1.XOR a string with a Zero

AIM: Write a C program that contains a string (char pointer) with a value \HelloWorld'. The program should XOR each character in this string with 0 and display the result.

PROGRAM:

```
#include <stdlib.h>
void main()
{
    char str[] = "Hello World";
    char str1[11];
    int i, len;
    len = strlen(str);
    for (i = 0; i < len; i++)
    {
        str1[i] = str[i] ^ 0;
        printf("%c", str1[i]);
    }
    printf("\n");
}
```

Output:

```
Hello World

Hello World
```

2.XOR a string with a 127

AIM: Write a C program that contains a string (char pointer) with a value \HelloWorld'. The program should AND or and XOR each character in this string with 127 and display the result.

PROGRAM:

```
#include <stdio.h>
#include <stdlib.h>
void main()
{
    char str[] = "Hello World";
    char str1[11];
    char str2[11] = str[];
    int i, len;
    len = strlen(str);
    for (i = 0; i < len; i++)
    {
        str1[i] = str[i] & 127;
        printf("%c", str1[i]);
    }
    printf("\n");
    for (i = 0; i < len; i++)
    {
        str3[i] = str2[i] ^ 127;
        printf("%c", str3[i]);
    }
    printf("\n");
}
```

Output:

Hello World

Hello World

Hello World

3.Encryption & Decryption using Cipher Algorithms

AIM: Write a Java program to perform encryption and decryption using the following algorithms:

a) Ceaser Cipher

b) Substitution Cipher

c) Hill Cipher

PROGRAM:

a) Ceaser Cipher

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.util.Scanner;

public class CeaserCipher {
    static Scanner sc = new Scanner(System.in);
    static BufferedReader br = new BufferedReader(new InputStreamReader(System.in));

    public static void main(String[] args) throws IOException {
        System.out.print("Enter any String: ");
        String str = br.readLine();
        System.out.print("\nEnter the Key: ");
        int key = sc.nextInt();
        String encrypted = encrypt(str, key);
        System.out.println("\nEncrypted String is: " + encrypted);
        String decrypted = decrypt(encrypted, key);
        System.out.println("\nDecrypted String is: " + decrypted);
        System.out.println("\n");
    }

    public static String encrypt(String str, int key) {
        String encrypted = "";
        for (int i = 0; i < str.length(); i++) {
            int c = str.charAt(i);
            if (Character.isUpperCase(c)) {
                c = c + (key % 26);
                if (c > 'Z')
                    c = c - 26;
            } else if (Character.isLowerCase(c)) {
                c = c + (key % 26);
                if (c > 'z')
                    c = c - 26;
            }
            encrypted += (char) c;
        }
        return encrypted;
    }

    public static String decrypt(String str, int key) {
        String decrypted = "";
        for (int i = 0; i < str.length(); i++) {
            int c = str.charAt(i);
            if (Character.isUpperCase(c)) {
                c = c - (key % 26);
                if (c < 'A')
                    c = c + 26;
            } else if (Character.isLowerCase(c)) {
                c = c - (key % 26);
                if (c < 'a')
                    c = c + 26;
            }
            decrypted += (char) c;
        }
        return decrypted;
    }
}
```

Output:

```
Enter any String: Hello, World!

Enter the Key: 3

Encrypted String is: Khoor, Zruog!

Decrypted String is: Hello, World!
```

b) Substitution Cipher

PROGRAM:

```
import java.io.*;
import java.util.*;

public class SubstitutionCipher {
    static Scanner sc = new Scanner(System.in);
    static BufferedReader br = new BufferedReader(new InputStreamReader(System.in));

    public static void main(String[] args) throws IOException {
        String a = "abcdefghijklmnopqrstuvwxyz";
        String b = "zyxwvutsrqponmlkjihgfedcba";
        System.out.print("Enter any string: ");
        String str = br.readLine();
        String decrypt = "";
        char c;
        for (int i = 0; i < str.length(); i++) {
            c = str.charAt(i);
            int j = a.indexOf(c);
            decrypt = decrypt + b.charAt(j);
        }
        System.out.println("The encrypted data is: " + decrypt);
    }
}
```

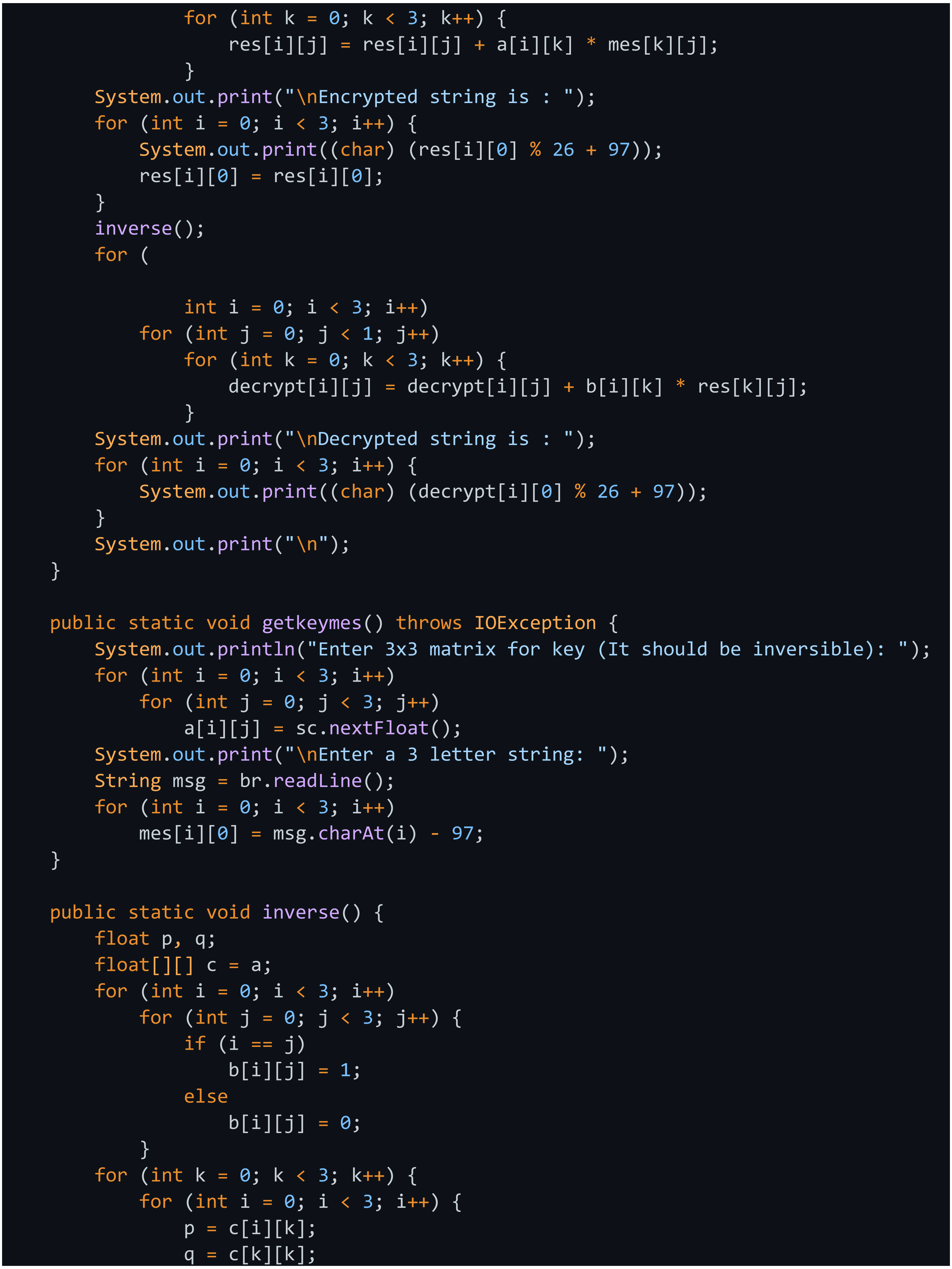
Output:

```
Enter any string: hello

The encrypted data is: svool
```

c) Hill Cipher

PROGRAM:

```
import java.io.*;
import java.util.*;

public class HillCipher {
    static float[][] decrypt = new float[3][1];
    static float[][] a = new float[3][3];
    static float[][] b = new float[3][3];
    static float[][] mes = new float[3][1];
    static float[][] res = new float[3][1];
    static BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
    static Scanner sc = new Scanner(System.in);

    public static void main(String[] args) throws IOException {

        getkeymes();
        for (int i = 0; i < 3; i++)
            for (int j = 0; j < 1; j++)
```



```
                for (int k = 0; k < 3; k++) {
                    res[i][j] = res[i][j] + a[i][k] * mes[k][j];
                }
        System.out.print("\nEncrypted string is : ");
        for (int i = 0; i < 3; i++) {
            System.out.print((char) (res[i][0] % 26 + 97));
            res[i][0] = res[i][0];
        }
        inverse();
        for (

                int i = 0; i < 3; i++)
            for (int j = 0; j < 1; j++)
                for (int k = 0; k < 3; k++) {
                    decrypt[i][j] = decrypt[i][j] + b[i][k] * res[k][j];
                }
        System.out.print("\nDecrypted string is : ");
        for (int i = 0; i < 3; i++) {
            System.out.print((char) (decrypt[i][0] % 26 + 97));
        }
        System.out.print("\n");
    }

    public static void getkeymes() throws IOException {
        System.out.println("Enter 3x3 matrix for key (It should be inversible): ");
        for (int i = 0; i < 3; i++)
            for (int j = 0; j < 3; j++)
                a[i][j] = sc.nextFloat();
        System.out.print("\nEnter a 3 letter string: ");
        String msg = br.readLine();
        for (int i = 0; i < 3; i++)
            mes[i][0] = msg.charAt(i) - 97;
    }

    public static void inverse() {
        float p, q;
        float[][] c = a;
        for (int i = 0; i < 3; i++)
            for (int j = 0; j < 3; j++) {
                if (i == j)
                    b[i][j] = 1;
                else
                    b[i][j] = 0;
            }
        for (int k = 0; k < 3; k++) {
            for (int i = 0; i < 3; i++) {
                p = c[i][k];
                q = c[k][k];
```

```java
                for (int j = 0; j < 3; j++) {
                    if (i != k) {
                        c[i][j] = c[i][j] * q - p * c[k][j];
                        b[i][j] = b[i][j] * q - p * b[k][j];
                    }
                }
            }
        }
        for (int i = 0; i < 3; i++)
            for (int j = 0; j < 3; j++) {
                b[i][j] = b[i][j] / c[i][i];
            }
        System.out.println("");
        System.out.println("\nInverse Matrix is : ");
        for (int i = 0; i < 3; i++) {
            for (int j = 0; j < 3; j++)
                System.out.print(b[i][j] + " ");
            System.out.print("\n");
        }
    }
}
```

Output:

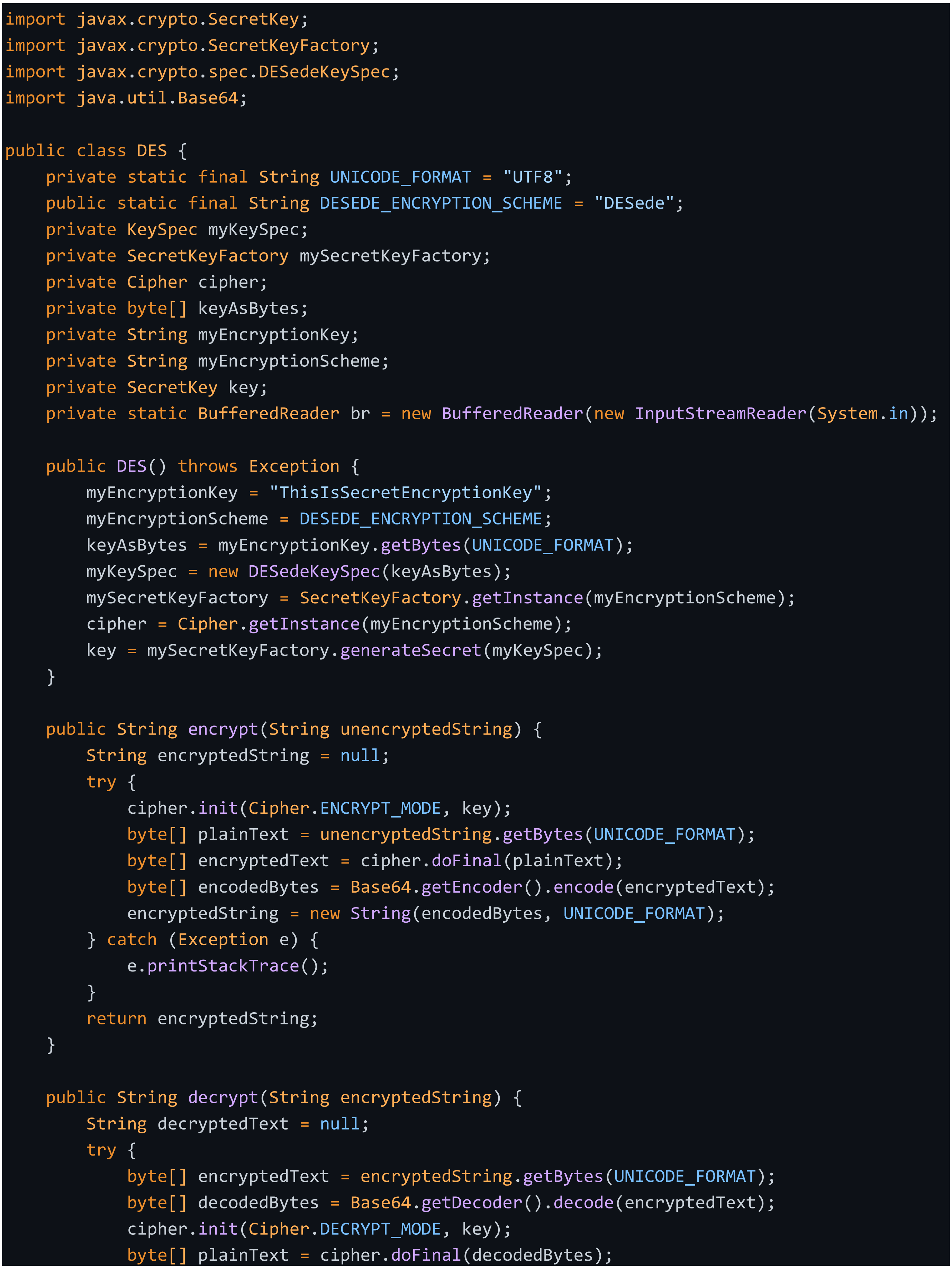
```
Enter 3x3 matrix for key (It should be inversible):

2 4 1

1 7 3

3 3 3

Enter a 3 letter string: abc

Encrypted string is : gnj

Inverse Matrix is :

0.4 -0.3 0.16666667

0.2 0.1 -0.16666667

-0.6 0.2 0.33333334

Decrypted string is : abc
```

4. Java program for DES algorithm logic

AIM: Write a Java program to implement the DES algorithm logic.

PROGRAM:

```java
import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.security.spec.KeySpec;
import javax.crypto.Cipher;
```



```java
import javax.crypto.SecretKey;
import javax.crypto.SecretKeyFactory;
import javax.crypto.spec.DESedeKeySpec;
import java.util.Base64;

public class DES {
    private static final String UNICODE_FORMAT = "UTF8";
    public static final String DESEDE_ENCRYPTION_SCHEME = "DESede";
    private KeySpec myKeySpec;
    private SecretKeyFactory mySecretKeyFactory;
    private Cipher cipher;
    private byte[] keyAsBytes;
    private String myEncryptionKey;
    private String myEncryptionScheme;
    private SecretKey key;
    private static BufferedReader br = new BufferedReader(new InputStreamReader(System.in));

    public DES() throws Exception {
        myEncryptionKey = "ThisIsSecretEncryptionKey";
        myEncryptionScheme = DESEDE_ENCRYPTION_SCHEME;
        keyAsBytes = myEncryptionKey.getBytes(UNICODE_FORMAT);
        myKeySpec = new DESedeKeySpec(keyAsBytes);
        mySecretKeyFactory = SecretKeyFactory.getInstance(myEncryptionScheme);
        cipher = Cipher.getInstance(myEncryptionScheme);
        key = mySecretKeyFactory.generateSecret(myKeySpec);
    }

    public String encrypt(String unencryptedString) {
        String encryptedString = null;
        try {
            cipher.init(Cipher.ENCRYPT_MODE, key);
            byte[] plainText = unencryptedString.getBytes(UNICODE_FORMAT);
            byte[] encryptedText = cipher.doFinal(plainText);
            byte[] encodedBytes = Base64.getEncoder().encode(encryptedText);
            encryptedString = new String(encodedBytes, UNICODE_FORMAT);
        } catch (Exception e) {
            e.printStackTrace();
        }
        return encryptedString;
    }

    public String decrypt(String encryptedString) {
        String decryptedText = null;
        try {
            byte[] encryptedText = encryptedString.getBytes(UNICODE_FORMAT);
            byte[] decodedBytes = Base64.getDecoder().decode(encryptedText);
            cipher.init(Cipher.DECRYPT_MODE, key);
            byte[] plainText = cipher.doFinal(decodedBytes);
            decryptedText = new String(plainText, UNICODE_FORMAT);
        } catch (Exception e) {
            e.printStackTrace();
        }
        return decryptedText;
    }

    public static void main(String args[]) throws Exception {
        System.out.print("Enter the string: ");
        DES myEncryptor = new DES();
        String stringToEncrypt = br.readLine();
        String encrypted = myEncryptor.encrypt(stringToEncrypt);
        String decrypted = myEncryptor.decrypt(encrypted);
        System.out.println("\nString To Encrypt: " + stringToEncrypt);
        System.out.println("\nEncrypted Value : " + encrypted);
        System.out.println("\nDecrypted Value : " + decrypted);
        System.out.println("");
    }
}
```

Output:

```
Enter the string: Hello, World!

String To Encrypt: Hello, World!

Encrypted Value : wRxQ/3AZwzSsj8nSoIFTdA==

Decrypted Value : Hello, World!
```

5. Program to implement BlowFish algorithm logic

AIM: Write a C/JAVA program to implement the BlowFish algorithm logic.

PROGRAM:

```java
import java.io.FileInputStream;
import java.io.FileOutputStream;
import java.security.Key;
import javax.crypto.Cipher;
import javax.crypto.CipherOutputStream;
import javax.crypto.KeyGenerator;
import java.util.Base64;

public class BlowFish {
    public static void main(String[] args) throws Exception {
        KeyGenerator keyGenerator = KeyGenerator.getInstance("Blowfish");
        keyGenerator.init(128);
        Key secretKey = keyGenerator.generateKey();
        Cipher cipherOut = Cipher.getInstance("Blowfish/CFB/NoPadding");
        cipherOut.init(Cipher.ENCRYPT_MODE, secretKey);
        Base64.Encoder encoder = Base64.getEncoder();
        byte[] iv = cipherOut.getIV();
        if (iv != null) {
            System.out.println("Initialization Vector of the Cipher: " + encoder.encodeToString(iv));
        }
        FileInputStream fin = new FileInputStream("inputFile.txt");
        FileOutputStream fout = new FileOutputStream("outputFile.txt");
        CipherOutputStream cout = new CipherOutputStream(fout, cipherOut);
        int input = 0;
        while ((input = fin.read()) != -1) {
            cout.write(input);
        }
        fin.close();
        cout.close();
    }
}
```

Output:

Initialization Vector of the Cipher: 9cUvFIVGbio=

6. Program to implement Rijndael algorithm logic

AIM: Write a C/JAVA program to implement the Rijndael algorithm logic.

PROGRAM:

```
import javax.crypto.*;
import javax.crypto.spec.*;

public class AES {
    public static String asHex(byte buf[]) {
        StringBuffer strbuf = new StringBuffer(buf.length *2);
        int i;
        for (i = 0; i < buf.length; i++) {
            if (((int) buf[i] & 0xff) < 0x10)
                strbuf.append("0");
            strbuf.append(Long.toString((int) buf[i] & 0xff, 16));
        }
        return strbuf.toString();
    }

    public static void main(String[] args) throws Exception {
        String message = "AES still rocks!!";
        // Get the KeyGenerator
        KeyGenerator kgen = KeyGenerator.getInstance("AES");
        kgen.init(128); // 192 and 256 bits may not be available
        // Generate the secret key specs.
        SecretKey skey = kgen.generateKey();
        byte[] raw = skey.getEncoded();
        SecretKeySpec skeySpec = new SecretKeySpec(raw, "AES");
        // Instantiate the cipher
        Cipher cipher = Cipher.getInstance("AES");
        cipher.init(Cipher.ENCRYPT_MODE, skeySpec);
        byte[] encrypted = cipher.doFinal((args.length == 0 ? message : args[0]).getBytes());
        System.out.println("encrypted string: " +
                asHex(encrypted));
        cipher.init(Cipher.DECRYPT_MODE, skeySpec);
        byte[] original = cipher.doFinal(encrypted);
        String originalString = new String(original);
        System.out.println("Original string: " + originalString + " " + asHex(original));
    }
}
```

Output:

```
encrypted string: 6d4e7ebbfb03fc99b38e2d55c9b3c4143449bb8e86fefdbb2bc53ad31078078d

Original string: AES still rocks!! 414553207374696c6c20726f636b732121
```

7. Encrypt a string using BlowFish algorithm

AIM: Using Java Cryptography, encrypt the text “Hello world” using Blowfish. Create your own key using Java key tool.

PROGRAM:

```
import javax.crypto.Cipher;
import javax.crypto.KeyGenerator;
import javax.crypto.SecretKey;
import javax.swing.JOptionPane;

public class BlowFishCipher {
    public static void main(String[] args) throws Exception {
        KeyGenerator keygenerator = KeyGenerator.getInstance("Blowfish");
        SecretKey secretkey = keygenerator.generateKey();
        Cipher cipher = Cipher.getInstance("Blowfish");
        cipher.init(Cipher.ENCRYPT_MODE, secretkey);
        String inputText = JOptionPane.showInputDialog("Input your message:");
        byte[] encrypted = cipher.doFinal(inputText.getBytes());
        cipher.init(Cipher.DECRYPT_MODE, secretkey);
        byte[] decrypted = cipher.doFinal(encrypted);
        JOptionPane.showMessageDialog(
                JOptionPane.getRootFrame(),
                "\nEncrypted text: " + new String(encrypted) + "\n" +
                        "\nDecrypted text: " + new String(decrypted));
        System.exit(0);
    }
}
```

OUTPUT:

Input your message: Hello world

Encrypted text: 3ooo&&(*&*4r4

Decrypted text: Hello world

8. RSA Algorithm

AIM: Write a Java program to implement RSA Algorithm.

PROGRAM:

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

public class RSA {
    static Scanner sc = new Scanner(System.in);

    public static void main(String[] args) {
        System.out.print("Enter a Prime number: ");
        BigInteger p = sc.nextBigInteger(); // Here's one prime number..
        System.out.print("Enter another prime number: ");
        BigInteger q = sc.nextBigInteger(); // ..and another.
        BigInteger n = p.multiply(q);
        BigInteger n2 = p.subtract(BigInteger.ONE).multiply(q.subtract(BigInteger.ONE));
        BigInteger e = generateE(n2);
        BigInteger d = e.modInverse(n2); // Here's the multiplicative inverse
        System.out.println("Encryption keys are: " + e + ", " + n);
        System.out.println("Decryption keys are: " + d + ", " + n);
    }

    public static BigInteger generateE(BigInteger fiofn) {
        int y;
        int intGCD;
        BigInteger e;
        BigInteger gcd;
        Random x = new Random();
        do {
            y = x.nextInt(fiofn.intValue() - 2) + 2; // Adjust range to [2, fiofn - 1]
            e = BigInteger.valueOf(y);
            gcd = fiofn.gcd(e);
            intGCD = gcd.intValue();
        } while (y <= 2 || intGCD != 1);
        return e;
    }
}
```

OUTPUT:

```
Enter a Prime number: 5

Enter another prime number: 11

Encryption keys are: 7, 55

Decryption keys are: 23, 55
```

9. Diffie-Hellman

AIM: Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).

PROGRAM:

```java
import java.math.BigInteger;
import java.security.KeyFactory;
import java.security.KeyPair;
import java.security.KeyPairGenerator;
import java.security.PublicKey;
import java.security.spec.X509EncodedKeySpec;
import javax.crypto.spec.DHParameterSpec;
import java.security.SecureRandom;

public class DiffieHellman {
    public final static int pValue = 47;
    public final static int gValue = 71;
    public final static int XaValue = 9;
    public final static int XbValue = 14;

    public static void main(String[] args) throws Exception {
        int bitLength = 512; // 512 bits
        SecureRandom rnd = new SecureRandom();
        BigInteger p = BigInteger.probablePrime(bitLength, rnd);
        BigInteger g = BigInteger.probablePrime(bitLength, rnd);

        createSpecificKey(p, g);
    }

    public static void createKey() throws Exception {
        KeyPairGenerator kpg = KeyPairGenerator.getInstance("DiffieHellman");
        kpg.initialize(512);
        KeyPair kp = kpg.generateKeyPair();
        KeyFactory kfactory = KeyFactory.getInstance("DiffieHellman");
        X509EncodedKeySpec x509KeySpec = new X509EncodedKeySpec(kp.getPublic().getEncoded());
        PublicKey publicKey = kfactory.generatePublic(x509KeySpec);
        System.out.println("Public key is: " + publicKey);
    }

    public static void createSpecificKey(BigInteger p, BigInteger g) throws Exception {
        KeyPairGenerator kpg = KeyPairGenerator.getInstance("DiffieHellman");
        kpg.initialize(new DHParameterSpec(p, g));
        KeyPair kp = kpg.generateKeyPair();
        KeyFactory kfactory = KeyFactory.getInstance("DiffieHellman");
        X509EncodedKeySpec x509KeySpec = new X509EncodedKeySpec(kp.getPublic().getEncoded());
        PublicKey publicKey = kfactory.generatePublic(x509KeySpec);
        System.out.println("\nPublic key is : " + publicKey);
    }
}
```

OUTPUT:

```
Public key is : SunJCE Diffie-Hellman Public Key:
y:
  1af437bb 47934bbb 0b111c45 ea81ee5a a3b2a0c6 269d8bb2 6c4b0c32 8478cc0b
  c5830cd1 b7d1abab 29993a9f b1739fcf 7fe30feb d7511eaa 8823d07b e1b4ed58
p:
  ad2553e9 4521d8f0 92609ff0 99d7157e 4c2b8bde f0f9aa96 2b0aca63 417e24ba
  7e81fe32 4bb11530 05710a2f 73922528 103eabbc 74d6659e 8bace8ef 25f6cacf
g:
  ea790cdc f312a9e9 0748bea2 d0ee1dd2 f195c87a da0a0077 112c2857 9f16beea
  b61edc54 ced0b0eb 1af45434 239bf1d4 0fe0700f 337ce6c4 c43d116f c0b2c5f1
l:
  384
```

10. SHA-1

AIM: Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

PROGRAM:

```java
import java.security.*;

public class SHA1 {
    public static void main(String[] a) {
        try {
            MessageDigest md = MessageDigest.getInstance("SHA1");
            System.out.println("Message digest object info: ");
            System.out.println(" Algorithm = " + md.getAlgorithm());
            System.out.println(" Provider = " + md.getProvider());
            System.out.println(" ToString = " + md.toString());
            String input = "";
            md.update(input.getBytes());
            byte[] output = md.digest();
            System.out.println();
            System.out.println("SHA1(\"" + input + "\") = " + bytesToHex(output));
            input = "abc";
            md.update(input.getBytes());
            output = md.digest();
            System.out.println();
            System.out.println("SHA1(\"" + input + "\") = " + bytesToHex(output));
            input = "abcdefghijklmnopqrstuvwxyz";
            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:

```
Message digest object info:

 Algorithm = SHA1

 Provider = SUN version 20

 ToString = SHA1 Message Digest from SUN, <initialized>

SHA1("") = DA39A3EE5E6B4B0D3255BFEF95601890AFD80709

SHA1("abc") = A9993E364706816ABA3E25717850C26C9CD0D89D

SHA1("abcdefghijklmnopqrstuvwxyz") = 32D10C7B8CF96570CA04CE37F2A19D84240D3A89
```

11. Message Digest Algorithm5 (MD5)

AIM: Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

PROGRAM:

```
import java.security.*;
```

```java
public class MD5 {
    public static void main(String[] a) {
        try {
            MessageDigest md = MessageDigest.getInstance("MD5");
            System.out.println("Message digest object info: ");
            System.out.println(" Algorithm = " + md.getAlgorithm());
            System.out.println(" Provider = " + md.getProvider());
            System.out.println(" ToString = " + md.toString());
            String input = "";
            md.update(input.getBytes());
            byte[] output = md.digest();
            System.out.println();
            System.out.println("MD5(\"" + input + "\") = " + bytesToHex(output));
            input = "abc";
            md.update(input.getBytes());
            output = md.digest();
            System.out.println();
            System.out.println("MD5(\"" + input + "\") = " + bytesToHex(output));
            input = "abcdefghijklmnopqrstuvwxyz";
            md.update(input.getBytes());
            output = md.digest();
            System.out.println();
            System.out.println("MD5(\"" + 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:
Message digest object info:

Algorithm = MD5

Provider = SUN version 20
```

```
ToString = MD5 Message Digest from SUN, <initialized>

MD5("") = D41D8CD98F00B204E9800998ECF8427E

MD5("abc") = 900150983CD24FB0D6963F7D28E17F72

MD5("abcdefghijklmnopqrstuvwxyz") = C3FCD3D76192E4007DFB496CCA67E13B
```