Practical.No-01

Aim : Design and implement algorithms to encrypt and decrypt messages using classical substitution and transposition techniques.

- **Caesar Cipher**
- **Monoalphabetic Cipher**
- **Rail Fence Cipher**
- **Simple Columnar Technique**
- **Vernam Cipher**

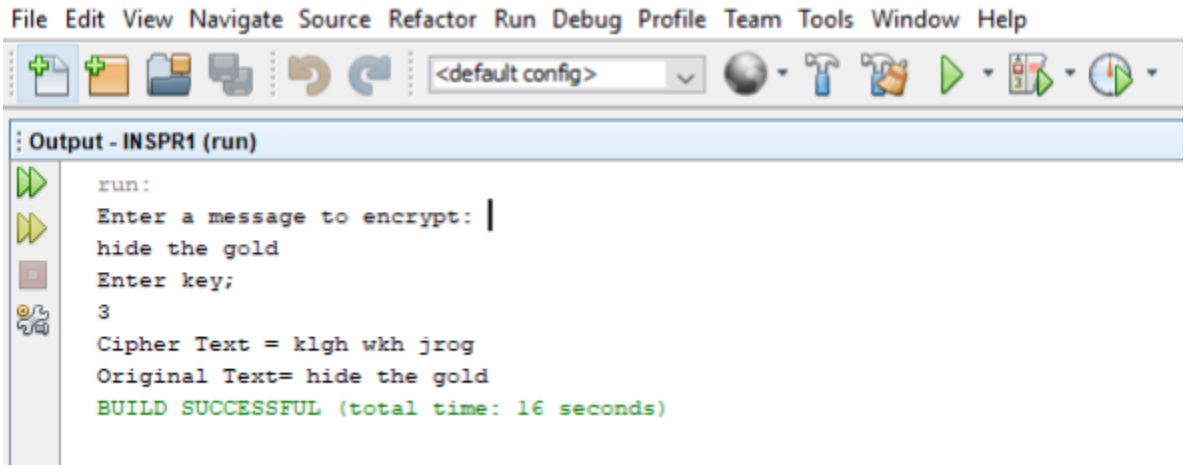
Source Code:

- **Caesar Cipher :**

```
import java.util.Scanner;

public class CeasarCiphar {

    String message;
    static int key;

    static String encryptCaesar(String message1, int key1) {

        char ch;
        String encryptMessage = "";
        for (int i = 0; i < message1.length(); ++i) {
            ch = message1.charAt(i);

            if (ch >= 'a' && ch <= 'z') {
                ch = (char) (ch + key1);

                if (ch > 'z') {
                    ch = (char) (ch - 'z' + 'a' - 1);
                }
                encryptMessage += ch;
            } else if (ch >= 'A' && ch <= 'Z') {
                ch = (char) (ch + key1);

                if (ch > 'Z') {
                    ch = (char) (ch - 'Z' + 'A' - 1);
                }
                encryptMessage += ch;
            } else {
                encryptMessage += ch;
            }

        }
```

```
        return encryptMessage;
    }

    static String descryptCeasar(String message1, int key1) {
        char ch;
        String decryptMessage = "";
        for (int i = 0; i < message1.length(); ++i) {
            ch = message1.charAt(i);

            if (ch >= 'a' && ch <= 'z') {
                ch = (char) (ch - key1);

                if (ch < 'a') {
                    ch = (char) (ch + 'z' - 'a' + 1);
                }
                decryptMessage += ch;
            } else if (ch >= 'A' && ch <= 'Z') {
                ch = (char) (ch - key1);

                if (ch > 'A') {
                    ch = (char) (ch + 'Z' - 'A' + 1);
                }
                decryptMessage += ch;
            } else {
                decryptMessage += ch;
            }

        }
        return decryptMessage;
    }


    public static void main(String args[]) {
        String plainText;
        int key;
        String CipherText;

        Scanner sc = new Scanner(System.in);

        System.out.println("Enter a message to encrypt: ");
        plainText = sc.nextLine();

        System.out.println("Enter key; ");
        key = sc.nextInt();
        CipherText = encryptCaesar(plainText, key);
        System.out.println("Cipher Text = " + CipherText);

        System.out.println("Original Text= " + descryptCeasar(CipherText,
key));
    }

}
```

Output:



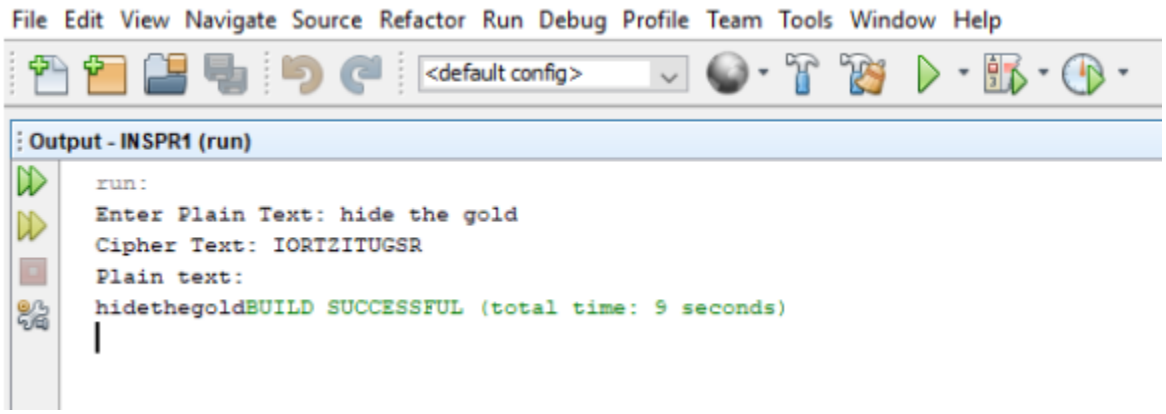
Source Code:

- **Monoalphabetic Cipher:**

```
import java.util.Scanner;

public class MonoalplabetCipher {

    public static void main(String args[]) {
        final char RALPHABETS[] = {'a', 'b', 'c',
'd','e','f','g','h','i','j','k','l','m','n','o','p','q','r','s','t','u','v
','w','x','y','z'};
        final char MALPHABETS[] =
{'Q','W','E','R','T','Y','U','I','O','P','A','S','D','F','G','H','J','K','
L','Z','X','C','V','B','B','N','M'};

        Scanner s = new Scanner(System.in);
        String pltext;
        char citext[] = new char[20];
        char detext[] = new char[20];

        int i, l;
        System.out.print("Enter Plain Text: ");
        pltext = s.nextLine();

        pltext = pltext.toLowerCase();

        l = (pltext.length());
        for (i = 0; i < l; i++) {
            for (int j = 0; j < 26; j++) {
                if (RALPHABETS[j] == pltext.charAt(i)) {
                    citext[i] = MALPHABETS[j];
                    break;
                }
            }
        }
        System.out.print("Cipher Text: ");
```

```
        for (i = 0; i < l; i++) {
            System.out.print(citext[i]);
        }

        String b = new String(citext);

        for (i = 0; i < l; i++) {
            for (int j = 0; j < 26; j++) {
                if (MALPHABETS[j] == b.charAt(i)) {
                    detext[i] = RALPHABETS[j];
                    break;
                }
            }
        }

        System.out.println("\nPlain text:");

        for (i = 0; i < l; i++) {
            System.out.print(detext[i]);
        }
    }
}
```

Output:



Source Code:

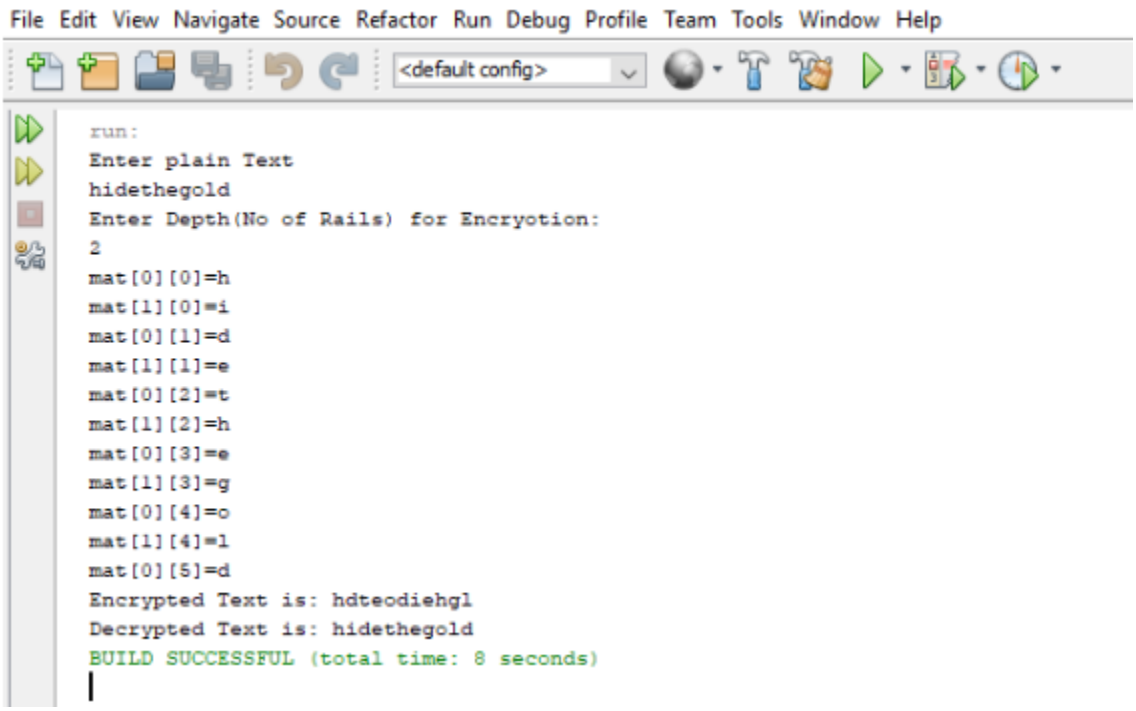
- **Rail Fence Cipher:**

```
import java.util.*;

public class Railfence {

    String Encryption(String plainText, int depth) throws Exception {
        int r = depth, len = plainText.length();
        int c = len / depth;
        c = c + 1;
        char mat[][] = new char[r][c];
        int k = 0;
```

```
        String cipherText = "";
        for (int i = 0; i < c; i++) {
            for (int j = 0; j < r; j++) {
                if (k != len) {
                    mat[j][i] = plainText.charAt(k++);
                    System.out.println("mat[" + j + "][" + i + "]=" +
mat[j][i]);

                }
            }
        }
        for (int i = 0; i < r; i++) {
            for (int j = 0; j < c; j++) {
                cipherText += mat[i][j];

            }
        }
        return cipherText;

    }

    String Decryption(String cipherText, int depth) throws Exception {
        int r = depth, len = cipherText.length();
        int c = len / depth;
        char mat[][] = new char[r][c];
        int k = 0;
        String plainText = "";

        for (int i = 0; i < r; i++) {
            for (int j = 0; j < c; j++) {
                mat[i][j] = cipherText.charAt(k++);
            }
        }
        for (int j = 0; j < c; j++) {
            for (int i = 0; i < r; i++) {
                plainText += mat[i][j];
            }

        }
        return plainText;
    }
}

class RailFenceB {

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

        Scanner sc = new Scanner(System.in);
        int depth;

        String plainText, cipherText, decryptedText;

        System.out.println("Enter plain Text");
        plainText = sc.nextLine();
```

```
        System.out.println("Enter Depth(No of Rails) for Encryotion: ");
        depth = sc.nextInt();

        Railfence rf = new Railfence();

        cipherText = rf.Encryption(plainText, depth);
        System.out.println("Encrypted Text is: " + cipherText);

        decryptedText = rf.Decryption(cipherText, depth);
        System.out.println("Decrypted Text is: " + decryptedText);

    }

}
```

Output:



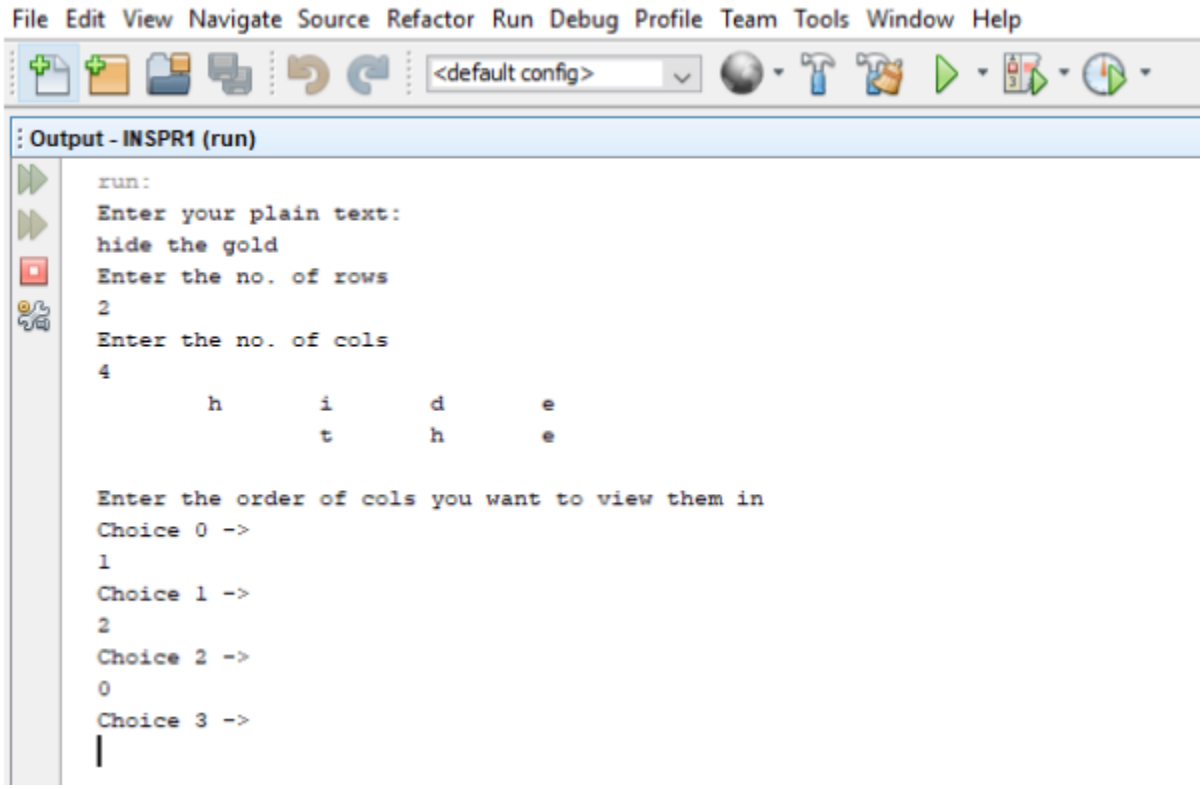
Source Code:

- **Simple Columnar Technique:**

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

public class SCT {

    public static void main(String args[]) throws Exception {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter your plain text: ");
        String accept = sc.nextLine();
```

```
        System.out.println("Enter the no. of rows");
        int r = Integer.parseInt(sc.nextLine());
        System.out.println("Enter the no. of cols");
        int c = Integer.parseInt(sc.nextLine());

        int count = 0;
        char cont[][] = new char[r][c];

        for (int i = 0; i < r; i++) {
            for (int j = 0; j < c; j++) {
                if (count >= accept.length()) {
                    cont[i][j] = ' ';

                } else {
                    cont[i][j] = accept.charAt(count);
                    count++;
                }
            }
        }

        for (int i = 0; i < r; i++) {
            for (int j = 0; j < c; j++) {
                System.out.print("\t" + cont[i][j]);
            }
            System.out.print("\n");
        }

        System.out.println("\nEnter the order of cols you want to view
them in");
        int choice[] = new int[c];
        for (int k = 0; k < c; k++) {
            System.out.println("Choice " + k + " -> ");
            choice[k] = Integer.parseInt(sc.nextLine());
        }

        System.out.println("\ncipher text in matrix is -> ");
        String cipher = "";
        for (int j = 0; j < c; j++) {
            int k = choice[j];
            for (int i = 0; i < r; i++) {
                cipher += cont[i][k];
            }
        }
        System.out.println(cipher);
    }

}
```

Output:



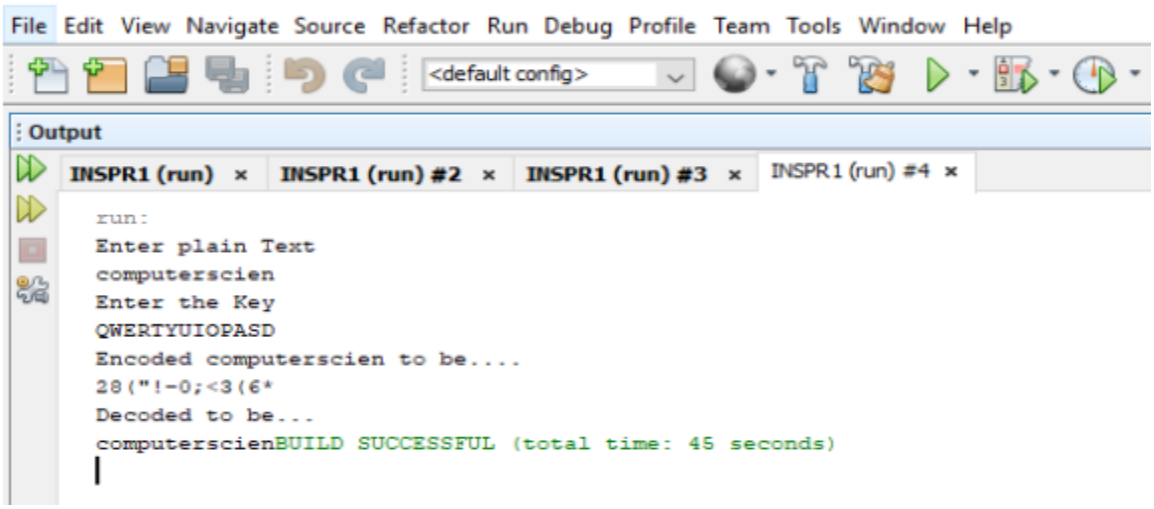
Source Code:

- **Vernam Cipher:**

```
import java.lang.Math;
import java.util.Scanner;

public class Vernam {

    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        String plainText = null, key = null;

        System.out.println("Enter plain Text");
        plainText = sc.nextLine();
        char[] arText = plainText.toCharArray();

        System.out.println("Enter the Key ");
        key = sc.nextLine();
        char[] arKey = key.toCharArray();

        char[] cipherText = new char[13];
        System.out.println("Encoded " + plainText + " to be....");

        for (int i = 0; i < arText.length; i++) {

            cipherText[i] = (char) (arText[i] ^ arKey[i]);
            System.out.print(cipherText[i]);

        }
```

```
        System.out.println("\nDecoded to be...");
        for (int i = 0; i < cipherText.length; i++) {
            char temp = (char) (cipherText[i] ^ arKey[i]);
            System.out.print(temp);
        }

    }

}
```

Output:



Practical.No:02

Aim : Implement the RSA algorithm for public-key encryption and decryption, and explore its properties and security considerations.

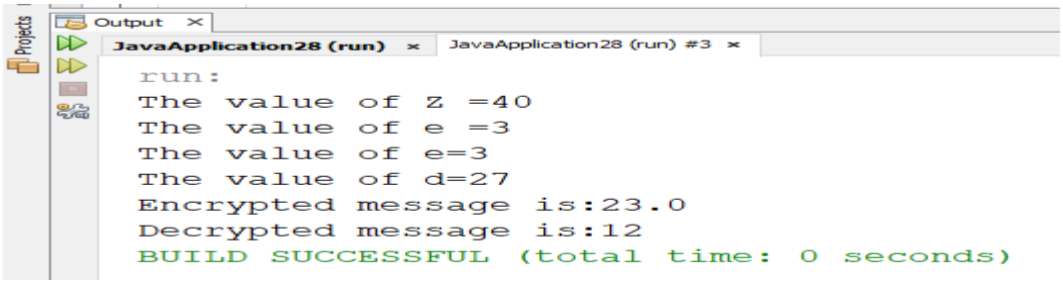
Source Code:

- **RSA:**

```
import java.math.*;
import java.util.*;

public class RSA {
    public static void main(String args[]){
        int p,q,n,z,d=0,e,i;

        double c;
        BigInteger msgback;

        p=5;

        q=11;

        int msg=12;

        n=p*q;
        z=(p-1)*(q-1);
        System.out.println("The value of Z ="+z);

        for(e=2;e<z;e++){
            if(gcd(e,z)==1){
                break;

            }

        }
        System.out.println("The value of e ="+e);
        for(i=0;i<=9;i++){
            int x=1+(i*z);
            if(x%e==0){
                d=x/e;
                break;
            }
        }
        System.out.println("The value of e="+e);
        for(i=0;i<=9;i++){
            int x=1+(i*z);

            if(x%e==0){
                d=x/e;
                break;
```

```
            }
        }
        System.out.println("The value of d="+d);
        c=(Math.pow(msg,e))%n;
        System.out.println("Encrypted message is:"+c);

        BigInteger N= BigInteger.valueOf(n);

        BigInteger C=BigDecimal.valueOf(c).toBigInteger();
        msgback=(C.pow(d)).mod(N);
        System.out.println("Decrypted message is:"+msgback);

    }
    static int gcd(int e, int z){
        if(e==0){
            return z;

        } else{
            return gcd(z%e,e);
        }

    }
}
```

Output:



Practical.No:03

Aim : Implement algorithms to generate and verify message authentication codes (MACs) for ensuring data integrity and authenticity.

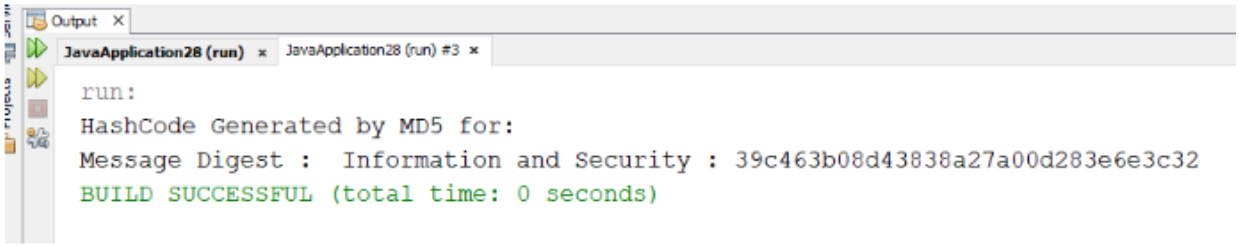
Source Code:

- **Message Authentication Codes:**

```
import java.math.BigInteger;
import java.nio.charset.StandardCharsets;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;

public class MDS {

    public static String toHexString(byte[] hash){

        BigInteger number = new BigInteger(1,hash);

        StringBuilder hexString=new StringBuilder(number.toString(16));

        while(hexString.length () > 32){
            hexString.insert(0,'0');
        }
        return hexString.toString();

    }

    public static void main(String args[])throws NoSuchAlgorithmException
    {
        try{
            System.out.println("HashCode Generated by MD5 for:");

            String s1=" Information and Security";
            MessageDigest md;
            md = MessageDigest.getInstance("MD5");
            byte[] hash=md.digest(s1.getBytes(StandardCharsets.UTF_8));

            System.out.println("Message Digest : "+s1+" : " +
toHexString(hash));

        }
        catch(NoSuchAlgorithmException e){
```

```
            System.out.println("Exception throw for incorrect algorithm :
"+e);
        }
    }
}
```

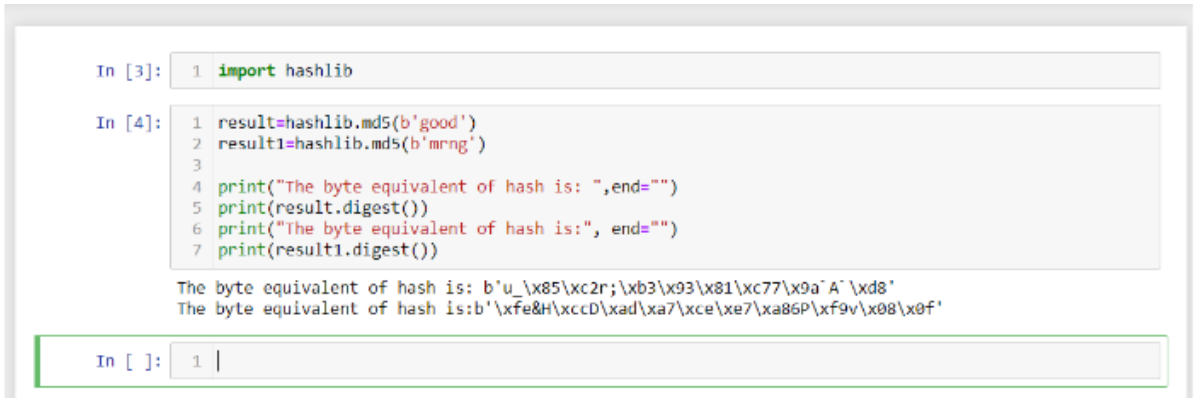
Output:



1) In Jupiter notebook:MD5

```
import hashlib
result=hashlib.md5(b'good')
result1=hashlib.md5(b'mrng')

print("The byte equivalent of hash is: ",end="")
print(result.digest())
print("The byte equivalent of hash is:", end="")
print(result1.digest())
```

Output:



2)

```
#python code to implement MD5
import hashlib
#provide Input and apply MD5
result=hashlib.md5(b'good')
```

#convert hsh value into hexadecimal

result=result.digest()

#Display Result

print('Message Digest',result)

```
In [5]:
#python code to implement MD5
import hashlib

In [6]:
#provide Input and apply MD5
result=hashlib.md5(b'good')

#convert hsh value into hexadecimal
result=result.digest()

#Display Result
print('Message Digest',result)

Message Digest b'u_\x85\xc2r;\xb3\x93\x81\xc77\x9a`A`\xd8'
```

SHA

1)in jupiternotebook

#python code to implement SHA

import hashlib

str=input('Enter string to encode')

#Apply SHA1

result=hashlib.sha1(str.encode())

#convert it into hexadecimal value

result=result.hexdigest()

#Display Result

print('Output of SHA1',result)

Practical.No:04

Aim : Implement digital signature algorithms such as RSA-based signatures, and verify the integrity and authenticity of digitally signed messages.

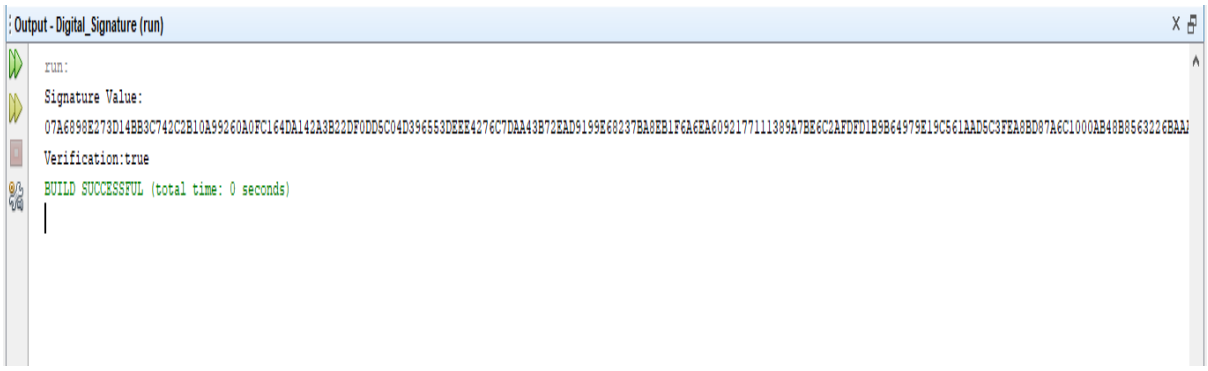
Source Code:

- **Digital Signatures:**

```
package digital_signature;

import java.security.PrivateKey;

import java.security.*;

import java.util.Scanner;

import javax.xml.bind.DatatypeConverter;


public class Digital_Signature {

   private static final String SIGNING_ALGORITHM="SHA256withRSA";

   private static final String RSA="RSA";

   private static Scanner sc;

   // Function to implement Digital signature

   //using SHA256 and RSA algorithm

   //by passing private key.

   public static byte[] Create_Digital_Signature(byte[] input, PrivateKey Key)throws Exception{

        Signature signature=Signature.getInstance(SIGNING_ALGORITHM);

        signature.initSign(Key);

        signature.update(input);

        return signature.sign();

   }

   public static KeyPair Generate_RSA_Keypair() throws Exception{

        SecureRandom secureRandom = new SecureRandom();

        KeyPairGenerator keyPairGenerator=KeyPairGenerator.getInstance(RSA);

        keyPairGenerator.initialize(2048,secureRandom);
```

```
        return keyPairGenerator.generateKeyPair();
    }
    public static boolean Verify_Digital_Signature(byte[] input,byte[] signatureToVerify,PublicKey key)
throws Exception{
        Signature  signature= Signature.getInstance(SIGNING_ALGORITHM);
        signature.initVerify(key);
        signature.update(input);
        return  signature.verify(signatureToVerify);
    }
    public static void main(String args[]) throws Exception{

        String input="Good Morning";
        KeyPair keyPair=Generate_RSA_Keypair();
        byte[] signature=Create_Digital_Signature(input.getBytes(),keyPair.getPrivate());
        System.out.println("Signature Value:\n"+DatatypeConverter.printHexBinary(signature));
        System.out.println("Verification:"+Verify_Digital_Signature(input.getBytes(),signature,keyPair.getPu
blic()));

    }
}
```

Output:



Practical.No:05

Aim: Implement the Diffie-Hellman key exchange algorithm to securely exchange keys between two entities over an insecure network.

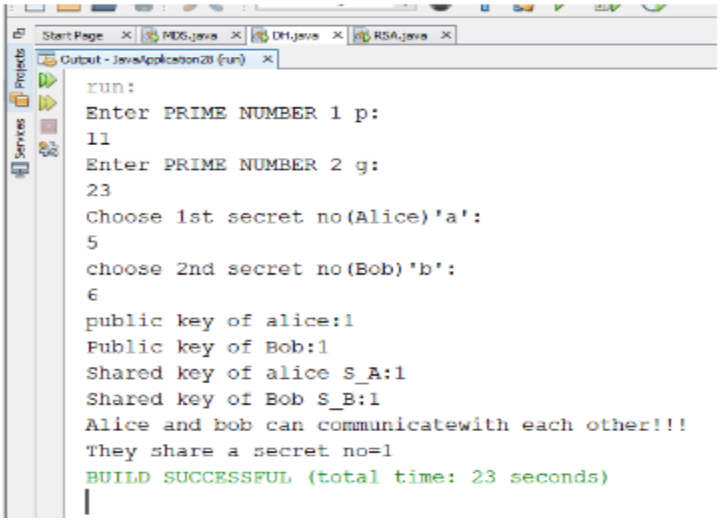
Source Code:

- **DH:**

```
import java.util.*;

public class DH {
   public static void main(String args[]){
        Scanner sc=new Scanner(System.in);
        System.out.println("Enter PRIME NUMBER 1 p:");
        int p =sc.nextInt();
        System.out.println("Enter PRIME NUMBER 2 g:");
        int g=sc.nextInt();
        System.out.println("Choose 1st secret no(Alice)'a':");
        int a= sc.nextInt();
        System.out.println("choose 2nd secret no(Bob)'b':");
        int b=sc.nextInt();

        int A=(int)Math.pow(g,a)%p;
        int B=(int)Math.pow(g, p)%p;

        System.out.println("public key of alice:"+A);
        System.out.println("Public key of Bob:"+B);

        int S_A = (int)Math.pow(B, a)% p;
        int S_B = (int)Math.pow(A,b)% p;

        System.out.println("Shared key of alice S_A:"+S_A);
        System.out.println("Shared key of Bob S_B:"+S_B);

        if(S_A == S_B){
            System.out.println("Alice and bob can communicate"+"with each
other!!!");
            System.out.println("They share a secret no=" + S_A);
        }
        else{
            System.out.println("Alice and Bob cannot"+"communicate with
each other!!!" );
        }
   }
```

}

Output:


Start Page
MD5.java
DH.java
RSA.java
Output - JavaApplication28 (run)
run:
Enter PRIME NUMBER 1 p:
11
Enter PRIME NUMBER 2 g:
23
Choose 1st secret no(Alice)'a':
5
choose 2nd secret no(Bob)'b':
6
public key of alice:1
Public key of Bob:1
Shared key of alice S_A:1
Shared key of Bob S_B:1
Alice and bob can communicatewith each other!!!
They share a secret no=1
BUILD SUCCESSFUL (total time: 23 seconds)