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III. INTRODUCTION

“ROW TRANSPOSITION CIPHER IMPLEMENTATION”

Encryption is defined as a process of expressing data in the form of a code (encoding). This can also be mentioned as converting Plaintext to Ciphertext.

Decryption is the process of decoding the encoded data. Converting the ciphertext into plain text.

This process requires a key that we used for encryption. We require a key for encryption. There are two main types of keys used for encryption and decryption. As part of this project, we are instructed to perform Encryption and Decryption on a Ciphertext in row transposition.

We chose the python programming language and implemented the tasks using two methods:

1. Encryption and Decryption data type using dictionaries and arrays.
2. Encryption and Decryption data type using matrix and arrays.

As a team, we plan our activities regarding any person's skills, and we decide to split our tasks to accomplish the 2nd assignment on time. During the process, we worked into two different approaches in code. In the beginning, we were thinking in handy out only one approach, but in the end, the decision was to have the two approaches in one code in order to show our effort and interest in the lecture. One code was using data type dictionaries and arrays, and another was done with arrays and matrix. We also create a menu that allows the user to choose what feature to use.

IV. TASKS

Question 1:

Using any programming language of your choice, implement the Row Transposition Cipher encryption algorithm. Encryption using Python programming language

Answer :

```
def Encrypted(combine_dict, msg_filled):
    #create an array and its length is as same as that of key
    Array = [""] * key_length
    for column_length in range (key_length): #Run how many times in column
        msg_length = column_length
        while msg_length < len(msg_filled):
            # Store message string value to array
            Array[column_length] += msg_filled[msg_length]
            # The message pointer adds the key length
            msg_length = msg_length + key_length

        # Create a dictionary that has pairs of key and value
        for x in range (key_length):
            dict_x = {key[column_length] : Array[column_length]}
            combine_dict.update(dict_x)
            x +=1
    return combine_dict

def Sorted(combine_dict, sorted_str):
    #Sort Key alphabetical order in dictionary, and this also sorted the pair of
    value
    sorted_keys = sorted(combine_dict)
    #Store sorted key corresponding value to empty string "sorted_str"
    sorted_dict ={}
    for w in sorted_keys:
        sorted_dict[w] = combine_dict[w]
        sorted_str += sorted_dict[w]
    print(sorted_str)
    return sorted_str

def msg_extend(lowercase_msg,key_length):

    # calculate remainder empty spaces
    msg_list = list(lowercase_msg)
    row = len(lowercase_msg) % key_length
    # Padding empty spaces with X in the last row
    msg_list.extend('X' * int(key_length - row))
    msg_filled = ''.join(msg_list)
    return msg_filled
```

```

print("Encrypt The message M")
msg = input()
print("Enter the Key of w ") # The word w is a key
key = input()
key_length = len(key) # its length is k
#create an empty dictionary
combine_dict = {}

# msg.lower() means all input message covert to lowercase
Encrypted(combine_dict, msg_extend(msg.lower(),key_length))

print("Unencrypted Message is M =", msg)
print("Key is w = ", key)
print("Encrypted Message is C = ", Sorted(combine_dict, sorted_str = ""))

```

My whole picture of the Row Transposition Encrypt algorithm with Python programming language is that it creates an array whose length is the same as the key's length—padding the lowercase plaintext with the character 'X' in the last row.

Secondly, pair the key and the code's arrays to form a dictionary. Because dictionary has a property {key: Value}, this gives an approach to follow-up code working (Python w3schools).

After creating the dictionary, sort the dictionary of keys in alphabet order to sort the corresponding value simultaneously.

Eventually, convert the sorted dictionary and extract the dictionary value, which forms the encrypted message string and print out.

Take a simple example; if the key is NYIT, the plaintext message is How Are You. The given table shows the encrypted process.

Key = NYIT, the key length is four, so the code creates the exact size of the row.

Step 1:

Lowercase the plaintext

N	Y	I	T
h	o	w	
a	r	e	
y	o	u	X

Step 2:

dictionary {'N': 'hay', 'Y': 'oro', 'I': 'weu', 'T': ' X'}

After sorting the dictionary = {'I': 'weu', 'N': 'hay', 'T': ' X', 'Y': 'oro' }

Step 3:

Get the dictionary value = weuhay Xoro, which is the ciphertext.

The screenshot below shows the result and meets the Q1 requirement.

The screenshot shows a Python IDE with a file named 'INCS 741 2nd_Assignment.py'. The code defines a function 'encrypted' that takes a dictionary, a message, and a key. It creates an array of the same length as the key, then iterates through the key to build the ciphertext. The terminal window shows the following output:

```

Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays
Please select a choice: 1
Encrypt The Unencrypted Message M =
How Are You
Enter the Key of w
NYIT
Unencrypted Message is M = How Are You
The Key of w = NYIT
Encrypted Message is C = weuhay Xoro

```

Question 2:

What will be the decryption algorithm for a Row Transposition Cipher? Write down the pseudocode for the algorithm.

Answer :

Method 1->

Decryption pseudocode with data type dictionaries and arrays:

Main Decrypted algorithm with dictionaries arrays Function():

Input an encrypted message

Input a key

Calculate a maximum number of messages in a row

Create an empty dictionary

Call Decrypted function(empty dictionary, encrypted message, key, raw numbers):

print Encrypted message

print key)

print Call Decrypted sorted function(dictionary, key, raw numbers, empty string)

Decrypted function(empty dictionary, encrypted message, key, raw numbers):

Create a key length of empty array

Create a sorted key

for run x times of key length

for run y times based on the calculation of maximum messages in a row

store accumulates message to array

pair the array with the sorted key and update to the empty dictionary

return dictionary

Decrypted sorted function(dictionary, key, raw numbers, empty string):

Created a maximum message length of array

for run x times in range of key length

```

    Get the dictionary item of original key[x] and store accumulately to the empty
    string

for run y times based on the calculation of maximum messages in a raw

    counter is equal to y

    while counter < length of empty string:

        store accumulately the string value to array

        counter add accumulately the calculation of maximum messages in a raw

return array is called a plaintext

```

Explanation: The concepts and steps of decryption pseudocode with dictionaries and arrays are that the encrypted message wich pairs with a sorted key, and form into a dictionary.

Step 1: Sort key

Step 2: Use sorted pair with encrypted message and each key pair with the maximum length of messages in a raw in order to form into a dictionary

Step 3: Get the dictionary value of original key index and store its value to the string

Step 4: Print the string which is a plaintext

Method 2->

Decryption pseudocode with data type matrix and arrays:

Decryption code

```

M=cipher text
W = key
Function Decrypt (M,w)
    numbers to key= function key_id()
    rows= lenght W/Len w
    get_position + function key pointer
    Process fill the Matrix in order.
        counter
        for l range w
            for j range Rows
                Matrix[j][h] = M[counter]
    process print columns of the matrix
    depending the return position.
        for l range matrix rows
            for j range w
                read vertically
    
```

```

Function key_id(w)
    Compare and get numbers vs
    alphabet
    Return array with position in numbers
    
```

```

Function key_pointer(w, key id number)
    get positions in the array or matrix
    Return position
    
```

Function decrypt.

```

for i in range(len(M)):
    h = 0
    if decrypt_counter == len(w):
        decrypt_counter = 0
    else:
        h: int = int(position_number[decrypt_counter])
        for j in range(matrix_rows):
            matrix[j][h] = M[decrypt_counter2]
            decrypt_counter2 += 1
        if decrypt_counter2 == len(M):
            break
        decrypt_counter += 1
    print()
for i in range(matrix_rows):
    for j in range(len(w)):
        plain_text += str(matrix[i][j])
    
```

Function key_id ()


```

for i in range(len(alphabet)):
    for j in range(len(w)):
        if alphabet[i] == w[j]:
            total += 1
            numbers_to_key[j] = total

```

Function key_pointer()

```

def key_pointer(w, key_id_number):
    position_number = ""
    for i in range(len(w) + 1):
        for j in range(len(w)):
            if key_id_number[j] == i:
                position_number += str(j)

```

Question 3:

Using any programming language of your choice, implement the Row Transposition Cipher decryption algorithm. Decryption using Python programming language

Answer :

Method 1->

Decryption algorithm data type using dictionaries and arrays:

```

##### Decrypt using dictionaries and arrays Function#####

def Main_Decrypted_dictionaries_arrays():
    print("\nEnter the Encrypted Message C = ")
    msg = input().lower()
    print("\nEnter The Key of W = ")
    key = input()
    # calculate how many rows
    num_row = math.ceil(len(msg)/len(key))
    #create an empty dictionary
    combine_dict = {}

```

```

Decrypted(combine_dict,msg_extend(msg,len(key)),key,num_row)
print("\nEncrypted Message is C = ",msg)
print("\nThe key of w = ",key)
print("\nDecrypted Message is M = ", Decrypted_sorted(combine_dict,key,num_row,sorted_str = ""))

def Decrypted (combine_dict,msg,key,num_row):
    #create an array and its length is as same as that of key
    array = [""] * len(key)
    sorted_key = sorted(key)
    for i in range (len(key)):
        for msg_pointer in range(num_row):
            # Store message string value to array
            array [i] += msg[ msg_pointer + i * num_row]

        for column_counter in range(num_row):
            dictionary_x={sorted_key[i] : array[i]}
            combine_dict.update(dictionary_x)
    return combine_dict

def Decrypted_sorted(combine_dict,key, num_row,sorted_str):
    #create an array to print the plaintext from row to row
    plaintext = [""] * num_row
    for i in range (len(key)):
        sorted_str += combine_dict.get(key[i])

    for column_length in range (num_row): #Run how many times in column
        msg_length = column_length
        while msg_length < len(sorted_str):
            # Store message string value to array
            plaintext[column_length] += sorted_str[msg_length]
            # The message pointer adds the key length
            msg_length = msg_length + num_row
    return "".join(plaintext)

```

Method 2->

Decryption algorithm data type using matrixs and arrays:

```

##### Encrypt & Decrypted using matrix and arrays key pointer Function#####
def key_pointer(w, key_id_number):
    position_number = ""
    for i in range(len(w) + 1):
        for j in range(len(w)):
            if key_id_number[j] == i:
                position_number += str(j)
    return position_number
##### Encrypt & Decrypted using matrix and arrays key id Function#####

```

```

def key_id(w):
    alphabet = "abcdefghijklmnopqrstuvwxyz"
    numbers_to_key = list(range(len(w)))

    total = 0
    for i in range(len(alphabet)):
        for j in range(len(w)):
            if alphabet[i] == w[j]:
                total += 1
                numbers_to_key[j] = total

##### Decrypted algorithm using matrix and arrays main Function#####

def Main_Decrypted_matrix_arrays():
    M = input("\nEnter the Encrypted Message C = ").lower()
    w = input("\nEnter the Key of w = ").lower()
    # assigning numbers to keywords
    numbers_to_key = key_id(w)
    ##### identify number of rows of the matrix#####
    matrix_rows = int(len(M) / len(w))
    position_number = key_pointer(w, numbers_to_key)
    matrix = [[0] * len(w) for i in range(matrix_rows)]
    plain_text = ""
    decrypt_counter = 0
    decrypt_counter2 = 0

    ##### Fill up the matrix #####
    for i in range(len(M)):
        h = 0
        if decrypt_counter == len(w):
            decrypt_counter = 0
        else:
            h: int = int(position_number[decrypt_counter])
            for j in range(matrix_rows):
                matrix[j][h] = M[decrypt_counter2]
                decrypt_counter2 += 1
            if decrypt_counter2 == len(M):
                break
        decrypt_counter += 1
    print()
    for i in range(matrix_rows):
        for j in range(len(w)):
            plain_text += str(matrix[i][j])
    print("\nEncrypted Message is C = " + plain_text)

```

Question 4: (Encryption Test)

- Using a **w** value of **NYITV**, use your code to encrypt the following text: “CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES.”
- Output your results.

Answer :

Method 1->

Encrypting algorithm using data type with dictionary and arrays:

Plaintext:

CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES

Key: NYITV

Ciphertext: yos tatocuocnnin eoiasldaXco hae yti sema heet ia repg pinufheruoio pnfr
evrXtytrcdd ns rmcntrc dtcdeiXrlic s eqfe uties hpelass

The screenshot shows a Python IDE with a file named 'INCS 741 2nd_Assignment.py'. The code defines a function 'Main_Encrypted_dictionaries_arrays()' that prompts the user for a message and a key, then encrypts the message using a dictionary-based algorithm. The output in the terminal window shows the encryption of the plaintext 'CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES' using the key 'NYITV', resulting in the ciphertext 'yos tatocuocnnin eoiasldaXco hae yti sema heet ia repg pinufheruoio pnfr evrXtytrcdd ns rmcntrc dtcdeiXrlic s eqfe uties hpelass'.

```

15 def Main_Encrypted_dictionaries_arrays():
16     print("\nEncrypt The Unencrypted Message M =")
17     msg = input()
18     # The word w is a key
19     print("\nEnter the Key of w ")
20     key = input()
21     #create an empty dictionary
22     combine_dict = {}
23
24     # msg.lower() means all input message covert to lowercase
25     Encrypted(combine_dict, msg_extend(msg.lower(), len(key)), key)
26
27     print("\nUnencrypted Message is M =", msg)
28     print("\nThe Key of w = ", key)
29     print("\nEncrypted Message is C = " + Encrypted(sorted(combine_dict), sorted(str = "")))

```

Encrypt The Unencrypted Message M =
CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES

Enter the Key of w
NYITV

Unencrypted Message is M = CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES

The Key of w = NYITV

Encrypted Message is C = yos tatocuocnnin eoiasldaXco hae yti sema heet ia repg pinufheruoio pnfr evrXtytrcdd ns rmcntrc dtcdeiXrlic s eqfe uties hpelass

(Reverse Test-1):

Reverse the encryption algorithm data type with dictionaries and arrays, using decryption with same data type to verify the right ciphertext.

Ciphertext: yos tatocuoccnin eoiasldaXco hae yti sema heet ia repg pinufheruoio pnfr
evrXtytrcdd ns rmcntrc dtcdeiXrlic s eqfe uties hpelass

key: NYITV

Plaintext: cryptology is the practice and study of techniques for secure communication in the presence of third parties called adversariesxxx

Overall: The encrypted message in encryption dictionaries and arrays result is correct.

Ciphertext: yos tatocuoccnin eoiasldaXco hae yti sema heet ia repg pinufheruoio pnfr
evrXtytrcdd ns rmcntrc dtcdeiXrlic s eqfe uties hpelass

```
INCS741_2nd_Assignment.py
Users > roy > Desktop > Dockerfile > INCS741_2nd_Assignment.py > ...
187 print("\n-----We use two approaches to finish the assignemnt in our group-----\n")
188 print("Choose 1 for Encrypt algorithm data type using dictionaries and arrays\n")
189 print("Choose 2 for Encrypt algorithm data type using matrix and arrays\n")
190 print("Choose 3 for Decrypt algorithm data type using dictionaries nd arrays\n")
191 print("Choose 4 for Decrypt algorithm data type using matrix and arrays")
192 print("\nPlease select a choice:")

問題 輸出 偵錯主控台 終端機 Python Debug Console
es/lib/python/debugpy/launcher 52792 -- /Users/roy/Desktop/Dockerfile/INCS741_2nd_Assignment.py

-----We use two approaches to finish the assignemnt in our group-----
Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays
Please select a choice:
3
Enter the Encrypted Message C =
yos tatocuoccnin eoiasldaXco hae yti sema heet ia repg pinufheruoio pnfr evrXtytrcdd ns rmcntrc dtcdeiXrlic s eqfe uties hpelass
Enter The Key of W =
NYITV
Encrypted Message is C = yos tatocuoccnin eoiasldaxco hae yti sema heet ia repg pinufheruoio pnfr evrxytrcdd ns rmcntrc dtcdeixrlic s
eqfe uties hpelass
The key of w = NYITV
Decrypted Message is M = cryptology is the practice and study of techniques for secure communication in the presence of third parties cal
led adversariesxxx
MacBook-Pro:~$
```

Method 2->

Encrypting algorithm using data type with matrix and arrays:

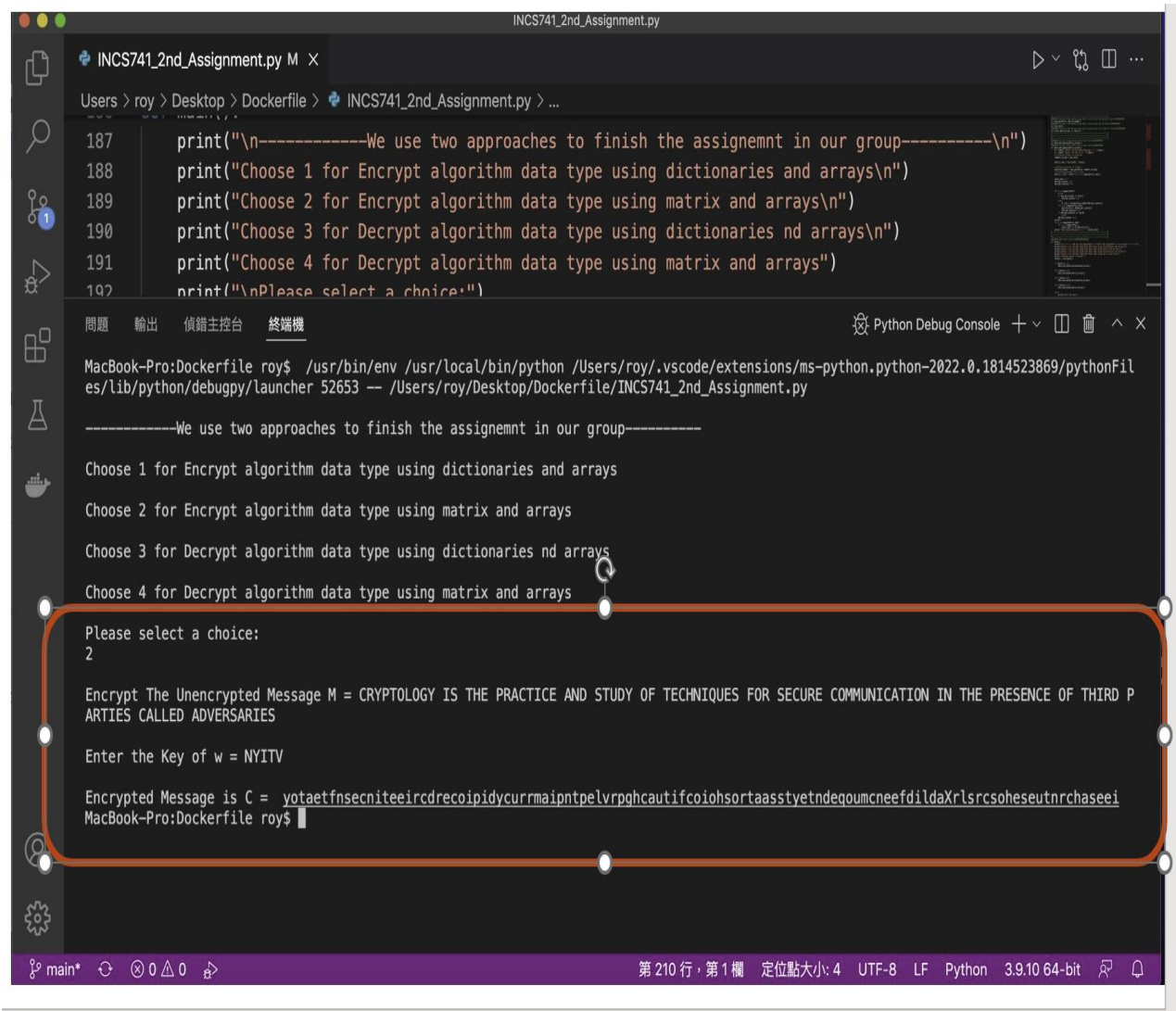
Plaintext:

CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES

Key: NYITV

Ciphertext:

yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoihsortaasstyetndeoumcneefdildaXrlsrcsoheseutnrchaseei



```
INCS741_2nd_Assignment.py
Users > roy > Desktop > Dockerfile > INCS741_2nd_Assignment.py > ...
187 print("\n-----We use two approaches to finish the assignemnt in our group-----\n")
188 print("Choose 1 for Encrypt algorithm data type using dictionaries and arrays\n")
189 print("Choose 2 for Encrypt algorithm data type using matrix and arrays\n")
190 print("Choose 3 for Decrypt algorithm data type using dictionaries nd arrays\n")
191 print("Choose 4 for Decrypt algorithm data type using matrix and arrays")
192 print("\nPlease select a choice:")

問題 輸出 偵錯主控台 終端機 Python Debug Console
MacBook-Pro:~$ /usr/bin/env /usr/local/bin/python /Users/roy/.vscode/extensions/ms-python.python-2022.0.1814523869/pythonFiles/lib/python/debugpy/launcher 52653 -- /Users/roy/Desktop/Dockerfile/INCS741_2nd_Assignment.py

-----We use two approaches to finish the assignemnt in our group-----
Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays

Please select a choice:
2

Encrypt The Unencrypted Message M = CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES

Enter the Key of w = NYITV

Encrypted Message is C = yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoihsortaasstyetndeoumcneefdildaXrlsrcsoheseutnrchaseei
MacBook-Pro:~$
```

(Reverse Test-2):

Reverse the encryption algorithm data type with matrix and arrays, using decryption with same data type to verify the right ciphertext.

Ciphertext:

yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoiohsortaasstyetndeqoumcneefdildaXrlsr
csoheseutnrchaseei

Key: NYITV

Plaintext:

cryptologyisthepracticeandstudyoftechniquesforsecurecommunicationinthepresenceofthirdparties
calledadversariesx

Overall: The encrypted message in encryption with matrix and arrays result is correct.

Ciphertext:

yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoiohsortaasstyetndeqoumcneefdildaXrlsr
csoheseutnrchaseei

```
INCS741_2nd_Assignment.py
Users > roy > Desktop > Dockerfile > INCS741_2nd_Assignment.py > ...
187 print("\n-----We use two approaches to finish the assignemnt in c
188 print("Choose 1 for Encrypt algorithm data type using dictionaries and a
189 print("Choose 2 for Encrypt algorithm data type using matrix and arrays\
190 print("Choose 3 for Decrypt algorithm data type using dictionaries nd a
191 print("Choose 4 for Decrypt algorithm data type using matrix and arrays\
192 print("\n-----")

MacBook-Pro:~ roy$ /usr/bin/env /usr/local/bin/python /Users/roy/.vscode/extensions/ms-python.py
thon-2022.0.1814523869/pythonFiles/lib/python/debugpy/launcher 52892 -- /Users/roy/Desktop/Dockerfile/INCS
741_2nd_Assignment.py

-----We use two approaches to finish the assignemnt in our group-----
Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrvot algorithm data type using matrix and arrays
Please select a choice:
4
Enter the Encrypted Message C = yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoiohsortaasstyetndeq
oumcneefdildaXrlsrcsoheseutnrchaseei
Enter the Key of w = NYITV

Encrypted Message is C = cryptologyisthepracticeandstudyoftechniquesforsecurecommunicationinthepresenceoft
hirdpartiescalledadversariesx
MacBook-Pro:~ roy$
```

Question 5: (Decryption Test)

- Using a w value of NYITV use your code to decrypt the following text:
- “eroohalpsmeptroohalsefxphtnlefhxwtstiiieoecrastitosplmgeasentmitrasnefylypnhiasnet
oiroitaetaxoeetonicrasetltesnicrfwmurnhrrhitcrxhttpipsrmainiitpihlaleiucciptotpe”
- Output your results

Answer:

Method 1->

Decrypting algorithm using data type with dictionary and arrays:

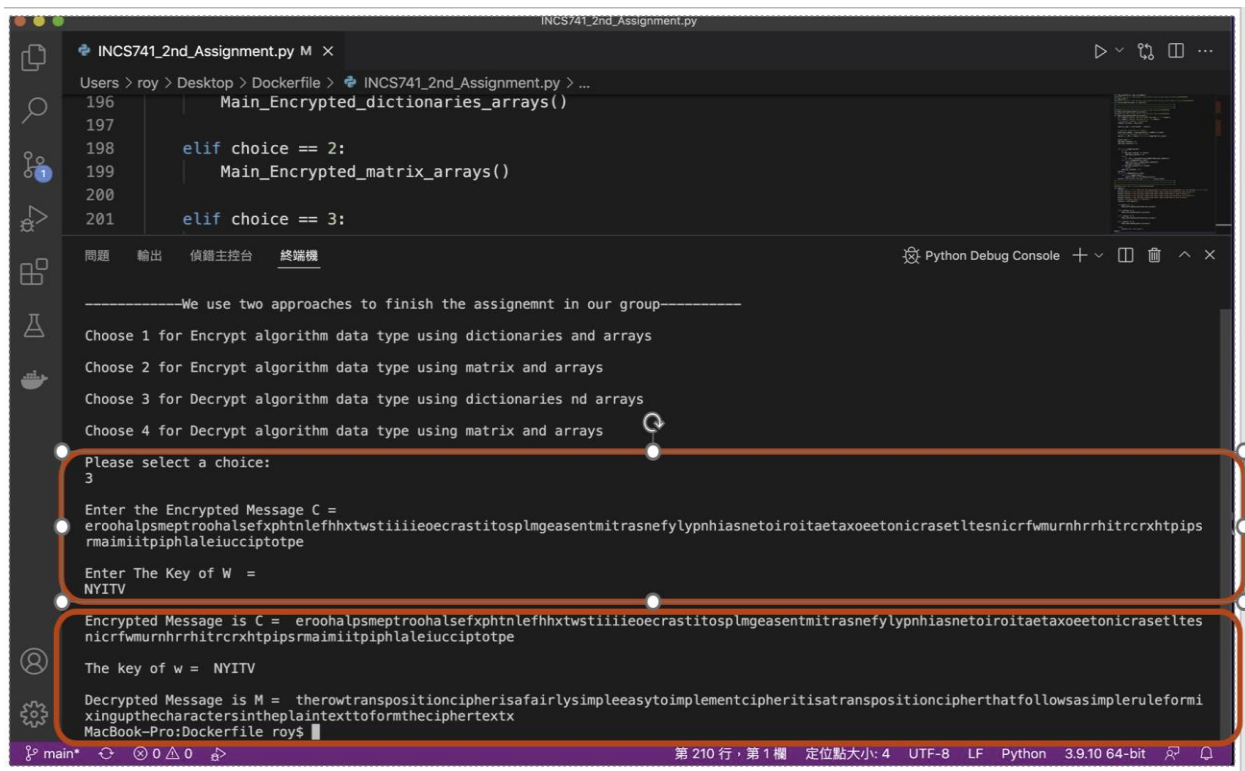
Plaintext:

eroohalpsmeptroohalsefxphtnlefhxwtstiiieoeocrastitosplmgeasentmitrasnefylypnhiasnetoiroitaet
axoeetonicrasetltesnicrfwmurnhrrhitrcrxhtpipsrmaimitpihlaleiucciptotpe

Key: NYITV

Ciphertext:

therowtranspositioncipherisafairlysimpleeasytoimplementcipheritisatranspositioncipherthatfollo
wsasimpleruleformixingupthecharactersintheplaintexttoformtheciphertextx



```
INCS741_2nd_Assignment.py
Users > roy > Desktop > Dockerfile > INCS741_2nd_Assignment.py > ...
196 Main_Encrypted_dictionaries_arrays()
197
198 elif choice == 2:
199     Main_Encrypted_matrix_arrays()
200
201 elif choice == 3:
202
-----We use two approaches to finish the assignemnt in our group-----
Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays
Please select a choice:
3
Enter the Encrypted Message C =
eroohalpsmeptroohalsefxphtnlefhxwtstiiieoeocrastitosplmgeasentmitrasnefylypnhiasnetoiroitaetaxoeetonicrasetltesnicrfwmurnhrrhitrcrxhtpipsrmaimitpihlaleiucciptotpe
Enter The Key of W =
NYITV
Encrypted Message is C = eroohalpsmeptroohalsefxphtnlefhxwtstiiieoeocrastitosplmgeasentmitrasnefylypnhiasnetoiroitaetaxoeetonicrasetltesnicrfwmurnhrrhitrcrxhtpipsrmaimitpihlaleiucciptotpe
The key of w = NYITV
Decrypted Message is M = therowtranspositioncipherisafairlysimpleeasytoimplementcipheritisatranspositioncipherthatfollowsasimpleruleformixingupthecharactersintheplaintexttoformtheciphertextx
MacBook-Pro: Dockerfile roy$
```

Method 2 ->

Decrypting algorithm using data type with matrix and arrays:

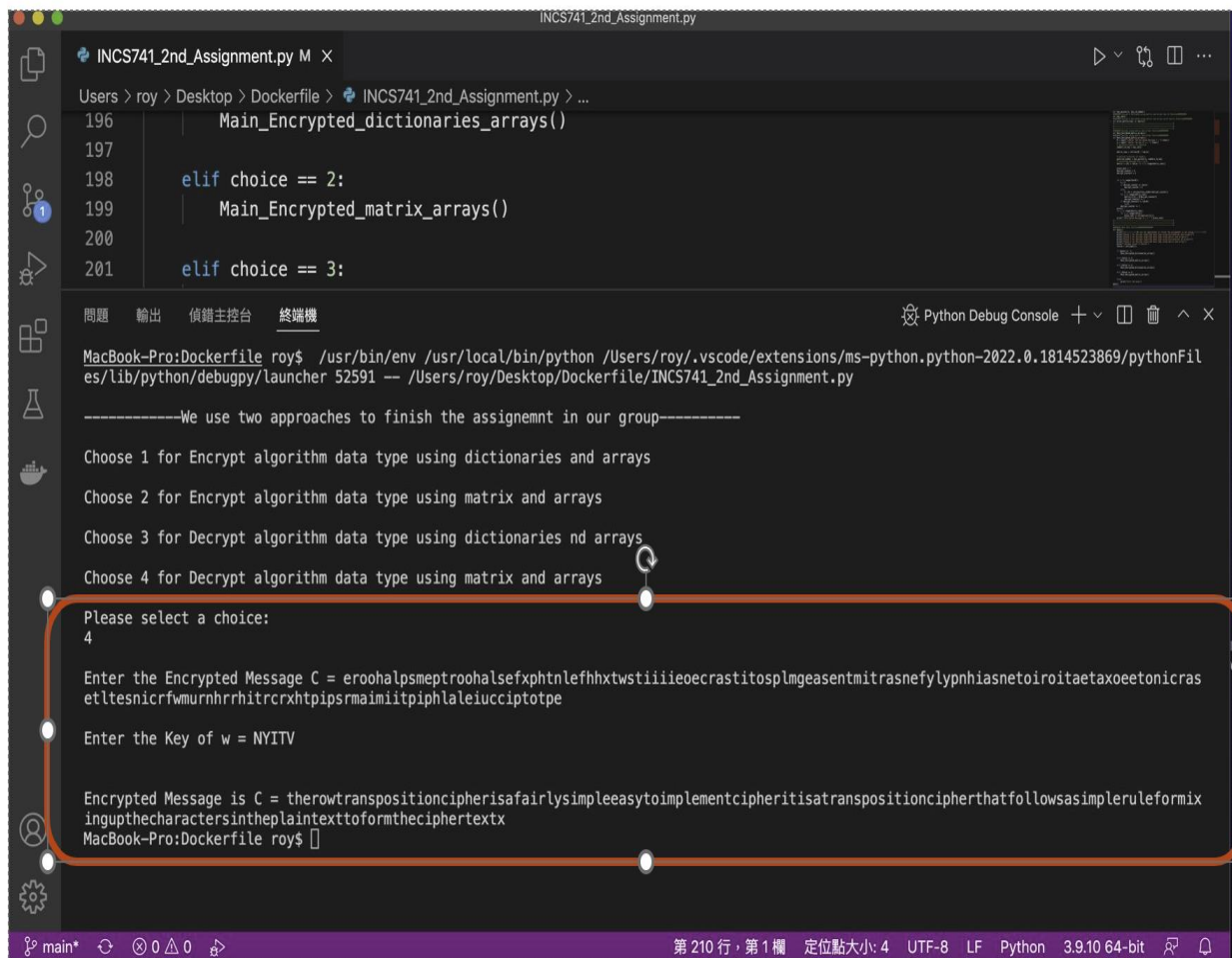
Plaintext:

eroohalpsmeptroohalsefxphtnlefhxwtstiiieoeocrastitosplmgeasentmitrasnefylypnhiasnetoiroitaet
axoeetonicrasetltesnicrfwmurnhrrhitrcrxhtpipsrmaimitpihlaleiucciptotpe

Key: NYITV

Ciphertext:

therowtranspositioncipherisafairlysimpleeasytoimplementcipheritisatranspositioncipherthatfollowsasimpleruleformixingupthecharactersintheplaintexttoformtheciphertextx



The screenshot shows a VS Code editor window with a file named `INCS741_2nd_Assignment.py`. The editor displays the following code:

```
196 Main_Encrypted_dictionaries_arrays()
197
198 elif choice == 2:
199     Main_Encrypted_matrix_arrays()
200
201 elif choice == 3:
```

Below the editor, the Python Debug Console shows the execution output:

```
MacBook-Pro:Dockefile roy$ /usr/bin/env /usr/local/bin/python /Users/roy/.vscode/extensions/ms-python.python-2022.0.1814523869/pythonFiles/lib/python/debugpy/launcher 52591 -- /Users/roy/Desktop/Dockefile/INCS741_2nd_Assignment.py

-----We use two approaches to finish the assignemnt in our group-----

Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays

Please select a choice:
4

Enter the Encrypted Message C = eroohalpsmeptroohalsefxphtnlefhxwtstiiieocrastitosplmgeasentmitrasnefylypnhiasnetoiroitaetaxoeetonicras
etltesnicrfwmurnhrhitrctrxhtpipsrmaimittipihlaleiucpiptotpe

Enter the Key of w = NYITV

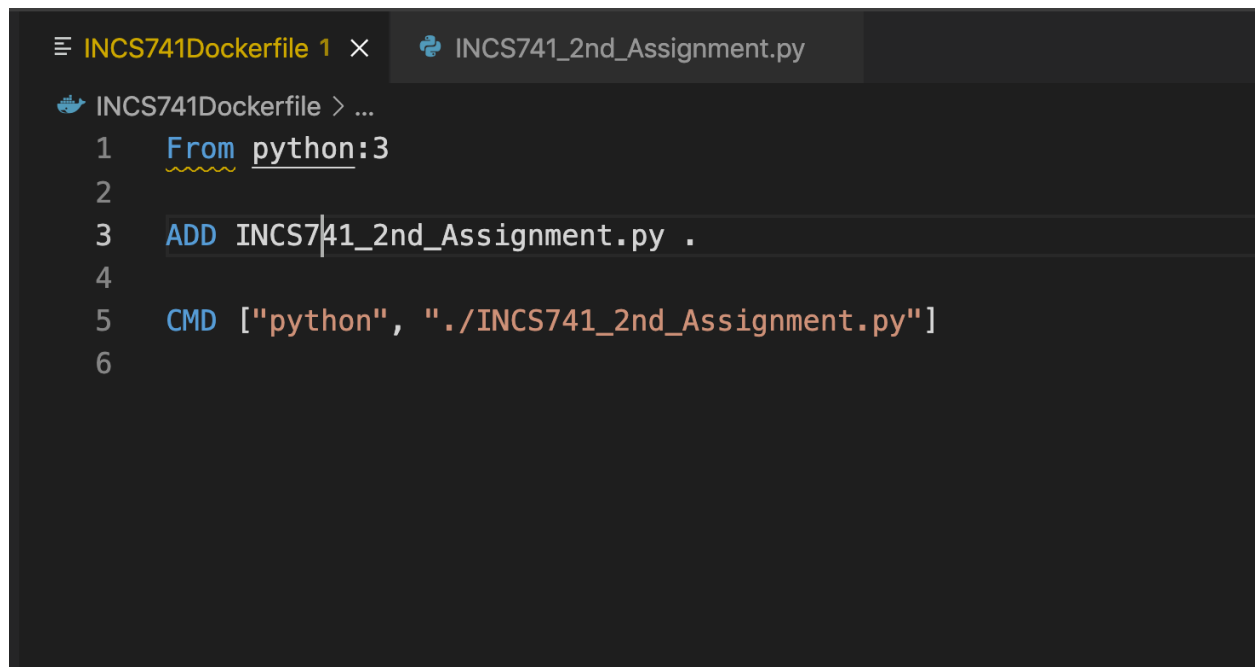
Encrypted Message is C = therowtranspositioncipherisafairlysimpleeasytoimplementcipheritisatranspositioncipherthatfollowsasimpleruleformix
ingupthecharactersintheplaintexttoformtheciphertextx
MacBook-Pro:Dockefile roy$
```

The status bar at the bottom indicates the file is at line 210, column 1, with a UTF-8 encoding and LF line endings.

DOCKER FILE:

The screenshots below show how the docker is working with our python file.

Step 1: Add the python file from the working directory.



```
INCS741Dockerfile 1 x INCS741_2nd_Assignment.py
INCS741Dockerfile > ...
1  From python:3
2
3  ADD INCS741_2nd_Assignment.py .
4
5  CMD ["python", "../INCS741_2nd_Assignment.py"]
6
```

Step 2: Run the below command:

“docker build . -f INCS741Dockerfile -t 741assignmentnt”

```

Build an image from a Dockerfile
MacBook-Pro:Dockerrfile roy$ docker build . -f INCS741Dockerfile -t 741assignment
[+] Building 2.0s (8/8) FINISHED
=> [internal] load build definition from INCS741Dockerfile 0.1s
=> => transferring dockerfile: 43B 0.0s
=> [internal] load .dockerignore 0.0s
=> => transferring context: 2B 0.0s
=> [internal] load metadata for docker.io/library/python:3 1.8s
=> [auth] library/python:pull token for registry-1.docker.io 0.0s
=> [internal] load build context 0.0s
=> => transferring context: 130B 0.0s
=> [1/2] FROM docker.io/library/python:3@sha256:b3b75721c450a91bd12445e492 0.0s
=> CACHED [2/2] ADD INCS741_2nd_Assignment.py . 0.0s
=> exporting to image 0.0s
=> => exporting layers 0.0s
=> => writing image sha256:50de1c2fb76f722f38f06e5073f66867b3ca384237da26e 0.0s
=> => naming to docker.io/library/741assignment 0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them
MacBook-Pro:Dockerrfile roy$

```

Explanation: The reason using “.” and “-f” in the command means that “.” will build the docker image to the working directory, “-f” will follow the specific name of docker file content as well.

Step 3: Docker run image command

“docker run -it 741assignment.”

Because our python code involved the interactive mode, we need to use “-it” before the image name. Otherwise, this will have EOF reading line errors (Docker EOF error).

EOF Error Screenshot:

```
MacBook-Pro:Dockfile roy$ docker run 741assignment
-----We use two approaches to finish the assignemnt in our group-----
Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays
Please select a choice:
Traceback (most recent call last):
  File "///./INCS741_2nd_Assignment.py", line 240, in <module>
    main()
  File "///./INCS741_2nd_Assignment.py", line 224, in main
    choice = int(input())
EOFError: EOF when reading a line
MacBook-Pro:Dockfile roy$
```

The final docker image results of questions 1 and 4 with data type dictionaries and arrays will look like this:

Encryption & Decryption with data type dictionaries and arrays:

```

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them
MacBook-Pro:~ roy$ docker run -it 741assignment
-----We use two approaches to finish the assignemnt in our group-----

Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays

Please select a choice:
1

Encrypt The Unencrypted Message M =
CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMMUNICATION IN THE PRESENCE OF THIRD P
ARTIES CALLED ADVERSARIES

Enter the Key of w
NYITV

Unencrypted Message is M = CRYPTOLOGYISTHEPRACTICEANDSTUDYOFTECHNIQUESFORSECURECOMMUNICATIONINTHEPRES
ENCEOFTHIRDPARTIESCALLEDADVERSARIES

The Key of w = NYITV

Encrypted Message is C = yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoiohsortaaasstyetndequ
mcneefdildaXrlsrcsoheseutnrchaseei
MacBook-Pro:~ roy$

```

```

roy — -bash — 81x32
Encrypted Message is C = yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifco
iohsortaaasstyetndequomcneefdildaXrlsrcsoheseutnrchaseei
MacBook-Pro:~ roy$ docker run -it 741assignment
-----We use two approaches to finish the assignemnt in our group-----

Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries nd arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays

Please select a choice:
3

Enter the Encrypted Message C =
yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifcoiohsortaaasstyetndequomcneel
fdildaXrlsrcsoheseutnrchaseei

Enter The Key of W =
NYITV

Encrypted Message is C = yotaetfnsecniteeircdrecoipidycurrmaipntpelvrpghcautifco
iohsortaaasstyetndequomcneefdildaxrlsrcsoheseutnrchaseei

The key of w = NYITV

Decrypted Message is M = cryptologyisthepracticeandstudyoftechniquesforsecurecom
municationinthepresenceofthirdpartiescalledadversariesx
MacBook-Pro:~ roy$

```

The final docker image results of questions 2 and 5 with data type matrix and arrays will look like this:

Encryption & Decryption with data type matrix and arrays:


```
roy ~ -bash — 102x32
Enter the Encrypted Message C = eroohalpsmeptroohalsefxphntlefhhxtwstiiieoeocrastitosplmgeasentmitrasn
efylpnhiasnetoiroitaetaxoeetonicrasetltesnicrfwmurnhrrhitrcrxhtpipsrmaimittipihlaleiucciptotpe

Enter the Key of w = NYITV

Encrypted Message is C = therowtranspositioncipherisafairlysimpleeasytoimplementcipheritisatranspositi
oncipherthatfollowsasimpleruleformixingupthecharactersintheplaintexttoformtheciphertextx
MacBook-Pro:~ roy$ docker run -it 741assignment

-----We use two approaches to finish the assignemnt in our group-----

Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries and arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays

Please select a choice:
2

Encrypt The Unencrypted Message M = CRYPTOLOGY IS THE PRACTICE AND STUDY OF TECHNIQUES FOR SECURE COMM
UNICATION IN THE PRESENCE OF THIRD PARTIES CALLED ADVERSARIES

Enter the Key of w = NYITV

Encrypted Message is C = ygeisfioruihetacaaXcltcnyhscmaneodeerspypcttqrenoenhradrXtireueuscincpitlvix
rohtdonfumttsfpsdsXosaadceeocirerileeX
MacBook-Pro:~ roy$
```

```
roy ~ -bash — 102x32
Last login: Mon Feb 28 19:09:19 on ttys000
MacBook-Pro:~ roy$ docker images
REPOSITORY          TAG             IMAGE ID         CREATED          SIZE
741assignment        latest          50delc2fb76f    2 days ago      917MB
MacBook-Pro:~ roy$ docker run -it 741assignment

-----We use two approaches to finish the assignemnt in our group-----

Choose 1 for Encrypt algorithm data type using dictionaries and arrays
Choose 2 for Encrypt algorithm data type using matrix and arrays
Choose 3 for Decrypt algorithm data type using dictionaries and arrays
Choose 4 for Decrypt algorithm data type using matrix and arrays

Please select a choice:
4

Enter the Encrypted Message C = eroohalpsmeptroohalsefxphntlefhhxtwstiiieoeocrastitosplmgeasentmitrasn
efylpnhiasnetoiroitaetaxoeetonicrasetltesnicrfwmurnhrrhitrcrxhtpipsrmaimittipihlaleiucciptotpe

Enter the Key of w = NYITV

Encrypted Message is C = therowtranspositioncipherisafairlysimpleeasytoimplementcipheritisatranspositi
oncipherthatfollowsasimpleruleformixingupthecharactersintheplaintexttoformtheciphertextx
MacBook-Pro:~ roy$
```

V. CONCLUSION

1. We created the executable file that can work on the macos and windows system.
2. It was a challenge to place the logical ideas and coding problems However, it was fascinating as a team to get deeper into this and apply it to crypto science.
3. For the decryption algorithm data type using matrix and arrays, if some text is trying to be decrypted with spaces, it would have some possibilities of errors. So the text may be decrypted has to contain no spaces.
4. The assignment was very interesting in the sense that, which includes many challenges, activities, and instructions to deliver at the end. Those activities include some other new popular approaches like Docker image, which play as a good complement for understanding new area development.
5. The assignment pushes us to go deeper into a programming language again for some of the participants in the team. In contrast to other basic programs done, this assignment specifies a good challenge.
6. The final decision of the team was to include all the hard work done in this document, so as a result two codes were compiled and handy out into the assignment, and explained in this report.

VI. REFERENCES

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