Department of Information and Communication Technology

Faculty of Technology

University of Ruhuna

Assignment 01

Lab sheet 01 (Tasks 6)

Network, Computer and Application Security

ICT- 3243

Submitted by:

TG/2020/675

S.K.M Perera

Submitted to:

Lecturer in Charge: (Probationary) Ms. RDN Shakya

Date of submission:

1st November 2024

RandomShift AES Encryption and Decryption Program

Design a logic

01). generateKey() function

Purpose: generate a 256bit AES encryption key

How it works: using AES algorithm create a AES encryption key use for encryption and decryption

02). keyToString() function

Purpose: convert secret objects to string for easier storage and shearing.

How it works: using base64 encoding covert the byte array of the key

Step 03). StringToKey() function

Purpose: convert a string format of a key back to secret key

How it works: This function takes the Base64-encoded key and returns bytes. Then, reconstructs the SecretKey using the bytes obtained with a new SecretKeySpec that specifies the AES algorithm.

04.) encrypt() function

Purpose: Encodes a message with AES and applies some random character shift for extra obscurity.

How it works:

- Creates an AES Cipher instance with encryption, using the provided SecretKey.
- Encrypts the body of message bytes and encodes to Base64
- Creates a random shift (1-10) and then shifts only characters of the encrypted string with this value(shiftString).
- Here it returns the shift value and shifted encrypted message in a single string separated by a colon, to make sure decrypt method knows how much offset was done.

5. Decrypt() function

Purpose: For decrypting the message by inverting the random shift and employing AES encryption algorithm.

How it works:

- Divides the input string into the shift and shifted messages with the use of split(“:”)
- Determines a new shift in order to undo character shift by making use of negative of the shiftString.
- Recovers bytes from the Base64 encoded reversed string: through this step in essence it is all RSIW position already.
- With the provided SecretKey, these bytes are decrypted with the AES Cipher in decryption mode.
- Reestablishes the potentially altered bytes having been decrypted back to a string that gives out the original message.

6. shiftString () function

Purpose: Shifts positions of each character in the string lines up to a given number of positions of that character.

How it works: For each character position in the input string, the shift amount is added (or subtracted during decryption) to that character’s ASCII code, and the result is kept in a StringBuilder. As a result, a shifted string is produced.

7. Main Class

Purpose: Lets the user interact with the program in a way that they are able to encrypt messages or decrypt messages or exit.

How it works

- Employs a loop that repeatedly asks the user to take an action which is either Encrypt a message, Decrypt a message or Exit the program.

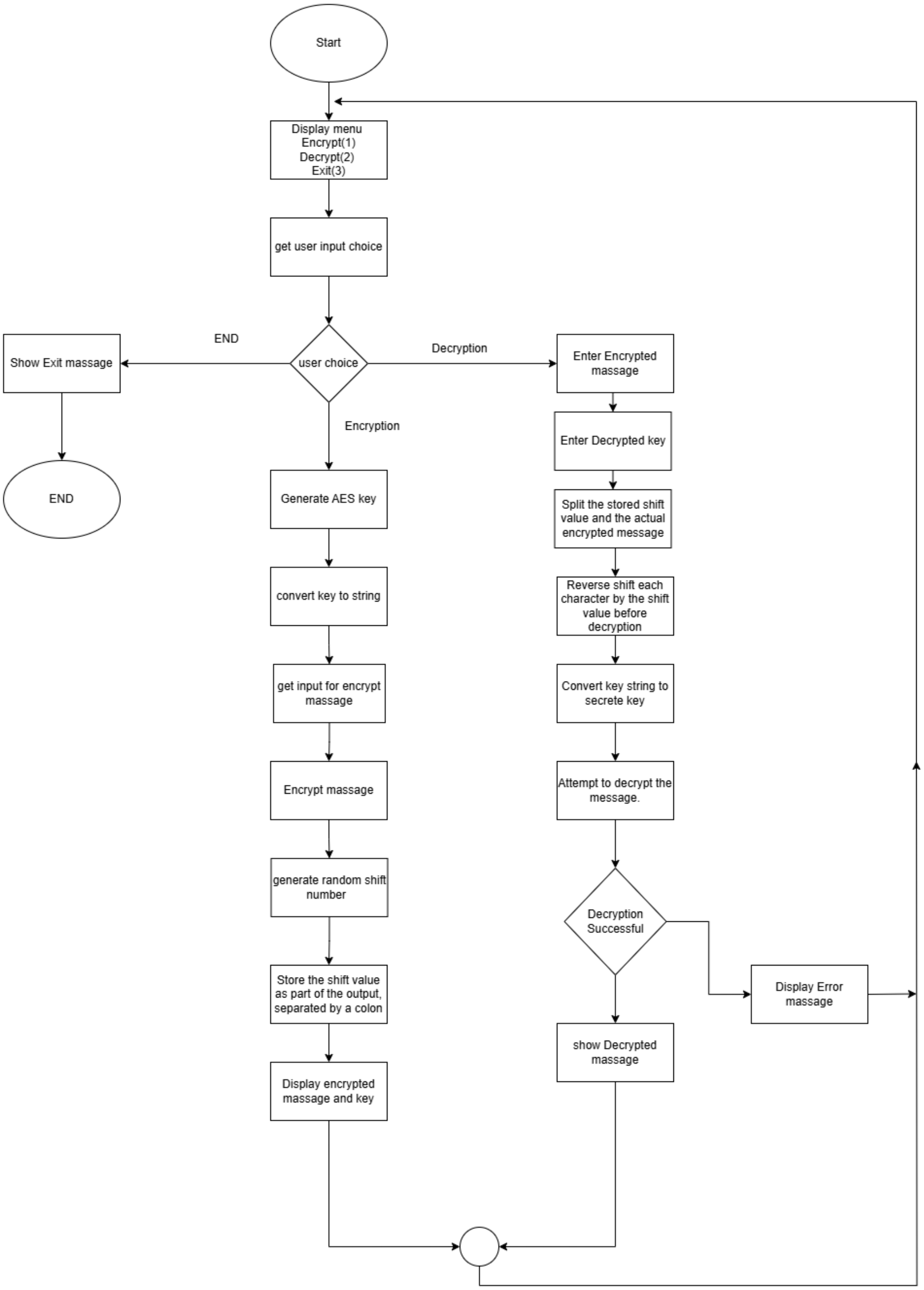
- In case He chooses Encrypt:

- Invokes generateKey and creates an encryption key which is then converted to string format using keyToString while asking the user for a message.

- Allows for the message to be compressed using encrypt and provides the recipient with the concealed message and the encryption key.

- In case He chooses Decrypt:
- After an encrypted message and a key string is entered, the system converts the key string to SecretKey using stringToKey and tries to decrypt using decrypt.
- Provided that this succeeds, the user is shown the message that was decrypted, in the other case an error is displayed that decryption attempts had been unsuccessful.
- In case He chooses Exit: Closes the application.

Flow Chart


Start
Display menu
Encrypt(1)
Decrypt(2)
Exit(3)
get user input choice
user choice
END
Show Exit massage
END
Decryption
Encryption
Generate AES key
convert key to string
get input for encrypt massage
Encrypt massage
generate random shift number
Store the shift value as part of the output, separated by a colon
Display encrypted massage and key
Enter Encrypted massage
Enter Decrypted key
Split the stored shift value and the actual encrypted message
Reverse shift each character by the shift value before decryption
Convert key string to secrete key
Attempt to decrypt the message.
Decryption Successful
Display Error massage
show Decrypted massage

Pseudo Code

Pseudo Logic for Encryption Process

```
FUNCTION generateKey()
    // Generate a new AES key of 256 bits
    INITIALIZE KeyGenerator for "AES"
    SET keyGen to KeyGenerator instance
    INITIALIZE keyGen with 256 bits
    RETURN keyGen.generateKey()

FUNCTION keyToString(secretKey)
    // Convert the SecretKey to a Base64 encoded string
    RETURN Base64.encode(secretKey.encoded)

FUNCTION stringToKey(keyStr)
    // Decode the Base64 string back to bytes
    SET decodedKey to Base64.decode(keyStr)
    RETURN new SecretKeySpec(decodedKey, "AES")

FUNCTION encrypt(message, secretKey)
    // Initialize AES cipher in encrypt mode
    INITIALIZE cipher with "AES"
    cipher.init(ENCRYPT_MODE, secretKey)

    // Encrypt the message
    SET encryptedBytes to cipher.doFinal(message.bytes)
    SET encryptedMessage to Base64.encode(encryptedBytes)

    // Generate a random shift value between 1 and 10
    SET shift to random integer between 1 and 10
    SET shiftedMessage to shiftString(encryptedMessage, shift)

    // Return shift value and shifted message
    RETURN shift + ":" + shiftedMessage

FUNCTION decrypt(shiftedMessageWithKey, secretKey)
    // Split the input into shift value and shifted message
    SET parts to split(shiftedMessageWithKey, ":")
    SET shift to integer(parts[0])
    SET shiftedMessage to parts[1]

    // Reverse the character shift
    SET encryptedMessage to shiftString(shiftedMessage, -shift)
```

```
   // Initialize AES cipher in decrypt mode
   INITIALIZE cipher with "AES"
   cipher.init(DECRYPT_MODE, secretKey)

   // Decrypt the message
   SET decodedBytes to Base64.decode(encryptedMessage)
   SET decryptedBytes to cipher.doFinal(decodedBytes)
   RETURN decryptedBytes as string

FUNCTION shiftString(input, shift)
   // Shift each character in the input string
   INITIALIZE shifted to empty string
   FOR each character c in input DO
      APPEND (c + shift) to shifted
   RETURN shifted

FUNCTION main()
   INITIALIZE scanner for console input
   SET continueProgram to true

   WHILE continueProgram DO
      PRINT "Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?"
      READ choice

      SWITCH choice DO
         CASE 1: // Encryption flow
            SET secretKey to generateKey()
            SET keyString to keyToString(secretKey)

            PRINT "Enter a message to encrypt:"
            READ message

            SET encryptedMessage to encrypt(message, secretKey)
            PRINT "Encrypted Message: " + encryptedMessage
            PRINT "Encryption Key (save this securely): " + keyString

         CASE 2: // Decryption flow
            PRINT "Enter the encrypted message to decrypt:"
            READ encryptedInput

            PRINT "Enter the key for decryption:"
            READ keyInput

            TRY
               SET userKey to stringToKey(keyInput)
               SET decryptedMessage to decrypt(encryptedInput, userKey)
```

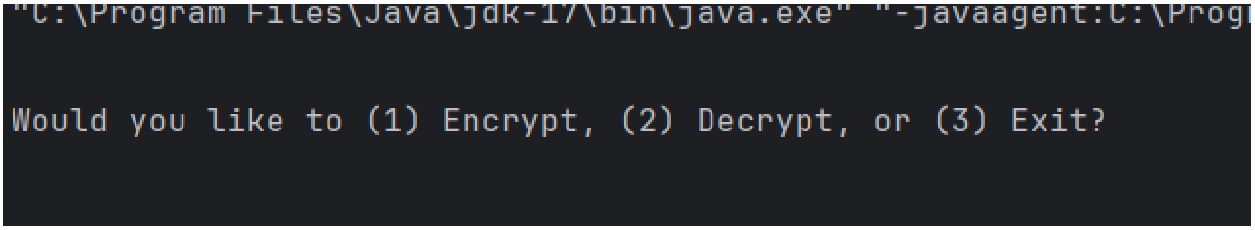
```
                PRINT "Decrypted Message: " + decryptedMessage
            CATCH Exception
                PRINT "Decryption failed: Incorrect key or message format."

        CASE 3: // Exit
            SET continueProgram to false
            PRINT "Exiting the program. Goodbye!"

        DEFAULT:
            PRINT "Invalid choice. Please select 1 for Encryption, 2 for Decryption, or 3 to Exit."
```

Verify the logic

Encryption Process

Step 01

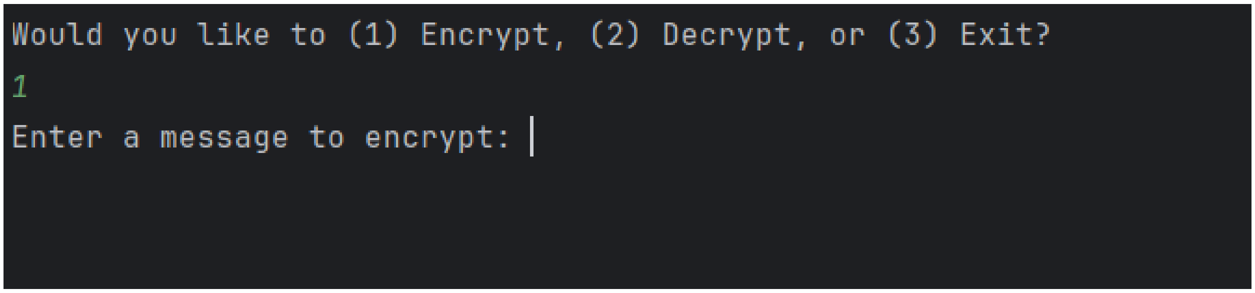
Run program



```
"C:\Program Files\Java\jdk-17\bin\java.exe" "-javaagent:C:\Prog

Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?
```

Step 02

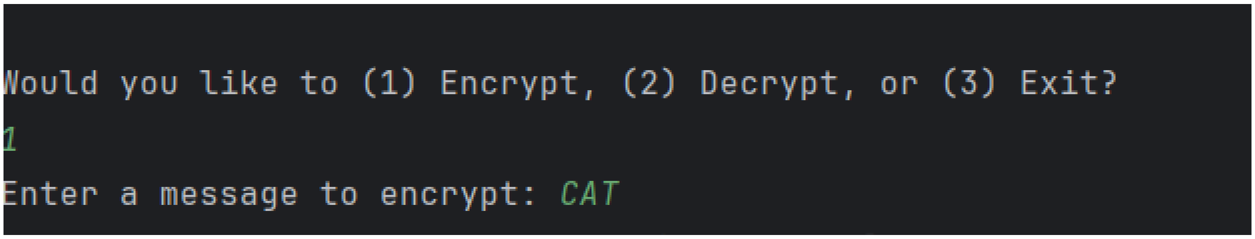
Choice option to encrypt



```
Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?
1
Enter a message to encrypt: 
```

Step 03

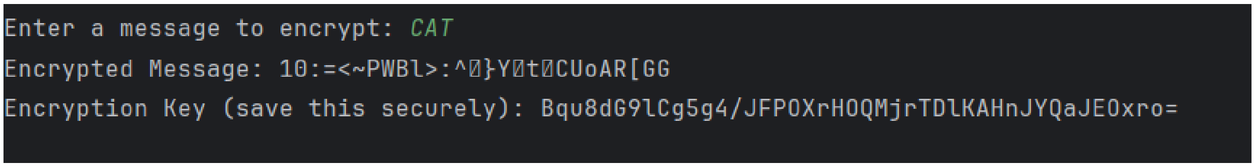
Enter massage to encrypt



```
Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?
1
Enter a message to encrypt: CAT
```

Step 04

Output encrypted massage and encrypted key

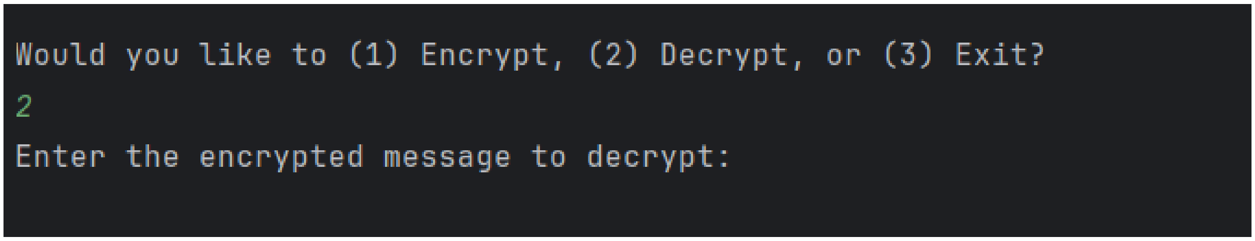


```
Enter a message to encrypt: CAT
Encrypted Message: 10:=<~PWBl>:^▯}Y▯t▯CUoAR[GG
Encryption Key (save this securely): Bqu8dG9lCg5g4/JFPOXrHOQMjrTDlKAHnJYQaJEOxro=
```

Decryption Process

Step 01

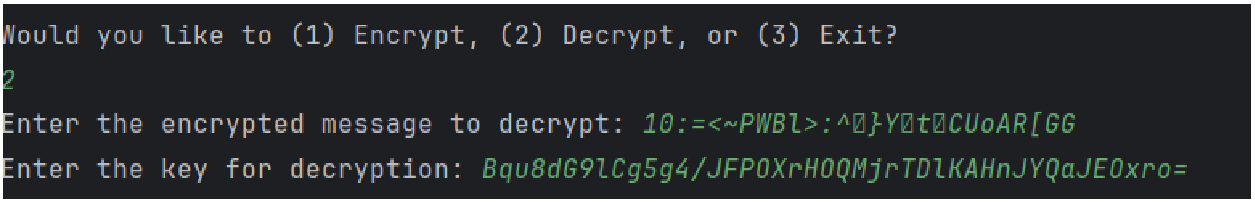
Choice option to decrypt



```
Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?
2
Enter the encrypted message to decrypt:
```

Step 02

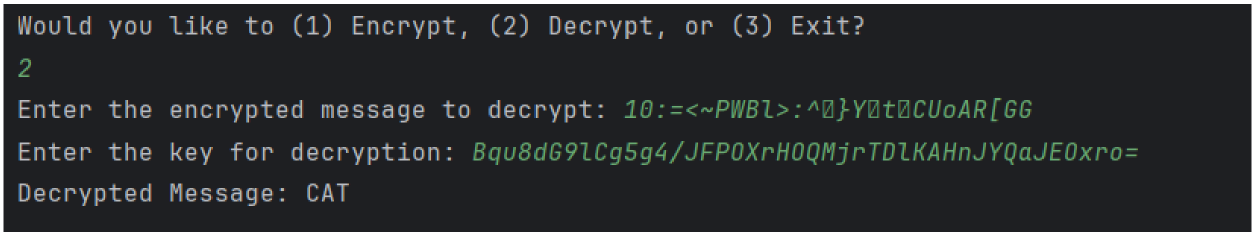
Enter encrypted massage and encrypted key



```
Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?
2
Enter the encrypted message to decrypt: 10:=<~PWBl>:^▯}Y▯t▯CUoAR[GG
Enter the key for decryption: Bqu8dG9lCg5g4/JFPOXrHOQMjrTDlKAHnJYQaJEOxro=
```

Step 03

Output decrypted massage



```
Would you like to (1) Encrypt, (2) Decrypt, or (3) Exit?
2
Enter the encrypted message to decrypt: 10:=<~PWBl>:^▯}Y▯t▯CUoAR[GG
Enter the key for decryption: Bqu8dG9lCg5g4/JFPOXrHOQMjrTDlKAHnJYQaJEOxro=
Decrypted Message: CAT
```