



R.M.K. COLLEGE OF ENGINEERING AND TECHNOLOGY

(ISO 9001:2008 Certified Institution)

RSM Nagar, Puduvoyal – 601206



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

IT8761 – SECURITY LAB MANUAL

IV Year / 7th Sem

ANNA UNIVERSITY REGULATIONS 2017



RMK College of Engineering and Technology
RSM Nagar, Puduvoyal-601206



INSTITUTION VISION

To be knowledge hub of providing quality technical education and promoting research for building up of our nation and its contribution for the betterment of humanity.

INSTITUTION MISSION

- To make the best use of state-of-the-art infrastructure to ensure quality technical education.
- To develop industrial collaborations to promote innovation and research capabilities.
- To inculcate values and ethics to serve humanity



RMK College of Engineering and Technology
RSM Nagar, Pudukkottai-601206



Department of Computer Science and Engineering

VISION

To be a source of knowledge in the field of Computer Science and Engineering to cater to the growing need of industry and society.

MISSION

- To avail state-of-the art infrastructure for adopting cutting edge technologies and encouraging research activities.
- To promote industrial collaborations for professional competency.
- To nurture social responsibility and ethics to become worthy citizens.

PROGRAM EDUCATIONAL OBJECTIVES

Graduates of Computer Science and Engineering Program will

PEO I: Become globally competent professionals in all spheres and pursue higher education world over.

PEO II: Successfully carry forward domain knowledge in computing and allied areas to solve complex real world engineering problems.

PEO III: Continuously upgrade their technical knowledge and expertise to keep pace with the technological revolution.

PEO IV: Serve the humanity with social responsibility combined with ethics.

PROGRAM SPECIFIC OUTCOMES

Graduates of Computer Science and Engineering Program will be able to:

- Analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering.
- Apply software engineering principles and practices for developing quality software for scientific and business applications.
- To implement cost-effective solutions for the betterment of both industry and society with the technological skills acquired through the Centers of Excellence.



Department of Computer Science and Engineering

PROGRAM OUTCOME

- **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
- **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
- **Conduct investigations of complex problems** using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
- **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.
- **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
- **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
- **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
- **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.
- **Project Management and Finance:** Demonstrate knowledge and understanding of 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.
- **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.



RMK College of Engineering and Technology
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Department of Computer Science and Engineering

GENERAL LABORATORY INSTRUCTIONS

1. Students are advised to come to the laboratory at least 5 minutes before (to starting time), those who come after 5 minutes will not be allowed into the lab.
2. Plan your task properly much before to the commencement, come prepared to the lab with the synopsis / program / experiment details.
3. Student should enter into the laboratory with:
 - a. Laboratory observation notes with all the details (Problem statement, Aim, Algorithm, Procedure, Program, Expected Output, etc..) filled in for the lab session.
 - b. Laboratory Record updated up to the last session experiments and other utensils (if any) needed in the lab.
 - c. Proper Dress code and Identity card.
4. Sign in the laboratory login register, write the TIME-IN, and occupy the computer system allotted to you by the faculty.
5. Execute your task in the laboratory, and record the results / output in the lab observation notebook, and get certified by the concerned faculty.
6. All the students should be polite and cooperative with the laboratory staff, must maintain the discipline and decency in the laboratory.
7. Computer labs are established with sophisticated and high end branded systems, which should be utilized properly.
8. Students / Faculty must keep their mobile phones in SWITCHED OFF mode during the lab sessions. Misuse of the equipment, misbehaviors with the staff and systems etc., will attract severe punishment.
9. Students must take the permission of the faculty in case of any urgency to go out; if anybody found loitering outside the lab / class without permission during working hours will be treated seriously and punished appropriately.
10. Students should LOG OFF/ SHUT DOWN the computer system before he/she leaves the lab after completing the task (experiment) in all aspects. He/she must ensure the system / seat is kept properly.

Head of the Department



RMK College of Engineering and Technology

RSM Nagar, Puduvoyal-601206



Department of Computer Science and Engineering

COURSE OUTCOMES AND KNOWLEDGE LEVEL

Upon Completion of the course, the students will be able to

Course Outcomes	Description	Level in Bloom's Taxonomy
C408.1	Develop code for classical Encryption Techniques to solve the problems.	K3
C408.2	Build cryptosystems by applying symmetric and public key encryption algorithms.	K3
C408.3	Construct code for authentication algorithms.	K3
C408.4	Develop a signature scheme using Digital signature standard.	K3
C408.5	Demonstrate the network security system using open source tools	K2
C408.6	Develop code for classical Encryption Techniques to solve the problems.	K3
C408.7	Exhibit ethical principles in engineering practices	A3
C408.8	Perform task as an individual and / or team member to manage the task in time	A3
C408.9	Express the Engineering activities with effective presentation and report.	A3
C408.10	Interpret the findings with appropriate technological / research citation.	A2

Correlation between Outcomes (COs) and Program Outcomes (POs)

[illegible]

SYLLABUS

IT8761

SECURITY LABORATORY

L T P C

0 0 4 2

OBJECTIVES:

- To learn different cipher techniques
- To implement the algorithms DES, RSA, MD5, SHA-1
- To use network security tools and vulnerability assessment tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10. Automated Attack and Penetration Tools
Exploring N-Stalker, a Vulnerability Assessment Tool
11. Defeating Malware
i) Building Trojans ii) Rootkit Hunter

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Develop code for classical Encryption Techniques to solve the problems.
- Build cryptosystems by applying symmetric and public key encryption algorithms.
- Construct code for authentication algorithms.
- Develop a signature scheme using Digital signature standard.
- Demonstrate the network security system using open source tools

REFERENCES:

1. Build Your Own Security Lab, Michael Gregg, Wiley India

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE: C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent

HARDWARE: Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

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Ex. No: 1 (a)

CAESAR CIPHER

Date :

AIM

To perform encryption and decryption using Caesar Cipher.

ALGORITHM

1. Encryption:

$$\mathbf{C = E(k, p) = (p + k) \bmod 26}$$

C - Cipher Text, p – Plain Text, k – key and E – Encryption Function

2. Decryption:

$$\mathbf{p = D(k, C) = (C - k) \bmod 26}$$

D – Decryption Function

3. For ease of encryption and decryption:

- i) Input string is converted into uppercase and then to character array.
- ii) Each character is converted into its appropriate ASCII character. So A = 65, B = 66 and Z = 90.
- iii) Before Encryption/Decryption operation, input ASCII character is subtracted by 65 to make A = 0, B = 1 and Z = 25. (Since key space = {0,1,2,...,25})
- iv) After Encryption/Decryption operation, output ASCII character are added by 65 to compensate for earlier subtraction. (Since ASCII for Upper case alphabets are from 65-90)

```

        /* Ex.No.1(a) CeaserCipher */

import java.util.Scanner;

class CeaserCipher {
    public String encryption(String plainText, int key) {
        String cipherText = "";
        char[] plainTextArray = plainText.toUpperCase().toCharArray();
        char[] cipherTextArray = new char[plainTextArray.length];
        for (int i = 0; i < plainTextArray.length; i++) {
            /*
             * cipherTextArray[i] = (char) (((int) plainTextArray[i]
+ key - 65) % 26 + 65);
            */
            cipherTextArray[i] = (char) (((int)
Math.floorMod(plainTextArray[i] + key - 65, 26)) + 65);
        }
        cipherText = String.valueOf(cipherTextArray);
        return cipherText;
    }

    public String decryption(String cipherText, int key) {
        String plainText = "";
        char[] cipherTextArray = cipherText.toCharArray();
        char[] plainTextArray = new char[cipherTextArray.length];
        for (int i = 0; i < cipherTextArray.length; i++) {
            /*
             * plainTextArray[i] = (char) (((int) cipherTextArray[i]
- key - 65) % 26 + 65);
             * Negative value produces wrong value
            */
            plainTextArray[i] = (char) (((int)
Math.floorMod(cipherTextArray[i] - key - 65, 26)) + 65);
        }
        plainText = String.valueOf(plainTextArray).toLowerCase();
        return plainText;
    }
}

```

```
}
```

```
public class CeaserCipherDemo {
```

```
    public static void main(String[] args) {
```

```
        // TODO Auto-generated method stub
```

```
        CeaserCipher ceaserCipher = new CeaserCipher();
```

```
        Scanner scanner = new Scanner(System.in);
```

```
        String plainText = scanner.nextLine();
```

```
        int key = scanner.nextInt();
```

```
        String cipherText = ceaserCipher.encryption(plainText, key);
```

```
        System.out.println("CipherText=" + cipherText);
```

```
        String recoveredPlainText =
```

```
ceaserCipher.decryption(cipherText, key);
```

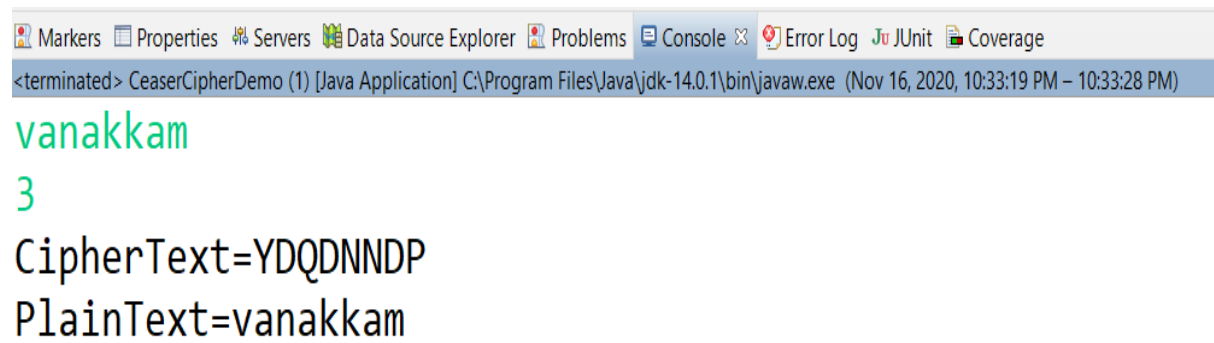
```
        System.out.println("PlainText=" + recoveredPlainText);
```

```
        scanner.close();
```

```
    }
```

```
}
```

OUTPUT



The screenshot shows an IDE console window with the following tabs: Markers, Properties, Servers, Data Source Explorer, Problems, Console, Error Log, JUnit, and Coverage. The console output is as follows:

```
<terminated> CeaserCipherDemo (1) [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 16, 2020, 10:33:19 PM – 10:33:28 PM)  
vanakkam  
3  
CipherText=YDQDNNDP  
PlainText=vanakkam
```

RESULT

The Java program to perform encryption and decryption using Caesar Cipher was successfully implemented.

Ex. No: 1 (b)

PLAYFAIR CIPHER

Date :

AIM

To perform encryption using PlayFair Cipher.

ALGORITHM

1. Generate Digrams.
 - a) Two characters in the digram should be unique.
 - i) Repeating plaintext letters that are in the same pair are separated with a filler letter, such as x.
Example: “success” should be constructed as “su cx ce sx sx”
 - b) Character ‘i’ and ‘j’ are same.
2. Generate Key Matrix.
 - a) Remove redundant characters in the key and should be filled first.
 - b) Then fill the matrix with the remaining alphabets and it should not repeat any of the characters in the key.
3. Substitute. Once the plaintext digrams and key matrix are generated, perform substitution.
 - a) Two plaintext letters that fall in the same row of the matrix are each replaced by the letter to the right, with the first element of the row circularly following the last.
 - b) Two plaintext letters that fall in the same column are each replaced by the letter beneath, with the top element of the column circularly following the last.
 - c) Otherwise, each plaintext letter in a pair is replaced by the letter that lies in its own row and the column occupied by the other plaintext letter.

/*Ex.No.1(b) PlayFair Cipher*/

```
import java.util.ArrayList;
import java.util.Arrays;
import java.util.LinkedHashSet;
import java.util.List;
import java.util.Scanner;
import java.util.Set;

class PlayFairCipher {
    public String encrypt(String plainText, String key) {
        List<Character> digrams = generateDigrams(plainText);
        StringBuilder cipherText = new StringBuilder();
        Character[][] keyMatrix = generateKeyMatrix(key);
        // System.out.println(Arrays.deepToString(keyMatrix));
        List<Character> pair = new ArrayList<>();
        char ch1 = '\0';
        char ch2 = '\0';
        for (int i = 0; i < digrams.size(); i = i + 2) {
            ch1 = digrams.get(i);
            ch2 = digrams.get(i + 1);
            pair = substitute(ch1, ch2, digrams, keyMatrix);
            cipherText.append(pair.get(0));
            cipherText.append(pair.get(1));
        }
        return (cipherText.toString().toUpperCase());
    }

    public static List<Character> generateDigrams(String msg) {
        List<Character> msgDigram = new ArrayList<>();
        for (char ch : msg.toCharArray()) {
            msgDigram.add(ch);
        }
        int i = 0;
        System.out.println("Plaintext Digrams:");
        while (i < msgDigram.size()) {
```



```

        if (i == msgDigram.size() - 1) {
            msgDigram.add('x');
        }
        // If 'j' present in plaintext, replace it with 'i'
        if (msgDigram.get(i) == 'j') {
            msgDigram.remove(i);
            msgDigram.add(i, 'i');
        }
        if (msgDigram.get(i + 1) == 'j') {
            msgDigram.remove(i + 1);
            msgDigram.add(i + 1, 'i');
        }
        // If both the characters are same
        if (msgDigram.get(i) == msgDigram.get(i + 1)) {
            msgDigram.add(i + 1, 'x');
        }
        System.out.print(msgDigram.get(i) + "" + msgDigram.get(i
+ 1) + " ");

        i = i + 2;
    }
    return msgDigram;
}

```

// Construct a 5 x 5 Matrix

```

private Character[][] generateKeyMatrix(String key) {
    Character[] uniqueKey = findUniqueKey(key);
    Character[] keyVector = generateKeyVector(uniqueKey);
    Character[][] matrix = new Character[5][5];
    System.out.println("\nKEY MATRIX");
    for (int i = 0; i < matrix.length; i++) {
        for (int j = 0; j < matrix[0].length; j++) {
            matrix[i][j] = keyVector[(i * matrix[0].length) +
j];

            System.out.print(Character.toUpperCase(matrix[i][j]) + "\t");
        }
    }
}

```

```

        System.out.println("\n");
    }
    return matrix;
}

    public List<Character> substitute(char ch1, char ch2,
List<Character> digrams, Character[][] keyMatrix) {
    List<Character> pair = new ArrayList<>();
    int row1 = 0, col1 = 0, row2 = 0, col2 = 0;
    for (int i = 0; i < keyMatrix.length; i++) {
        for (int j = 0; j < keyMatrix[0].length; j++) {
            if (ch1 == keyMatrix[i][j]) {
                row1 = i;
                col1 = j;
            }
            if (ch2 == keyMatrix[i][j]) {
                row2 = i;
                col2 = j;
            }
        }
    }
    if (row1 == row2) {
        pair.add(keyMatrix[row1][(col1 + 1) % 5]);
        pair.add(keyMatrix[row2][(col2 + 1) % 5]);
    } else if (col1 == col2) {
        pair.add(keyMatrix[(row1 + 1) % 5][col1]);
        pair.add(keyMatrix[(row2 + 1) % 5][col2]);
    } else {
        pair.add(keyMatrix[row1][col2]);
        pair.add(keyMatrix[row2][col1]);
    }
    return pair;
}

```

// Remove Redundancy from Key

```

public Character[] findUniqueKey(String key) {

```

```

        Set<Character> uniqueKey = new LinkedHashSet<>();
        for (Character c : key.toCharArray()) {
            if (c == 'j') {
                uniqueKey.add('i');
            } else {
                uniqueKey.add(c);
            }
        }
        // System.out.println(uniqueKey);
        return uniqueKey.toArray(new Character[uniqueKey.size()]);
    }

```

```

    public Character[] generateKeyVector(Character[] uniqueKey) {
        Character[] alphabets = new Character[26];
        Character[] tempKey = new Character[25];
        for (int i = 0; i < 26; i++) {
            char c = (char) (i + 97);
            alphabets[i] = c;
        }
        tempKey = difference(uniqueKey, alphabets);
        Character[] matrixKey = appendKey(uniqueKey, tempKey);
        return matrixKey;
    }

```

```

    // Get characters for remaining Key Matrix
    private Character[] difference(Character[] uniqueKey, Character[]
alphabets) {
        Set<Character> set1 = new
LinkedHashSet<>(Arrays.asList(uniqueKey));
        Set<Character> set2 = new
LinkedHashSet<>(Arrays.asList(alphabets));
        set2.removeAll(set1);
        if (set1.contains('j')) {
            set2.remove('i');
        } else {
            set2.remove('j');
        }
    }

```

```

    }
    return set2.toArray(new Character[set2.size()]);
}

// Append Remaining Characters to the Key Matrix
private Character[] appendKey(Character[] uniqueKey, Character[]
tempKey) {
    Character[] finalKey = new Character[25];
    for (int i = 0; i < uniqueKey.length; i++) {
        finalKey[i] = uniqueKey[i];
    }
    for (int i = uniqueKey.length, j = 0; i < 25; i++, j++) {
        finalKey[i] = tempKey[j];
    }
    return finalKey;
}

}

public class PlayFairCipherDemo {

    public static void main(String[] args) {
        PlayFairCipher playFairCipher = new PlayFairCipher();
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the plaintext:");
        String plainText = sc.nextLine().toLowerCase();
        System.out.println("Enter the key:");
        String key = sc.nextLine().toLowerCase();
        String cipherText = playFairCipher.encrypt(plainText, key);
        System.out.println("CipherText=" + cipherText);
        sc.close();
    }
}

```

OUTPUT

```
<terminated> PlayFairCipherDemo [Java Application] C:\Pro
Enter the plaintext:
success
Enter the key:
dravid
Plaintext Digrams:
su cx ce sx sx
KEY MATRIX
D      R      A      V      I
B      C      E      F      G
H      K      L      M      N
O      P      Q      S      T
U      W      X      Y      Z

CipherText=OYWEFQYQY
```

RESULT

The Java program to perform encryption using PlayFair Cipher was successfully implemented.

Ex. No: 1 (c)

HILL CIPHER

Date :

AIM

To perform encryption using Hill Cipher.

ALGORITHM

4. Encryption:

$$c1 = (k11p1 + k21p2 + k31p3) \bmod 26$$

$$c2 = (k12p1 + k22p2 + k32p3) \bmod 26$$

$$c3 = (k13p1 + k23p2 + k33p3) \bmod 26$$

c1, c2 and c3 are cipher text matrix elements

k11, k21, k31, k12, k22, k32, k13, k23 and k33 are key matrix elements

p1, p2, p3 are plain text matrix elements

5. For ease of encryption and decryption:

- i) Input string is converted into uppercase and then to character array.
- ii) Each character is converted into its appropriate ASCII character. So A = 65, B = 66 and Z = 90.
- iii) Before Encryption/Decryption operation, input ASCII character is subtracted by 65 to make A = 0, B = 1 and Z = 25. (Since key space = {0,1,2,...,25})
- iv) After Encryption/Decryption operation, output ASCII character are added by 65 to compensate for earlier subtraction. (Since ASCII for Upper case alphabets are from 65-90)

```

        /*Ex.No.1(c) Hill Cipher*/

import java.util.Scanner;

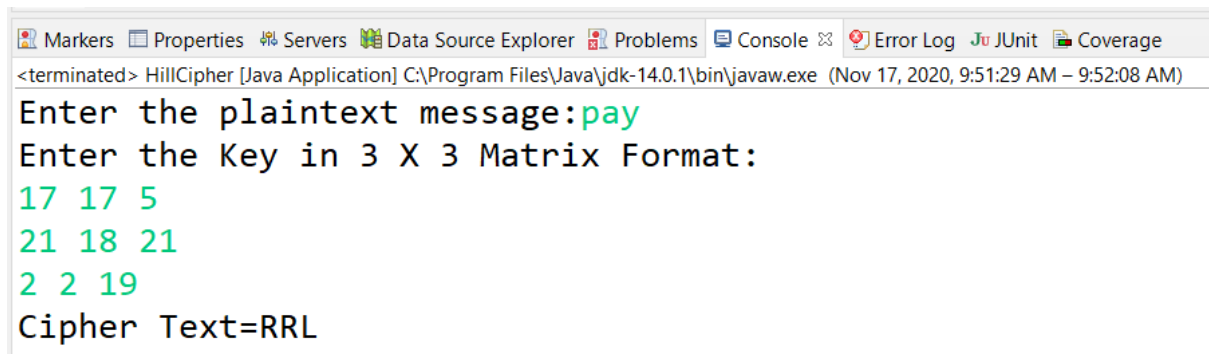
public class HillCipher {

    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter the plaintext message:");
        String plainText = sc.nextLine();
        int[][] key = new int[3][3];
        System.out.println("Enter the Key in 3 X 3 Matrix Format:");
        for (int i = 0; i < 3; i++) {
            for (int j = 0; j < 3; j++) {
                key[i][j] = sc.nextInt();
            }
        }
        String cipherText = encrypt(plainText.toUpperCase(), key);
        System.out.println("Cipher Text=" + cipherText);
    }

    public static String encrypt(String plainText, int key[][]){
        char[] text = plainText.toCharArray();
        int c1, c2, c3, p1, p2, p3;
        p1 = (int) text[0] - 65;
        p2 = (int) text[1] - 65;
        p3 = (int) text[2] - 65;
        c1 = (key[0][0] * p1 + key[1][0] * p2 + key[2][0] * p3) % 26;
        c2 = (key[0][1] * p1 + key[1][1] * p2 + key[2][1] * p3) % 26;
        c3 = (key[0][2] * p1 + key[1][2] * p2 + key[2][2] * p3) % 26;
        char[] cipherText = new char[3];
        cipherText[0] = (char) (c1 + 65);
        cipherText[1] = (char) (c2 + 65);
        cipherText[2] = (char) (c3 + 65);
        return String.valueOf(cipherText);
    }
}

```

OUTPUT



The screenshot shows an IDE console window with the following content:

```
<terminated> HillCipher [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 9:51:29 AM – 9:52:08 AM)
Enter the plaintext message:pay
Enter the Key in 3 X 3 Matrix Format:
17 17 5
21 18 21
2 2 19
Cipher Text=RRL
```

RESULT

The Hill Cipher encryption was successfully implemented.

Ex. No: 1 (d)

VIGENERE CIPHER

Date :

AIM

To perform encryption and decryption using Vigenere Cipher.

ALGORITHM

1. Encryption

$$C_i = (p_i + k_i \bmod m) \bmod 26$$

2. Decryption

$$p_i = (C_i - k_i \bmod m) \bmod 26$$

3. For ease of encryption and decryption:

- i) Input string is converted into uppercase and then to character array.
- ii) Each character is converted into its appropriate ASCII character. So A = 65, B = 66 and Z = 90.
- iii) Before Encryption/Decryption operation, input ASCII character is subtracted by 65 to make A = 0, B = 1 and Z = 25. (Since key space = {0,1,2,...,25})
- iv) After Encryption/Decryption operation, output ASCII character are added by 65 to compensate for earlier subtraction. (Since ASCII for Upper case alphabets are from 65-90)

/*Ex.No.1(d) Vigenere Cipher*/

```
package com.securitylab.classical;

import java.util.Arrays;
import java.util.Scanner;

public class VigenereCipher {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the plaintext:");
        String plainText = sc.nextLine();
        System.out.println("Enter the key:");
        String key = sc.nextLine();
        String cipherText = encrypt(plainText, key);
        System.out.println("Cipher Text=" + cipherText);
        System.out.println("Recovered Plain Text=" +
decrypt(cipherText, key));
        sc.close();
    }

    public static String encrypt(String plainText, String key) {
        char[] plainTextChar = plainText.toUpperCase().toCharArray();
        char[] keyChar = padKey(key, plainTextChar.length);
        char[] cipherTextChar = new char[keyChar.length];
        for (int i = 0; i < cipherTextChar.length; i++) {
            cipherTextChar[i] = (char) (int) ((plainTextChar[i] +
keyChar[i] - 130) % 26 + 65);
        }
        return (String.valueOf(cipherTextChar));
    }

    public static String decrypt(String cipherText, String key) {
        char[] recoveredPlainTextChar = cipherText.toCharArray();
        char[] keyChar = padKey(key, recoveredPlainTextChar.length);
        for (int i = 0; i < recoveredPlainTextChar.length; i++) {
```

```

        recoveredPlainTextChar[i] = (char) (int)
((cipherText.charAt(i) - keyChar[i] + 26) % 26 + 65);
    }
    return String.valueOf(recoveredPlainTextChar).toLowerCase();
}

// Making length of Key same as length of Plain Text message
public static char[] padKey(String key, int length) {
    char[] keyChar =
Arrays.copyOf(key.toUpperCase().toCharArray(), length);
    int i = 0;
    for (int j = key.toCharArray().length; j < keyChar.length;
j++) {
        keyChar[j] = keyChar[i];
        i++;
    }
    return keyChar;
}
}

```

OUTPUT

```
Markers Properties Servers Data Source Explorer Problems Console Error Log JUnit Coverage
<terminated> VigenereCipher [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 3:55:53 PM – 3:56:23 PM)
Enter the plaintext:
thisisvigenerecipher
Enter the key:
rmkcet
Cipher Text=KTSUMLMUQGRXIQMKTAVD
Recovered Plain Text=thisisvigenerecipher
```

RESULT

The Vigenere Cipher has been successfully implemented.

Ex. No: 2(a)

RAIL FENCE CIPHER

Date :

AIM

To perform encryption and decryption using Rail Fence technique.

ALGORITHM

1. Encryption

- The plaintext is written down as a sequence of diagonals and then read off as a sequence of rows.
- For example, to encipher the message “meet me after the toga party” with a rail fence of depth 2, we write the following:

```
m e m a t r h t g p r y
e t e f e t e o a a t
```

- The encrypted message is MEMATRHTGPRYETEFETEOAAT.

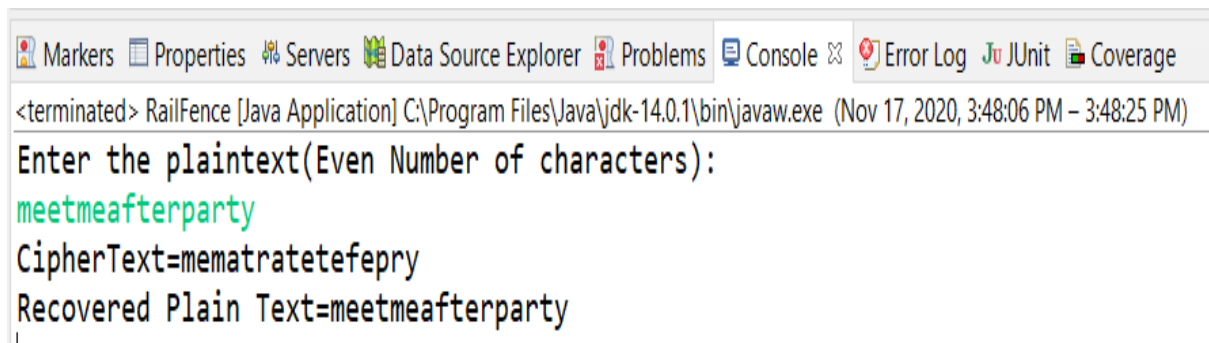
/*Ex.No.2(a) Rail Fence Cipher*/

```
import java.util.Scanner;

public class RailFence {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the plaintext(Even Number of characters):");
        String plainText = sc.nextLine();
        char[] plainTextChar = plainText.toCharArray();
        char[] cipherTextChar = new char[plainTextChar.length];
        int i, j = 0;
        for (i = 0; i < (cipherTextChar.length / 2); i++) {
            cipherTextChar[i] = plainTextChar[j];
            cipherTextChar[i + plainTextChar.length / 2] = plainTextChar[j + 1];
            j = j + 2;
        }

        System.out.println("CipherText=" + String.valueOf(cipherTextChar));
        char[] recoveredPlainTextChar = new char[cipherTextChar.length];
        j = 0;
        for (i = 0; i < recoveredPlainTextChar.length; i = i + 2) {
            recoveredPlainTextChar[i] = cipherTextChar[j];
            recoveredPlainTextChar[i + 1] = cipherTextChar[j +
(plainTextChar.length / 2)];
            j++;
        }
        System.out.println("Recovered Plain Text=" +
String.valueOf(recoveredPlainTextChar));
        sc.close();
    }
}
```

OUTPUT



The screenshot shows an IDE console window with a toolbar at the top containing icons for Markers, Properties, Servers, Data Source Explorer, Problems, Console, Error Log, JUnit, and Coverage. The console text reads: "<terminated> RailFence [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 3:48:06 PM – 3:48:25 PM)". Below this, the program prompts "Enter the plaintext(Even Number of characters):". The user input "meetmeafterparty" is shown in green. The program then outputs "CipherText=mematratetefepry" and "Recovered Plain Text=meetmeafterparty".

```
<terminated> RailFence [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 3:48:06 PM – 3:48:25 PM)
Enter the plaintext(Even Number of characters):
meetmeafterparty
CipherText=mematratetefepry
Recovered Plain Text=meetmeafterparty
```

RESULT

The Rail Fence Cipher has been successfully implemented using Java.

Ex. No: 2(b)

COLUMN TRANSPOSITION CIPHER

Date :

AIM

To perform encryption using column transposition technique.

ALGORITHM

2. Encryption

- The plaintext is written down as a sequence of diagonals and then read off as a sequence of rows.
- For example, to encipher the message “meet me after the toga party” with a rail fence of depth 2, we write the following:

```
m e m a t r h t g p r y
e t e f e t e o a a t
```

- The encrypted message is MEMATRHTGPRYETEFETEOAAT.


```

        /* Ex. No. 2(b) Column Transformation*/

import java.util.Map;
import java.util.Scanner;
import java.util.TreeMap;

public class ColumnTransposition {

    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the Plaintext:");
        String plainText = sc.nextLine();
        System.out.println("Enter the Key:");
        int key = sc.nextInt();
        encrypt(plainText, key);
        sc.close();
    }

    public static void encrypt(String plainText, int key) {
        StringBuilder sb = new StringBuilder(plainText);
        // Padding with filler characters
        if (plainText.length() % 5 != 0) {
            for (int i = plainText.length() % 5; i < 5; i++) {
                sb.append("x");
            }
        }
        // keyArr is the key vector: 43215
        char[] keyArr = String.valueOf(key).toCharArray();
        Map<Integer, Integer> keyInfo = new TreeMap<>();
        int index = 0;
        System.out.println("\nPlaintext Matrix\n");
        for (int j : keyArr) {
            j = Character.getNumericValue(keyArr[index]);
            // Printing key vector
            System.out.print(j + "\t");
            // keyInfo Map: Col1-4, Col2-3, Col3-2, Col4-1, Col5-5
            // index: Column number; j:key value

```

```

        keyInfo.put(j, index);
        index++;
    }
    System.out.println("\n");
    // Plaintext Matrix
    char[][] matrix = getMatrix(sb, key);
    String cipherText = permuteMatrix(matrix, keyInfo);
    System.out.println("CipherText=" + cipherText.toUpperCase());
}

// Transposed String
public static String permuteMatrix(char[][] matrix, Map<Integer,
Integer> keyInfo) {
    StringBuilder sb = new StringBuilder();
    int colIndex = 0;
    for (int k = 1; k <= keyInfo.size(); k++) {
        colIndex = keyInfo.get(k);
        for (int row = 0; row < matrix.length; row++) {
            sb.append(matrix[row][colIndex]);
        }
    }
    return sb.toString();
}

public static char[][] getMatrix(StringBuilder sb, int key) {
    int strLen = sb.length();
    int keyLen = (int) Math.log10(key) + 1;
    char[][] matrix = new char[strLen / keyLen][keyLen];
    for (int i = 0; i < matrix.length; i++) {
        for (int j = 0; j < matrix[0].length; j++) {
            matrix[i][j] = sb.charAt((i * matrix[0].length) +
j));

System.out.print(Character.toUpperCase(matrix[i][j]) + "\t");
        }
        System.out.println("\n");
    }
}

```

```
    }  
    return matrix;  
}  
  
}
```

OUTPUT

```
<terminated> ColumnTransposition [Java Application] C:\Program
Enter the Plaintext:
wearethebestintheworld
Enter the Key:
34215

Plaintext Matrix

3      4      2      1      5
W      E      A      R      E
T      H      E      B      E
S      T      I      N      T
H      E      W      O      R
L      D      X      X      X

CipherText=RBNOXAEIWXWTSHLEHTEDEETRX
```

RESULT

The Column Transposition Cipher has been successfully implemented using Java.

Ex. No: 3

DATA ENCRYPTION STANDARD

Date :

AIM

To perform encryption and decryption using DES.

ALGORITHM

1. Using Java's in-built packages, DES algorithm is implemented.
2. Import necessary packages.
3. Add security provider.
4. Convert the input message to byte format for easy manipulation.
5. Get key and other cryptographic details using appropriate methods.
6. Perform encryption using appropriate methods.
7. To recover the plain text message, perform decryption using appropriate method.

/*Ex.No.3 DES*/

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.math.BigInteger;
import java.security.InvalidKeyException;
import java.security.Key;
import java.security.NoSuchAlgorithmException;

import javax.crypto.BadPaddingException;
import javax.crypto.Cipher;
import javax.crypto.IllegalBlockSizeException;
import javax.crypto.KeyGenerator;
import javax.crypto.NoSuchPaddingException;

public class DESDemo {
    public static void main(String[] args) throws IOException,
    NoSuchAlgorithmException {
        Key key = getKey();
        BufferedReader br = new BufferedReader(new
        InputStreamReader(System.in));
        System.out.println("Enter the plaintext message");
        String plainTextMessage = br.readLine();
        byte[] cipherText = encrypt(plainTextMessage, key);
        BigInteger b = new BigInteger(1, cipherText);
        System.out.println("CipherText in Hexadecimal Form:" +
        b.toString(16));
        System.out.println("Recovered Plain Text Message:" +
        decrypt(cipherText, key));
    }

    public static Key getKey() throws NoSuchAlgorithmException {
        KeyGenerator kg = KeyGenerator.getInstance("DES");
        kg.init(56);
        Key k = kg.generateKey();
    }
}
```

```

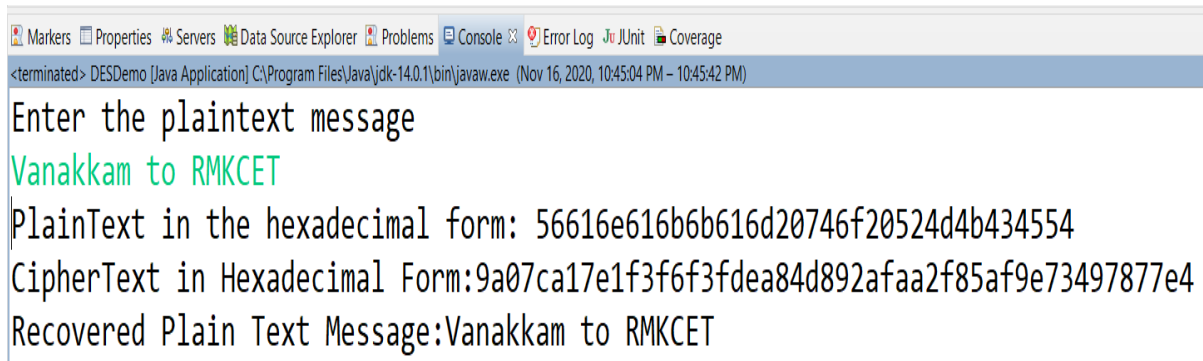
        return k;
    }

    public static byte[] encrypt(String plainTextMessage, Key key) {
        byte[] cipherText = null;
        try {
            Cipher cipher = Cipher.getInstance("DES");
            byte[] input = plainTextMessage.getBytes();
            BigInteger b = new BigInteger(1, input);
            System.out.println("PlainText in the hexadecimal form: "
+ b.toString(16));
            cipher.init(Cipher.ENCRYPT_MODE, key);
            cipherText = cipher.doFinal(input);
        } catch (InvalidKeyException | IllegalBlockSizeException |
BadPaddingException | NoSuchAlgorithmException
                | NoSuchPaddingException e) {
            e.printStackTrace();
        }
        return cipherText;
    }

    public static String decrypt(byte[] cipherTextMessage, Key key) {
        byte[] plainText = null;
        try {
            Cipher cipher = Cipher.getInstance("DES");
            cipher.init(Cipher.DECRYPT_MODE, key);
            plainText = cipher.doFinal(cipherTextMessage);
        } catch (InvalidKeyException | IllegalBlockSizeException |
BadPaddingException | NoSuchAlgorithmException
                | NoSuchPaddingException e) {
            e.printStackTrace();
        }
        return new String(plainText);
    }
}

```

OUTPUT



The screenshot shows an IDE console window with the following content:

```
<terminated> DESDemo [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 16, 2020, 10:45:04 PM – 10:45:42 PM)
Enter the plaintext message
Vanakkam to RMKCET
PlainText in the hexadecimal form: 56616e616b6b616d20746f20524d4b434554
CipherText in Hexadecimal Form:9a07ca17e1f3f6f3fdea84d892afaa2f85af9e73497877e4
Recovered Plain Text Message:Vanakkam to RMKCET
```

RESULT

The Java program to perform encryption and decryption using DES was successfully implemented.

Ex. No : 4

ADVANCED ENCRYPTION STANDARD

Date :

AIM

To perform encryption and decryption using AES.

ALGORITHM

1. Using Java's in-built packages, AES algorithm is implemented.
2. Import necessary packages.
3. Add security provider.
4. Convert the input message to byte format for easy manipulation.
5. Get key and other cryptographic details using appropriate methods.
6. Perform encryption using appropriate methods.
7. To recover the plain text message, perform decryption using appropriate method.

/*Ex.No.4 AES*/

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.math.BigInteger;
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 AESDemo {

    public static void main(String[] args) throws IOException,
    NoSuchAlgorithmException {
        SecretKey key = getKey();
        BufferedReader br = new BufferedReader(new
        InputStreamReader(System.in));
        System.out.println("Enter the plaintext message");
        String plainTextMessage = br.readLine();
        byte[] cipherText = encrypt(plainTextMessage, key);
        BigInteger b = new BigInteger(1, cipherText);
        System.out.println("CipherText in Hexadecimal Form:" +
        b.toString(16));
        System.out.println("Recovered Plain Text Message:" +
        decrypt(cipherText, key));
    }

    public static SecretKey getKey() throws NoSuchAlgorithmException {
        KeyGenerator kg = KeyGenerator.getInstance("AES");
        kg.init(128);
```

```

        SecretKey k = kg.generateKey();
        return k;
    }

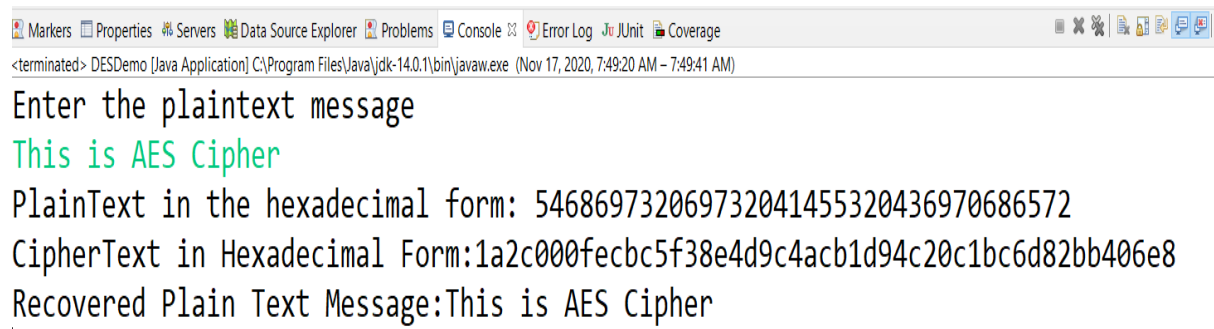
    public static byte[] encrypt(String plainTextMessage, SecretKey key)
    {
        byte[] cipherText = null;
        try {
            Cipher cipher =
Cipher.getInstance("AES/ECB/PKCS5Padding");
            byte[] input = plainTextMessage.getBytes();
            BigInteger b = new BigInteger(1, input);
            System.out.println("PlainText in the hexadecimal form: "
+ b.toString(16));
            cipher.init(Cipher.ENCRYPT_MODE, key);
            cipherText = cipher.doFinal(input);
        } catch (InvalidKeyException | IllegalBlockSizeException |
BadPaddingException | NoSuchAlgorithmException
            | NoSuchPaddingException e) {
            e.printStackTrace();
        }
        return cipherText;
    }

    public static String decrypt(byte[] cipherTextMessage, SecretKey
key) {
        byte[] plainText = null;
        try {
            Cipher cipher =
Cipher.getInstance("AES/ECB/PKCS5Padding");
            cipher.init(Cipher.DECRYPT_MODE, key);
            plainText = cipher.doFinal(cipherTextMessage);
        } catch (InvalidKeyException | IllegalBlockSizeException |
BadPaddingException | NoSuchAlgorithmException
            | NoSuchPaddingException e) {
            e.printStackTrace();
        }
    }

```

```
    }  
  
    return new String(plainText);  
}  
  
}
```

OUTPUT



The screenshot shows an IDE console window with the following content:

```
<terminated> DESDemo [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 7:49:20 AM - 7:49:41 AM)
Enter the plaintext message
This is AES Cipher
PlainText in the hexadecimal form: 546869732069732041455320436970686572
CipherText in Hexadecimal Form:1a2c000fecbc5f38e4d9c4acb1d94c20c1bc6d82bb406e8
Recovered Plain Text Message:This is AES Cipher
```

RESULT

The Java program to perform encryption and decryption using AES was successfully implemented.

Ex. No: 5

RSA

Date :

AIM

To perform encryption and decryption using RSA.

ALGORITHM

Version 1:

1. Using Java's in-built packages, RSA algorithm is implemented.
2. Import necessary packages.
3. Add security provider.
4. Convert the input message to byte format for easy manipulation.
5. Get key and other cryptographic details using appropriate methods.
6. Perform encryption using appropriate methods.
7. To recover the plain text message, perform decryption using appropriate method.

Version 2:

1. Use BigInteger class to perform RSA encryption and decryption.
2. Encryption
$$C = M^e \bmod n$$
3. Decryption
$$M = C^d \bmod n$$
4. Get encryption constant, prime numbers p and q from the user.
5. Calculate n and phi(n).
6. Calculate decryption constant.
7. Use various methods of BigInteger to perform modular arithmetic.

Version 3:

1. Use HTML for creating user interaction form and JavaScript for computing the formulae.
2. Encryption: $C = M^e \bmod n$
3. Decryption: $M = C^d \bmod n$
4. Get encryption constant, prime numbers p and q from the user.
5. Calculate n, phi(n), decryption constant.
6. Compute encryption and decryption using the above formulae.

/*Ex.No.5(a) RSA Using Java Crypto & Security Packages*/

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.math.BigInteger;
import java.security.InvalidKeyException;
import java.security.Key;
import java.security.KeyPair;
import java.security.KeyPairGenerator;
import java.security.NoSuchAlgorithmException;
import java.security.NoSuchProviderException;

import javax.crypto.BadPaddingException;
import javax.crypto.Cipher;
import javax.crypto.IllegalBlockSizeException;
import javax.crypto.NoSuchPaddingException;

public class RSADemo {

    public static void main(String[] args) throws IOException,
    NoSuchAlgorithmException, NoSuchPaddingException,
        InvalidKeyException, IllegalBlockSizeException,
    BadPaddingException, NoSuchProviderException {
        KeyPair kp = getKeys();
        BufferedReader br = new BufferedReader(new
    InputStreamReader(System.in));
        System.out.println("Enter the plaintext message");
        String plainTextMessage = br.readLine();
        byte[] cipherText = encrypt(plainTextMessage, kp.getPublic());
        System.out.println("CipherText in the hexadecimal form: " +
    new BigInteger(1, cipherText).toString(16));
        byte[] recoveredPlainText = decrypt(cipherText,
    kp.getPrivate());
        System.out.println("Recovered PlainText : " + new
    String(recoveredPlainText));
    }
```

```

    }

    public static KeyPair getKeys() throws NoSuchAlgorithmException {
        KeyPairGenerator kpg = KeyPairGenerator.getInstance("RSA");
        kpg.initialize(2048);
        KeyPair kp = kpg.genKeyPair();
        return kp;
    }

    public static byte[] encrypt(String plainTextMessage, Key publicKey)
{
        byte[] cipherText = null;
        try {
            Cipher cipher = Cipher.getInstance("RSA/ECB/OAEPWithSHA-
256AndMGF1Padding");
            byte[] input = plainTextMessage.getBytes();
            BigInteger b = new BigInteger(1, input);
            System.out.println("PlainText in the hexadecimal form: "
+ b.toString(16));
            cipher.init(Cipher.ENCRYPT_MODE, publicKey);
            cipherText = cipher.doFinal(input);
            // System.out.println(new String(cipherText));
        } catch (InvalidKeyException | IllegalBlockSizeException |
BadPaddingException | NoSuchAlgorithmException
                | NoSuchPaddingException e) {
            e.printStackTrace();
        }
        return cipherText;
    }

    public static byte[] decrypt(byte[] cipherText, Key privateKey) {
        byte[] plainText = null;
        try {
            Cipher cipher = Cipher.getInstance("RSA/ECB/OAEPWithSHA-
256AndMGF1Padding");
            cipher.init(Cipher.DECRYPT_MODE, privateKey);

```



```
        plainText = cipher.doFinal(cipherText);
    } catch (NullPointerException | InvalidKeyException |
IllegalBlockSizeException | BadPaddingException
        | NoSuchAlgorithmException |
NoSuchPaddingException e) {
        e.printStackTrace();
    }
    return plainText;
}

}
```

/*Ex.No.5(b): RSA Using Java BigInteger*/

```
import java.io.BufferedReader;
import java.io.IOException;
import java.math.BigInteger;

public class RSABigIntegerDemo {

    public static void main(String[] args) throws IOException {
        // TODO Auto-generated method stub
        BufferedReader br = new BufferedReader(new
java.io.InputStreamReader(System.in));
        System.out.println("Enter Prime p:");
        BigInteger p = new BigInteger(br.readLine());
        System.out.println("Enter Prime q:");
        BigInteger q = new BigInteger(br.readLine());
        BigInteger phi =
p.subtract(BigInteger.ONE).multiply(q.subtract(BigInteger.ONE));
        BigInteger n = p.multiply(q);
        System.out.println("Enter Encryption Constant e:");
        BigInteger e = new BigInteger(br.readLine());
        BigInteger d = e.modInverse(phi);
        System.out.println("Enter Plaintext Message M:");
        BigInteger M = new BigInteger(br.readLine());
        BigInteger C = encrypt(M, e, n);
        System.out.println("Encrypted Message C=" + C);
        BigInteger M2 = decrypt(C, d, n);
        System.out.println("Decrypted Message M=" + M2);
    }

    public static BigInteger encrypt(BigInteger M, BigInteger e,
BigInteger n) {
        BigInteger C = M.modPow(e, n);
        return C;
    }
}
```

```
        public static BigInteger decrypt(BigInteger C, BigInteger d,
BigInteger n) {
            BigInteger M = BigInteger.ONE;
            M = C.modPow(d, n);
            return M;
        }
    }
```

/*Ex.No.5(c) RSA Using HTML and JavaScript*/

```
<!-- index.html -->
<!DOCTYPE html>
<html>
<head>
<meta charset="ISO-8859-1">
<title>RSA</title>
<link href="style.css" rel="stylesheet">
<script type="text/javascript" src="rsaencrypt.js"></script>
</head>
<body>
<form name="rsaform">
<fieldset>
<legend>Selecting Primes and Key Generation by Receiver:</legend>
<label for="p">Enter Prime p:</label>
<input type="text" id="p" name="p"><br>
<label for="q">Enter Prime q:</label>
<input type="text" id="q" name="q"><br>
<label for="e">Enter Encryption Constant e:</label>
<input type="text" id="e" name="e"><br>
</fieldset> <br>
<fieldset>
<legend>Encryption by Sender:</legend>
<label for="M">Enter Message:</label>
<input type="text" id="M" name="M"><br>
<input type="button" value="Encrypt" onClick="encrypt()">
<input type="reset" value="Clear"><br>
<label for="M">Encrypted Message:</label>
<input type="text" id="C" name="C"><br>
</fieldset><br>

<fieldset>
<legend>Decryption by Sender:</legend>
<label for="C2">Cipher Text Message Received:</label>
<input type="text" id="C2" name="C2"><br>
```

```

<input type="button" value="Calculate Decryption Constant d"
onClick="getDecryptionConstant()"><br>
<label for="d">Decryption Constant:</label>
<input type="text" id="d" name="d"><br>
<input type="button" value="Decrypt" onClick="decrypt()">
<input type="reset" value="Clear"><br>
<label for="M2">Decrypted Message:</label>
<input type="text" id="M2" name="M2">
</fieldset>

</form>
</body>
</html>

```

/*rsaencrypt.js*/

```

function getPrimes() {
    var p = parseInt(document.rsaform.p.value);
    var q = parseInt(document.rsaform.q.value);
    return [p,q];
}

function calculateN(){
    let p,q;
    [p,q] = getPrimes();
    var n = p * q;
    return n;
}

function calculatePhi(){
    let p,q;
    [p,q] = getPrimes();
    var phi = (p-1) * (q-1);
    return phi;
}

function getEncryptionConstant(){

```

```

        var e = parseInt(document.rsaform.e.value);
        return e;
    }

function getDecryptionConstant() {
    var phi = calculatePhi();
    var e = getEncryptionConstant();
    var d = (modInverse(e, phi) + phi) % phi;
    document.getElementById('d').value = d;
    return d;
}

function getPublicKey() {
    var e = getEncryptionConstant();
    var n = calculateN();
    return [e, n];
}

function getPrivateKey() {
    var d = getDecryptionConstant();
    var n = calculateN();
    return [d, n];
}

function encrypt() {
    let e, n;
    [e,n] = getPublicKey();
    var M = parseInt(document.rsaform.M.value);
    const C = powerMod(M, e, n);
    //alert("Encrypted Cipher Text="+ C);
    document.getElementById('C').value = C;
    document.getElementById('C2').value = C;
    return C;
}

```

```
function decrypt(){
    let d, n;
    [d, n] = getPrivateKey();
    var C = document.getElementById('C2').value;
    const M = powerMod(C, d, n);
    document.getElementById('M2').value = M;
}
```

/*Source: <http://umaranis.com/2018/07/12/calculate-modular-exponentiation-powermod-in-javascript-ap-n/>*/

```
function powerMod(base, exponent, modulus) {
    if (modulus === 1) return 0;
    var result = 1;
    base = base % modulus;
    while (exponent > 0) {
        if (exponent % 2 === 1) //odd number
            result = (result * base) % modulus;
        exponent = exponent >> 1; //divide by 2
        base = (base * base) % modulus;
    }
    return result;
}
```

```
function modInverse(b, m) {
    let A1, A2, A3;
    [A1, A2, A3] = [1, 0, m];
    let B1, B2, B3;
    [B1, B2, B3] = [0, 1, b];
    let T1, T2, T3;
    var Q;
    while (B3 !== 0 || B3 !== 1) {
        if (B3 == 0)
            return 0;
        if (B3 == 1)
            return B2;
        Q = Math.floor(A3 / B3);
```

```

        [T1, T2, T3] = [A1 - Q * B1, A2 - Q * B2, A3 - Q * B3];
        [A1, A2, A3] = [B1, B2, B3];
        [B1, B2, B3] = [T1, T2, T3];
    }
    return 0;
}

/*style.css*/
body {
    background-color: yellow;
}

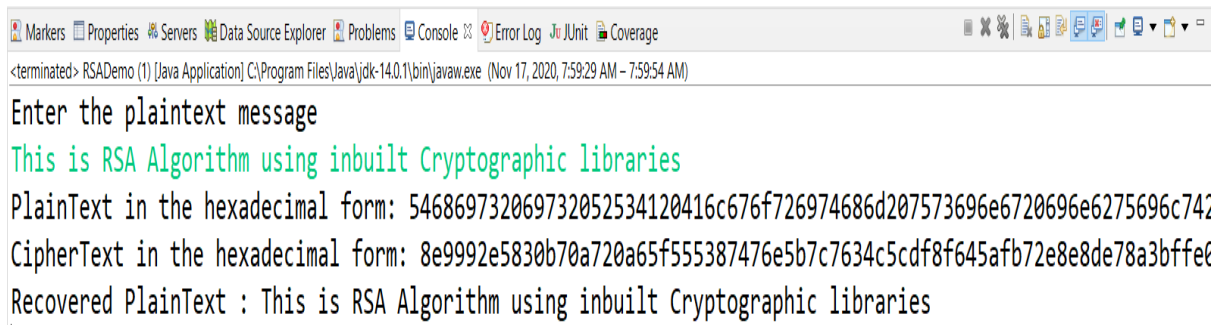
.clearfix::after {
    clear: both;
}

label {
    float:left;
    width:20em;
    text-align:right;
}

input[type=text] {
    margin-left: 1em;
    margin-bottom: 1em;
}

```

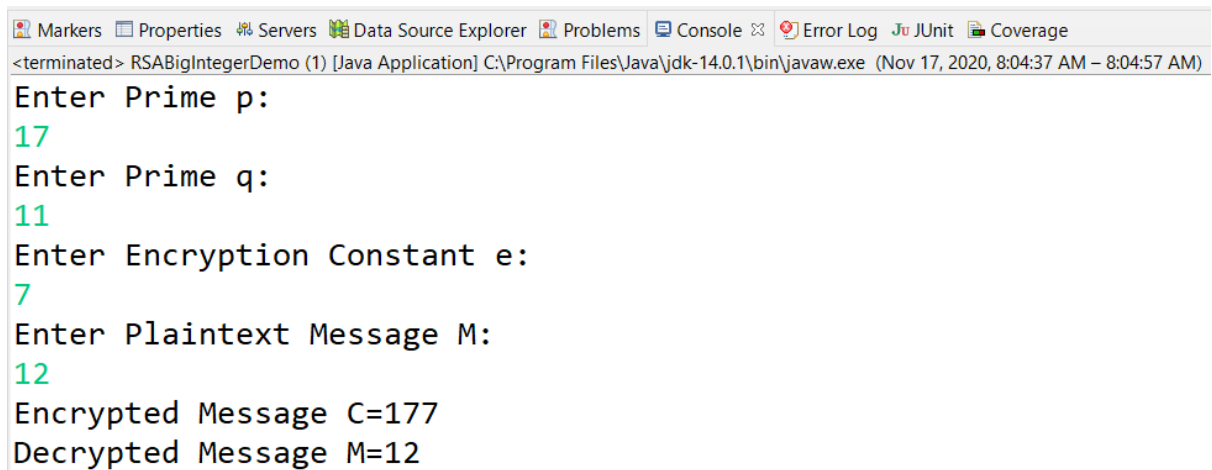

OUTPUT



The screenshot shows an IDE console window with the following content:

```
<terminated> RSADemo (1) [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 7:59:29 AM - 7:59:54 AM)

Enter the plaintext message
This is RSA Algorithm using inbuilt Cryptographic libraries
PlainText in the hexadecimal form: 546869732069732052534120416c676f726974686d207573696e6720696e6275696c7420
CipherText in the hexadecimal form: 8e9992e5830b70a720a65f555387476e5b7c7634c5cdf8f645afb72e8e8de78a3bffe6
Recovered PlainText : This is RSA Algorithm using inbuilt Cryptographic libraries
```



The screenshot shows an IDE console window with the following content:

```
<terminated> RSABigIntegerDemo (1) [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 8:04:37 AM - 8:04:57 AM)

Enter Prime p:
17
Enter Prime q:
11
Enter Encryption Constant e:
7
Enter Plaintext Message M:
12
Encrypted Message C=177
Decrypted Message M=12
```

The screenshot shows a web browser window titled "RSA" with the URL `D:/Dropbox/LAB%20MANUALS/SecurityLab/SecurityLab_R2017/RSA_JavaScript/index.html`. The page has a yellow background and contains three main sections:

- Selecting Primes and Key Generation by Receiver:** This section has three input fields: "Enter Prime p:", "Enter Prime q:", and "Enter Encryption Constant e:". All fields are currently empty.
- Encryption by Sender:** This section has an input field for "Enter Message:" and an "Encrypted Message:" output field. Below the input field are two buttons: "Encrypt" and "Clear".
- Decryption by Sender:** This section has an input field for "Cipher Text Message Received:", a "Calculate Decryption Constant d" button, an input field for "Decryption Constant:", and a "Decrypted Message:" output field. Below the input field are two buttons: "Decrypt" and "Clear".

The Windows taskbar at the bottom shows the search bar and several application icons. The system clock indicates 8:09 AM on 11/17/2020.

This screenshot shows the same RSA application after a series of operations. The values in the input and output fields are as follows:

- Selecting Primes and Key Generation by Receiver:**
 - Enter Prime p: 17
 - Enter Prime q: 11
 - Enter Encryption Constant e: 7
- Encryption by Sender:**
 - Enter Message: 12
 - Encrypted Message: 177
- Decryption by Sender:**
 - Cipher Text Message Received: 177
 - Calculate Decryption Constant d: (button clicked)
 - Decryption Constant: 23
 - Decrypted Message: 12

The Windows taskbar at the bottom shows the search bar and several application icons. The system clock indicates 8:11 AM on 11/17/2020.

RESULT

The RSA algorithm was successfully implemented by (i) Java crypto and security packages, (ii) Java BigInteger methods, and (iii) HTML and JavaScript successfully.

Ex. No : 6

DIFFIE – HELLMAN KEY EXCHANGE

Date :

AIM

To perform Diffie-Hellman Key Exchange.

ALGORITHM

1. Use various methods of BigInteger to perform modular arithmetic.
2. Get the prime number and one of its primitive root from the user.
3. Get the private keys of User A and User B.
4. Calculate public keys of User A and User B.
5. Calculate shared secret key.
6. Algorithm Formulae

x_A - User A's Private Key

x_B - User B's Private Key

User A's Public Key: $Y_A = \alpha^{x_A} \bmod q$

User B's Public Key: $Y_B = \alpha^{x_B} \bmod q$

Shared Secret Key calculated by User A: $K = (Y_B)^{x_A} \bmod q$

Shared Secret Key calculated by User B: $K = (Y_A)^{x_B} \bmod q$

/*Ex.No.6 Diffie-Hellman*/

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

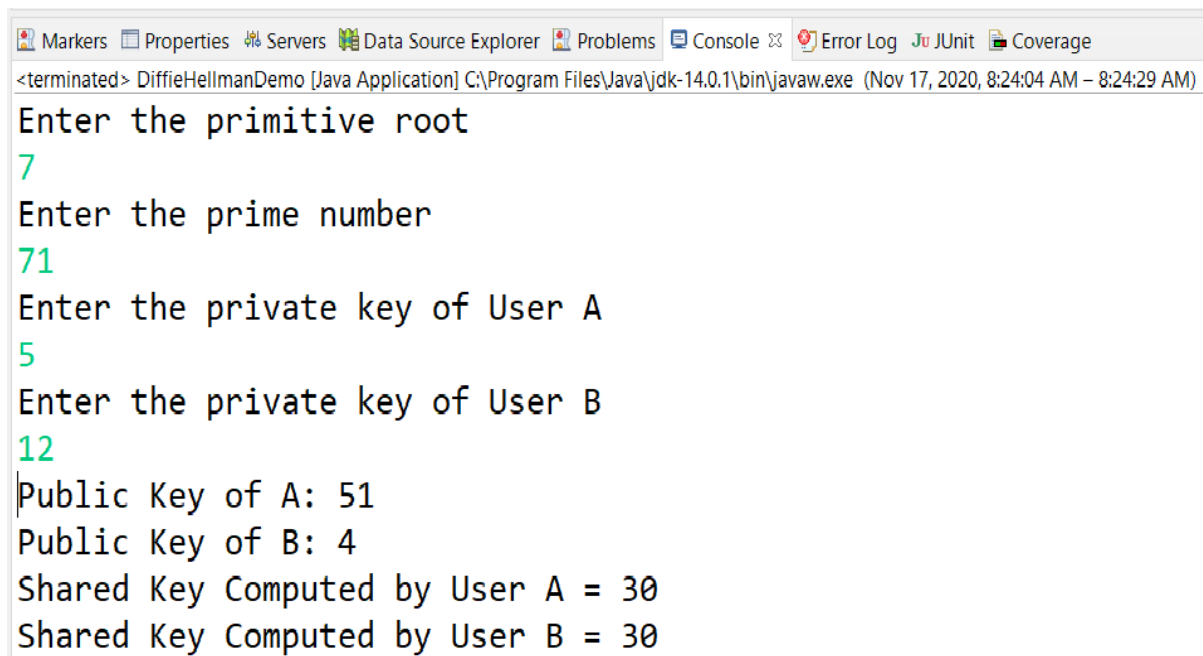
public class DiffieHellmanDemo {

    public static void main(String[] args) {
        // TODO Auto-generated method stub
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the primitive root");
        BigInteger g = sc.nextBigInteger();
        System.out.println("Enter the prime number");
        BigInteger q = sc.nextBigInteger();
        System.out.println("Enter the private key of User A");
        BigInteger xA = sc.nextBigInteger();
        System.out.println("Enter the private key of User B");
        BigInteger xB = sc.nextBigInteger();
        BigInteger yA = computePublicKey(g, xA, q);
        BigInteger yB = computePublicKey(g, xB, q);
        System.out.println("Public Key of A: " + yA);
        System.out.println("Public Key of B: " + yB);
        BigInteger K1 = computeSharedKey(xA, yB, q);
        BigInteger K2 = computeSharedKey(xB, yA, q);
        System.out.println("Shared Key Computed by User A = " + K1);
        System.out.println("Shared Key Computed by User B = " + K2);
        sc.close();
    }

    public static BigInteger computePublicKey(BigInteger g, BigInteger
xA, BigInteger q) {
        BigInteger Y = g.modPow(xA, q);
        return Y;
    }
}
```

```
        public static BigInteger computeSharedKey(BigInteger X, BigInteger
Y, BigInteger q) {
            BigInteger K = Y.modPow(X, q);
            return K;
        }
    }
```

OUTPUT



```
<terminated> DiffieHellmanDemo [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 8:24:04 AM - 8:24:29 AM)
Enter the primitive root
7
Enter the prime number
71
Enter the private key of User A
5
Enter the private key of User B
12
Public Key of A: 51
Public Key of B: 4
Shared Key Computed by User A = 30
Shared Key Computed by User B = 30
```

RESULT

The Diffie-Hellman algorithm was successfully implemented using Java.

Ex. No: 7

SHA-1

Date :

AIM

To generate message digest value using SHA-1.

ALGORITHM

1. Using Java's in-built packages, SHA-1 algorithm is implemented.
2. Import necessary packages.
3. Convert the input message to byte format for easy manipulation.
4. Using appropriate methods, message digest is generated.
5. Message digest is displayed in hexadecimal format.

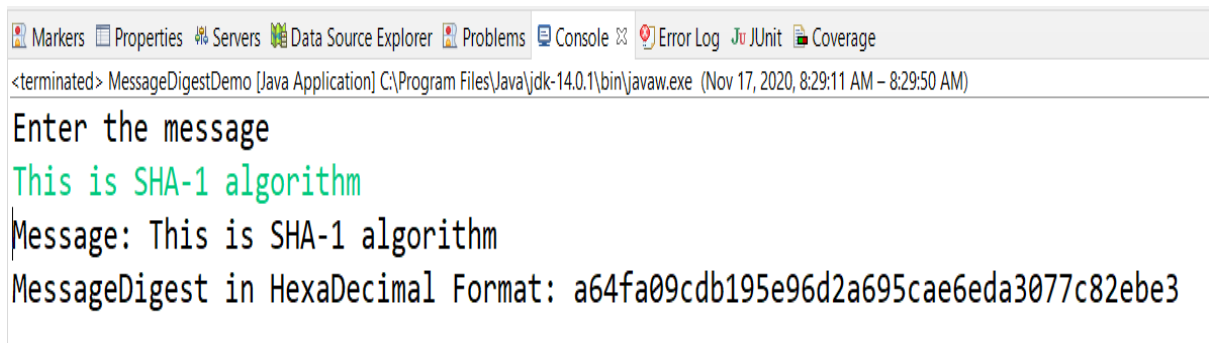
/*Ex.No.7 SHA-1*/

```
import java.math.BigInteger;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
import java.util.Scanner;

public class MessageDigestDemo {
    public static void main(String[] args) {
        // TODO Auto-generated method stub
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the message");
        String message = sc.nextLine();
        byte[] hash = generateMessagedigest(message);
        BigInteger b = new BigInteger(1, hash);
        String hashValue = b.toString(16);
        System.out.println("MessageDigest in HexaDecimal Format: " +
hashValue);
    }

    public static byte[] generateMessagedigest(String message) {
        byte[] hash = null;
        byte[] input = message.getBytes();
        System.out.println("Message: " + new String(input));
        MessageDigest md;
        try {
            md = MessageDigest.getInstance("SHA-1");
            md.update(input);
            hash = md.digest();
        } catch (NoSuchAlgorithmException e) {
            e.printStackTrace();
        }
        return hash;
    }
}
```


OUTPUT



The screenshot shows an IDE console window with a toolbar at the top containing icons for Markers, Properties, Servers, Data Source Explorer, Problems, Console, Error Log, JUnit, and Coverage. The console text starts with a status bar line: "<terminated> MessageDigestDemo [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 8:29:11 AM – 8:29:50 AM)". Below this, the program output is displayed: "Enter the message" followed by "This is SHA-1 algorithm" in green text. Then, "Message: This is SHA-1 algorithm" is shown, and finally, "MessageDigest in HexaDecimal Format: a64fa09cdb195e96d2a695cae6eda3077c82ebe3".

```
<terminated> MessageDigestDemo [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 8:29:11 AM – 8:29:50 AM)
Enter the message
This is SHA-1 algorithm
Message: This is SHA-1 algorithm
MessageDigest in HexaDecimal Format: a64fa09cdb195e96d2a695cae6eda3077c82ebe3
```

RESULT

The SHA-1 algorithm was successfully implemented using Java.

Ex. No: 8

DIGITAL SIGNATURE STANDARD

Date :

AIM

To generate and verify digital signature using DSS.

ALGORITHM

1. Using Java's in-built packages, DSS algorithm is implemented.
2. Import necessary packages.
3. Add security provider.
4. Convert the input message to byte format for easy manipulation.
5. Get cryptographic details using appropriate methods.
6. Sign and verify the message using appropriate methods.

/*Ex.No.8 Digital Signature Standard*/

```
import java.math.BigInteger;
import java.security.KeyPair;
import java.security.KeyPairGenerator;
import java.security.NoSuchAlgorithmException;
import java.security.PrivateKey;
import java.security.PublicKey;
import java.security.Signature;
import java.util.Scanner;

public class DSSDemo {

    public static void main(String[] args) throws Exception {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the message");
        String inputMessage = sc.nextLine();
        Signature signAlgorithm =
Signature.getInstance("SHA256withDSA");
        KeyPair kp = getKeys();
        byte[] signBytes = generateSignature(inputMessage,
kp.getPrivate(), signAlgorithm);
        BigInteger signedMessage = new BigInteger(1, signBytes);
        System.out.println("Digital Signature generated by sender:" +
signedMessage.toString(16));

        if (verifySignature(inputMessage, signBytes, kp.getPublic(),
signAlgorithm))
            System.out.println("Signature is verified");
        else
            System.out.println("Signature is not matching");
        sc.close();
    }

    public static byte[] generateSignature(String inputMessage,
PrivateKey privateKey, Signature signAlgorithm) {
```

```

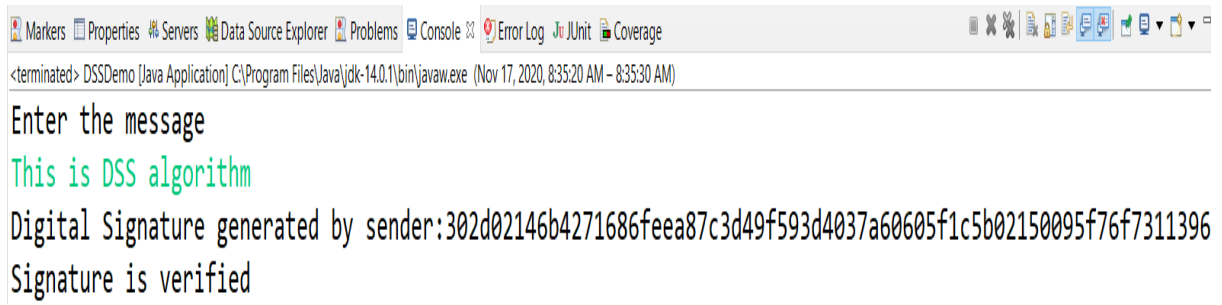
        byte[] sigBytes = null;
        try {
            signAlgorithm.initSign(privateKey);
            byte[] message = inputMessage.getBytes();
            signAlgorithm.update(message);
            sigBytes = signAlgorithm.sign();
        } catch (Exception e) {
            e.printStackTrace();
        }
        return sigBytes;
    }

    public static boolean verifySignature(String inputMessage, byte[]
sigBytes, PublicKey publicKey,
        Signature signAlgorithm) {
        boolean result = true;
        try {
            signAlgorithm.initVerify(publicKey);
            signAlgorithm.update(inputMessage.getBytes());
            result = signAlgorithm.verify(sigBytes);
        } catch (Exception e) {
            e.printStackTrace();
        }
        return result;
    }

    public static KeyPair getKeys() throws NoSuchAlgorithmException {
        KeyPairGenerator kpg = KeyPairGenerator.getInstance("DSA");
        kpg.initialize(512);
        KeyPair kp = kpg.genKeyPair();
        return kp;
    }
}

```

OUTPUT



The screenshot shows an IDE console window with the following content:

```
<terminated> DSSDemo [Java Application] C:\Program Files\Java\jdk-14.0.1\bin\javaw.exe (Nov 17, 2020, 8:35:20 AM - 8:35:30 AM)

Enter the message
This is DSS algorithm
Digital Signature generated by sender:302d02146b4271686f6ea87c3d49f593d4037a60605f1c5b02150095f76f7311396
Signature is verified
```

RESULT

The Digital Signature Standard algorithm was successfully implemented using Java.

Ex. No : 9

SNORT

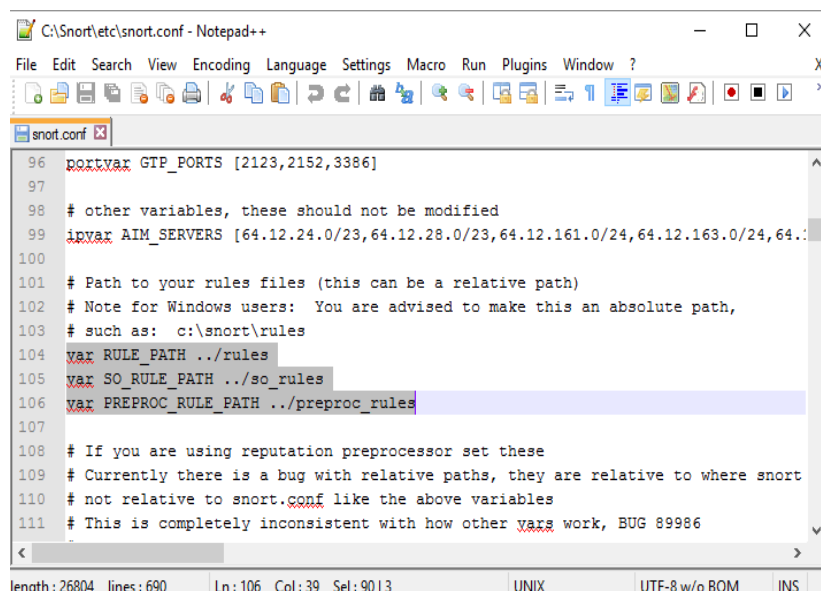
Date :

AIM

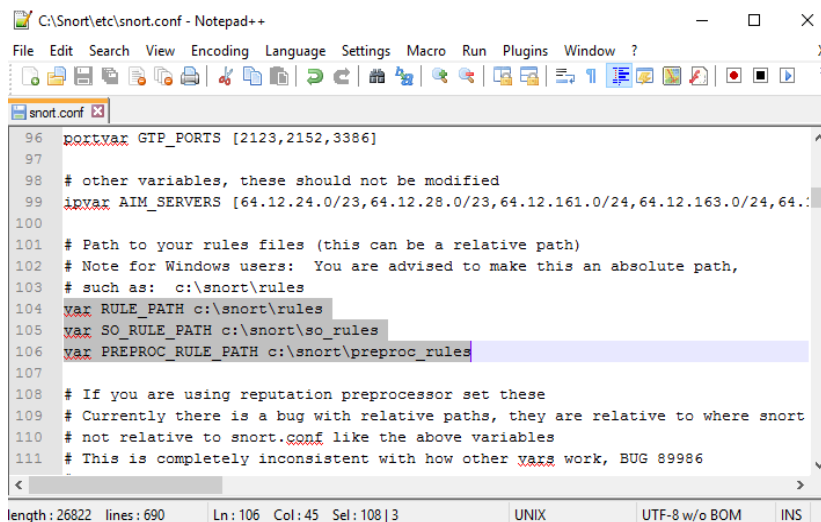
To demonstrate intrusion detection using Snort.

PROCEDURE

1. Install WinPcap libraries.
2. Install Snort
3. After installation, open *snort.conf* using any text editor. (It is present in the location C:\Snort\etc)
4. Edit the contents specifying rules path.



```
C:\Snort\etc\snort.conf - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
snort.conf
96 portvar GTP_PORTS [2123,2152,3386]
97
98 # other variables, these should not be modified
99 ipvar AIM_SERVERS [64.12.24.0/23,64.12.28.0/23,64.12.161.0/24,64.12.163.0/24,64.12.164.0/24,64.12.165.0/24,64.12.166.0/24,64.12.167.0/24,64.12.168.0/24,64.12.169.0/24,64.12.170.0/24,64.12.171.0/24,64.12.172.0/24,64.12.173.0/24,64.12.174.0/24,64.12.175.0/24,64.12.176.0/24,64.12.177.0/24,64.12.178.0/24,64.12.179.0/24,64.12.180.0/24,64.12.181.0/24,64.12.182.0/24,64.12.183.0/24,64.12.184.0/24,64.12.185.0/24,64.12.186.0/24,64.12.187.0/24,64.12.188.0/24,64.12.189.0/24,64.12.190.0/24,64.12.191.0/24,64.12.192.0/24,64.12.193.0/24,64.12.194.0/24,64.12.195.0/24,64.12.196.0/24,64.12.197.0/24,64.12.198.0/24,64.12.199.0/24,64.12.200.0/24,64.12.201.0/24,64.12.202.0/24,64.12.203.0/24,64.12.204.0/24,64.12.205.0/24,64.12.206.0/24,64.12.207.0/24,64.12.208.0/24,64.12.209.0/24,64.12.210.0/24,64.12.211.0/24,64.12.212.0/24,64.12.213.0/24,64.12.214.0/24,64.12.215.0/24,64.12.216.0/24,64.12.217.0/24,64.12.218.0/24,64.12.219.0/24,64.12.220.0/24,64.12.221.0/24,64.12.222.0/24,64.12.223.0/24,64.12.224.0/24,64.12.225.0/24,64.12.226.0/24,64.12.227.0/24,64.12.228.0/24,64.12.229.0/24,64.12.230.0/24,64.12.231.0/24,64.12.232.0/24,64.12.233.0/24,64.12.234.0/24,64.12.235.0/24,64.12.236.0/24,64.12.237.0/24,64.12.238.0/24,64.12.239.0/24,64.12.240.0/24,64.12.241.0/24,64.12.242.0/24,64.12.243.0/24,64.12.244.0/24,64.12.245.0/24,64.12.246.0/24,64.12.247.0/24,64.12.248.0/24,64.12.249.0/24,64.12.250.0/24,64.12.251.0/24,64.12.252.0/24,64.12.253.0/24,64.12.254.0/24,64.12.255.0/24]
100
101 # Path to your rules files (this can be a relative path)
102 # Note for Windows users: You are advised to make this an absolute path,
103 # such as: c:\snort\rules
104 var RULE_PATH ../rules
105 var SO_RULE_PATH ../so_rules
106 var PREPROC_RULE_PATH ../preproc_rules
107
108 # If you are using reputation preprocessor set these
109 # Currently there is a bug with relative paths, they are relative to where snort
110 # not relative to snort.conf like the above variables
111 # This is completely inconsistent with how other vars work, BUG 89986
```



```
C:\Snort\etc\snort.conf - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
snort.conf
96 portvar GTP_PORTS [2123,2152,3386]
97
98 # other variables, these should not be modified
99 ipvar AIM_SERVERS [64.12.24.0/23,64.12.28.0/23,64.12.161.0/24,64.12.163.0/24,64.12.164.0/24,64.12.165.0/24,64.12.166.0/24,64.12.167.0/24,64.12.168.0/24,64.12.169.0/24,64.12.170.0/24,64.12.171.0/24,64.12.172.0/24,64.12.173.0/24,64.12.174.0/24,64.12.175.0/24,64.12.176.0/24,64.12.177.0/24,64.12.178.0/24,64.12.179.0/24,64.12.180.0/24,64.12.181.0/24,64.12.182.0/24,64.12.183.0/24,64.12.184.0/24,64.12.185.0/24,64.12.186.0/24,64.12.187.0/24,64.12.188.0/24,64.12.189.0/24,64.12.190.0/24,64.12.191.0/24,64.12.192.0/24,64.12.193.0/24,64.12.194.0/24,64.12.195.0/24,64.12.196.0/24,64.12.197.0/24,64.12.198.0/24,64.12.199.0/24,64.12.200.0/24,64.12.201.0/24,64.12.202.0/24,64.12.203.0/24,64.12.204.0/24,64.12.205.0/24,64.12.206.0/24,64.12.207.0/24,64.12.208.0/24,64.12.209.0/24,64.12.210.0/24,64.12.211.0/24,64.12.212.0/24,64.12.213.0/24,64.12.214.0/24,64.12.215.0/24,64.12.216.0/24,64.12.217.0/24,64.12.218.0/24,64.12.219.0/24,64.12.220.0/24,64.12.221.0/24,64.12.222.0/24,64.12.223.0/24,64.12.224.0/24,64.12.225.0/24,64.12.226.0/24,64.12.227.0/24,64.12.228.0/24,64.12.229.0/24,64.12.230.0/24,64.12.231.0/24,64.12.232.0/24,64.12.233.0/24,64.12.234.0/24,64.12.235.0/24,64.12.236.0/24,64.12.237.0/24,64.12.238.0/24,64.12.239.0/24,64.12.240.0/24,64.12.241.0/24,64.12.242.0/24,64.12.243.0/24,64.12.244.0/24,64.12.245.0/24,64.12.246.0/24,64.12.247.0/24,64.12.248.0/24,64.12.249.0/24,64.12.250.0/24,64.12.251.0/24,64.12.252.0/24,64.12.253.0/24,64.12.254.0/24,64.12.255.0/24]
100
101 # Path to your rules files (this can be a relative path)
102 # Note for Windows users: You are advised to make this an absolute path,
103 # such as: c:\snort\rules
104 var RULE_PATH c:\snort\rules
105 var SO_RULE_PATH c:\snort\so_rules
106 var PREPROC_RULE_PATH c:\snort\preproc_rules
107
108 # If you are using reputation preprocessor set these
109 # Currently there is a bug with relative paths, they are relative to where snort
110 # not relative to snort.conf like the above variables
111 # This is completely inconsistent with how other vars work, BUG 89986
```

- To use snort from any window path, set **path** variable as **C:\Snort\bin** under **Environment Variables**.
- Run **snort -W** to see a list of interfaces available to Snort

```

C:\Users\madhu.amarnath>snort -W

-*> Snort! <*-
Version 2.9.8.3-WIN32 GRE (Build 383)
By Martin Roesch & The Snort Team: http://www.snort.org/contact#team
Copyright (C) 2014-2015 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      E0:DB:55:B1:61:45      0000:0000:fe80:0000:0000:0000:7ca3:0d3d \Device\NPF_{0F5D141C-0CC8-4
425-A161-17E236D43FB0} Realtek  PCIe GBE Family Controller
2      00:00:00:00:00:00      0000:0000:fe80:0000:0000:0000:e58c:ddfc \Device\NPF_{3358EE96-D9CD-4
97D-AA56-E40E12CAF40C} Microsoft
3      00:00:00:00:00:00      0000:0000:fe80:0000:0000:0000:349e:43eb \Device\NPF_{B715300D-2E72-4
CC7-A335-40CF98CBB04A} Microsoft

C:\Users\madhu.amarnath>_

```

- Snort Options

```

C:\Users\madhu.amarnath>snort -h

Options:
-a          Set alert mode: fast, full, console, test or none (alert file alerts only)
-b          Log packets in tcpdump format (much faster!)
-B <mask>   Obfuscated IP addresses in alerts and packet dumps using CIDR mask
-c <rules>  Use Rules File <rules>
-C          Print out payloads with character data only (no hex)
-d          Dump the Application Layer
-e          Display the second layer header info
-E          Log alert messages to NT Eventlog. (Win32 only)
-f          Turn off fflush() calls after binary log writes
-F <bpf>    Read BPF filters from file <bpf>
-G <gid>    Log Identifier (to uniquely id events for multiple snorts)
-h <hn>     Set home network = <hn>
            (for use with -I or -B, does NOT change $HOME_NET in IDS mode)
-H          Make hash tables deterministic.
-i <if>     Listen on interface <if>
-I          Add Interface name to alert output
-k <mode>   Checksum mode (all,noip,notcp,noudp,noicmp,none)
-K <mode>   Logging mode (pcap|default|ascii,none)
-l <ld>     Log to directory <ld>
-L <file>   Log to this tcpdump file
-n <cnt>    Exit after receiving <cnt> packets
-N          Turn off logging (alerts still work)
-O          Obfuscate the logged IP addresses
-p          Disable promiscuous mode sniffing
-P <snap>   Set explicit snaplen of packet (default: 1514)
-q          Quiet. Don't show banner and status report
-r <tf>     Read and process tcpdump file <tf>
-R <id>     Include 'id' in snort_intf<id>.pid file name
-s          Log alert messages to syslog
-S <n=v>    Set rules file variable n equal to value v
-T          Test and report on the current Snort configuration
-U          Use UTC for timestamps
-v          Be verbose
-V          Show version number
-W          Lists available interfaces. (Win32 only)
-X          Dump the raw packet data starting at the link layer
-x          Exit if Snort configuration problems occur
-y          Include year in timestamp in the alert and log files
-Z <file>   Set the performonitor preprocessor file path and name
-?         Show this information

```

- Sniffer Mode

snort -i 1 -v

- Packet Logger Mode

snort -l c:\snort\log -il

- Network IDS Mode

snort -d -h 192.168.10.0 -c C:/Snort/etc/snort.conf

```
Command Prompt
C:\Users\madhu.amarnath>snort -d -h 192.168.10.0 -c C:/Snort/etc/snort.conf
Running in IDS mode

--== Initializing Snort ==--
Initializing Output Plugins!
Initializing Preprocessors!
Initializing Plug-ins!
Parsing Rules file "C:/Snort/etc/snort.conf"
PortVar 'HTTP_PORTS' defined : [ 80:81 311 383 591 593 901 1220 1414 1741 1830 2301 2381 2809 3037
3128 3702 4343 4848 5250 6988 7000:7001 7144:7145 7510 7777 7779 8000 8008 8014 8028 8080 8085 8088
8090 8118 8123 8180:8181 8243 8280 8300 8800 8888 8899 9000 9060 9080 9090:9091 9443 9999 11371 3444
3:34444 41080 50002 55555 ]
PortVar 'SHELLCODE_PORTS' defined : [ 0:79 81:65535 ]
PortVar 'ORACLE_PORTS' defined : [ 1024:65535 ]
PortVar 'SSH_PORTS' defined : [ 22 ]
PortVar 'FTP_PORTS' defined : [ 21 2100 3535 ]
PortVar 'SIP_PORTS' defined : [ 5060:5061 5600 ]
PortVar 'FILE_DATA_PORTS' defined : [ 80:81 110 143 311 383 591 593 901 1220 1414 1741 1830 2301 23
81 2809 3037 3128 3702 4343 4848 5250 6988 7000:7001 7144:7145 7510 7777 7779 8000 8008 8014 8028 80
80 8085 8088 8090 8118 8123 8180:8181 8243 8280 8300 8800 8888 8899 9000 9060 9080 9090:9091 9443 99
99 11371 34443:34444 41080 50002 55555 ]
PortVar 'GTP_PORTS' defined : [ 2123 2152 3386 ]
Detection:
Search-Method = AC-Full-Q
```

RESULT

The Snort tool was used to demonstrate Intrusion Detection System.

Ex. No : 10

Automated Attack and Penetration Tools: ZAP

Date :

AIM

To perform penetration testing on a web application using ZAP.

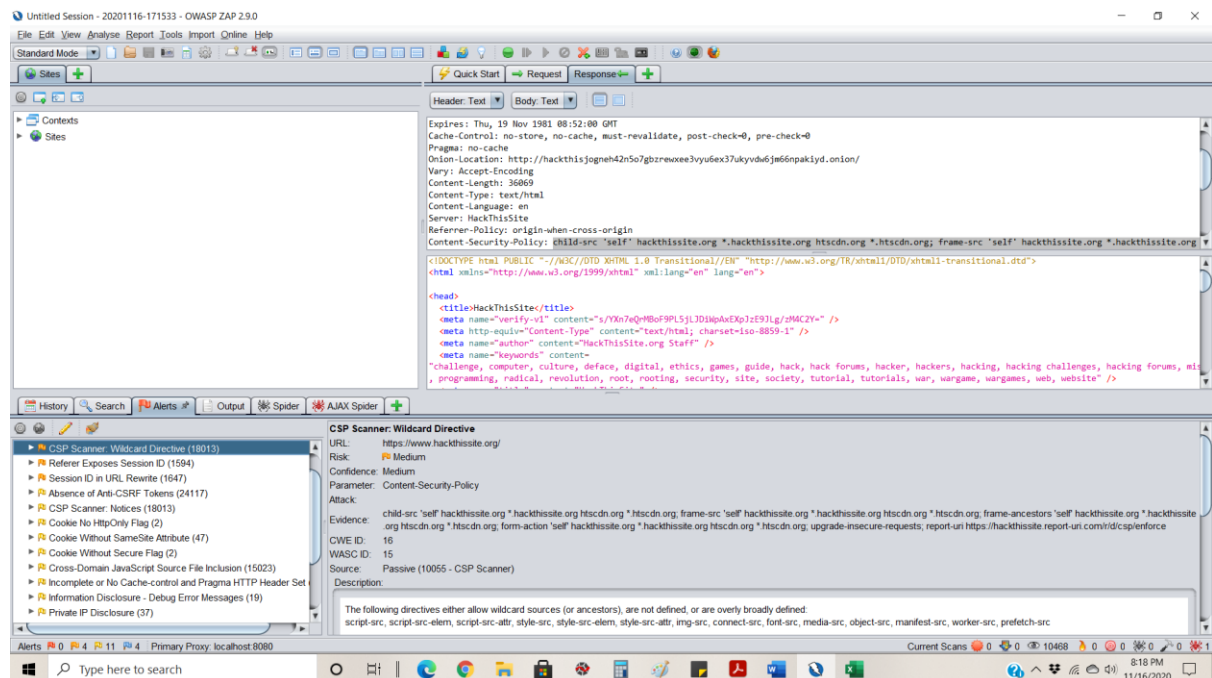
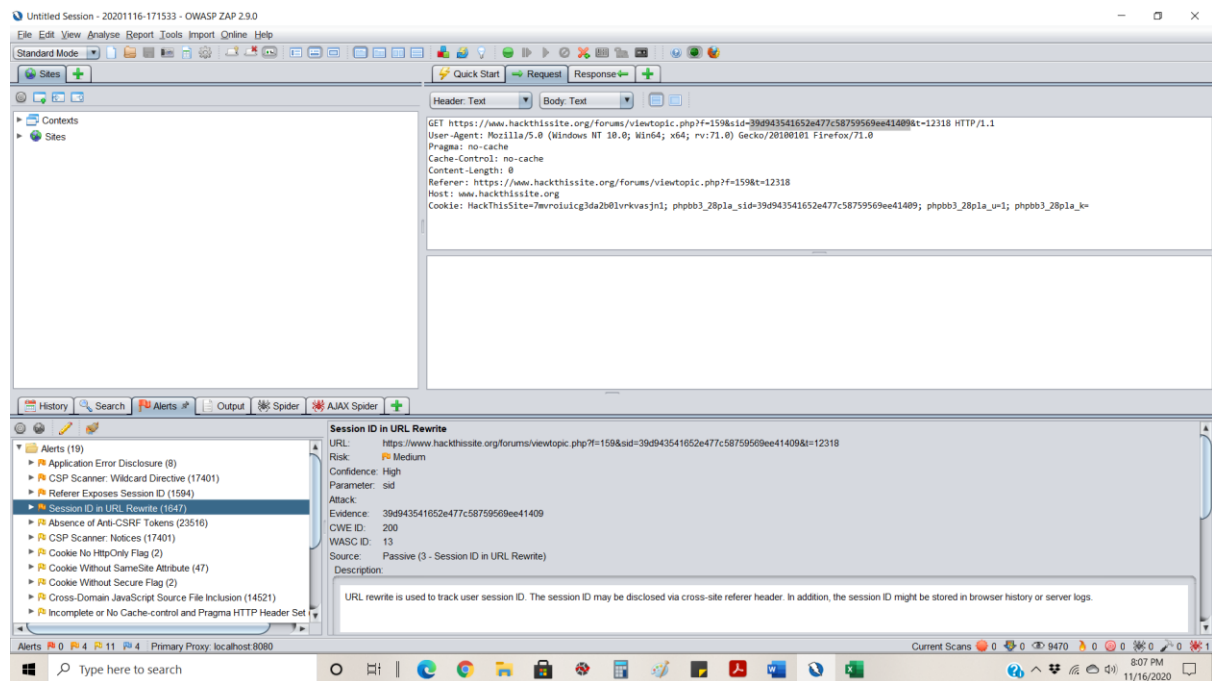
DESCRIPTION

- Zed Attack Proxy (ZAP) is a free, open-source penetration testing tool being maintained under the umbrella of the Open Web Application Security Project (OWASP).
- ZAP is designed specifically for testing web applications and is both flexible and extensible.
- A penetration test, also known as a pen test or ethical hacking, is a simulated cyber- attack against your computer system to check for exploitable vulnerabilities.
- The Open Web Application Security Project (OWASP) is a nonprofit foundation that works to improve the security of software. (Website: <https://owasp.org/>)
- Requirements: The Windows and Linux versions require Java 8 or higher to run.
- Download Link: <https://www.zaproxy.org/download/>
- Getting Started: <https://www.zaproxy.org/getting-started/>

PROCEDURE

1. Start ZAP and click the Quick Start tab of the Workspace Window.
2. Click the large Automated Scan button.
3. In the URL to attack text box, enter the full URL of the web application you want to attack.
 - a. Choose a website that you have permission to perform penetration testing.
 - b. <https://securitytrails.com/blog/vulnerable-websites-for-penetration-testing>
 - c. <https://www.hackthissite.org/>
4. Click the Attack.
5. Once the scanning is complete, click the “Alerts” tab to view the vulnerabilities details.

OUTPUT



RESULT

Thus, the OWASP ZAP tool was used to perform pen testing on a website and discover vulnerabilities successfully.

Ex. No : 11

GMER – Rootkit Detection and Removal

Date :

AIM

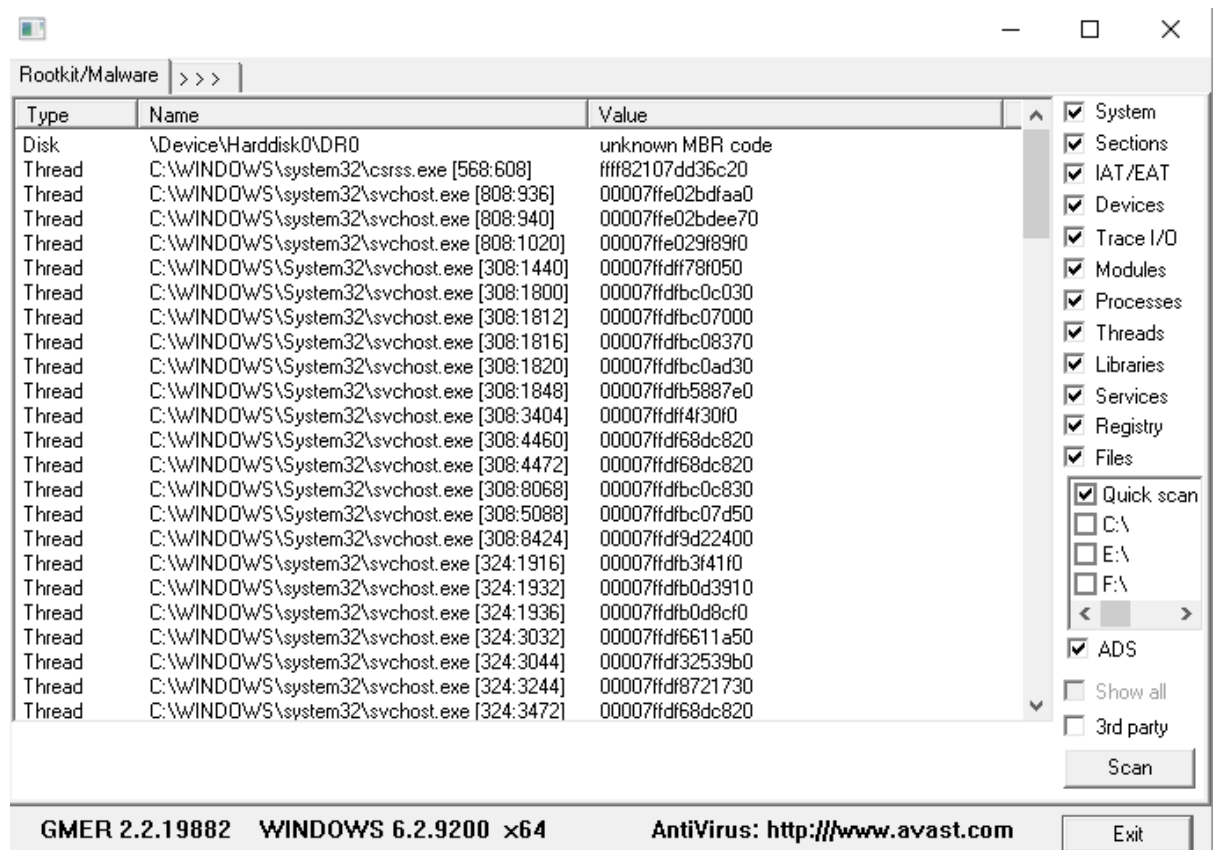
To use GMER application to detect and remove rootkits.

DESCRIPTION

- GMER is an application that detects and removes rootkits.
- A rootkit is a malicious software that allows an unauthorized user to have privileged access to a computer and to restricted areas of its software.
- A rootkit allows someone to maintain command and control over a computer without the computer user/owner knowing about it.

PROCEDURE

1. Click the **Scan** button.



RESULT

The GMER application was installed and run for detection of rootkits. No rootkits were found.

APPENDIX 1 – Important Links

1. Java JDK
<https://www.oracle.com/in/java/technologies/javase/javase-jdk8-downloads.html>
2. Eclipse IDE
<https://www.eclipse.org/downloads/packages/release/2020-09/r/eclipse-ide-enterprise-java-developers>
3. ZAP – Penetration Testing Tool
<https://www.zaproxy.org/download/>
4. Snort - Network Intrusion Detection & Prevention System
https://www.snort.org/downloads/snort/Snort_2_9_8_3_Installer.exe
5. GMER – Application to detect and remove rootkits
<http://www.gmer.net/>
6. WinPcap – Windows Packet Capture Library
<http://www.winpcap.org/install/default.htm>