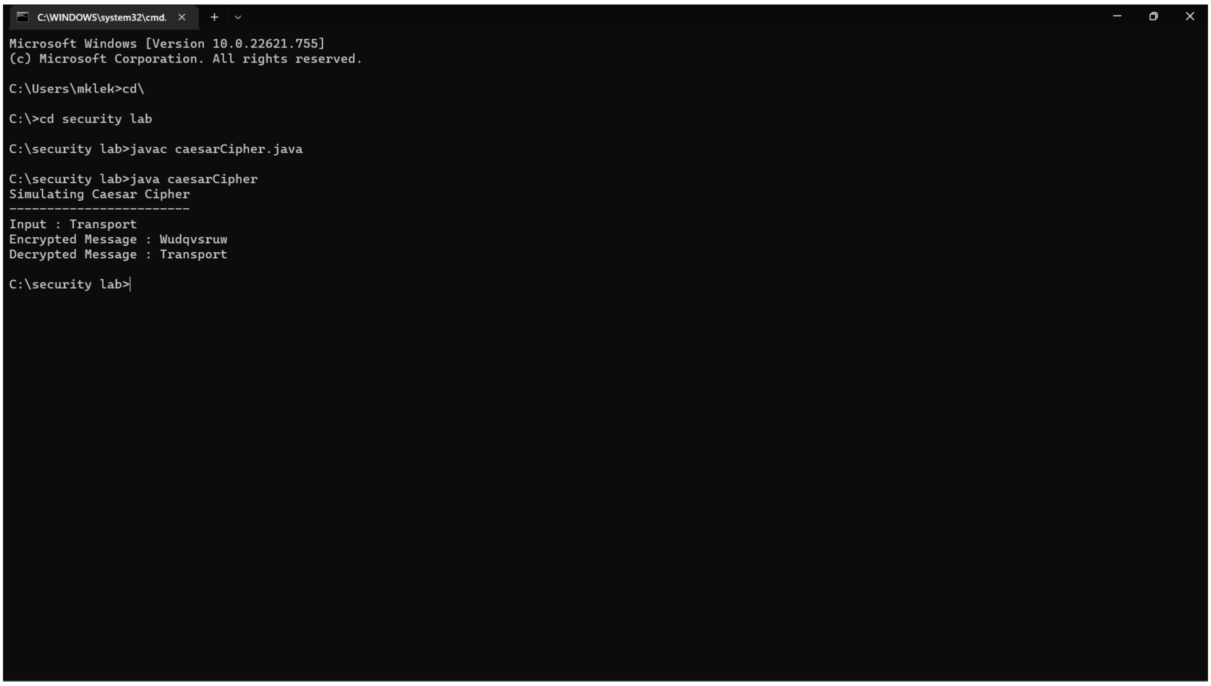
1(a). Caesar Cipher

Abdul Rahman S - 7881

```
class caesarCipher {
 public static String encode(String enc, int offset) {
 offset = offset % 26 + 26;
 StringBuilder encoded = new StringBuilder();
 for (char i : enc.toCharArray()) {
 if (Character.isLetter(i)) {
 if (Character.isUpperCase(i)) {
 encoded.append((char) ('A' + (i - 'A' + offset) % 26));
 } else {
 encoded.append((char) ('a' + (i - 'a' + offset) % 26));
 }
 } else {
 encoded.append(i);
 }
 }
return encoded.toString();
 }
 public static String decode(String enc, int offset) {
 return encode(enc, 26 - offset);
 }
 public static void main(String[] args) throws java.lang.Exception {
 String msg = "Transport";
 System.out.println("Simulating Caesar Cipher\n------------------------");
 System.out.println("Input : " + msg);
 System.out.printf("Encrypted Message : ");
 System.out.println(caesarCipher.encode(msg, 3));
 System.out.printf("Decrypted Message : ");
System.out.println(caesarCipher.decode(caesarCipher.encode(msg, 3), 3)); }}
```

OUTPUT:



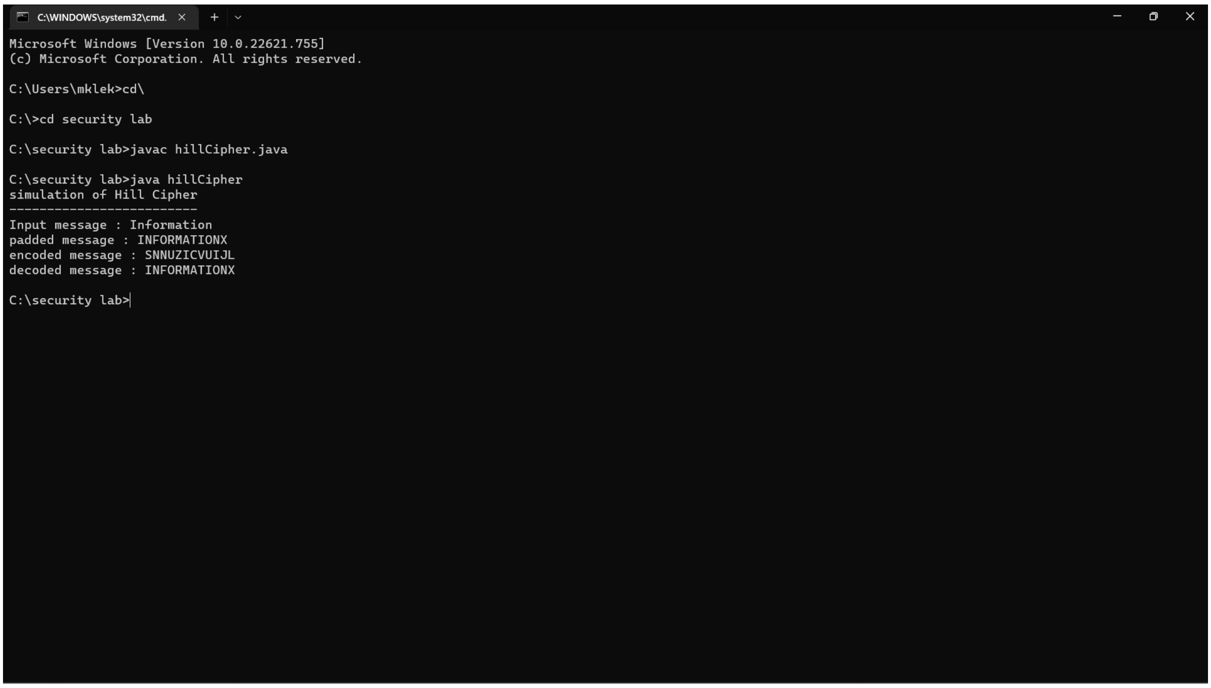
```
Microsoft Windows [Version 10.0.22621.755]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac caesarCipher.java

C:\security lab>java caesarCipher
Simulating Caesar Cipher
------------------------
Input : Transport
Encrypted Message : Wudqvsruw
Decrypted Message : Transport

C:\security lab>
```

1(b).Hill Cipher

Abdul Rahman S - 7881

```
class hillCipher {
 /* 3x3 key matrix for 3 characters at once */
 public static int[][] keymat = new int[][] { { 1, 2, 1 }, { 2, 3, 2 },
 { 2, 2, 1 } }; /* key inverse matrix */
 public static int[][] invkeymat = new int[][] { { -1, 0, 1 }, { 2, -1, 0 }, { -2, 2, -1
} };
 public static String key = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
 private static String encode(char a, char b, char c) {
 String ret = "";
 int x, y, z;
 int posa = (int) a - 65;
 int posb = (int) b - 65;
 int posc = (int) c - 65;
 x = posa * keymat[0][0] + posb * keymat[1][0] + posc * keymat[2][0];
 y = posa * keymat[0][1] + posb * keymat[1][1] + posc * keymat[2][1];
 z = posa * keymat[0][2] + posb * keymat[1][2] + posc * keymat[2][2];
 a = key.charAt(x % 26);
 b = key.charAt(y % 26);
 c = key.charAt(z % 26);
 ret = "" + a + b + c;
 return ret;
 }
 private static String decode(char a, char b, char c) {
 String ret = "";
 int x, y, z;
 int posa = (int) a - 65;
 int posb = (int) b - 65;
 int posc = (int) c - 65;
 x = posa * invkeymat[0][0] + posb * invkeymat[1][0] + posc *
invkeymat[2][0];
 y = posa * invkeymat[0][1] + posb * invkeymat[1][1] + posc *
invkeymat[2][1];
 z = posa * invkeymat[0][2] + posb * invkeymat[1][2] + posc *
invkeymat[2][2];
 a = key.charAt((x % 26 < 0) ? (26 + x % 26) : (x % 26));
 b = key.charAt((y % 26 < 0) ? (26 + y % 26) : (y % 26));
 c = key.charAt((z % 26 < 0) ? (26 + z % 26) : (z % 26));
 ret = "" + a + b + c;
 return ret;
 }
 public static void main(String[] args) throws java.lang.Exception {
 String msg;
 String enc = "";
 String dec = "";
 int n;
 msg = ("Information");
 System.out.println("simulation of Hill Cipher\n-------------------------");
 System.out.println("Input message : " + msg);
 msg = msg.toUpperCase();
 msg = msg.replaceAll("\\s", "");
 /* remove spaces */ n = msg.length() % 3;
 /* append padding text X */ if (n != 0) {
 for (int i = 1; i <= (3 - n); i++) {
 msg += 'X';
 }
 }
 System.out.println("padded message : " + msg);
 char[] pdchars = msg.toCharArray();
 for (int i = 0; i < msg.length(); i += 3) {
 enc += encode(pdchars[i], pdchars[i + 1], pdchars[i + 2]);
 }
 System.out.println("encoded message : " + enc);
 char[] dechars = enc.toCharArray();
 for (int i = 0; i < enc.length(); i += 3) {
 dec += decode(dechars[i], dechars[i + 1], dechars[i + 2]);
 }
 System.out.println("decoded message : " + dec);
 }
}
```

OUTPUT:



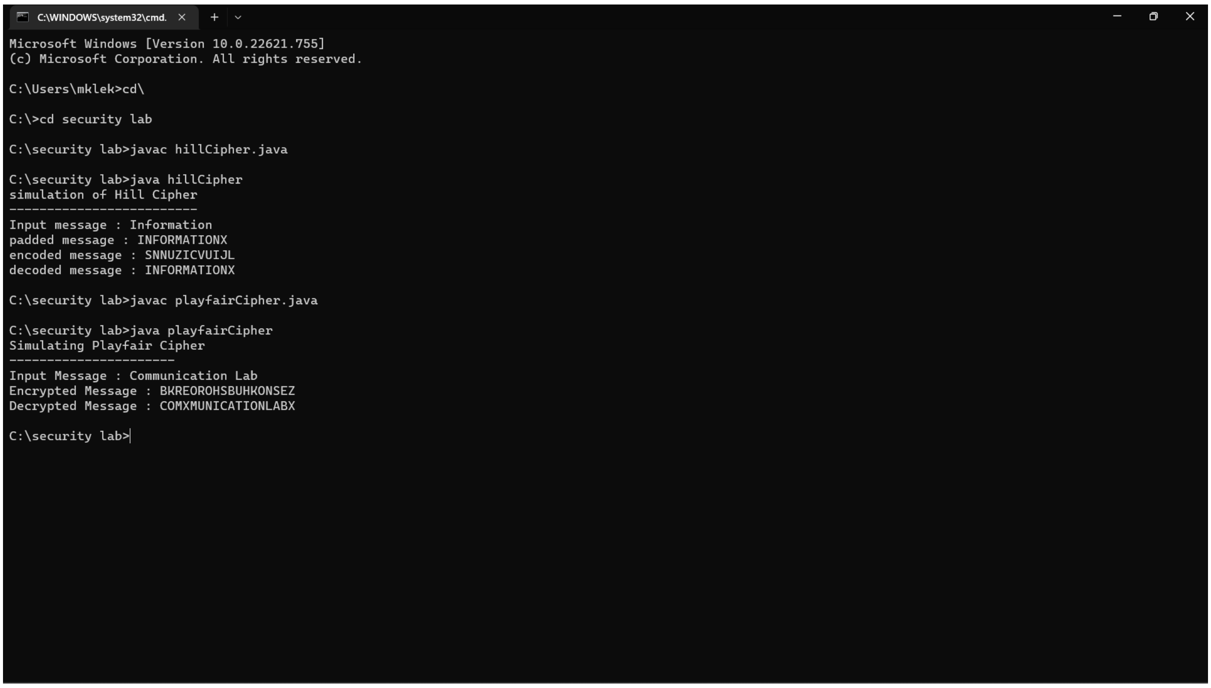
```
Microsoft Windows [Version 10.0.22621.755]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac hillCipher.java

C:\security lab>java hillCipher
simulation of Hill Cipher
-------------------------
Input message : Information
padded message : INFORMATIONX
encoded message : SNNUZICVUIJL
decoded message : INFORMATIONX

C:\security lab>
```

1(c). Playfair Cipher

Abdul Rahman S - 7881

```
import java.awt.Point;
class playfairCipher {
 private static char[][] charTable;
 private static Point[] positions;
 private static String prepareText(String s, boolean chgJtoI) {
 s = s.toUpperCase().replaceAll("[^A-Z]", "");
 return chgJtoI ? s.replace("J", "I") : s.replace("Q", "");
 }
 private static void createTbl(String key, boolean chgJtoI) {
 charTable = new char[5][5];
 positions = new Point[26];
 String s = prepareText(key + "ABCDEFGHIJKLMNOPQRSTUVWXYZ",
chgJtoI);
 int len = s.length();
 for (int i = 0, k = 0; i < len; i++) {
 char c = s.charAt(i);
 if (positions[c - 'A'] == null) {
 charTable[k / 5][k % 5] = c;
 positions[c - 'A'] = new Point(k % 5, k / 5);
 k++;
 }
 }
 }
 private static String codec(StringBuilder txt, int dir) {
 int len = txt.length();
 for (int i = 0; i < len; i += 2) {
 char a = txt.charAt(i);
 char b = txt.charAt(i + 1);
int row1 = positions[a - 'A'].y;
int row2 = positions[b - 'A'].y;
int col1 = positions[a - 'A'].x;
int col2 = positions[b - 'A'].x;
if (row1 == row2) {
col1 = (col1 + dir) % 5;
col2 = (col2 + dir) % 5;
} else if (col1 == col2) {
row1 = (row1 + dir) % 5;
row2 = (row2 + dir) % 5;
} else {
int tmp = col1;
col1 = col2;
col2 = tmp;
}
txt.setCharAt(i, charTable[row1][col1]);
txt.setCharAt(i + 1, charTable[row2][col2]);
}
return txt.toString();
}
private static String encode(String s) {
StringBuilder sb = new StringBuilder(s);
for (int i = 0; i < sb.length(); i += 2) {
if (i == sb.length() - 1) {
sb.append(sb.length() % 2 == 1 ? 'X' : "");
} else if (sb.charAt(i) == sb.charAt(i + 1)) {
sb.insert(i + 1, 'X');
}
}
return codec(sb, 1);
```

```
 }
 private static String decode(String s) {
 return codec(new StringBuilder(s), 4);
 }
 public static void main(String[] args) throws java.lang.Exception {
 String key = "CSE";
 String txt = "Communication Lab"; /* make sure string length is even */ /* change J
to I */
 boolean chgJtoI = true;
 createTbl(key, chgJtoI);
 String enc = encode(prepareText(txt, chgJtoI));
 System.out.println("Simulating Playfair Cipher\n----------------------");
 System.out.println("Input Message : " + txt);
 System.out.println("Encrypted Message : " + enc);
 System.out.println("Decrypted Message : " + decode(enc));
 }
}
```



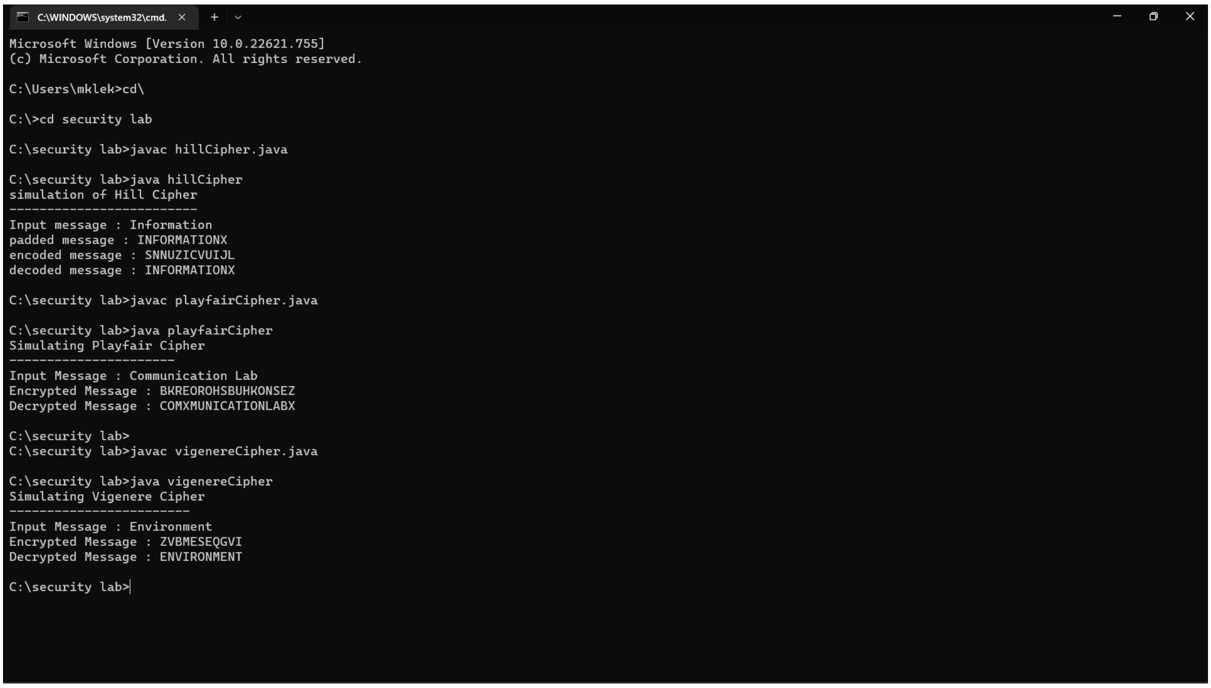
```
Microsoft Windows [Version 10.0.22621.755]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac hillCipher.java

C:\security lab>java hillCipher
simulation of Hill Cipher
-------------------------
Input message : Information
padded message : INFORMATIONX
encoded message : SNNUZICVUIJL
decoded message : INFORMATIONX

C:\security lab>javac playfairCipher.java

C:\security lab>java playfairCipher
Simulating Playfair Cipher
----------------------
Input Message : Communication Lab
Encrypted Message : BKREOROHSBUHKONSEZ
Decrypted Message : COMXMUNICATIONLABX

C:\security lab>
```

1d. Vigenere Cipher

Abdul Rahman S - 7881

```
public class vigenereCipher {
 static String encode(String text, final String key) {
 String res = "";
 text = text.toUpperCase();
 for (int i = 0, j = 0; i < text.length(); i++) {
 char c = text.charAt(i);
 if (c < 'A' || c > 'Z') {
 continue;
 }
 res += (char) ((c + key.charAt(j) - 2 * 'A') % 26 + 'A');
 j = ++j % key.length();
 }
 return res;
 }
 static String decode(String text, final String key) {
 String res = "";
 text = text.toUpperCase();
 for (int i = 0, j = 0; i < text.length(); i++) {
 char c = text.charAt(i);
 if (c < 'A' || c > 'Z') {
 continue;
 }
 res += (char) ((c - key.charAt(j) + 26) % 26 + 'A');
 j = ++j % key.length();
 }
 return res;
 }
public static void main(String[] args) throws java.lang.Exception {
String key = "VIGENERECIPHER";
String msg = "Environment";
System.out.println("Simulating Vigenere Cipher\n------------------------");
System.out.println("Input Message : " + msg);
String enc = encode(msg, key);
System.out.println("Encrypted Message : " + enc);
System.out.println("Decrypted Message : " + decode(enc, key));
}
}
```

OUTPUT:



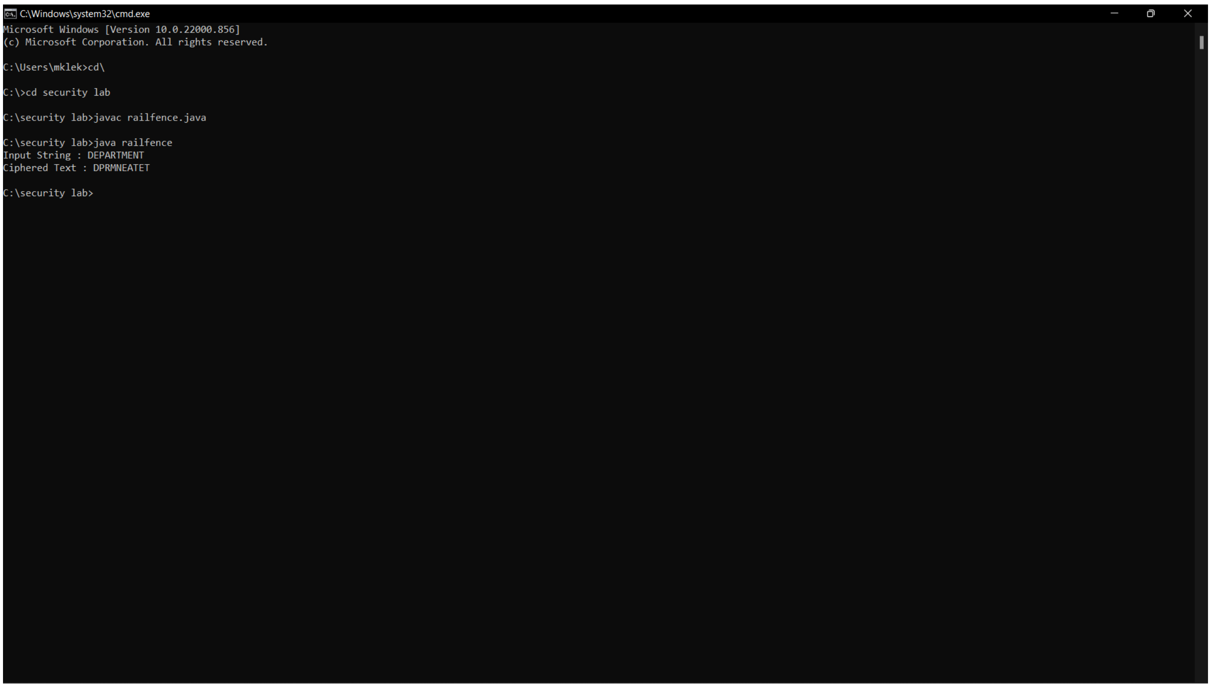
```
Microsoft Windows [Version 10.0.22621.755]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac hillCipher.java

C:\security lab>java hillCipher
simulation of Hill Cipher
-------------------------
Input message : Information
padded message : INFORMATIONX
encoded message : SNNUZICVUIJL
decoded message : INFORMATIONX

C:\security lab>javac playfairCipher.java

C:\security lab>java playfairCipher
Simulating Playfair Cipher
----------------------
Input Message : Communication Lab
Encrypted Message : BKREOROHSBUHKONSEZ
Decrypted Message : COMXMUNICATIONLABX

C:\security lab>
C:\security lab>javac vigenereCipher.java

C:\security lab>java vigenereCipher
Simulating Vigenere Cipher
------------------------
Input Message : Environment
Encrypted Message : ZVBMESEQGVI
Decrypted Message : ENVIRONMENT

C:\security lab>
```

2(a).Rail Fence Cipher Transposition Technique

Abdul Rahman S - 7881

```
import java.util.*;
class RailFenceBasic{
 int depth;
 String Encryption(String plainText,int depth)throws Exception
 {
  int r=depth,len=plainText.length();
  int c=len/depth;
  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++);
    else
     mat[j][i]='X';
   }
  }
  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 i=0;i< c;i++)
  {
   for(int j=0;j< r;j++)
   {
    plainText+=mat[j][i];
   }
  }

  return plainText;
 }
}

class RailFence{
 public static void main(String args[])throws Exception
 {
  RailFenceBasic rf=new RailFenceBasic();
                Scanner scn=new Scanner(System.in);
                int depth;

                String plainText,cipherText,decryptedText;

                System.out.println("Enter plain text:");
                plainText=scn.nextLine();

                System.out.println("Enter depth for Encryption:");
                depth=scn.nextInt();

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

                decryptedText=rf.Decryption(cipherText, depth);

  System.out.println("Decrypted text is:\n"+decryptedText);

 }
}
```

OUTPUT:



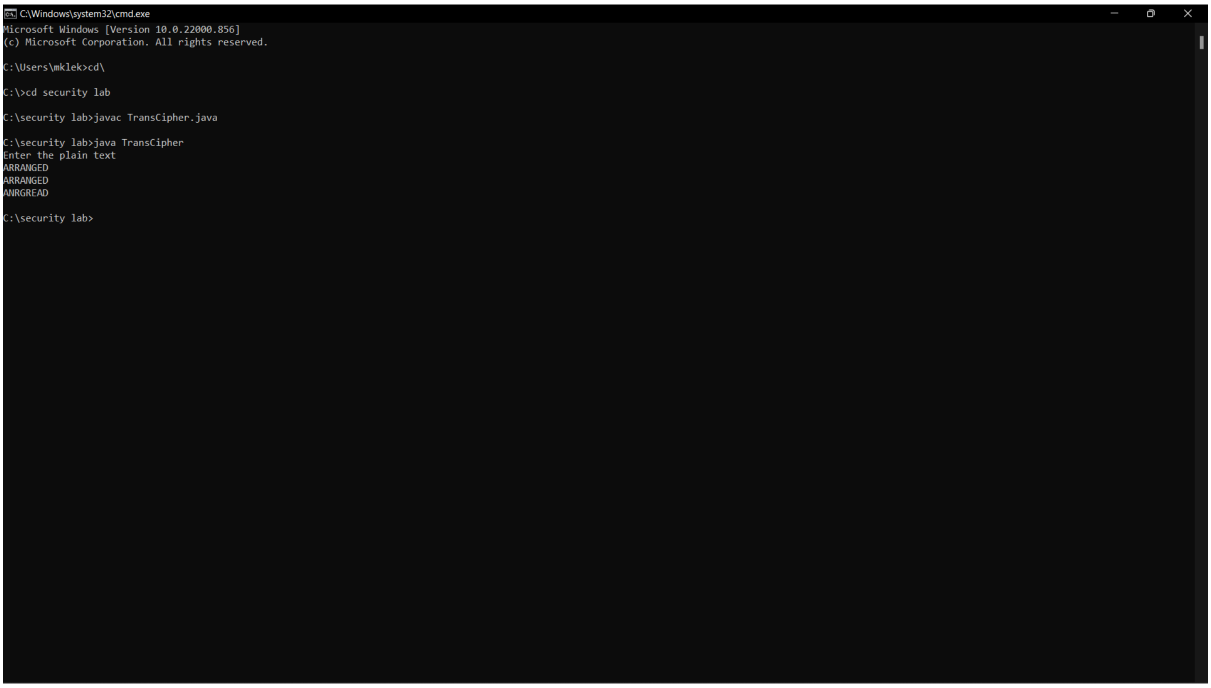
```
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac railfence.java

C:\security lab>java railfence
Input String : DEPARTMENT
Ciphered Text : DPRMNEATET

C:\security lab>
```

2(b).Row and Column Transformation Technique

Abdul Rahman S - 7881

```
import java.util.*;
class TransCipher {
 public static void main(String args[]) {
 Scanner sc = new Scanner(System.in);
 System.out.println("Enter the plain text");
 String pl = sc.nextLine();
 sc.close();
 String s = "";
 int start = 0;
 for (int i = 0; i < pl.length(); i++) {
 if (pl.charAt(i) == ' ') {
 s = s + pl.substring(start, i);
 start = i + 1;
 }
 }
 s = s + pl.substring(start);
System.out.print(s);
 System.out.println();
 int k = s.length();
 int l = 0;
 int col = 4;
 int row = s.length() / col;
 char ch[][] = new char[row][col];
 for (int i = 0; i < row; i++) {
 for (int j = 0; j < col; j++) {
 if (l < k) {
 ch[i][j] = s.charAt(l);
l++;
} else {
ch[i][j] = '#';
}
}
}
char trans[][] = new char[col][row];
for (int i = 0; i < row; i++) {
for (int j = 0; j < col; j++) {
trans[j][i] = ch[i][j];
}
}
for (int i = 0; i < col; i++) {
for (int j = 0; j < row; j++) {
System.out.print(trans[i][j]);
}
}
System.out.println();
}
}
```

OUTPUT:



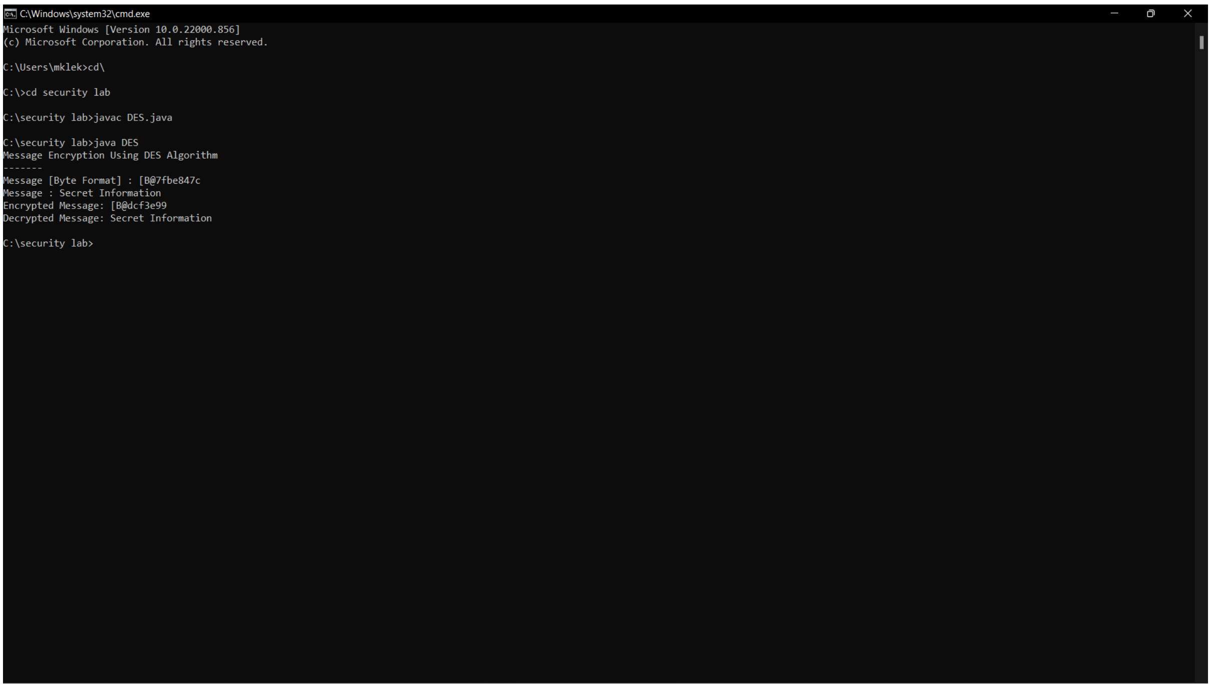
```
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac TransCipher.java

C:\security lab>java TransCipher
Enter the plain text
ARRANGED
ARRANGED
ANRGREAD

C:\security lab>
```

3.Data Encryption Standard (DES) Algorithm (User Message Encryption)

Abdul Rahman S - 7881

```
import java.security.InvalidKeyException;
import java.security.NoSuchAlgorithmException;
import javax.crypto.BadPaddingException;
import javax.crypto.Cipher;
import javax.crypto.IllegalBlockSizeException;
import javax.crypto.KeyGenerator;
import javax.crypto.NoSuchPaddingException;
import javax.crypto.SecretKey;
public class DES
{
public static void main(String[] argv) {
try{
 System.out.println("Message Encryption Using DES Algorithm\n-------");
 KeyGenerator keygenerator = KeyGenerator.getInstance("DES");
 SecretKey myDesKey = keygenerator.generateKey();
 Cipher desCipher;
desCipher = Cipher.getInstance("DES/ECB/PKCS5Padding");
 desCipher.init(Cipher.ENCRYPT_MODE, myDesKey);
 byte[] text = "Secret Information ".getBytes();
 System.out.println("Message [Byte Format] : " + text);
 System.out.println("Message : " + new String(text));
 byte[] textEncrypted = desCipher.doFinal(text);
 System.out.println("Encrypted Message: " + textEncrypted);
 desCipher.init(Cipher.DECRYPT_MODE, myDesKey);
 byte[] textDecrypted = desCipher.doFinal(textEncrypted);
 System.out.println("Decrypted Message: " + new
String(textDecrypted));
}catch(NoSuchAlgorithmException e){
e.printStackTrace();
}catch(NoSuchPaddingException e){
e.printStackTrace();
}catch(InvalidKeyException e){
e.printStackTrace();
}catch(IllegalBlockSizeException e){
e.printStackTrace();
}catch(BadPaddingException e){
e.printStackTrace();
}
}
}
```

OUTPUT:



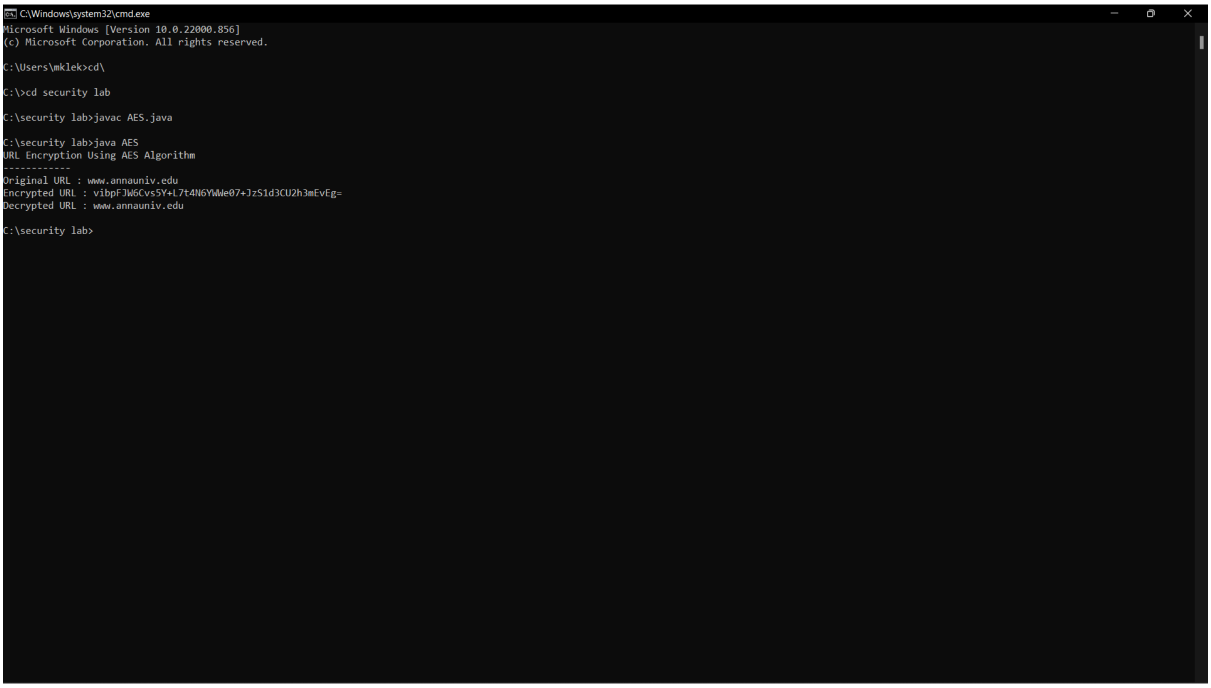
```
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac DES.java

C:\security lab>java DES
Message Encryption Using DES Algorithm
-------
Message [Byte Format] : [B@7fbe847c
Message : Secret Information
Encrypted Message: [B@dcf3e99
Decrypted Message: Secret Information

C:\security lab>
```

4. Advanced Encryption Standard (DES) Algorithm (URL Encryption)

Abdul Rahman S - 7881

```
import java.io.UnsupportedEncodingException;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
import java.util.Arrays;
import java.util.Base64;
import javax.crypto.Cipher;
import javax.crypto.spec.SecretKeySpec;
public class AES {
 private static SecretKeySpec secretKey;
 private static byte[] key;
 public static void setKey(String myKey) {
 MessageDigest sha = null;
 try {
 key = myKey.getBytes("UTF-8");
 sha = MessageDigest.getInstance("SHA-1");
 key = sha.digest(key);
 key = Arrays.copyOf(key, 16);
 secretKey = new SecretKeySpec(key, "AES");
 } catch (NoSuchAlgorithmException e) {
e.printStackTrace();
 } catch (UnsupportedEncodingException e) {
 e.printStackTrace();
 }
 }
 public static String encrypt(String strToEncrypt, String secret) {
 try {
 setKey(secret);
 Cipher cipher = Cipher.getInstance("AES/ECB/PKCS5Padding");
 cipher.init(Cipher.ENCRYPT_MODE, secretKey);
 return
Base64.getEncoder().encodeToString(cipher.doFinal(strToEncrypt.getBytes("UTF-8")));
 } catch (Exception e) {
 System.out.println("Error while encrypting: " + e.toString());
 }
 return null;
 }
 public static String decrypt(String strToDecrypt, String secret) {
 try {
 setKey(secret);
 Cipher cipher = Cipher.getInstance("AES/ECB/PKCS5PADDING");
 cipher.init(Cipher.DECRYPT_MODE, secretKey);
 return new
String(cipher.doFinal(Base64.getDecoder().decode(strToDecrypt)));
 } catch (Exception e) {
 System.out.println("Error while decrypting: " + e.toString());
 }
 return null;
 }
 public static void main(String[] args) {
 final String secretKey = "annaUniversity";
 String originalString = "www.annauniv.edu";
 String encryptedString = AES.encrypt(originalString, secretKey);
 String decryptedString = AES.decrypt(encryptedString, secretKey);
System.out.println("URL Encryption Using AES Algorithm\n------------");
 System.out.println("Original URL : " + originalString);
 System.out.println("Encrypted URL : " + encryptedString);
 System.out.println("Decrypted URL : " + decryptedString);
 }
}
```

OUTPUT:



```
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac AES.java

C:\security lab>java AES
URL Encryption Using AES Algorithm
------------
Original URL : www.annauniv.edu
Encrypted URL : vibpFJW6Cvs5Y+L7t4N6YWWe07+JzS1d3CU2h3mEvEg=
Decrypted URL : www.annauniv.edu

C:\security lab>
```

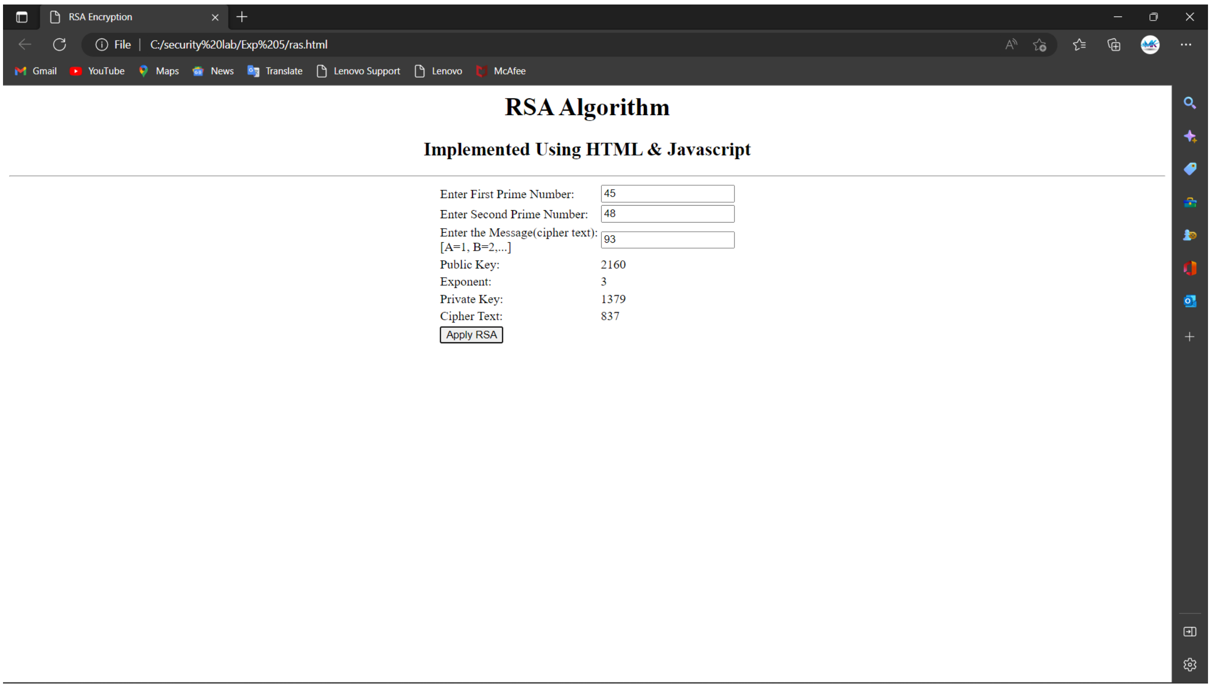
5. RSA Algorithm

Abdul Rahman S - 7881

```
<html>
<head>
 <title>RSA Encryption</title>
 <meta name="viewport" content="width=device-width, initial-scale=1.0">
</head>
<body>
 <center>
 <h1>RSA Algorithm</h1>
 <h2>Implemented Using HTML & Javascript</h2>
 <hr>
 <table>
 <tr>
 <td>Enter First Prime Number:</td>
 <td><input type="number" value="53" id="p"></td>
 </tr>
 <tr>
 <td>Enter Second Prime Number:</td>
 <td><input type="number" value="59" id="q"></p>
 </td>
 </tr>
 <tr>
 <td>Enter the Message(cipher text):<br>[A=1, B=2,...]</td>
 <td><input type="number" value="89" id="msg"></p>
 </td>
 </tr>
 <tr>
 <td>Public Key:</td>
 <td>
 <p id="publickey"></p>
 </td>
 </tr>
 <tr>
 <td>Exponent:</td>
 <td>
 <p id="exponent"></p>
 </td>
 </tr>
 <tr>
 <td>Private Key:</td>
 <td>
 <p id="privatekey"></p>
 </td>
 </tr>
 <tr>
 <td>Cipher Text:</td>
 <td>
 <p id="ciphertext"></p>
 </td>
 </tr>
 <tr>
 <td><button onclick="RSA();">Apply RSA</button></td>
 </tr>
 </table>
 </center>
</body>
<script type="text/javascript">
 function RSA() {
```

```
 var gcd, p, q, no, n, t, e, i, x;
 gcd = function (a, b) { return (!b) ? a : gcd(b, a % b); };
 p = document.getElementById('p').value;
 q = document.getElementById('q').value;
 no = document.getElementById('msg').value;
 n = p * q;
 t = (p - 1) * (q - 1);
 for (e = 2; e < t; e++) {
 if (gcd(e, t) == 1) {
 break;
 }
 }
 for (i = 0; i < 10; i++) {
 x = 1 + i * t
 if (x % e == 0) {
 d = x / e;
 break;
 }
 }
 ctt = Math.pow(no, e).toFixed(0);
 ct = ctt % n;
 dtt = Math.pow(ct, d).toFixed(0);
 dt = dtt % n;
 document.getElementById('publickey').innerHTML = n;
 document.getElementById('exponent').innerHTML = e;
 document.getElementById('privatekey').innerHTML = d;
 document.getElementById('ciphertext').innerHTML = ct;
 }
</script>
</html>
```

OUTPUT:



RSA Algorithm

Implemented Using HTML & Javascript

Enter First Prime Number: 45

Enter Second Prime Number: 48

Enter the Message(cipher text): [A=1, B=2,...] 93

Public Key: 2160

Exponent: 3

Private Key: 1379

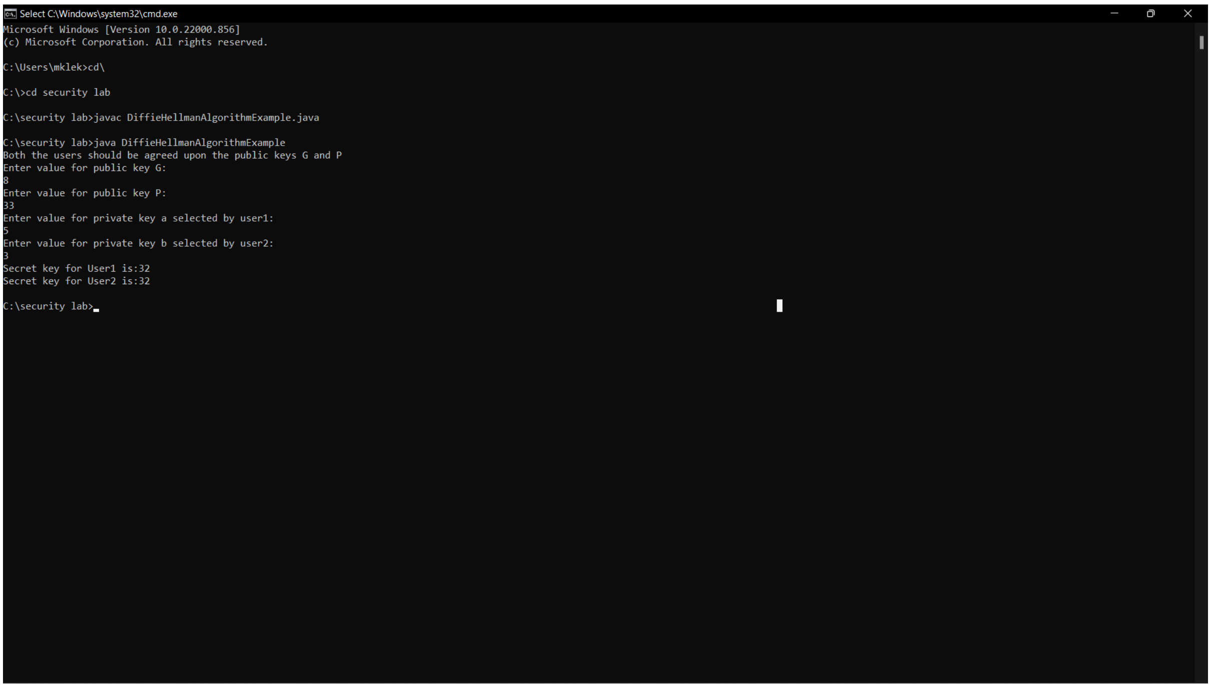
Cipher Text: 837

6 . Diffie-Hellman key exchange algorithm

(S. Manoj Kumar-7577)

```
import java.util.*;
class DiffieHellmanAlgorithmExample {
    public static void main(String[] args)
    {
        long P, G, x, a, y, b, ka, kb;
        Scanner sc = new Scanner(System.in);
        System.out.println("Both the users should be agreed upon the public keys G and P");
        System.out.println("Enter value for public key G:");
        G = sc.nextLong();
        System.out.println("Enter value for public key P:");
        P = sc.nextLong();
        System.out.println("Enter value for private key a selected by user1:");
        a = sc.nextLong();
        System.out.println("Enter value for private key b selected by user2:");
        b = sc.nextLong();
        x = calculatePower(G, a, P);
        y = calculatePower(G, b, P);
        ka = calculatePower(y, a, P);
        kb = calculatePower(x, b, P);
        System.out.println("Secret key for User1 is:" + ka);
        System.out.println("Secret key for User2 is:" + kb);
    }
    private static long calculatePower(long x, long y, long P)
    {
        long result = 0;
        if (y == 1){
            return x;
        }
    else{
        result = ((long)Math.pow(x, y)) % P;
        return result;
    }
  }
}
```

OUTPUT:



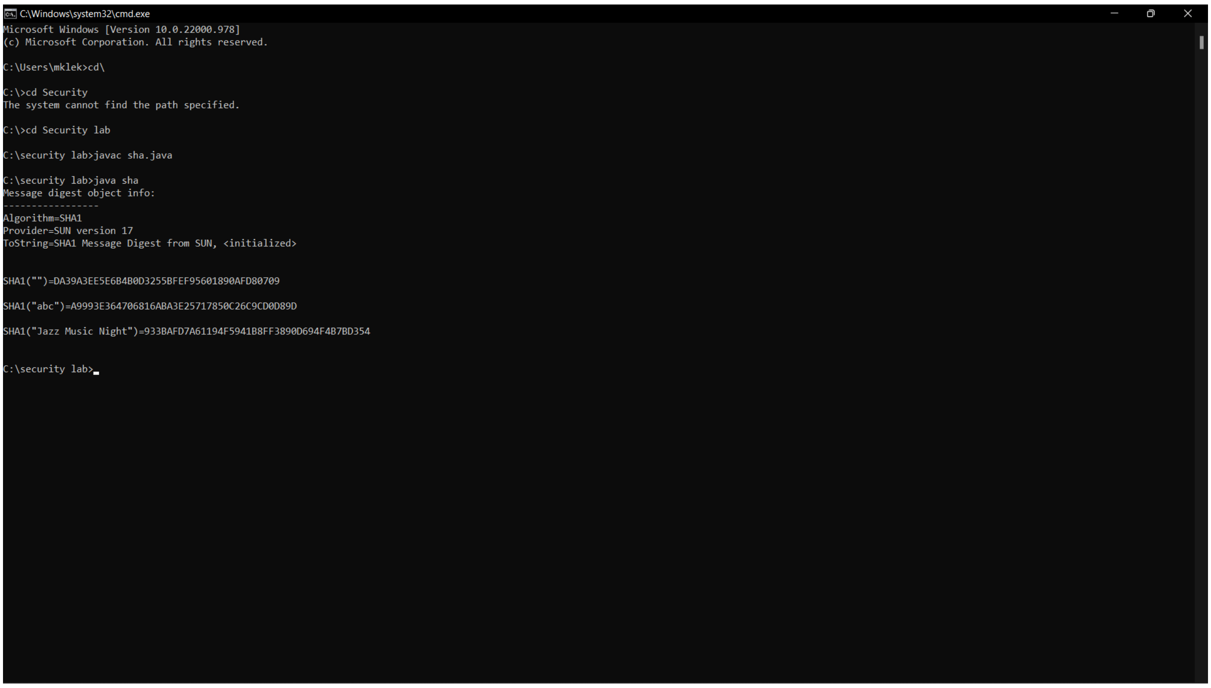
```
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd security lab

C:\security lab>javac DiffieHellmanAlgorithmExample.java

C:\security lab>java DiffieHellmanAlgorithmExample
Both the users should be agreed upon the public keys G and P
Enter value for public key G:
8
Enter value for public key P:
33
Enter value for private key a selected by user1:
5
Enter value for private key b selected by user2:
3
Secret key for User1 is:32
Secret key for User2 is:32

C:\security lab>
```

7. SHA-1 Algorithm

Abdul Rahman S - 7881

```
import java.security.*;
public class sha {
 public static void main(String[] a) {
 try {
 MessageDigest md = MessageDigest.getInstance("SHA1");
 System.out.println("Message digest object info:\n-----------------");
 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 = "Jazz Music Night";
 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);
 }
 }
 private 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 (byte aB : b) {
 buf.append(hexDigit[(aB >> 4) & 0x0f]);
 buf.append(hexDigit[aB & 0x0f]);
 }
 return buf.toString();
 }
}
```

OUTPUT:



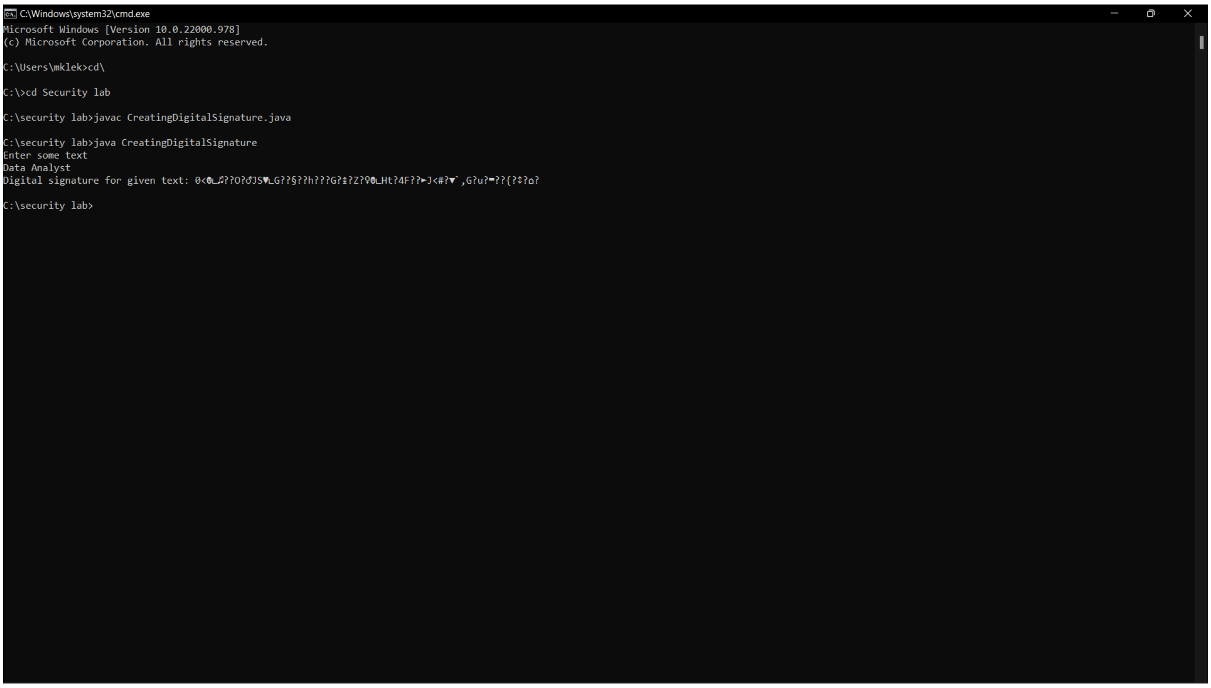
```
Microsoft Windows [Version 10.0.22000.978]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd Security
The system cannot find the path specified.

C:\>cd Security lab

C:\security lab>javac sha.java

C:\security lab>java sha
Message digest object info:
-----------------
Algorithm=SHA1
Provider=SUN version 17
ToString=SHA1 Message Digest from SUN, <initialized>


SHA1("")=DA39A3EE5E6B4B0D3255BFEF95601890AFD80709

SHA1("abc")=A9993E364706816ABA3E25717850C26C9CD0D89D

SHA1("Jazz Music Night")=933BAFD7A61194F5941B8FF3890D694F4B7BD354


C:\security lab>
```

8. Digital Signature Standard

Abdul Rahman S - 7881

```
import java.security.KeyPair;
import java.security.KeyPairGenerator;
import java.security.PrivateKey;
import java.security.Signature;
import java.util.Scanner;
public class CreatingDigitalSignature {
 public static void main(String args[]) throws Exception {
 Scanner sc = new Scanner(System.in);
 System.out.println("Enter some text");
 String msg = sc.nextLine();

 KeyPairGenerator keyPairGen = KeyPairGenerator.getInstance("DSA");

 keyPairGen.initialize(2048);
 KeyPair pair = keyPairGen.generateKeyPair();

 PrivateKey privKey = pair.getPrivate();

 Signature sign = Signature.getInstance("SHA256withDSA");
 sign.initSign(privKey);
 byte[] bytes = "msg".getBytes();

 sign.update(bytes);

 byte[] signature = sign.sign();

 System.out.println("Digital signature for given text: "+new String(signature,
"UTF8"));
 }
}
```

OUTPUT:



```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 10.0.22000.978]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mklek>cd\

C:\>cd Security lab

C:\security lab>javac CreatingDigitalSignature.java

C:\security lab>java CreatingDigitalSignature
Enter some text
Data Analyst
Digital signature for given text: 0<☻└♫??O?♂JS♥└G??§??h???G?↨?Z?♀☻└Ht?4F??►J<#?▼`,G?u?▬??{?↕?⌂?

C:\security lab>
```

9. Demonstration of Intrusion Detection System(IDS)

Abdul Rahman S - 7881

1. Download Snort from the Snort.org website.

2. Download Rules. You must register to get the rules.

3. Double-click on the .exe to install snort.

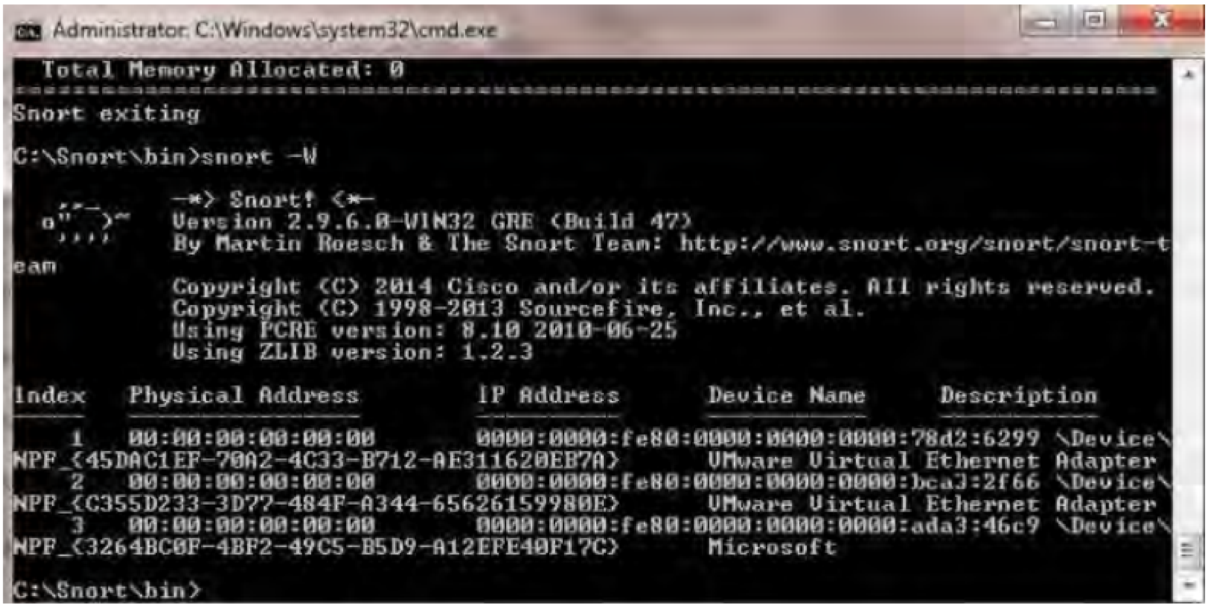
4. Extract the Rules file. You will need WinRAR for the .gz file.

5. Copy all files from the “rules” folder of the extracted folder. Now paste the rules into the “C:\Snort\rules” folder.

6. Copy the “snort. conf” file from the “etc” folder of the extracted folder. You must paste it into the “C:\Snort\etc” folder.

7. Open a command prompt (cmd.exe) and navigate to the folder “C:\Snort\bin” folder. (at the Prompt, type cd\snort\bin)

8. To start (execute) snort in sniffer mode use the following command: snort -dev -i 3 -i Indicates the interface number.



```
 Total Memory Allocated: 0
===============================================================================
Snort exiting

C:\Snort\bin>snort -W

   ,,_     -*> Snort! <*-
  o"  )~   Version 2.9.6.0-WIN32 GRE (Build 47)
   ''''    By Martin Roesch & The Snort Team: http://www.snort.org/snort/snort-t
eam
           Copyright (C) 2014 Cisco and/or its affiliates. All rights reserved.
           Copyright (C) 1998-2013 Sourcefire, Inc., et al.
           Using PCRE version: 8.10 2010-06-25
           Using ZLIB version: 1.2.3

Index   Physical Address          IP Address         Device Name      Description
-----   ----------------          ----------         -----------      -----------
    1   00:00:00:00:00:00         0000:0000:fe80:0000:0000:0000:78d2:6299 \Device\
NPF_{45DAC1EF-70A2-4C33-B712-AE311620EB7A}         VMware Virtual Ethernet Adapter
    2   00:00:00:00:00:00         0000:0000:fe80:0000:0000:0000:bca3:2f66 \Device\
NPF_{C355D233-3D77-484F-A344-65626159980E}         VMware Virtual Ethernet Adapter
    3   00:00:00:00:00:00         0000:0000:fe80:0000:0000:0000:ada3:46c9 \Device\
NPF_{3264BC0F-4BF2-49C5-B5D9-A12EFE40F17C}         Microsoft

C:\Snort\bin>
```

9. To run snort in IDS mode, you will need to configure the file “snort. conf” according to your network environment.

10. To specify the network address that you want to protect in snort.conf file, look for the following line.

11. To set the addresses of DNS_SERVERS if you have some on your network.

12. Change the RULE_PATH variable to the path of the rules folder. var RULE_PATH c:\snort\rules.

13. Change the path of all library files with the name and path on your system. and you must change the path of snort_dynamicpreprocessorvariable.

14. Change the path of the “dynamic engine” variable value in the “snort. conf” file.

15 Add the paths for the “include classification. config” and “include reference. config” files.

16. Remove the comment (#) on the line to allow ICMP rules, if it is commented with a #.

17. The comment of the ICMP-info rules comment if it is commented.

18. To add log files to store alerts generated by snort, search for the “output log” test in snort. conf and add the following line:

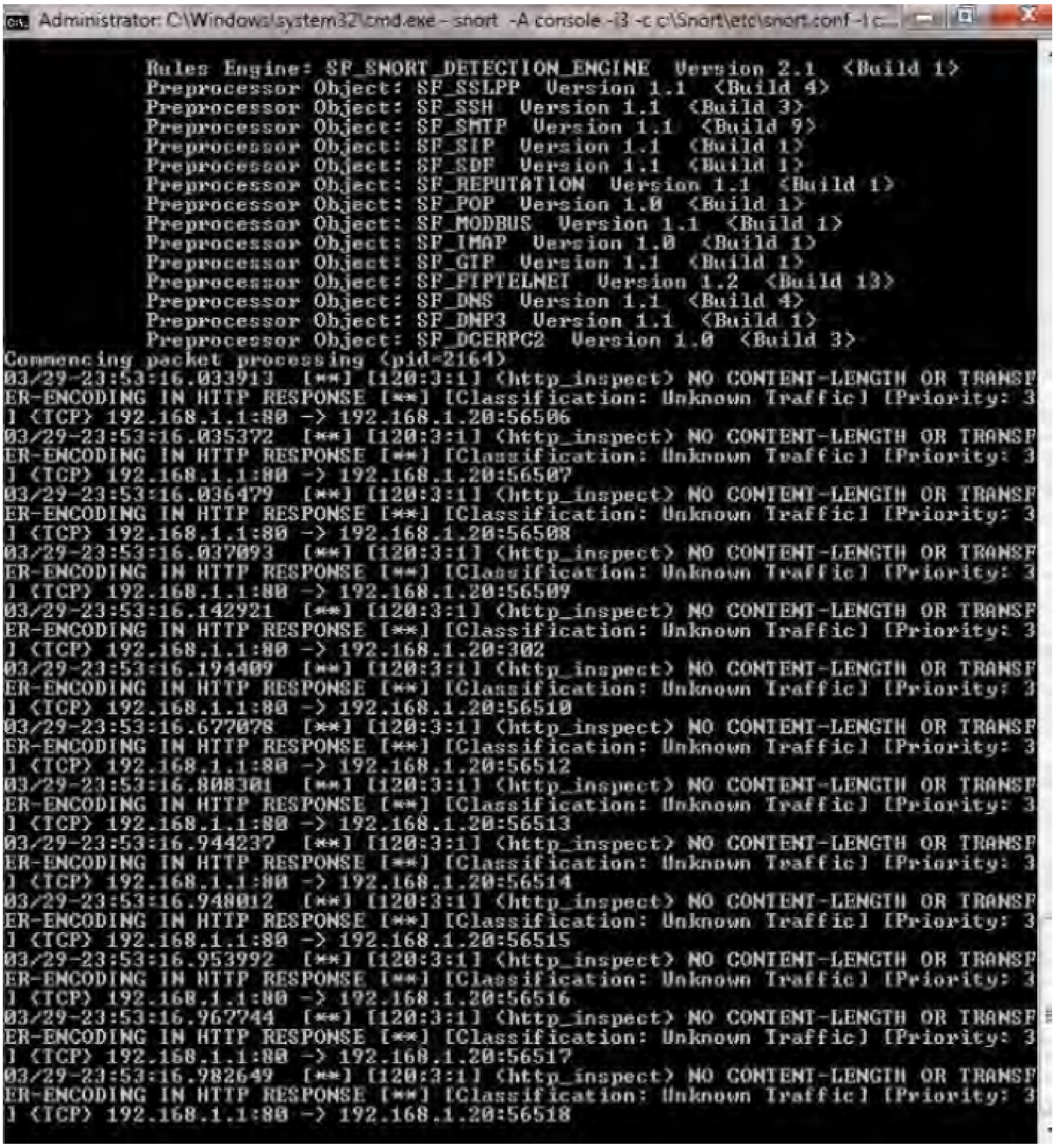
19. Comment (add a #) the whitelist $WHITE_LIST_PATH/white_list.rules and the blacklist

20. Comment out (#) the following lines:

21. Save the “snort. conf” file.

22. To start snort in IDS mode, run the following command:

23. Scan the computer running snort from another computer using PING or NMap (ZenMap).



Administrator: C:\Windows\system32\cmd.exe - snort -A console -i3 -c c:\Snort\etc\snort.conf -l c...

```
          Rules Engine: SF_SNORT_DETECTION_ENGINE  Version 2.1  <Build 1>
          Preprocessor Object: SF_SSLPP  Version 1.1  <Build 4>
          Preprocessor Object: SF_SSH  Version 1.1  <Build 3>
          Preprocessor Object: SF_SMTP  Version 1.1  <Build 9>
          Preprocessor Object: SF_SIP  Version 1.1  <Build 1>
          Preprocessor Object: SF_SDF  Version 1.1  <Build 1>
          Preprocessor Object: SF_REPUTATION  Version 1.1  <Build 1>
          Preprocessor Object: SF_POP  Version 1.0  <Build 1>
          Preprocessor Object: SF_MODBUS  Version 1.1  <Build 1>
          Preprocessor Object: SF_IMAP  Version 1.0  <Build 1>
          Preprocessor Object: SF_GTP  Version 1.1  <Build 1>
          Preprocessor Object: SF_FTPTELNET  Version 1.2  <Build 13>
          Preprocessor Object: SF_DNS  Version 1.1  <Build 4>
          Preprocessor Object: SF_DNP3  Version 1.1  <Build 1>
          Preprocessor Object: SF_DCERPC2  Version 1.0  <Build 3>
Commencing packet processing (pid=2164)
03/29-23:53:16.033913  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56506
03/29-23:53:16.035372  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56507
03/29-23:53:16.036479  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56508
03/29-23:53:16.037093  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56509
03/29-23:53:16.142921  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:302
03/29-23:53:16.194409  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56510
03/29-23:53:16.677078  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56512
03/29-23:53:16.808301  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56513
03/29-23:53:16.944237  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56514
03/29-23:53:16.948012  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56515
03/29-23:53:16.953992  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56516
03/29-23:53:16.967744  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56517
03/29-23:53:16.982649  [**] [120:3:1] (http_inspect) NO CONTENT-LENGTH OR TRANSF
ER-ENCODING IN HTTP RESPONSE [**] [Classification: Unknown Traffic] [Priority: 3
] {TCP} 192.168.1.1:80 -> 192.168.1.20:56518
```

10. Exploring N-Stalker, a Vulnerability Assessment Tool

Abdul Rahman S - 7881

1. Start N-Stalker from a Windows computer. The program is installed under Start ➪ Programs ➪ N-Stalker ➪ N-Stalker Free Edition.

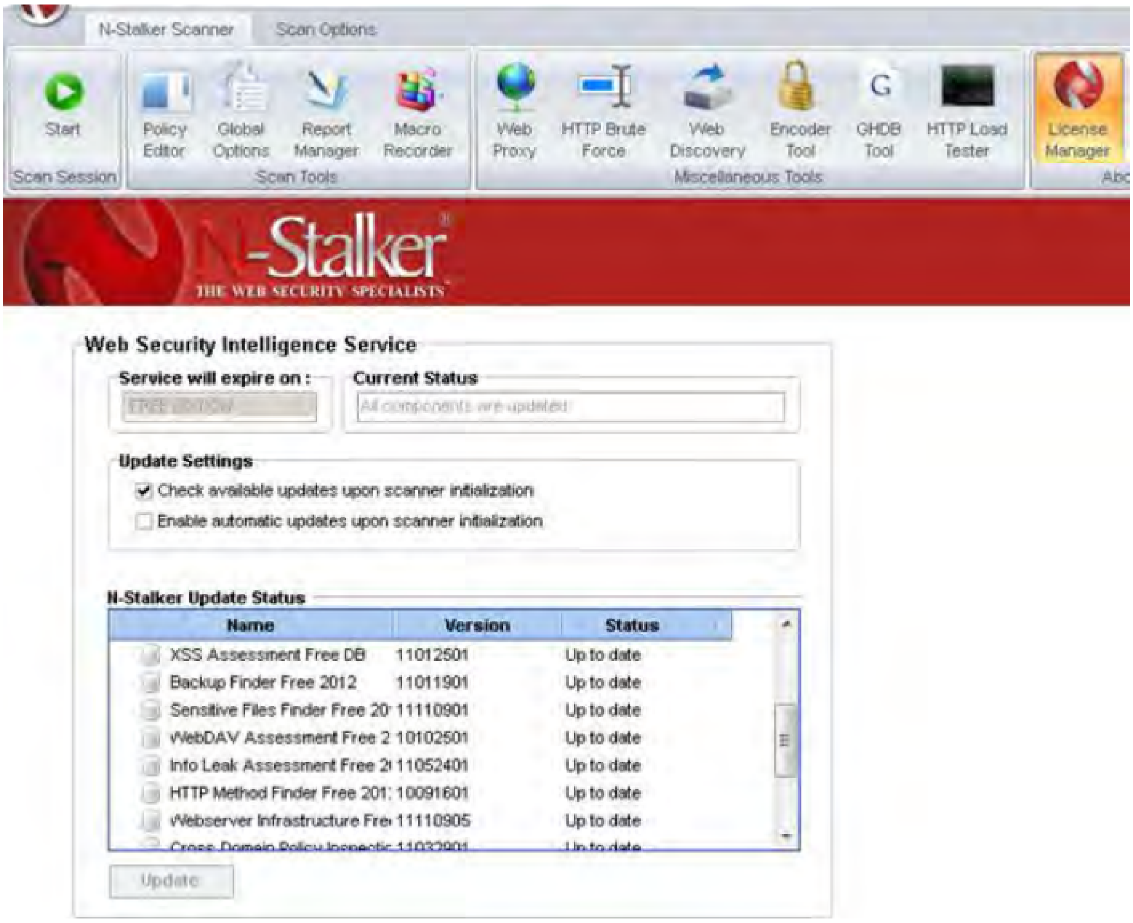
2. Enter a host address or a range of addresses to scan.

3. Click Start Scan.

4. After the scan completes, the N-Stalker Report Manager will prompt

5. you to select a format for the resulting report and choose to Generate HTML.

6. Review the HTML report for vulnerabilities.



Web Security Intelligence Service

Service will expire on : FREE EDITION

Current Status: All components are updated

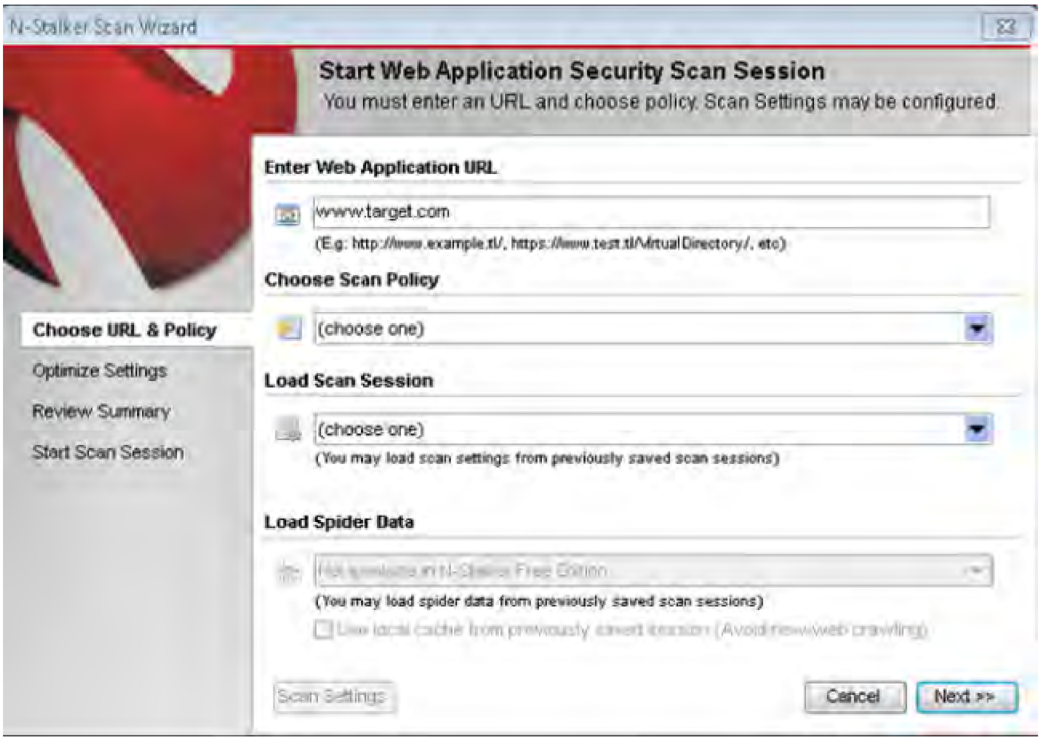
Update Settings

☑ Check available updates upon scanner initialization

□ Enable automatic updates upon scanner initialization

N-Stalker Update Status

Name	Version	Status
XSS Assessment Free DB	11012501	Up to date
Backup Finder Free 2012	11011901	Up to date
Sensitive Files Finder Free 20	11110901	Up to date
WebDAV Assessment Free 2	10102501	Up to date
Info Leak Assessment Free 2	11052401	Up to date
HTTP Method Finder Free 201	10091601	Up to date
Webserver Infrastructure Fre	11110905	Up to date
Cross Domain Policy Inspectic	11032901	Up to date



Start Web Application Security Scan Session

You must enter an URL and choose policy. Scan Settings may be configured.

Enter Web Application URL

www.target.com

(E.g: http://www.example.tl/, https://www.test.tl/VirtualDirectory/, etc)

Choose Scan Policy

(choose one)

Load Scan Session

(choose one)

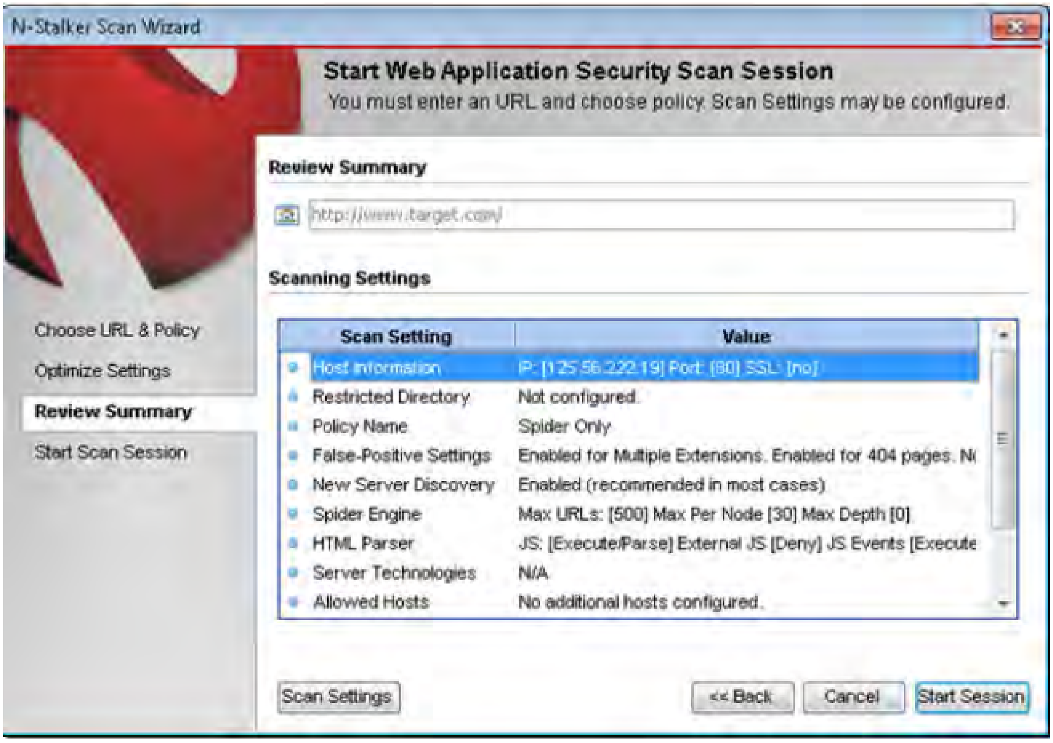
(You may load scan settings from previously saved scan sessions)

Load Spider Data

Not available in N-Stalker Free Edition

(You may load spider data from previously saved scan sessions)

□ Use local cache from previously saved session (Avoid new web crawling)



Start Web Application Security Scan Session

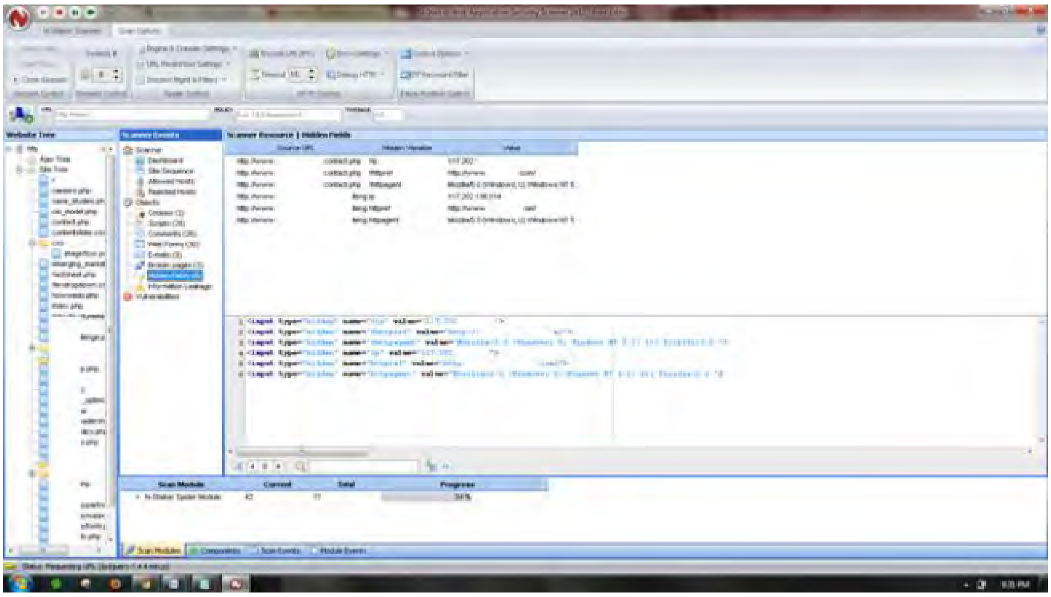
You must enter an URL and choose policy. Scan Settings may be configured.

Review Summary

http://www.target.com/

Scanning Settings

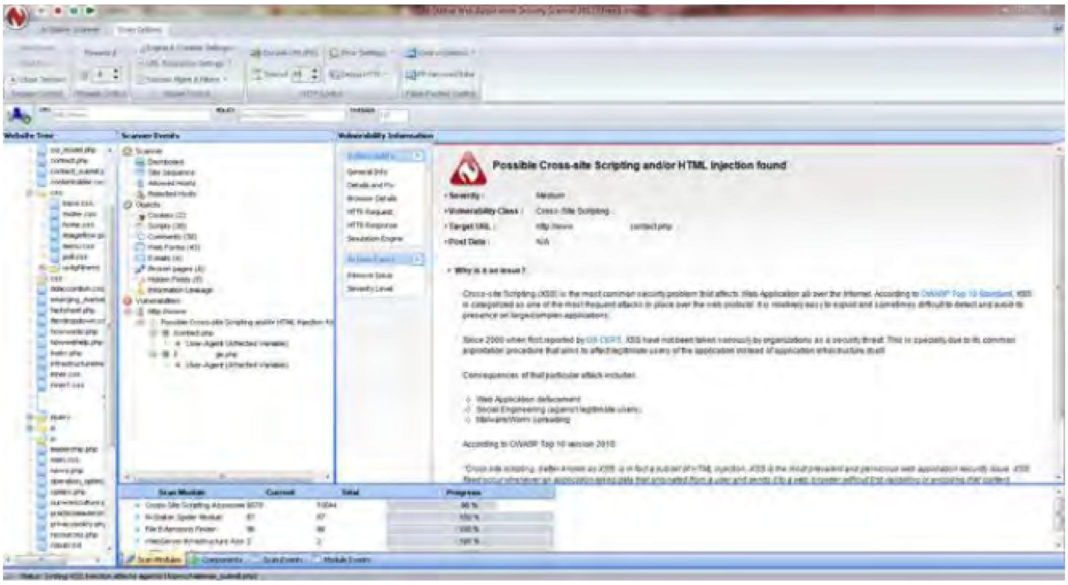
Scan Setting	Value
Host Information	IP: [125.56.222.19] Port: [80] SSL: [no]
Restricted Directory	Not configured.
Policy Name	Spider Only
False-Positive Settings	Enabled for Multiple Extensions. Enabled for 404 pages. N(
New Server Discovery	Enabled (recommended in most cases)
Spider Engine	Max URLs: [500] Max Per Node [30] Max Depth [0]
HTML Parser	JS: [Execute/Parse] External JS [Deny] JS Events [Execute
Server Technologies	N/A
Allowed Hosts	No additional hosts configured.



Scanner Resource | Hidden Fields

Source URL	Hidden Variable	Value
http://www contact.php	ip	117.202
http://www contact.php	httpref	http://www .com/
http://www contact.php	httpagent	Mozilla/5.0 (Windows; U; Windows NT 5
http://www	ip	117.202.138.214
http://www	httpref	http://www .net/
http://www	httpagent	Mozilla/5.0 (Windows; U; Windows NT 5

Scan Module	Current	Total	Progress
N-Stalker Spider Module	42	77	55%



Possible Cross-site Scripting and/or HTML Injection found

- Severity : Medium
- Vulnerability Class : Cross-Site Scripting
- Target URL : http://www contact.php
- Post Data : N/A

Why is it an issue ?

Cross-site Scripting (XSS) is the most common security problem that affects Web Application all over the Internet. According to OWASP Top 10 Standard, XSS is categorized as one of the most frequent attacks in place over the web protocol. It is relatively easy to exploit and sometimes difficult to detect and audit its presence on large/complex applications.

Since 2000 when first reported by US-CERT, XSS have not been taken seriously by organizations as a security threat. This is specially due to its common exploitation procedure that aims to affect legitimate users of the application instead of application infrastructure itself.

Consequences of that particular attack includes:

- Web Application defacement
- Social Engineering (against legitimate users)
- Malware/Worm spreading

According to OWASP Top 10 version 2010:

"Cross-site scripting, better known as XSS, is in fact a subset of HTML injection. XSS is the most prevalent and pernicious web application security issue. XSS flaws occur whenever an application takes data that originated from a user and sends it to a web browser without first validating or encoding that content

Scan Module	Current	Total	Progress
Cross-Site Scripting Advanced	9070	10044	90 %
N-Stalker Spider Module	87	87	100 %
File Extensions Finder	96	96	100 %
WebServer Infrastructure Analysis	2	2	100 %

11(a) Defeating Malware - Building Trojans

Abdul Rahman S - 7881

TROJAN:

- In computing, a Trojan horse,or trojan, is any malware which misleads users of its true intent.
- Trojans are generally spread by some form of social engineering, for example where a user is duped into executing an email attachment disguised to appear not suspicious, (e.g., a routine form to be filled in), or by clicking on some fake advertisement on social media or anywhere else.
- Although their payload can be anything, many modern forms act as a backdoor, contacting a controller which can then have unauthorized access to the affected computer.
- Trojans may allow an attacker to access users' personal information such as banking information, passwords, or personal identity.
- **Example:** Ransomware attacks are often carried out using a trojan.

CODE:

Trojan.bat

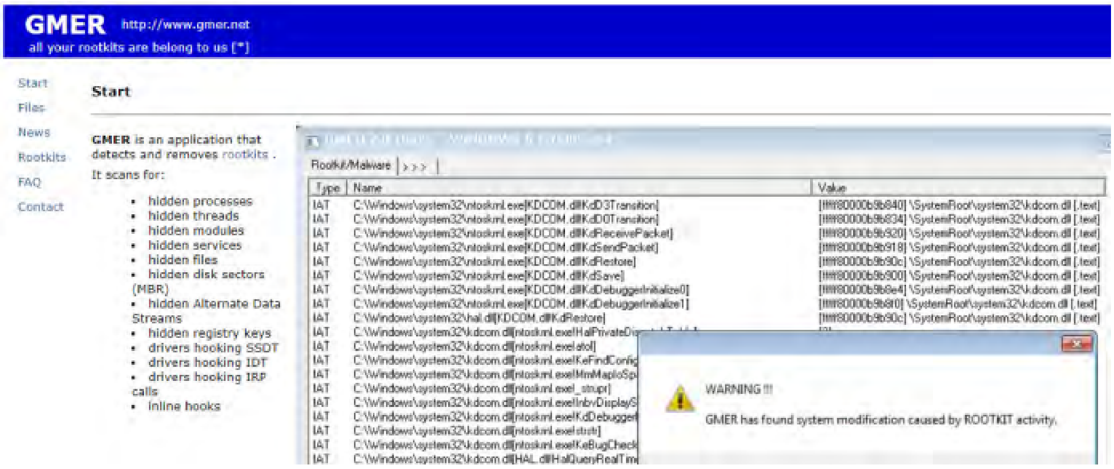
```
@echo off
 :x
start mspaint
start notepad
start cmd
start explorer
start control
start calc
goto x
```

OUTPUT:

(MS-Paint, Notepad, Command Prompt, Explorer will open infinitely)

11(b) Defeating Malware - Rootkit hunter

Abdul Rahman S - 7881



Start

GMER is an application that detects and removes rootkits .

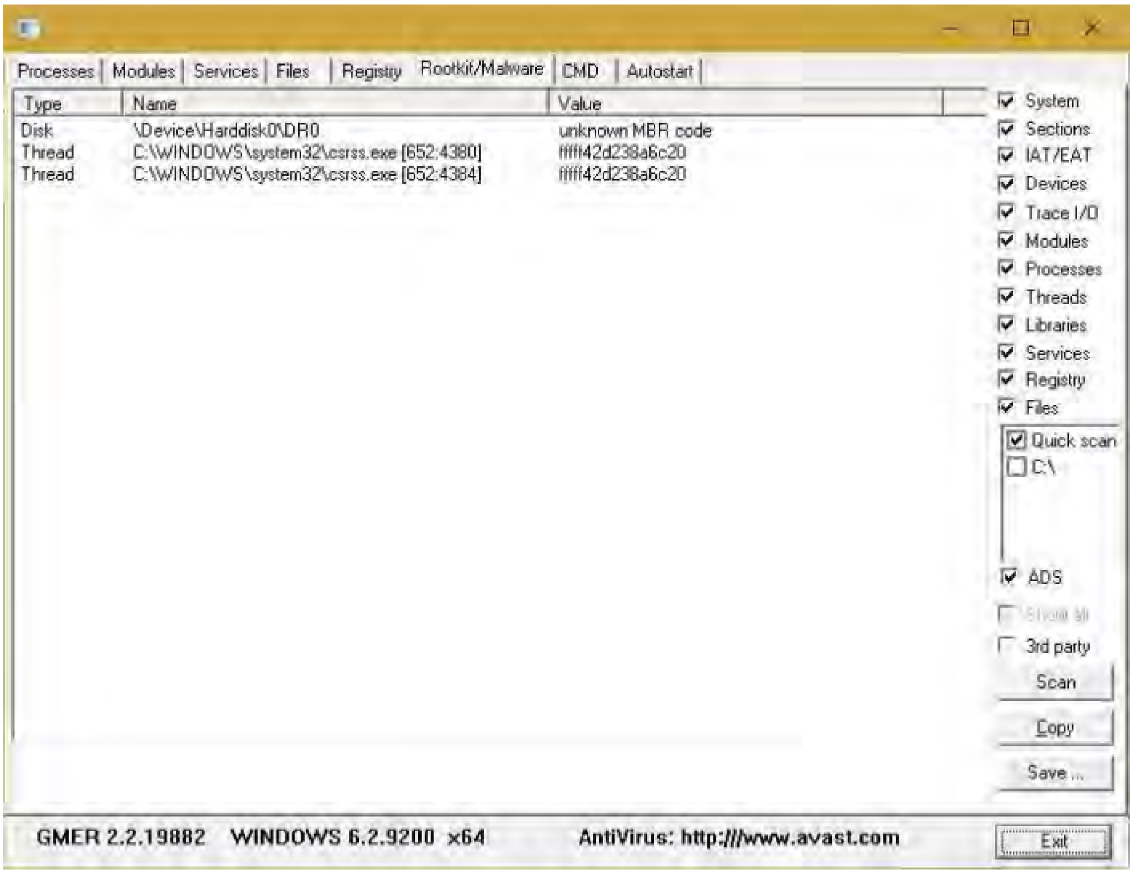
It scans for:

- hidden processes
- hidden threads
- hidden modules
- hidden services
- hidden files
- hidden disk sectors (MBR)
- hidden Alternate Data Streams
- hidden registry keys
- drivers hooking SSDT
- drivers hooking IDT
- drivers hooking IRP calls
- inline hooks

```
Type  Name                                                          Value
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdD3Transition]          [fffff80000b9b840] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdD0Transition]          [fffff80000b9b834] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdReceivePacket]         [fffff80000b9b920] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdSendPacket]            [fffff80000b9b918] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdRestore]               [fffff80000b9b90c] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdSave]                  [fffff80000b9b900] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdDebuggerInitialize0]   [fffff80000b9b8e4] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\ntoskrnl.exe[KDCOM.dll!KdDebuggerInitialize1]   [fffff80000b9b810] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\hal.dll[KDCOM.dll!KdRestore]                    [fffff80000b9b90c] \SystemRoot\system32\kdcom.dll [.text]
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!HalPrivateDi
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!atol]
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!KeFindConfig
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!MmMapIoSp
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!_strupr]
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!InbvDisplayS
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!KdDebugger
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!strstr]
IAT   C:\Windows\system32\kdcom.dll[ntoskrnl.exe!KeBugCheck
IAT   C:\Windows\system32\kdcom.dll[HAL.dll!HalQueryRealTim
```

WARNING !!!

GMER has found system modification caused by ROOTKIT activity.



```
Type     Name                                         Value
Disk     \Device\Harddisk0\DR0                        unknown MBR code
Thread   C:\WINDOWS\system32\csrss.exe [652:4380]     fffff42d238a6c20
Thread   C:\WINDOWS\system32\csrss.exe [652:4384]     fffff42d238a6c20
```

☑ System
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☑ Devices
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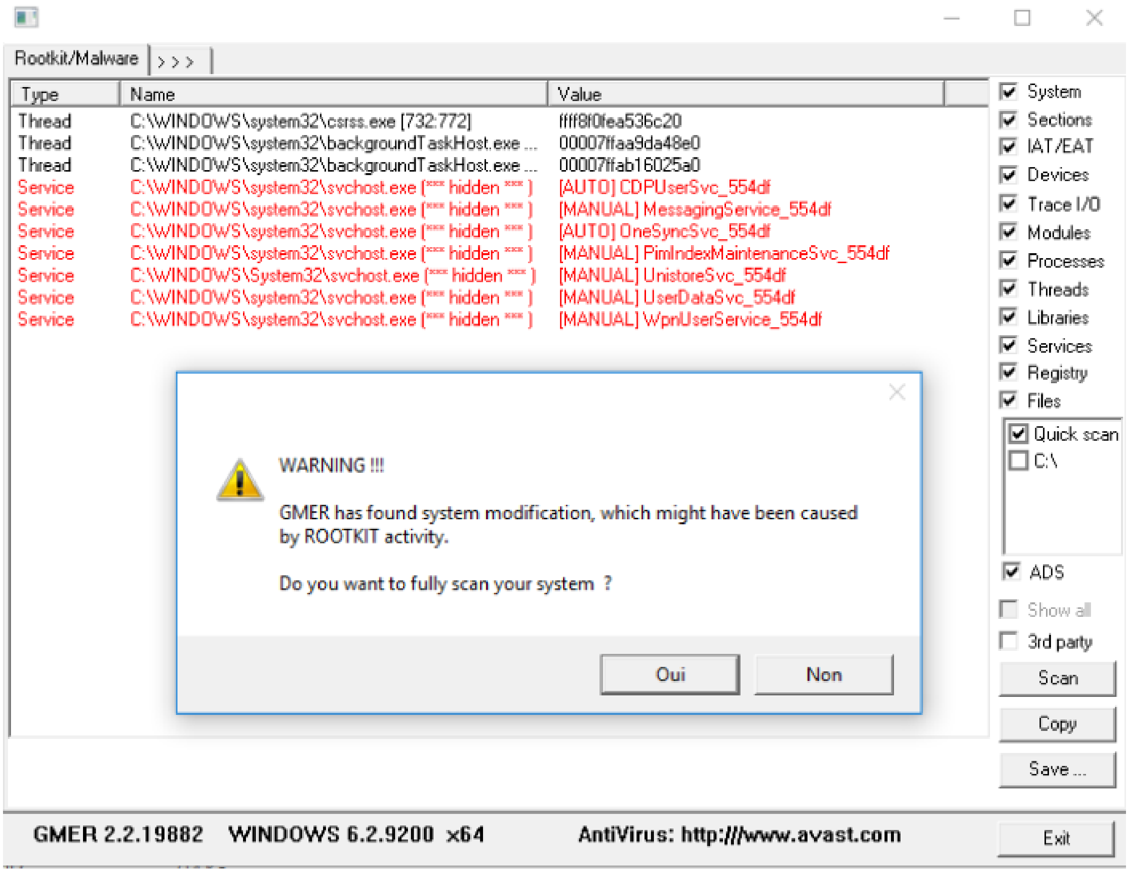
☑ Modules
☑ Processes
☑ Threads
☑ Libraries
☑ Services
☑ Registry
☑ Files
☑ Quick scan
☐ C:\
☑ ADS
☐ Show all
☐ 3rd party

GMER 2.2.19882 WINDOWS 6.2.9200 x64 AntiVirus: http://www.avast.com



Type	Name	Value
Thread	C:\WINDOWS\system32\csrss.exe [732:772]	ffff8f0fea536c20
Thread	C:\WINDOWS\system32\backgroundTaskHost.exe ...	00007ffaa9da48e0
Thread	C:\WINDOWS\system32\backgroundTaskHost.exe ...	00007ffab16025a0
Service	C:\WINDOWS\system32\svchost.exe (*** hidden ***)	[AUTO] CDPUserSvc_554df
Service	C:\WINDOWS\system32\svchost.exe (*** hidden ***)	[MANUAL] MessagingService_554df
Service	C:\WINDOWS\system32\svchost.exe (*** hidden ***)	[AUTO] OneSyncSvc_554df
Service	C:\WINDOWS\system32\svchost.exe (*** hidden ***)	[MANUAL] PimIndexMaintenanceSvc_554df
Service	C:\WINDOWS\System32\svchost.exe (*** hidden ***)	[MANUAL] UnistoreSvc_554df
Service	C:\WINDOWS\system32\svchost.exe (*** hidden ***)	[MANUAL] UserDataSvc_554df
Service	C:\WINDOWS\system32\svchost.exe (*** hidden ***)	[MANUAL] WpnUserService_554df

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□ C:\
☑ ADS
□ Show all
□ 3rd party

WARNING !!!

GMER has found system modification, which might have been caused by ROOTKIT activity.

Do you want to fully scan your system ?

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