtrmnt);
        for (i = 0; i < 3; i++) {
            for (j = 0; j < 3; j++)
                transkey[i][j] = key[j][i];
        }
        System.out.println("TRANSPOSED KEY");
        keydisplay(transkey);
        for (i = 0; i < 3; i++) {
            for (j = 0; j < 3; j++) {
                p = 0; q = 0;
                for (x = 0; x < 3; x++) {
                    for (y = 0; y < 3; y++) {
                        if (x != i && y != j) {
                            temp[p][q] = transkey[x][y];
                            q++;
                            if (q == 2) { q = 0; p++; }
                        }
                    }
                }
                minormat[i][j] = (temp[0][0] * temp[1][1]) - (temp[0][1] * temp[1][0]);
                minormat[i][j] = minormat[i][j] * (int) Math.pow(-1, (i + j));
            }
        }
        for (i = 0; i < 3; i++) {
            for (j = 0; j < 3; j++) {
                keyinverse[i][j] = (mulinvdtrmnt * minormat[i][j]) % 26;
                if (keyinverse[i][j] < 0) keyinverse[i][j] += 26;
            }
        }
        System.out.println("KEY INVERSE");
        keydisplay(keyinverse);
    }
    public void str2matrix(String text) {
        int k, p, n;
        flag = 0;
        if ((text.length() % 3) == 1) {
            n = text.length(); text += "XX"; flag = 2;
        } else if ((text.length() % 3) == 2) {
            text += "X"; flag = 1;
        }
        row = text.length() / 3; k = 0;
        for (int i = 0; i < row; i++) {
            for (int j = 0; j < 3; j++) {
                for (p = 0; p < 26; p++) {
                    if (text.charAt(k) == ALPHABET.charAt(p)) {
                        if (decrypt == 1) ciphermat[i][j] = p;
                        else plainmat[i][j] = p;
                    k++; break;
                }
            }
        }
    }
    System.out.println((decrypt == 1 ? "CIPHER" : "PLAIN") + " TEXT MATRIX");
    if (decrypt == 1) matdisplay(ciphermat);
    else matdisplay(plainmat);
    System.out.println();
}
public String matrix2str(int mat[][]) {
    String txt = "", tmp = "";
    for (int i = 0; i < row; i++) {
        for (int j = 0; j < 3; j++) {
            int k = mat[i][j];
            txt += ALPHABET.charAt(k);
        }
    }
    if (decrypt == 1) {
        if (flag == 1) { tmp = txt.substring(0, txt.length() - 1); return tmp; }
        if (flag == 2) { tmp = txt.substring(0, txt.length() - 2); return tmp; }
    }
    return txt;
}
public String hcencryption(String ptxt) {
    int sum; String ctxt = ""; decrypt = 0;
    System.out.println("HILL CIPHER ENCRYPTION");
    str2matrix(ptxt);
    for (int i = 0; i < row; i++) {
        for (int j = 0; j < 3; j++) {
            sum = 0;
            for (int k = 0; k < 3; k++) sum += plainmat[i][k] * key[k][j];
            ciphermat[i][j] = sum % 26;
        }
    }
    System.out.println("CIPHER TEXT MATRIX");
    matdisplay(ciphermat);
    ctxt = matrix2str(ciphermat);
    return ctxt;
}
public String hcdecryption(String ctxt) {
    int sum; String ptxt = ""; decrypt = 1;
    System.out.println("HILL CIPHER DECRYPTION");
    str2matrix(ctxt);
    for (int i = 0; i < row; i++) {
        for (int j = 0; j < 3; j++) {
            sum = 0;
            for (int k = 0; k < 3; k++) sum += ciphermat[i][k] * keyinverse[k][j];
```

```
                plainmat[i][j] = sum % 26;
                if (plainmat[i][j] < 0) plainmat[i][j] += 26;
            }
        }
        System.out.println("PLAIN TEXT MATRIX");
        matdisplay(plainmat);
        ptxt = matrix2str(plainmat);
        return ptxt;
    }
    public static void main(String[] args) {
        Hillcipher hc = new Hillcipher();
        Scanner sc = new Scanner(System.in);
        hc.inverse();
        System.out.println("Enter PLAIN TEXT");
        String ptext = sc.next().toUpperCase();
        String ctext = hc.hcencryption(ptext);
        System.out.println("\nCIPHER TEXT :" + ctext);
        String plaintext = hc.hcdecryption(ctext);
        System.out.println("\nPLAIN TEXT :" + plaintext);
        sc.close();
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java Hillcipher.java
HILL CIPHER KEY
17 17 5
21 18 21
2 2 19
DETERMINANT :23
MULTIPLICATIVE INVERSE OF DETERMINANT:17
TRANSPOSED KEY
17 21 2
17 18 2
5 21 19
KEY INVERSE
4 9 15
15 17 6
24 0 17
Enter PLAIN TEXT
PAY
HILL CIPHER ENCRYPTION
PLAIN TEXT MATRIX
15 0 24
CIPHER TEXT MATRIX
17 17 11
CIPHER TEXT :RRL
HILL CIPHER DECRYPTION
CIPHER TEXT MATRIX
17 17 11
PLAIN TEXT MATRIX
15 0 24
PLAIN TEXT :PAY
```

PROGRAM:

```
import java.util.*;
import java.io.*;
public class Vigenerecipher {
    public static String key = new String();
    public String extndkey;
    public String ALPHABET = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
    public String keyextnsn(String ptxt, String keytxt) {
        int j = 0;
        String nukey = "";
        for (int i = 0; i < ptxt.length(); i++) {
            nukey += keytxt.charAt(j);
            j++;
            if (j == keytxt.length()) j = 0;
        }
        return nukey;
    }
    public int valueofchar(char x) {
        for (int i = 0; i < 26; i++) {
            if (x == ALPHABET.charAt(i)) return i;
        }
        return 0;
    }
    public char charofvalue(int y) {
        return ALPHABET.charAt(y);
    }
    public String vcencryption(String txt) {
        int p, k, tmp1;
        char tmp;
        String ctxt = "";
        extndkey = keyextnsn(txt, key);
        System.out.println("VIGENERE ENCRYPTION");
        System.out.println("PLAIN TEXT : " + txt);
        System.out.println("VIGENERE KEY : " + extndkey);
        for (int i = 0; i < txt.length(); i++) {
            p = valueofchar(txt.charAt(i));
            k = valueofchar(extndkey.charAt(i));
            tmp1 = (p + k) % 26;
            tmp = charofvalue(tmp1);
            ctxt += tmp;
        }
        return ctxt;
    }
    public String vcdecryption(String txt) {
        int c, k, tmp1;
        char ch;
        String ptxt = "";
        System.out.println("VIGENERE DECRYPTION");
        System.out.println("CIPHER TEXT : " + txt);
        System.out.println("VIGENERE KEY : " + extndkey);
        for (int i = 0; i < txt.length(); i++) {
            c = valueofchar(txt.charAt(i));
            k = valueofchar(extndkey.charAt(i));
            tmp1 = (c - k + 26) % 26;
            ch = charofvalue(tmp1);
            ptxt += ch;
        }
        return ptxt;
    }
    public static void main(String[] args) {
        Vigenerecipher vc = new Vigenerecipher();
        Scanner sc = new Scanner(System.in);
        System.out.println("ENTER KEY");
        key = sc.next().toUpperCase();
        System.out.println("Enter PLAIN TEXT");
        String text = sc.next().toUpperCase();
        String ciphertext = vc.vcencryption(text);
        System.out.println("\nCIPHER TEXT :" + ciphertext);
        String plaintext = vc.vcdecryption(ciphertext);
        System.out.println("\nPLAIN TEXT :" + plaintext);
        sc.close();
    }
}
```

<u>OUTPUT:</u>

```
srmvec@cse-2:~/Downloads/Code$ java Vigenerecipher.java
ENTER KEY
LEMON
Enter PLAIN TEXT
ATTACKATDAWN
VIGENERE ENCRYPTION
PLAIN TEXT : ATTACKATDAWN
VIGENERE KEY : LEMONLEMONLE

CIPHER TEXT :LXFOPVEFRNHR
VIGENERE DECRYPTION
CIPHER TEXT : LXFOPVEFRNHR
VIGENERE KEY : LEMONLEMONLE

PLAIN TEXT :ATTACKATDAWN
```

PROGRAM:

```
import java.util.*;

public class Railfence {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int n = 7;
        int[] key = new int[n];

        System.out.println("Enter 7-digit key for column permutation (values 1 to 7 in any order):");
        for (int i = 0; i < n; i++) key[i] = sc.nextInt();

        System.out.print("\nEnter PLAIN TEXT: ");
        String plain = sc.next().toUpperCase();

        while (plain.length() % n != 0) plain += "X";

        int rows = plain.length() / n;
        char[][] mat = new char[rows][n];

        int k = 0;
        for (int i = 0; i < rows; i++) {
            for (int j = 0; j < n; j++) {
                mat[i][j] = plain.charAt(k++);
            }
        }
        System.out.println("\nColumn-wise filled Matrix:");
        for (char[] r : mat) {
            for (char c : r) System.out.print(c + " ");
            System.out.println();
        }
        StringBuilder cipher = new StringBuilder();
        for (int col : key) {
            for (int i = 0; i < rows; i++) cipher.append(mat[i][col - 1]);
        }
        System.out.println("\nCIPHER TEXT: " + cipher);
        char[][] decMat = new char[rows][n];
        k = 0;
        for (int col : key) {
            for (int i = 0; i < rows; i++) {
                decMat[i][col - 1] = cipher.charAt(k++);
            }
        }
        System.out.println("\nRow-wise filled Decryption Matrix:");
        for (char[] r : decMat) {
            for (char c : r) System.out.print(c + " ");
            System.out.println();
        }
        StringBuilder dec = new StringBuilder();
        for (int i = 0; i < rows; i++) {
            for (int j = 0; j < n; j++) dec.append(decMat[i][j]);
        }
        System.out.println("\nDECRYPTED TEXT: " + dec);
    }
}
```

OUTPUT:

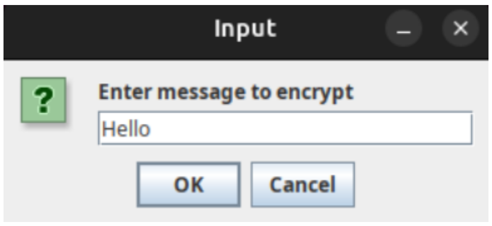
```
srmvec@cse-2:~/Downloads/Code$ java Railfence.java
Enter 7-digit key for column permutation (values 1 to 7 in any order):
3
1
4
7
2
6
5

Enter PLAIN TEXT: HELLOWORLD

Column-wise filled Matrix:
H E L L O W O
R L D X X X X

CIPHER TEXT: LDHRLXOXELWXOX

Row-wise filled Decryption Matrix:
H E L L O W O
R L D X X X X

DECRYPTED TEXT: HELLOWORLDXXXX
```

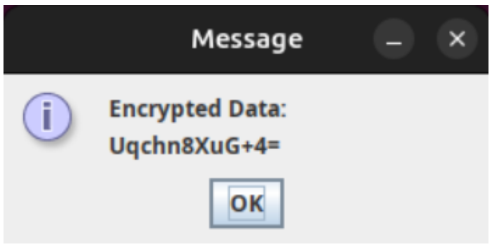
PROGRAM:

```
import javax.swing.*;
import java.security.SecureRandom;
import javax.crypto.Cipher;
import javax.crypto.KeyGenerator;
import javax.crypto.SecretKey;
import javax.crypto.spec.SecretKeySpec;
import java.util.Base64;
import java.util.Random;
public class DES {
    byte[] skey = new byte[1000];
    String skeyString;
    static byte[] raw;
    String inputMessage, encryptedData, decryptedMessage;
    public DES() {
        try {
            generateSymmetricKey();
            inputMessage = JOptionPane.showInputDialog(null, "Enter message to encrypt");
            if (inputMessage == null || inputMessage.isEmpty()) {
                JOptionPane.showMessageDialog(null, "No input provided.");
                return;
            }
            byte[] inputBytes = inputMessage.getBytes();
            byte[] encryptedBytes = encrypt(raw, inputBytes);
            encryptedData = Base64.getEncoder().encodeToString(encryptedBytes);
            System.out.println("Encrypted message: " + encryptedData);
            JOptionPane.showMessageDialog(null, "Encrypted Data:\n" + encryptedData);
            byte[] decryptedBytes = decrypt(raw, Base64.getDecoder().decode(encryptedData));
            decryptedMessage = new String(decryptedBytes);
            System.out.println("Decrypted message: " + decryptedMessage);
            JOptionPane.showMessageDialog(null, "Decrypted Data:\n" + decryptedMessage);
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
    void generateSymmetricKey() {
        try {
            Random r = new Random();
            int num = r.nextInt(10000);
            String knum = String.valueOf(num);
            byte[] knumb = knum.getBytes();
            skey = getRawKey(knumb);
            skeyString = Base64.getEncoder().encodeToString(skey);
            System.out.println("DES Symmetric key (Base64) = " + skeyString);
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
    private static byte[] getRawKey(byte[] seed) throws Exception {
        KeyGenerator kgen = KeyGenerator.getInstance("DES");
        SecureRandom sr = SecureRandom.getInstance("SHA1PRNG");
        sr.setSeed(seed);
        kgen.init(56, sr);
        SecretKey skey = kgen.generateKey();
        raw = skey.getEncoded();
        return raw;
    }
    private static byte[] encrypt(byte[] raw, byte[] clear) throws Exception {
        SecretKeySpec skeySpec = new SecretKeySpec(raw, "DES");
        Cipher cipher = Cipher.getInstance("DES");
        cipher.init(Cipher.ENCRYPT_MODE, skeySpec);
        return cipher.doFinal(clear);
    }
    private static byte[] decrypt(byte[] raw, byte[] encrypted) throws Exception {
        SecretKeySpec skeySpec = new SecretKeySpec(raw, "DES");
        Cipher cipher = Cipher.getInstance("DES");
        cipher.init(Cipher.DECRYPT_MODE, skeySpec);
        return cipher.doFinal(encrypted);
    }
    public static void main(String[] args) {
        new DES();
    }
}
```

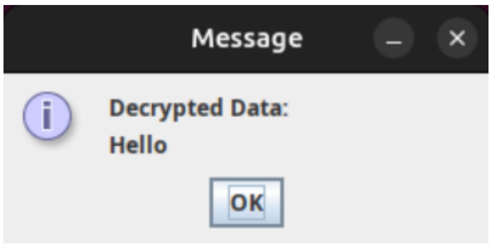
OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java DES.java
DES Symmetric key (Base64) = JQGA7wvHXdM=
Encrypted message: Uqchn8XuG+4=
Decrypted message: Hello
```





Encrypted Data:
Uqchn8XuG+4=



Decrypted Data:
Hello

PROGRAM:

```
package com.includehelp.stringsample;
import java.util.Base64;
import java.util.Scanner;
import javax.crypto.Cipher;
import javax.crypto.spec.IvParameterSpec;
import javax.crypto.spec.SecretKeySpec;
public class AES {
    private static final String encryptionKey = "ABCDEFGHIJKLMNOP";
    private static final String characterEncoding = "UTF-8";
    private static final String cipherTransformation = "AES/CBC/PKCS5PADDING";
    private static final String aesEncryptionAlgorithm = "AES";

    public static String encrypt(String plainText) {
        try {
            Cipher cipher = Cipher.getInstance(cipherTransformation);
            byte[] keyBytes = encryptionKey.getBytes(characterEncoding);
            SecretKeySpec secretKey = new SecretKeySpec(keyBytes, aesEncryptionAlgorithm);
            IvParameterSpec ivParameterSpec = new IvParameterSpec(keyBytes);
            cipher.init(Cipher.ENCRYPT_MODE, secretKey, ivParameterSpec);
            byte[] encryptedBytes = cipher.doFinal(plainText.getBytes(characterEncoding));
            return Base64.getEncoder().encodeToString(encryptedBytes);
        } catch (Exception e) {
            System.err.println("Encryption error: " + e.getMessage());
            return null;
        }
    }
    public static String decrypt(String encryptedText) {
        try {
            Cipher cipher = Cipher.getInstance(cipherTransformation);
            byte[] keyBytes = encryptionKey.getBytes(characterEncoding);
            SecretKeySpec secretKey = new SecretKeySpec(keyBytes, aesEncryptionAlgorithm);
            IvParameterSpec ivParameterSpec = new IvParameterSpec(keyBytes);
            cipher.init(Cipher.DECRYPT_MODE, secretKey, ivParameterSpec);
            byte[] decodedBytes = Base64.getDecoder().decode(encryptedText);
            byte[] decryptedBytes = cipher.doFinal(decodedBytes);
            return new String(decryptedBytes, characterEncoding);
        } catch (Exception e) {
            System.err.println("Decryption error: " + e.getMessage());
            return null;
        }
    }
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter String to Encrypt: ");
        String plainText = scanner.nextLine();
        String encrypted = encrypt(plainText);
        if (encrypted != null) {
            System.out.println("Encrypted String: " + encrypted);
            String decrypted = decrypt(encrypted);
            System.out.println("Decrypted String: " + decrypted);
        } else {
            System.out.println("Encryption failed.");
        }
        scanner.close();
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java AES.java
Enter String to Encrypt: Bolt
Encrypted String: yihmWC6eGdhMqZOkEaOSkg==
Decrypted String: Bolt
```

PROGRAM:

```
import java.math.BigInteger;
import java.util.Random;

public class RSA {
    private BigInteger p, q, n, phi, e, d;
    private int bitLen = 1024;
    private Random rand;

    private static String bytesToString(byte[] bytes) {
        StringBuilder result = new StringBuilder();
        for (byte b : bytes) {
            result.append(b).append(" ");
        }
        return result.toString();
    }

    public RSA() {
        rand = new Random();
        p = BigInteger.probablePrime(bitLen, rand);
        q = BigInteger.probablePrime(bitLen, rand);
        n = p.multiply(q);
        phi = p.subtract(BigInteger.ONE).multiply(q.subtract(BigInteger.ONE));
        e = BigInteger.probablePrime(bitLen / 2, rand);
        while (phi.gcd(e).compareTo(BigInteger.ONE) > 0 && e.compareTo(phi) < 0) {
            e = e.add(BigInteger.ONE);
        }
        d = e.modInverse(phi);
    }

    public byte[] encrypt(byte[] message) {
        return new BigInteger(message).modPow(e, n).toByteArray();
    }

    public byte[] decrypt(byte[] encrypted) {
        return new BigInteger(encrypted).modPow(d, n).toByteArray();
    }

    public static void main(String[] args) {
        try {
            RSA rsa = new RSA();
            String message = "SRM Valliammai";

            System.out.println("=== RSA Algorithm Simulation ===");
            System.out.println("Original message (string): " + message);
            System.out.println("Original message (bytes): " + bytesToString(message.getBytes()));
            byte[] encrypted = rsa.encrypt(message.getBytes());
            System.out.println("Encrypted message (bytes): " + bytesToString(encrypted));

            byte[] decrypted = rsa.decrypt(encrypted);
            System.out.println("Decrypted message (bytes): " + bytesToString(decrypted));
            System.out.println("Decrypted message (string): " + new String(decrypted));
        } catch (Exception e) {
            System.err.println("Exception: " + e.getMessage());
            e.printStackTrace();
        }
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java RSA.java
=== RSA Algorithm Simulation ===
Original message (string): Bolt
Original message (bytes): 66 111 108 116

Encrypted message (bytes): 43 -15 -52 -113 -50 -13 3 -7 -77 -28 -95 105 -94 11 -67 42 11 105 50 58
-82 -2 45 6 -78 47 64 -12 122 -23 40 -109 114 -21 96 78 27 0 122 -10 -72 -69 -30 99 -49 81 20 -33
-52 113 -89 -52 -101 50 93 -78 53 -25 67 59 -119 -95 35 -59 44 21 -112 -124 -99 83 118 -58 1 -120
124 -9 7 92 111 36 126 74 -26 -11 -105 -16 41 24 -86 39 -28 -89 -108 -74 90 79 -60 14 -32 -20 -14 47
-28 -56 -60 86 78 76 -34 49 -11 33 17 -55 5 127 -31 110 113 -124 53 16 40 -37 103 23 103 -104 -11
-117 -91 -102 40 62 119 94 -86 39 -100 -116 -73 -40 110 34 119 63 64 -74 28 -65 -102 -87 112 -71 5
118 115 -79 -20 -104 30 -37 -51 -114 96 55 -23 67 -69 61 -77 27 96 15 -127 -121 119 -65 -52 -49 38
37 115 58 94 112 107 118 -40 11 94 9 -17 7 -50 -90 -21 -20 70 74 25 23 -108 111 -39 19 -95 46 98
-10 -97 18 -106 42 70 54 -123 -12 62 109 56 82 119 -71 -93 -122 8 40 8 52 -128 119 -74 98 -105 54
-44 -109 -73 -103 -19 -70 -128 18 82 7 6 88 108 31 80 -38 -8 -21 -56 35

Decrypted message (bytes): 66 111 108 116
Decrypted message (string): Bolt
```

PROGRAM:

```
import java.io.*;
import java.math.BigInteger;

class DHKE {
    public static void main(String[] args) throws IOException {
        BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
        System.out.print("Enter a prime number (p): ");
        BigInteger p = new BigInteger(br.readLine());
        System.out.print("Enter a primitive root modulo p (g): ");
        BigInteger g = new BigInteger(br.readLine());
        System.out.print("Enter private key for sender (x), 0 < x < p: ");
        BigInteger x = new BigInteger(br.readLine());
        BigInteger R1 = g.modPow(x, p);
        System.out.println("Sender's public key (R1) = " + R1);
        System.out.print("Enter private key for receiver (y), 0 < y < p: ");
        BigInteger y = new BigInteger(br.readLine());
        BigInteger R2 = g.modPow(y, p);
        System.out.println("Receiver's public key (R2) = " + R2);
        BigInteger k1 = R2.modPow(x, p);
        System.out.println("Shared secret key computed by sender: " + k1);
        BigInteger k2 = R1.modPow(y, p);
        System.out.println("Shared secret key computed by receiver: " + k2);
        if (k1.equals(k2)) {
            System.out.println("Success! Both shared keys match.");
        } else {
            System.out.println("Error! Shared keys do not match.");
        }
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java DHKE.java
Enter a prime number (p): 23
Enter a primitive root modulo p (g): 5
Enter private key for sender (x), 0 < x < p: 6
Sender's public key (R1) = 8
Enter private key for receiver (y), 0 < y < p: 15
Receiver's public key (R2) = 19
Shared secret key computed by sender: 2
Shared secret key computed by receiver: 2
Success! Both shared keys match.
```

PROGRAM:

```
import java.security.*;

public class SHA {
    public static void main(String[] a) {
        try {
            MessageDigest md = MessageDigest.getInstance("SHA-1");
            String input = "srm";
            md.update(input.getBytes());
            byte[] output = md.digest();
            System.out.println();
            System.out.println("SHA1(\"" + input + "\") = " + bytesToHex(output));

            input = "vec";
            md.update(input.getBytes());
            output = md.digest();
            System.out.println();
            System.out.println("SHA1(\"" + input + "\") = " + bytesToHex(output));

            input = "valliammai";
            md.update(input.getBytes());
            output = md.digest();
            System.out.println();
            System.out.println("SHA1(\"" + input + "\") = " + bytesToHex(output));
            System.out.println();
        } catch (Exception e) {
            System.out.println("Exception: " + e);
        }
    }
    public static String bytesToHex(byte[] b) {
        char hexDigit[] = {'0', '1', '2', '3', '4', '5', '6', '7', '8', '9', 'A', 'B', 'C', 'D', 'E', 'F'};
        StringBuffer buf = new StringBuffer();
        for (int j = 0; j < b.length; j++) {
            buf.append(hexDigit[(b[j] >> 4) & 0x0f]);
            buf.append(hexDigit[b[j] & 0x0f]);
        }
        return buf.toString();
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java SHA.java

SHA1("srm") = FEB97F07D083079080E3AE6A9523F1FC3FFF6833

SHA1("vec") = B803E7CA5C714DBD85BF00D511FBC99A77690AD2

SHA1("valliammai") = BD46D71D6A8424C88ABBC25B40050B370A23B0FB
```

PROGRAM:

```
import java.util.*;
import java.math.BigInteger;
class DSS {
    final static BigInteger one = BigInteger.ONE;
    final static BigInteger zero = BigInteger.ZERO;
    public static BigInteger getNextPrime(String ans) {
        BigInteger test = new BigInteger(ans);
        while (!test.isProbablePrime(99)) {
            test = test.add(one);
        }
        return test;
    }
    public static BigInteger findQ(BigInteger n) {
        BigInteger start = new BigInteger("2");
        while (!n.isProbablePrime(99)) {
            while (!(n.mod(start).equals(zero))) {
                start = start.add(one);
            }
            n = n.divide(start);
        }
        return n;
    }
    public static BigInteger getGen(BigInteger p, BigInteger q, Random r) {
        BigInteger h;
        do {
            h = new BigInteger(p.bitLength(), r);
            h = h.mod(p.subtract(one)).add(one);
        } while (h.equals(one));
        return h.modPow((p.subtract(one)).divide(q), p);
    }
    public static void main(String[] args) throws Exception {
        Random randObj = new Random();
        BigInteger p = getNextPrime("10600");
        BigInteger q = findQ(p.subtract(one));
        BigInteger g = getGen(p, q, randObj);
        System.out.println("Digital Signature Algorithm");
        System.out.println("Global public key components are:");
        System.out.println("p is: " + p);
        System.out.println("q is: " + q);
        System.out.println("g is: " + g);
        BigInteger x = new BigInteger(q.bitLength(), randObj).mod(q);
        BigInteger y = g.modPow(x, p);
        BigInteger k;
        do {
            k = new BigInteger(q.bitLength(), randObj).mod(q);
        } while (k.equals(BigInteger.ZERO) || !k.gcd(q).equals(BigInteger.ONE));
        BigInteger hashVal = new BigInteger(p.bitLength(), randObj);
        BigInteger r = (g.modPow(k, p)).mod(q);
        BigInteger kInv = k.modInverse(q);
        BigInteger s = kInv.multiply(hashVal.add(x.multiply(r))).mod(q);
        System.out.println("Secret information:");
        System.out.println("x (private) is: " + x);
        System.out.println("k (secret) is: " + k);
        System.out.println("y (public) is: " + y);
        System.out.println("h (random hash) is: " + hashVal);
        System.out.println("Generating digital signature:");
        System.out.println("r is: " + r);
        System.out.println("s is: " + s);
        BigInteger w = s.modInverse(q);
        BigInteger u1 = (hashVal.multiply(w)).mod(q);
        BigInteger u2 = (r.multiply(w)).mod(q);
        BigInteger v = (g.modPow(u1, p).multiply(y.modPow(u2, p))).mod(p).mod(q);
        System.out.println("Verifying digital signature (checkpoints):");
        System.out.println("w is: " + w);
        System.out.println("u1 is: " + u1);
        System.out.println("u2 is: " + u2);
        System.out.println("v is: " + v);
        if (v.equals(r)) {
            System.out.println("Success: digital signature is verified! " + r);
        } else {
            System.out.println("Error: incorrect digital signature");
        }
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java DSS.java
Digital Signature Algorithm
Global public key components are:
p is: 10601
q is: 53
g is: 2863
Secret information:
x (private) is: 47
k (secret) is: 9
y (public) is: 5582
h (random hash) is: 13379
Generating digital signature:
r is: 25
s is: 33
Verifying digital signature (checkpoints):
w is: 45
u1 is: 28
u2 is: 12
v is: 25
Success: digital signature is verified! 25
```

PROGRAM:

```
import java.util.Arrays;
import java.security.MessageDigest;
import java.security.SecureRandom;
import javax.crypto.Cipher;
import javax.crypto.SecretKey;
import javax.crypto.spec.SecretKeySpec;
import javax.crypto.spec.IvParameterSpec;
import java.util.Base64;
import java.nio.charset.StandardCharsets;
public class TDES {
    public static void main(String[] args) throws Exception {
        String message = "Bolt";
        String secretKey = "SecretKey";
        TDES tdes = new TDES();
        String encrypted = tdes.encrypt(message, secretKey);
        String decrypted = tdes.decrypt(encrypted, secretKey);
        System.out.println("Encrypted (Base64): " + encrypted);
        System.out.println("Decrypted: " + decrypted);
    }
    public String encrypt(String message, String secretKey) throws Exception {
        MessageDigest md = MessageDigest.getInstance("SHA-1");
        byte[] digest = md.digest(secretKey.getBytes(StandardCharsets.UTF_8));
        byte[] keyBytes = Arrays.copyOf(digest, 24);
        for (int i = 16; i < 24; i++) {
            keyBytes[i] = keyBytes[i - 16];
        }
        SecretKey key = new SecretKeySpec(keyBytes, "DESede");
        byte[] ivBytes = new byte[8];
        SecureRandom random = new SecureRandom();
        random.nextBytes(ivBytes);
        IvParameterSpec iv = new IvParameterSpec(ivBytes);
        Cipher cipher = Cipher.getInstance("DESede/CBC/PKCS5Padding");
        cipher.init(Cipher.ENCRYPT_MODE, key, iv);
        byte[] plainTextBytes = message.getBytes(StandardCharsets.UTF_8);
        byte[] encryptedBytes = cipher.doFinal(plainTextBytes);
        byte[] combined = new byte[ivBytes.length + encryptedBytes.length];
        System.arraycopy(ivBytes, 0, combined, 0, ivBytes.length);
        System.arraycopy(encryptedBytes, 0, combined, ivBytes.length, encryptedBytes.length);
        return Base64.getEncoder().encodeToString(combined);
    }
    public String decrypt(String encryptedText, String secretKey) throws Exception {
        byte[] combined = Base64.getDecoder().decode(encryptedText);
        byte[] ivBytes = Arrays.copyOfRange(combined, 0, 8);
        IvParameterSpec iv = new IvParameterSpec(ivBytes);
        byte[] encryptedBytes = Arrays.copyOfRange(combined, 8, combined.length);
        MessageDigest md = MessageDigest.getInstance("SHA-1");
        byte[] digest = md.digest(secretKey.getBytes(StandardCharsets.UTF_8));
        byte[] keyBytes = Arrays.copyOf(digest, 24);
        for (int i = 16; i < 24; i++) {
            keyBytes[i] = keyBytes[i - 16];
        }
        SecretKey key = new SecretKeySpec(keyBytes, "DESede");
        Cipher cipher = Cipher.getInstance("DESede/CBC/PKCS5Padding");
        cipher.init(Cipher.DECRYPT_MODE, key, iv);
        byte[] decryptedBytes = cipher.doFinal(encryptedBytes);
        return new String(decryptedBytes, StandardCharsets.UTF_8);
    }
}
```

OUTPUT:

```
srmvec@cse-2:~/Downloads/Code$ java TDES.java
Encrypted (Base64): wnKIAXvesaoV7q6H+DQHHw==
Decrypted: Bolt
```