ASSIGNMENT 1

AIM: Implement any 4 substitution and 2 transposition classical encryption technique in any programming language.

SUBSTITUTION ALGORITHMS

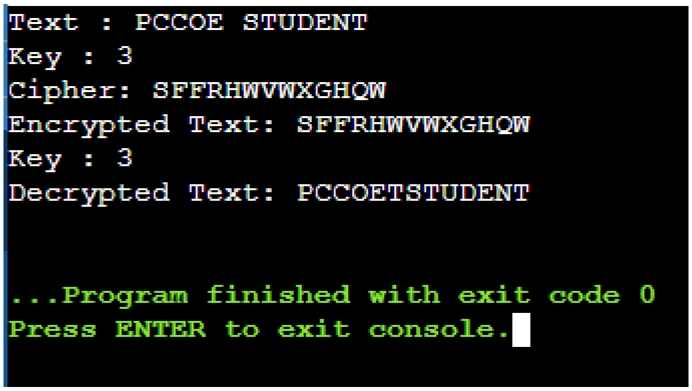
- CAESAR CIPHER

INPUT:

```
class Main {
  public static StringBuffer encrypt(String text, int s)
   {
      StringBuffer result= new StringBuffer();

      for (int i = 0; i < text.length(); i++)
      {
         if (Character.isUpperCase(text.charAt(i)))
         {
            char ch = (char)(((int)text.charAt(i) +
                  s - 65) % 26 + 65);
            result.append(ch);
         }
         else
         {
            char ch = (char)(((int)text.charAt(i) +
                  s - 97) % 26 + 97);
            result.append(ch);
         }
      }
      return result;
   }

   static StringBuffer decrypt(StringBuffer encryptedText, int s) {
      StringBuffer result = new StringBuffer();

      for (int i = 0; i < encryptedText.length(); i++) {
         if (Character.isUpperCase(encryptedText.charAt(i))) {
            char ch = (char) (((int) encryptedText.charAt(i) -
                  s - 65 + 26) % 26 + 65);
```

```
                result.append(ch);
            } else {
                char ch = (char) (((int) encryptedText.charAt(i) -
                        s - 97 + 26) % 26 + 97);
                result.append(ch);
            }
        }
        return result;
    }
    public static void main(String[] args)
    {
        String text = "YOURNAME";
        int s = 3;
        System.out.println("Text : " + text);
        System.out.println("Key : " + s);
        StringBuffer encryptedText = encrypt(text, s);
        System.out.println("Cipher: " + encryptedText);

        int s1 = 3;
        System.out.println("Encrypted Text: " + encryptedText);
        System.out.println("Key : " + s1);
        System.out.println("Decrypted Text: " + decrypt(encryptedText, s1));
    }
}
```

OUTPUT:



```
Text : PCCOE STUDENT
Key : 3
Cipher: SFFRHWVWXGHQW
Encrypted Text: SFFRHWVWXGHQW
Key : 3
Decrypted Text: PCCOETSTUDENT


...Program finished with exit code 0
Press ENTER to exit console.
```

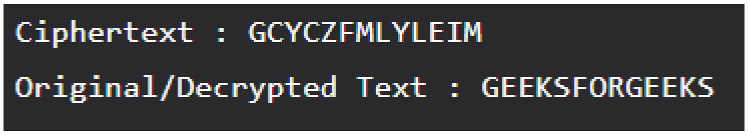
- POLYALPHABETIC CIPHER

INPUT

```
class HelloWorld {

static String generateKey(String str, String key)
{
   int x = str.length();

   for (int i = 0; ; i++)
   {
      if (x == i)
         i = 0;
      if (key.length() == str.length())
         break;
      key+=(key.charAt(i));
   }
   return key;
}

static String cipherText(String str, String key)
{
   String cipher_text="";

   for (int i = 0; i < str.length(); i++)
   {
      // converting in range 0-25
      int x = (str.charAt(i) + key.charAt(i)) %26;

      // convert into alphabets(ASCII)
      x += 'A';

      cipher_text+=(char)(x);
   }
   return cipher_text;
}


static String originalText(String cipher_text, String key)
{
   String orig_text="";
```

```
  for (int i = 0 ; i < cipher_text.length() &&
              i < key.length(); i++)
  {
    // converting in range 0-25
    int x = (cipher_text.charAt(i) -
          key.charAt(i) + 26) %26;

    // convert into alphabets(ASCII)
    x += 'A';
    orig_text+=(char)(x);
  }
  return orig_text;
}

static String LowerToUpper(String s)
{
  StringBuffer str =new StringBuffer(s);
  for(int i = 0; i < s.length(); i++)
  {
    if(Character.isLowerCase(s.charAt(i)))
    {
      str.setCharAt(i, Character.toUpperCase(s.charAt(i)));
    }
  }
  s = str.toString();
  return s;
}

public static void main(String[] args)
{
  String Str = "YOURNAME";
  String Keyword = "SEA";

   String str = LowerToUpper(Str);
   String keyword = LowerToUpper(Keyword);

  String key = generateKey(str, keyword);
  String cipher_text = cipherText(str, key);
  System.out.println("Ciphertext : "
    + cipher_text + "\n");

  System.out.println("Original Text : "
        + originalText(cipher_text, key));
    }
}
```

OUTPUT:



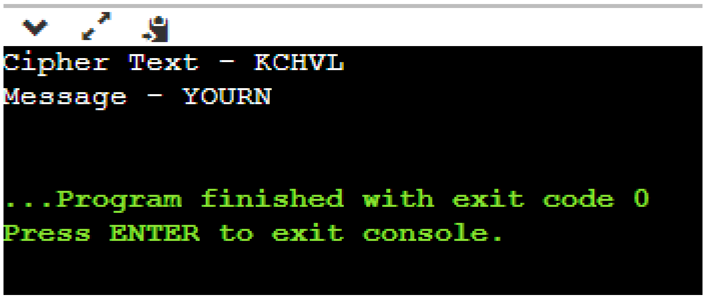
```
Ciphertext : GCYCZFMLYLEIM
Original/Decrypted Text : GEEKSFORGEEKS
```

- VERNAM CIPHER

INPUT

```
import java.io.*;

public class Main
{
        public static String stringEncryption(String text,
                                          String key)
    {

        String cipherText = "";


        int cipher[] = new int[key.length()];

        for (int i = 0; i < key.length(); i++) {
            cipher[i] = text.charAt(i) - 'A'
                        + key.charAt(i)
                        - 'A';
        }

        for (int i = 0; i < key.length(); i++) {
            if (cipher[i] > 25) {
                cipher[i] = cipher[i] - 26;
            }
        }

        for (int i = 0; i < key.length(); i++) {
            int x = cipher[i] + 'A';
            cipherText += (char)x;
        }

        return cipherText;
    }

    public static String stringDecryption(String s,
                                          String key)
    {
        String plainText = "";
        int plain[] = new int[key.length()];

        for (int i = 0; i < key.length(); i++) {
            plain[i]
                = s.charAt(i) - 'A'
                  - (key.charAt(i) - 'A');
        }

        for (int i = 0; i < key.length(); i++) {
            if (plain[i] < 0) {
                plain[i] = plain[i] + 26;
            }
        }

        for (int i = 0; i < key.length(); i++) {
            int x = plain[i] + 'A';
            plainText += (char)x;
        }
        return plainText;
    }


    public static void main(String[] args)
    {
        String plainText = "YOURNAME";

        String key = "MONEY";

        String encryptedText = stringEncryption(
            plainText.toUpperCase(), key.toUpperCase());

        System.out.println("Cipher Text - "
                           + encryptedText);

        System.out.println(
            "Message - "
            + stringDecryption(encryptedText,
                               key.toUpperCase()));
    }
}
```

OUTPUT:



```
Cipher Text - KCHVL
Message - YOURN


...Program finished with exit code 0
Press ENTER to exit console.
```

TRANSPOSITION ALGORITHMS

- COLUMNAR TRANSPOSITION

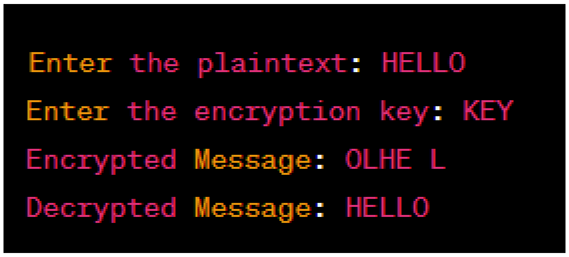
INPUT

```
import java.util.Scanner;

public class SimpleColumnarTransposition {

  // Encryption function
  public static String encrypt(String plaintext, String key) {
    int keyLength = key.length();
    int textLength = plaintext.length();

    // Calculate the number of rows required in the matrix
    int numRows = (int) Math.ceil((double) textLength / keyLength);

    // Create a 2D array to hold the characters
    char[][] matrix = new char[numRows][keyLength];

    // Fill the matrix with the plaintext characters
    int textIndex = 0;
    for (int i = 0; i < numRows; i++) {
      for (int j = 0; j < keyLength; j++) {
        if (textIndex < textLength) {
          matrix[i][j] = plaintext.charAt(textIndex);
          textIndex++;
        } else {
          matrix[i][j] = ' ';
        }
      }
    }

    // Encrypt the message by reading columns according to the key
    StringBuilder ciphertext = new StringBuilder();
    for (int j = 0; j < keyLength; j++) {
      int col = key.indexOf(key.charAt(j));
```

```
            for (int i = 0; i < numRows; i++) {
                ciphertext.append(matrix[i][col]);
            }
        }

        return ciphertext.toString();
    }

    // Decryption function
    public static String decrypt(String ciphertext, String key) {
        int keyLength = key.length();
        int textLength = ciphertext.length();

        // Calculate the number of rows required in the matrix
        int numRows = (int) Math.ceil((double) textLength / keyLength);

        // Calculate the number of characters in the last row
        int lastRowLength = textLength % keyLength;
        if (lastRowLength == 0) {
            lastRowLength = keyLength;
        }

        // Create a 2D array to hold the characters
        char[][] matrix = new char[numRows][keyLength];

        // Fill the matrix with the ciphertext characters
        int textIndex = 0;
        for (int j = 0; j < keyLength; j++) {
            int col = key.indexOf(key.charAt(j));
            for (int i = 0; i < numRows; i++) {
                if (i == numRows - 1 && j >= lastRowLength) {
                    matrix[i][col] = ' ';
                } else {
                    matrix[i][col] = ciphertext.charAt(textIndex);
                    textIndex++;
                }
            }
        }

        // Decrypt the message by reading rows
        StringBuilder plaintext = new StringBuilder();
        for (int i = 0; i < numRows; i++) {
```

```
        for (int j = 0; j < keyLength; j++) {
plaintext.append(matrix[i][j]);
}
}

return plaintext.toString().trim();
}

public static void main(String[] args) {
Scanner scanner = new Scanner(System.in);
System.out.print("Enter the plaintext: ");
String plaintext = scanner.nextLine();

System.out.print("Enter the encryption key: ");
String key = scanner.nextLine();

// Encryption
String ciphertext = encrypt(plaintext, key);
System.out.println("Encrypted Message: " + ciphertext);

// Decryption
String decryptedText = decrypt(ciphertext, key);
System.out.println("Decrypted Message: " + decryptedText);
}
}
```

OUTPUT:



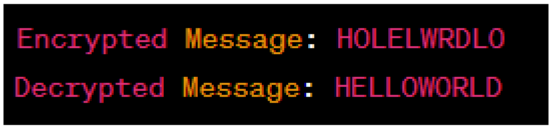
```
Enter the plaintext: HELLO
Enter the encryption key: KEY
Encrypted Message: OLHE L
Decrypted Message: HELLO
```

● RAIL FENCE TRANSPOSITION

INPUT:

```
public class RailFenceCipher {

    // Function to encrypt a message using Rail Fence Transposition
    static String encrypt(String message, int rails) {
        // Create a 2D array to represent the rail fence structure
        char[][] railFence = new char[rails][message.length()];

        // Initialize the array with space characters
        for (int i = 0; i < rails; i++) {
            for (int j = 0; j < message.length(); j++) {
                railFence[i][j] = ' ';
            }
        }

        // Fill in the rail fence with the message characters
        int row = 0;
        boolean down = false;

        for (int i = 0; i < message.length(); i++) {
            railFence[row][i] = message.charAt(i);

            // Change direction when reaching the top or bottom rail
            if (row == 0 || row == rails - 1) {
                down = !down;
            }

            // Move to the next row in the appropriate direction
            if (down) {
                row++;
            } else {
                row--;
            }
        }

        // Read the encrypted message row by row
        StringBuilder encryptedMessage = new StringBuilder();
        for (int i = 0; i < rails; i++) {
            for (int j = 0; j < message.length(); j++) {
                if (railFence[i][j] != ' ') {
                    encryptedMessage.append(railFence[i][j]);
                }
            }
        }

        return encryptedMessage.toString();
    }
public static String decryptRailFence(String cipherText, int rails) {
        int textLength = cipherText.length();
        char[][] railMatrix = new char[rails][textLength];
        boolean down = false;
        int row = 0, col = 0;

        // Initialize the rail matrix with placeholders
        for (int i = 0; i < rails; i++) {
            for (int j = 0; j < textLength; j++) {
                railMatrix[i][j] = ' ';
            }
        }

        // Fill the rail matrix with the cipherText
        for (int i = 0; i < textLength; i++) {
            if (row == 0 || row == rails - 1) {
                down = !down;
            }

            railMatrix[row][col] = '*';
            col++;

            if (down) {
                row++;
            } else {
                row--;
            }
        }

        // Reconstruct the plainText
        int index = 0;
        char[] plainText = new char[textLength];
        for (int i = 0; i < rails; i++) {
            for (int j = 0; j < textLength; j++) {
                if (railMatrix[i][j] == '*' && index < textLength) {
                    plainText[j] = cipherText.charAt(index);
                    index++;
                }
            }
        }

        return new String(plainText);
    }


    public static void main(String[] args) {
        String message = "HELLOWORLD";
        int rails = 3;

        String encryptedMessage = encrypt(message, rails);
        System.out.println("Encrypted Message: " + encryptedMessage);

String decryptedText = decryptRailFence(cipherText, rails);
        System.out.println("Decrypted Message: " + decryptedText);

    }
}
```

<u>OUTPUT</u> :



```
Encrypted Message: HOLELWRDLO
Decrypted Message: HELLOWORLD
```

CONCLUSION: We successfully implemented substitution and transposition encryption techniques using Java programming language.