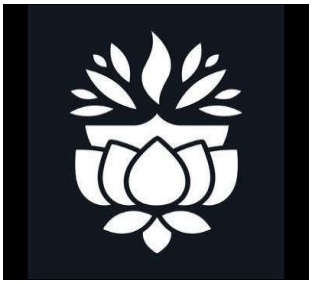
SPHOORTHY ENGINEERING COLLEGE

B.Tech | Visual Arts | BBA

CY504PC: NETWORK SECURITY AND CRYPTOGRAPHY LABLAB MANUAL



Department of CYBER SECURITY & IoT

(CYBER SECURITY)

R22-JNTUH

(2024-2025)

Faculty In charge:

Mr. G.Rakesh Reddy

Head of Dept.:

Dr Subba Rao

Department of CYBER SECURITY & IoT

CS701PC: CRYPTOGRAPHY AND NETWORK SECURITY
ACADEMIC YEAR 2024-2025

Lab Name /Course Name	**CRYPTOGRAPHY AND NETWORK SECURITY LAB**
Subject Code / Course Code	**CS701PC**
Year & Semester	**III YEAR / I SEM**
Branch	**CS & IoT**
Name of the Faculty's	**Mr. G. Rakesh Reddy**

VISION AND MISSION OF THE DEPARTMENT

Vision:

To be frontier of Cyber security & IoT and to produce globally competentengineers committed to serve the society.

Mission:

M1: To strengthen core competence in Computer Science & Engineering through Outcome Based Education.

M2: To produce successful graduates by providing state of art infrastructure and skill development activities.

M3: To produce innovative research in Computer Science & Engineering and encourage community development programs.

LAB DESCRIPTION

Course Title	CRYPTOGRAPHY AND NETWORK SECURITY LAB			
Course Code	CS701PC			
Regulation	R18			
Course Structure	Lectures	Tutorials	Practical	Credits
	0	0	2	1
Course Faculty's	Mr. G.Rakesh Reddy			

OVERVIEW:

- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPsec
- Understand Intrusions and intrusion detection
- Discuss the fundamental ideas of public-key cryptography.

PREREQUISITES:

Prior knowledge of C and JAVA Programming.

COURSE OBJECTIVES:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted email message.
- Discuss Web security and Firewalls

COURSE OUTCOME (CO):

S.NO	Course Outcomes (CO)	Blooms Taxonomy Level
After completing this course the student must demonstrate the knowledge and ability to:		
CO1	Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.	L2: Understand
CO2	Ability to identify information system requirements for both of them such as client and server.	L3: Apply
CO3	Ability to understand the current legal issues towards information security.	L2: Understand

PROGRAM OUTCOME (PO):

PO1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10:	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12:	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO):

PSO1	**Software Development and Research Ability:** Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of programming language and open source platforms. Use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.
PSO2	**Foundation of mathematical concepts:** Ability to apply the acquired knowledge of basic skills, principles of computing, mathematical foundations, algorithmic principles, modeling and design of computer- based systems in solving real world engineering Problems.
PSO3	**Successful Career:** Ability to update knowledge continuously in the tools like Rational Rose, MATLAB, Argo UML, R Language and technologies like Storage, Computing, Communication to meet the industry requirements in creating innovative career paths for immediate employment and for higher studies.

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	-	-	-	-	-	-	2	1	2
CO2	3	3	2	1	2	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	1	2	-	-	-	-	-	-	-	1	2	2
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

LAB CODE

1. Students should report to the concerned lab as per the time table.
2. Students who turn up late to the labs will in no case be permitted to do the program schedule for the day.
3. After completion of the program, certification of the concerned staff in-charge in the observation book is necessary.
4. Student should bring a notebook of 100 pages and should enter the readings observations into the notebook while performing the experiment.
5. The record of observations along with the detailed experimental procedure of the experiment in the immediate last session should be submitted and certified staff member in-charge.
6. Not more than 3-students in a group are permitted to perform the experiment on the set.
7. The group-wise division made in the beginning should be adhered to and no mix up of students among different groups will be permitted.
8. The components required pertaining to the experiment should be collected from stores in-charge after duly filling in the requisition form.
9. When the experiment is completed, should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.
10. Any damage of the equipment or burn-out components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year.
11. Students should be present in the labs for total scheduled duration.
12. Students are required to prepare thoroughly to perform the experiment before coming to laboratory.

LIST OF EXPERIMENTS

1. XOR a string with a Zero

AIM: Write a C program that contains a string (char pointer) 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

2. XOR a string with a 127

AIM: 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:

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:

d) 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 {
        // 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;
        }
```

```
decrypted += (char) c;
        }
return decrypted;
    }
}
```

Output:

Enter any String: Hello World

Enter the Key: 5

Encrypted String is: MjqqtBtwqi

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 {
        // TODO code application logic here
      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

a) Hill Cipher

PROGRAM:

```
 import java.io.*;
import java.util.*;
import java.io.*; 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 {
        // TODO code application
logic here 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() {
floatp,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:

```
Enter a 3 letter string: hai
Encrypted string is :fdx
Inverse Matrix is :
0.083333336 0.41666666  -0.33333334
-0.41666666 -0.083333336  0.6666667
0.5833333 -0.083333336  -0.33333334
Decrypted string is: hai
```

4. Java program for DES algorithm logic

AIM: 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";
public static final String DESEDE_ENCRYPTION_SCHEME = "DESede";
privateKeySpecmyKeySpec;
privateSecretKeyFactorymySecretKeyFactory;
private Cipher cipher;
byte[] keyAsBytes;
private String myEncryptionKey;
private String myEncryptionScheme;
SecretKey key;
static BufferedReader br = new BufferedReader(new
InputStreamReader(System.in)); public DES() throws Exception {
        // TODO code application logic here 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(); }
returnencryptedString; }
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:

```
Enter the string: Welcome
String To Encrypt: Welcome
Encrypted Value : BPQMwc0wKvg=
Decrypted Value : Welcome
```

5. Program to implement BlowFish algorithm logic

AIM: 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);
Key secretKey = 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 Vector of the Cipher: " + encoder.encode(iv)); }
FileInputStream fin = new FileInputStream("inputFile.txt");
FileOutputStreamfout = new FileOutputStream("outputFile.txt");
CipherOutputStreamcout = new CipherOutputStream(fout, cipherOut);
int input = 0;
while ((input = fin.read()) != -1) {
```

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

OUTPUT:

```
Initialization Vector of the Cipher: dI1MXzW97oQ=
Contents of inputFile.txt: Hello World
Contents of outputFile.txt: ùJÖ˜ NåI“
```

6. Program to implement Rijndael algorithm logic

AIM: 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 KGRCET

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

Decrypted text: Hello KGRCET

7. Encrypt a string using BlowFish algorithm

AIM: 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
KeyGeneratorkeygenerator = 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: Hello world
Encrypted text: 3ooo&&(*&*4r4
Decrypted text: Hello world
```

8. RSA Algorithm

AIM: Write a Java program to implement RSA Algoithm.

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 BigIntegergenerateE(BigIntegerfiofn) {
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
Enter another prime number: 11
Encryption keys are: 33, 55
Decryption keys are: 17, 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:

```
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 DiffeHellman { 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));
BigIntegerXa = new
BigInteger(Integer.toString(XaValue)); BigIntegerXb =
new BigInteger(Integer.toString(XbValue)); createKey();
intbitLength = 512; // 512 bits
SecureRandomrnd = new SecureRandom();
      p = BigInteger.probablePrime(bitLength, rnd);
      g = BigInteger.probablePrime(bitLength, rnd);
```

```
createSpecificKey(p, g);
   }
public static void createKey() throws Exception {
KeyPairGeneratorkpg =
KeyPairGenerator.getInstance("DiffieHellman"); kpg.initialize(512);
KeyPairkp = kpg.generateKeyPair();
KeyFactorykfactory = KeyFactory.getInstance("DiffieHellman");
DHPublicKeySpeckspec = (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");
DHPublicKeySpeckspec = (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@9971ad
```

10. SHA-1

AIM: 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 = "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'};
StringBufferbuf  =  new  StringBuffer();
for (int j=0; j<b.length; j++) {
buf.append(hexDigit[(b[j] >> 4) & 0x0f]);
buf.append(hexDigit[b[j] & 0x0f]); }
returnbuf.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
```

11. Message Digest Algorithm5 (MD5)

AIM: 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 = "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'};
StringBufferbuf = 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 = MD5 Message Digest from SUN, <initialized> MD5("") =
D41D8CD98F00B204E9800998ECF8427E MD5("abc") =
900150983CD24FB0D6963F7D28E17F72 MD5("abcdefghijklmnopqrstuvwxyz") =
C3FCD3D76192E4007DFB496CCA67E13B
```