

Lab Manual

CRYPTOGRAPHY AND NETWORK SECURITY

- 1) Write a C program that contains a string(char pointer) with a value\Hello World'. The programs should XOR each character in this string with 0 and display the result.
- 2) Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result.
- 3) Write a Java program to perform encryption and decryption using the following algorithms:
 - i. Ceaser Cipher
 - ii. Substitution Cipher
 - iii. Hill Cipher
- 4) Write a Java program to implement the DES algorithm logic.
- 5) Write a C/JAVA program to implement the Blowfish algorithm logic.
- 6) Write a C/JAVA program to implement the Rijndael algorithm logic.
- 7) Write the RC4 logic in Java Using Java Cryptography, encrypt text “Hello world” using Blowfish. Create your own key using Java key tool.
- 8) Write a Java program to implement RSA Algorithm.
- 9) Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
- 10) Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
- 11) Calculate the message digest of a text using the MD5 algorithm in JAVA

PROGRAMS

Week 1.

Write a C program that contains a string(charpointer) with a value 'Hello World'. The program should XOR each character in this string with 0 and display the result.

PROGRAM:

```
#include<stdlib.h>

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

Week 2

Write a C program that contains a string (char pointer) with a value \Hello World'. 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:

OUTPUT :Hello
World
Hello World
Hello World

Week 3

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

- a) Caesar Cipher
- b) Substitution Cipher
- c) Hill Cipher

PROGRAM:

a) Caesar 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 {
```

```
        // TODO code application logic here
```

```
        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;
```

```
}
```

Output:

Enter any String: HelloWorld Enter the Key: 5

Encrypted String is: MjqqtBtwqi DecryptedString is: HelloWorld

b) Substitution Cipher

PROGRAM:

```
import java.io.*;
import java.util.*;
public class SubstitutionCipher
{
    static Scanner sc = new Scanner(System.in);
    staticBufferedReaderbr=newBufferedReader(newInputStreamReader(System.in))
;public static void main(String[] args) throws IOException
    {
        // TODO code application logic here
        String a
        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: aceho

The encrypted data is: zxvsl

c) HillCipher

PROGRAM:

```
import java.io.*;
import java.util.*;
import java.io.*; public class HillCipher {
staticfloat[][] decrypt= newfloat[3][1];
staticfloat[][] a= newfloat[3][3];
static float[][]b=newfloat[3][3];
staticfloat[][] mes=newfloat[3][1];
staticfloat[][]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 {
//TODOcode applicationlogic here getkeymes();
for(int i=0;i<3;i++)
for(int j=0;j<1;j++)
(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.outprint((char)(res[i][0]% 26+97));
[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 getKeyMatrix() throws IOException
{
    System.out.println("Enter 3x3 matrix for key (It should be invertible): ");
    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++) {
        //a[i][j] = sc.nextFloat();
        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];
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:

Entera3letterstring:hai Encrypted string is :fdx Inverse Matrix is:

```

0.083333336 0.41666666 -0.33333334
-0.41666666 -0.083333336 0.66666667
0.58333333 -0.083333336 -0.33333334

```

Decrypted string is: hai

Week 4

Write a Java program to implement the DES algorithm logic.

PROGRAM:

```
import java.util.*;

import java.io.BufferedReader;

import java.io.InputStreamReader;

import java.security.spec.KeySpec;

import javax.crypto.Cipher;
import javax.crypto.SecretKey;

import javax.crypto.SecretKeyFactory;

import javax.crypto.spec.DESedeKeySpec;

import sun.misc.BASE64Decoder;
import sun.misc.BASE64Encoder;

public class DES{

private static final String UNICODE_FORMAT = "UTF8";

private static final String DESEDE_ENCRYPTION_SCHEME = "DESEde";

private KeySpec myKeySpec;

private SecretKeyFactory mySecretKeyFactory;

private Cipher cipher;

byte[] keyAsBytes;

private String myEncryptionKey;

private String myEncryptionScheme;

key;

static    BufferedReader    br    =    new    BufferedReader(new
InputStreamReader(System.in));

public DES() throws Exception{

        // TODO code application logic here my
```

```

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);

        BASE64Encoder base64encoder = new BASE64Encoder(); encryptedString

= base64encoder.encode(encryptedText); } catch
(Exception e)
{ e.printStackTrace(); }
return encryptedString; }

public String decrypt(String encryptedString)

    { String decryptedText=null;

try {

cipher.init(Cipher.DECRYPT_MODE, key);
        BASE64Decoder base64decoder = new BASE64Decoder(); byte[]
    encryptedText = base64decoder.decodeBuffer(encryptedString); byte[] plainText =
    cipher.doFinal(encryptedText); decryptedText= bytes2String(plainText); }
catch (Exception e)

```

```

{ e.printStackTrace();}
returndecryptedText; }

private static String bytes2String(byte[] bytes)

{ StringBufferstringBuffer =new StringBuffer(); for (int i
= 0; i <bytes.length;
i++) { stringBuffer.append((char) bytes[i]); }
returnstringBuffer.toString(); }

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:

```

Enterthestring:WelcomeString To
Encrypt: Welcome
Encrypted Value : BPQMwc0wKvg= Decrypted
Value: Welcome

```

Week 5

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

PROGRAM:

```
import java.io.*;
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
sun.misc.BASE64Encoder; public class BlowFish{
public static void main(String[] args) throws Exception {
// TODO code application logic here KeyGeneratorkeyGenerator
=keyGenerator.getInstance("Blowfish"); keyGenerator.init(128); KeysecretKey =
keyGenerator.generateKey();
Cipher cipherOut = Cipher.getInstance("Blowfish/CFB/NoPadding");
cipherOut.init(Cipher.ENCRYPT_MODE, secretKey); BASE64Encoder encoder = new
BASE64Encoder();
byte iv[] = cipherOut.getIV(); if (iv != null) {
System.out.println("Initialization Vectorofthe Cipher:" + encoder.encode(iv)); }
FileInputStream fin= new FileInputStream("inputFile.txt"); FileOutputStreamfout = new
FileOutputStream("outputFile.txt"); CipherOutputStreamcout = new CipherOutputStream(fout, cipherOut); intinput
= 0;
while ((input = fin.read()) != -1)
{ cout.write(input); }

fin.close(); cout.close(); } }
```

OUTPUT:

Initialization Vectorofthe Cipher: dI1MXzW97oQ= Contents of inputFile.txt: Hello World
Contents of outputFile.txt: ùJÖ~ NâI“

Week 6

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

PROGRAM:

```
import java.security.*; import javax.crypto.*; import javax.crypto.spec.*; import java.io.*;

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:

Input your message: Hello KGR CET Encrypted text: 3000&&(*&*4r4 Decrypted text: Hello
KGR CET

Week 7

Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java keytool.

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 {
// create a key generator based upon the Blowfish cipher KeyGenerator keygenerator =
KeyGenerator.getInstance("Blowfish");
// create a key
// create a cipher based upon Blowfish Cipher cipher
= Cipher.getInstance("Blowfish");
// initialise cipher to with secret key cipher.init(Cipher.ENCRYPT_MODE, secretkey);
// get the text to encrypt
String inputText = JOptionPane.showInputDialog("Input your message: "); // encrypt message
byte[] encrypted = cipher.doFinal(inputText.getBytes());
// re-initialise the cipher to be in decrypt mode cipher.init(Cipher.DECRYPT_MODE, secretkey);
// decrypt message
byte[] decrypted = cipher.doFinal(encrypted);
// and display the results

JOptionPane.showMessageDialog(JOptionPane.getRootFrame(), "\nEncrypted text:" + new
String(encrypted) + "\n" + "\nDecrypted text:" + new String(decrypted));
System.exit(0);
} }
```

OUTPUT:

Input your message: Helloworld Encrypted text: 3000&&(*&*4r4 Decrypted text: Hello world

Week 8

Write a Java program to implement RSA Algorithm.

PROGRAM:

```
import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.math.*;
import java.util.Random;
import java.util.Scanner;

public class RSA{

    static Scanner sc = new Scanner(System.in);

    public static void main(String[] args){
        // TODO code application logic here
        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 f)
    {
        int y, intGCD;
        BigInteger e; BigInteger gcd;
        Random x = new Random();
        do {
```

```
y = x.nextInt(fiofn.intValue()-1);
String z = Integer.toString(y);
e= new BigInteger(z);
gcd = fiofn.gcd(e);
intGCD = gcd.intValue();
}
while(y <= 2 ||intGCD != 1); return e;
}
}
```

OUTPUT:

Enter a Prime number: 5

Enteranotherprimenumber:11 Encryption keys are: 33, 55

Decryption keys are: 17, 55

Week 9

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:

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

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
    { // TODO code application logic here
        BigInteger p = new BigInteger(Integer.toString(pValue));
        BigInteger g = new BigInteger(Integer.toString(gValue));
        BigInteger Xa = new BigInteger(Integer.toString(XaValue));
        BigInteger Xb = new BigInteger(Integer.toString(XbValue));
        createKey(); int bitLength = 512; // 512 bits
        SecureRandom rnd = new SecureRandom();
        p = BigInteger.probablePrime(bitLength, rnd);
        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 kf = KeyFactory.getInstance("DiffieHellman");
        DHPublicKeySpec spec = (DHPublicKeySpec)
```

```

kfactory.getKeySpec(kp.getPublic().DHPublicKeySpec.class);
System.out.println("Public key is: " +kspec);
}

public static void createSpecificKey(BigInteger p, BigInteger g) throws Exception
{
    KeyPairGeneratorkpg = KeyPairGenerator.getInstance("DiffieHellman");
    DHParameterSpecparam = new DHParameterSpec(p, g);
    kpg.initialize(param);
    KeyPairkp = kpg.generateKeyPair();
    KeyFactorykfactory = KeyFactory.getInstance("DiffieHellman");
    DHPublicKeySpecspec = (DHPublicKeySpec) kfactory.getKeySpec(kp.getPublic(),
    DHPublicKeySpec.class);
    System.out.println("\nPublic key is : " +kspec);
}
}

```

OUTPUT:

```

Public key is: javax.crypto.spec.DHPublicKeySpec @ 5afd29 Public key is:
javax.crypto.spec.DHPublicKeySpec @ 9971a

```

Week 10

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

PROGRAM:

```
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 = "abcdefghijklmnopqrstuvwxy"; 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 1.6

ToString = SHA1 Message Digest from SUN, <initialized> SHA1("") =

DA39A3EE5E6B4B0D3255BFEF95601890AFD80709 SHA1("abc") =

A9993E364706816ABA3E25717850C26C9CD0D89D

SHA1("abcdefghijklmnopqrstuvwxyz")=32D10C7B8CF96570CA04CE37F2A19D8424 0D3A89

Week 11

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

PROGRAM:

```
import java.security.*;

public class MD5 {

    public static void main(String[] a) {
        // TODO code application logic here
        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 = "abcdefghijklmnopqrstuvwxy"; md.update(input.getBytes());
            output = md.digest();
            System.out.println();
            System.out.println("MD5(\""+input+"\") = "
            +bytesTo Hex(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 1.6

ToString=MD5MessageDigestfromSUN,<initialized>MD5("")=

D41D8CD98F00B204E9800998ECF8427E MD5("abc") =

900150983CD24FB0D6963F7D28E17F72 MD5("abcdefghijklmnopqrstuvxyz")

= C3FCD3D76192E4007DFB496CCA67E13B

2. Write a java program to implement Diffie Hellman Key Exchange

PROGRAM

```
class Diffie_Hellman
{
    public static void main(String args[])
    {
        Scanner sc=new Scanner(System.in);
        System.out.println("Enter modulo(p)");
        int p=sc.nextInt();
        System.out.println("Enter primitive root of "+p);
        int g=sc.nextInt();
        System.out.println("Choose 1st secret no(Alice)");
        int a=sc.nextInt();
        System.out.println("Choose 2nd secret no(BOB)");
        int b=sc.nextInt();

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

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

        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!!!");
        }
    }
}
```

3. Write a java program to implement AES ALGORITHM

PROGRAM

```
import javax.crypto.Cipher;
import javax.crypto.SecretKey;
import javax.crypto.SecretKeyFactory;
import javax.crypto.spec.IvParameterSpec;
import javax.crypto.spec.PBEKeySpec;
import javax.crypto.spec.SecretKeySpec;
import java.nio.charset.StandardCharsets;
import java.security.InvalidAlgorithmParameterException;
import java.security.InvalidKeyException;
import java.security.NoSuchAlgorithmException;
import java.security.spec.InvalidKeySpecException;
import java.security.spec.KeySpec;
import java.util.Base64;
import javax.crypto.BadPaddingException;
import javax.crypto.IllegalBlockSizeException;
import javax.crypto.NoSuchPaddingException;

public class AESExample
{
    /* Private variable declaration */
    private static final String SECRET_KEY = "123456789";
    private static final String SALTVALUE = "abcdefg";

    /* Encryption Method */
    public static String encrypt(String strToEncrypt)
    {
        try
        {
            /* Declare a byte array. */
            byte[] iv = {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0};
            IvParameterSpec ivspec = new IvParameterSpec(iv);
            /* Create factory for secret keys. */
            SecretKeyFactory factory = SecretKeyFactory.getInstance("PBKDF2WithHmacSHA256");
            /* PBEKeySpec class implements KeySpec interface. */
            KeySpec spec = new PBEKeySpec(SECRET_KEY.toCharArray(), SALTVALUE.getBytes(), 65536, 256);
            SecretKey tmp = factory.generateSecret(spec);
            SecretKeySpec secretKey = new SecretKeySpec(tmp.getEncoded(), "AES");
            Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
            cipher.init(Cipher.ENCRYPT_MODE, secretKey, ivspec);
            /* Returns encrypted value. */
            return Base64.getEncoder()
                .encodeToString(cipher.doFinal(strToEncrypt.getBytes(StandardCharsets.UTF_8)));
        }
        catch (InvalidAlgorithmParameterException | InvalidKeyException | NoSuchAlgorithmException | InvalidKeySpecException | BadPaddingException | IllegalBlockSizeException | NoSuchPaddingException e)
        {
            System.out.println("Error occurred during encryption: " + e.toString());
        }
    }
}
```

```

}
return null;

/* Decryption Method */
public static String decrypt(String strToDecrypt)
{
    try
    {
        /* Declare a byte array. */
        byte[] iv = {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0};
        IvParameterSpec ivspec = new IvParameterSpec(iv);
        /* Create factory for secret keys. */
        SecretKeyFactory factory = SecretKeyFactory.getInstance("PBKDF2WithHmacSHA256");
        /* PBEKeySpec class implements KeySpec interface. */
        KeySpec spec = new PBEKeySpec(SECRET_KEY.toCharArray(), SALTVALUE.getBytes(), 65536, 256);
        SecretKey tmp = factory.generateSecret(spec);
        SecretKeySpec secretKey = new SecretKeySpec(tmp.getEncoded(), "AES");
        Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5PADDING");
        cipher.init(Cipher.DECRYPT_MODE, secretKey, ivspec);
        /* Retrurns decrypted value. */
        return new String(cipher.doFinal(Base64.getDecoder().decode(strToDecrypt)));
    }
    catch (InvalidAlgorithmParameterException | InvalidKeyException | NoSuchAlgorithmException | InvalidKeySpecException |
    BadPaddingException | IllegalBlockSizeException | NoSuchPaddingException e)
    {
        System.out.println("Error occured during decryption: " + e.toString());
    }
    return null;
}

/* Driver Code */
public static void main(String[] args)
{
    /* Message to be encrypted. */
    String originalval = "AES Encryption";
    /* Call the encrypt() method and store result of encryption. */
    String encryptedval = encrypt(originalval);
    /* Call the decrypt() method and store result of decryption. */
    String decryptedval = decrypt(encryptedval);
    /* Display the original message, encrypted message and decrypted message on the console. */
    System.out.println("Original value: " + originalval);
    System.out.println("Encrypted value: " + encryptedval);
    System.out.println("Decrypted value: " + decryptedval);
}
}

```

14. Write a java program for Knapsack using Dynamic Programming based solution

PROGRAM:

```
// A Dynamic Programming based solution for 0-1 Knapsack problem
class Knapsack {

    // A utility function that returns maximum of two integers
    static int max(int a, int b)
    { return (a > b) ? a : b; }

    // Returns the maximum value that can be put in a knapsack
    // of capacity W
    static int knapSack(int W, int wt[], int val[], int n)
    {
        int i, w;
        int K[][] = new int[n + 1][W + 1];

        // Build table K[][] in bottom up manner
        for (i = 0; i <= n; i++) {
            for (w = 0; w <= W; w++) {
                if (i == 0 || w == 0)
                    K[i][w] = 0;
                else if (wt[i - 1] <= w)
                    K[i][w] = max(val[i - 1] + K[i - 1][w - wt[i - 1]], K[i - 1][w]);
                else
                    K[i][w] = K[i - 1][w];
            }
        }

        return K[n][W];
    }

    // Driver program to test above function
    public static void main(String args[])
    {
        int val[] = new int[] { 60, 100, 120 };
        int wt[] = new int[] { 10, 20, 30 };
        int W = 50;
        int n = val.length;
        System.out.println(knapSack(W, wt, val, n));
    }
}
```

OUTPUT:

220

SET 1

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The programs should XOR each character in this string with 0 and display the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms:
 - a) Ceaser Cipher
 - b) Substitution Cipher
 - c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic

SET 2

1. Write the RC4 logic in Java Using Java Cryptography, encrypt the text "Hello world"using Blowfish. Create your own key using Java key tool.
2. Write a Java program to implement RSA Algorithm.
3. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
4. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
5. Calculate the message digest of a text using the MD5 algorithm in JAVA.

Original value: AES SET2SE

Encrypted value: V5E9I52IxxMaW4+hJhl56g==

Decrypted

Viva questions

1. Define Cryptography and its benefits?
2. What are the few major applications of cryptography in the modern world?
3. What is decryption? What is its need?
4. What do you mean by Secret Key Cryptography and Public Key Cryptography? How they are different from one another?
5. What type of information can be secured with Cryptography?
6. What exactly do you know about RSA?
7. What is the Digital Signature Algorithm?
8. Differentiate symmetric and asymmetric encryption?
9. What is the Caesar cipher?
10. What is plaintext?
11. What is cipher text?
12. What are the mathematical algorithms used in symmetric cryptography?
13. What are the mathematical algorithms used in asymmetric cryptography?
14. What is the difference between a private key and a public key?
15. What is a block cipher?
16. What is Transposition Ciphers?
- 17.** What is the International Data Encryption Algorithm (IDEA)?
18. How is a Key Distribution Center (KDC) used?
19. What are the specific components of the Public Key Infrastructure (PKI)?
20. List down some Hashing Algorithms