Powerhouse Documentation

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# Research done

## AES and DES

### What’s AES encryption?

The advanced Encryption Standard is one of the most popular global encryption standards.  
 In order to select a secure AES, NIST considered three different block ciphers from the Rijndael family of ciphers. (Abdullah, A., 2017) These selected three ciphers were all 128 bits but the lengths of their keys were 128, 192 and 265 bits. (Cobb M. 2020)  
In the end, the block cipher developed by Rijmen and Daemen was selected. This AES was first adopted in the United States but in time, it became mainstream worldwide.  
AES is characterized as being a symmetric block cipher, in other words it uses the same key for encryption and decryption.( Wallen D, 2020)

### How does AES encryption work?

AES encryption has three different block ciphers: AES-128 (128 bit), AES-192 (192 bit) and AES-256 (256 bit). These block ciphers are named after the key length they use for encryption and decryption. All these ciphers encrypt and decrypt the data in 128-bit blocks but they use different sizes of cryptographic keys.( John Carl Villanueva, 2015)

• AES includes three block ciphers: AES-128, AES-192 and AES-256.

• AES-128 uses a 128-bit key length to encrypt and decrypt a block of messages, while AES-192 uses a 192-bit key length and AES-256 a 256-bit key length to encrypt and decrypt messages. Each cipher encrypts and decrypts data in blocks of 128 bits using cryptographic keys of 128, 192 and 256 bits, respectively.  
AES is developed using substitution-permutation network and it can be considered as a variant of Rijndael.  
Symmetric, also known as secret key, ciphers use the same key for encrypting and decrypting, so the sender and the receiver must both know -- and use -- the same secret key. The government classifies information in three categories: Confidential, Secret or Top Secret. All key lengths can be used to protect the Confidential and Secret level. Top Secret information requires either 192- or 256-bit key lengths.  
There are 10 rounds for 128-bit keys, 12 rounds for 192-bit keys and 14 rounds for 256-bit keys. A round consists of several processing steps that include substitution, transposition and mixing of the input plaintext to transform it into the final output of ciphertext.( Cobb M. 2020)

The AES encryption algorithm defines numerous transformations that are to be performed on data stored in an array. The first step of the cipher is to put the data into an array -- after which, the cipher transformations are repeated over multiple encryption rounds.

The first transformation in the AES encryption cipher is substitution of data using a substitution table; the second transformation shifts data rows, and the third mixes columns. The last transformation is performed on each column using a different part of the encryption key. Longer keys need more rounds to complete.( Wallen D, 2020)

### Choosing AES algorithms

Fifteen competing symmetric algorithm designs were subjected to preliminary analysis by the world cryptographic community, including the National Security Agency (NSA). In August 1999, NIST selected five algorithms for more extensive analysis:

1. MARS, submitted by a large team from IBM Research;

2. RC6, submitted by RSA Security;

3. Rijndael, submitted by two Belgian cryptographers, Joan Daemen and Vincent Rijmen;

4. Serpent, submitted by Ross Anderson, Eli Biham and Lars Knudsen; and

5. Twofish, submitted by a large team of researchers from Counterpane Internet Security, including noted cryptographer Bruce Schneier. (Cobb M. 2020)

### AES encryption uses:

AES uses symmetric key encryption, which involves the use of only one secret key to cipher and decipher information.

The Advanced Encryption Standard (AES) is the first and only publicly accessible cipher approved by the US National Security Agency (NSA) for protecting top secret information. AES was first called Rijndael after its two developers, Belgian cryptographers Vincent Rijmen and Joan Daemen.

AES-256, which has a key length of 256 bits, supports the largest bit size and is practically unbreakable by brute force based on current computing power, making it the strongest encryption standard. The following table shows that possible key combinations exponentially increase with the key size.

|  |  |
| --- | --- |
| Key Size | Possible Combinations |
| 1 bit | 2 |
| 2 bits | 4 |
| 4 bits | 16 |
| 8 bits | 256 |
| 16 bits | 65536 |
| 32 bits | 4.2 x 109 |
| 56 bits (DES) | 7.2 x 1016 |
| 64 bits | 1.8 x 1019 |
| 128 bits (AES) | 3.4 x 1038 |
| 192 bits (AES) | 6.2 x 1057 |
| 256 bits (AES) | 1.1 x 1077 |

Table 1. Key sizes and corresponding possible combinations to crack by brute force attack. Source: https://www.eetimes.com/document.asp?doc\_id=1279619#

### 

### AES security

Security experts maintain that AES is secure when implemented properly. However, AES encryption keys need to be protected. Even the most extensive cryptographic systems can be vulnerable if a hacker gains access to the encryption key.

Use of strong passwords, password managers, multifactor authentication (MFA), firewalls and antivirus software is critical to enterprise security. Employees should also be trained in ways to prevent social engineering and phishing attacks.

### Steps in the AES Encryption Process

1. Derive the set of round keys from the cipher key.

2. Initialize the state array with the block data (plaintext).

3. Add the initial round key to the starting state array.

4. Perform nine rounds of state manipulation.

5. Perform the tenth and final round of state manipulation.

## RAR files

### What are RAR files?

A compressed file, or data container, that holds one or more other files and folders inside of it. However, unlike a normal folder, a RAR file needs special software to open and "extract" out the contents.

It used the .rar extension. It provides several advanced features compared to the other compression tools, including multivolume archives, tight compression, recovery record and repair and EAS 256-but encryption. (Fisher T. 2020)

### What is the use of RAR files?

One probably only run into a RAR file when downloading computer software. File sharing websites and software distributors sometimes put their files in a RAR file so that they can compress it down to a smaller size, allowing you to download it faster than you otherwise could. Some RAR files are split into parts for easier transmission. (Fisher T. 2020)

RAR files can also be protected with a password and encrypted so that the contents inside of them stay hidden unless you know the password.

Another time a RAR file might be useful is when a friend has a long list of files they want to share with you, like photos, for example. Instead of having you download every single image file individually, your friend can first compile the photos into a RAR file and then share just that one file with you.

### How to open a RAR file?

If you double-click or double tap a RAR file without having specific software installed to open it, you will probably see one of the following messages: "Windows cannot open this file" or "How do you want to open this type of file (.rar)?".

RAR is the regular format of an archive program called WinRAR. The only problem with using WinRAR is that it is not free! Before you run off and buy it, please know that there are plenty of free RAR openers that can do the exact same thing but at zero cost.(Gibb, T. 2017)

Of all the un-RAR tools out there, 7-Zip is probably the best one. After installing 7-Zip, set it up to automatically associate itself with RAR files so that, going forward, you'll be able to just open a RAR file from anywhere on your computer and it'll open automatically in 7-Zip. (Gibb, T. 2017)

To do that, open 7-Zip File Manager from the Start menu and then go to Tools > Options. Select rar in the list of file types and then choose the + button for either the current user or all users (or both). A little disk icon will appear next to rar in the list. Save the changes with the OK button.

You can also open RAR files with 7-Zip by right-clicking on them and choosing 7-Zip > Open archive from the pop-up context menu. If you're dealing with multipart RAR files (named something like 123.part1.rar, 123.part2.rar, etc.), first select all the different parts of the RAR file and then right-click one of them; from that menu, choose 7-Zip > Extract files.

7-Zip is not the only free program that can open RAR files. PeaZip and jZip are two alternative RAR openers.

### Cracking a Password protected RAR file:

One problem with password protecting a RAR file is that you may have made your own RAR archive and secured it with a password but have since forgotten what that password is! This is where a RAR password cracker comes in handy.

One particularly effective, and completely free, program that can break the password on a RAR file is RAR Password Cracker Expert. It can use a brute force and/or a dictionary attack (with included wordlists) to attempt every possible angle at recovering the password. Lots of different options let you customize how the different attacks should work.

### How to convert a RAR file?

To convert a RAR file means to change it from a file with the RAR extension to a file with a different extension, usually 7Z, ZIP, LGH, TGZ, TAR, CAB, or some other archive format.

Like you now know, a RAR file is similar to a folder that contains other files. If your RAR file contains MP3 files, for example, you must open the RAR file, not convert it, to get the MP3s.

The quickest and most effective method to converting a RAR to ZIP, or any other common archive format, is a free file converter that supports RAR conversions, like Zamzar or FileZigZag. These two RAR converters are online services, which means you just upload the RAR file to the website and then download the converted file.

A free online RAR converter is perfect if the RAR file you're working with is small, but you probably don't want to use an online converter on a large RAR file. You'd first have to wait for the RAR file to upload and then wait for the converted file to download, something that might take quite a while for a really large file.

If you're converting a large RAR file, try IZArc. It's super easy to convert a RAR to 7Z, or one of several other archive file formats, from IZArc's Tools menu.

### How to make a RAR file?

Finding a free tool that can build a RAR file is not as easy as finding one that can open RAR files. This is because software developers must have explicit permission from Alexander Roshal (the copyright owner) in order to re-create the RAR compression algorithm.

The best suggestion we have for creating a RAR file is to use the trial version of WinRAR. Though it is a timed trial, technically valid for less than 30 days, it's the easiest way to build a new RAR file

# 

# What power house brings to the table:

There are two adaptation that were taken from the Predecessors algorithms which AES AND DES

DES - We took the LPT and RPT method of splitting data that will be encrypted .

AES - Using the the XOR operator to mix data with the refined key from the user in calculations .

What is better about Powerhouse

With this be added our own calculation on how to refine our our key this key refine method select specific characters in the key to use for out refined key for calculation . We also added a simple randomizing calculation for the data ranging from multiplication to addition and subtraction .WE also made a custom file extension which is a form of the JSON format so . We also used sonography to hide the reverse calculation arrays and data and filenames in the “.ph” file . We also added a custom way to differentiated which files where decrypted successfully if the file name starts with a “ph\_” it has been reverted successfully . More is explain below .

# Powerhouse :

# Powerhouse has two versions with is called Heavy and Lite with encrypt different information of files

# Powerhouse Heavy:

Powerhouse Heavy encrypts and decrypts the internal information of files. It can encrypt data specifically from a .txt files, .jpeg, .jpg, .png and rar files but it doesn’t return the rar files into a rar format.

### GUI.py – Powerhouse Heavy

Graphical user interface, text, application, email

Description automatically generated

### UML diagram – Powerhouse Heavy

|  |
| --- |
| Mainwindow |
| + Dialog |
| + \_\_init\_\_( self )  + browsefiles( self )  + encryptfiles( self )  + decryptfiles(self) |

### GUI Explained – Powerhouse Heavy

The Graphical user interface contains the class Mainwindow with the 4 methods shown in the UML diagram above.  
The GUI contains 3 buttons namely Encrypt, Decrypt and Browse.   
The encrypt button initializes encryption on a file chosen by the user using the GUI, the decrypt button decrypts the encrypted file and the browse button allows the user to open a file dialog whereby they’ll choose a file to encrypt and decrypt using the encrypt and decrypt buttons.   
There is a line edit where the user will be allowed to enter their own encryption key.  
The GUI also has two (2) list widgets.   
The first list widget is used to display files chosen by the user to encrypted and second list widget displays encrypted files after the encrypt button is pressed and encryption is done.

# Explanation:

file\_path\_finder() **Parameters and arguments**: path\_array(array of characters in file paths of the files to be encrypted files) and the key(given by the user) , password (is a variable that has a defined value)

**explanation:** the function goes through a series of if and elif statements and for statements to go through the file path and file extension of the files loaded to powerhouse. The file path is split into head and tail using the split. Followed by checking the tail of the file and the function decides on the file type and also decides what function or class to use for encryption. Note that only .jpeg files or .png files, .rar files, .txt

If tail ends with .rar: if tail.endswith(".rar"):

Function prints that an RAR is to be encrypted, requests the password for the .rar file password and extracts form the .rar file and they are store in the folder extract\_point .

If the file in extract\_point is a text file :

The information inside the file are read from the file and they are put through the ord() function and are saved in a array called array . A instance of Encrptor() is made and calls powerhouse and then array with key is sent to be encrypted .

If the file in extract\_point is a image :

If tail ends with .jpeg or .png:  
Function starts of by printing photo to be encrypted, reads the image file, converts the image to bytes, stores the bytes in an array and a instance of Encrptor() is made and calls powerhouse and then array with key is sent to be encrypted .

 elif tail.endswith(".jpeg") or tail.endswith(".png"):

If tail ends with .jpeg or .png:  
Function starts of by printing photo to be encrypted, reads the image file, converts the image to bytes, stores the bytes in an array and a instance of Encrptor() is made and calls powerhouse and then array with key is sent to be encrypted .

*elif*  tail.endswith(".txt"):

The information inside the file are read from the file and they are put through the ord() function and are saved in a array called array . A instance of Encrptor() is made and calls powerhouse and then array with key is sent to be encrypted .

If none of the tails for the ends of the files are found the function prints an error using exception handling.

The encrypted information is then save in the powerhouse specific file type (is a json file with a differentiated file extention .ph)

*with* open(*f*"endpool/{tail.split('.')[0]}.ph", "w") *as* outfile:

                     file\_content = json.dumps(

                                      {

                                                "reverse\_arrays": reverse\_arrays,

                                                "final\_text\_data": final\_text\_data,

                                                "file\_name": file\_path,

                                       }

                                            )

                                            outfile.write(file\_content)

                                        print("Encrypted file saved")

Decryption area of Heavy

### Pool\_search()

This function searches for files in the pool with the help of a key(That its takes in as input). Also consists of arrays: path\_arrays and file\_names that are related to the file paths of the files to be encrypted that are appended. Lastly this function calls the file\_path\_finder function.

def pool\_search():

        key = input("Please enter in the key : ")

        path\_array =[]

        file\_names = []

        for directory ,subdirectories,filenames in os.walk("pool"):

            for files in filenames:

                print (files)

                file\_names.append(files)

                paths = os.path.join(directory,files)

                path\_array.append(paths)

        file\_path\_finder(path\_array,key)

pool\_search searches through the end pool and retrevies the paths and file names of the files that have been encrypted and then the paths are appended into the array called path\_array and the key for the GUI is the sent to file\_path\_finder ()

File\_path\_finder() is also used for decryption on the boolean which checks if the file the file is powerhouse specific file type .ph

*elif* tail.endswith(".ph"):

.ph (.ph files are powerhouses own unreadable file type for saving encrypted files) files are expected if not then an error is returned.

Note .ph is only picked up if there are any encrypted files in the end pool.

Then the encrypted file is opened and the information inside is json loaded and assigned to the variable array .The variable array contains the reverse\_arrays and array of the file information and the original file name with are assigned to the variables final\_text\_data ,reverse\_arrays, filepath and then those variables are sent to the function decrypt().

*elif* tail.endswith(".ph"):

                data\_array = []

*with* open(file\_path,"r") *as* fi:

                        text\_file = fi.read()

                        array = json.loads(text\_file)

                        final\_text\_data =  array["final\_text\_data"]

                        reverse\_arrays =  array["reverse\_arrays"]

                        filepath =  array["file\_name"]

*for* values *in* final\_text\_data:

                            data\_array.append(values)

                        print("MODE == DECRYPT")

                        decrypt(data\_array , reverse\_arrays, key, filepath)

                        print("Encrypted file saved")

*def* decrypt(*data\_array*, *final\_text\_data*, *key*, *tail*):

        head, fileName = os.path.split(tail)

        export\_data = Decrptor()

        decryptedDataArray = export\_data.powerhouse\_decrypt(data\_array, final\_text\_data, key,fileName)

        decryptedData = bytearray(decryptedDataArray)

*with* open(*f*"reversed\_files/ph\_{fileName}", "wb") *as* outfile:

            outfile.write(decryptedData)

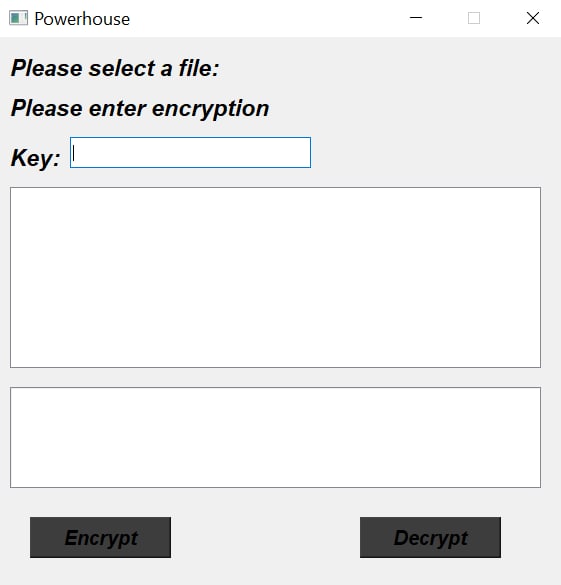
            print("decryption completed")

A instance of Decrptor() is made and then the if of final\_text\_data and the other variables is then sent to be powerhouse\_decrypt for decryption

# Powerhouse Lite:

This algorithm encrypts and decrypts the file itself instead of the internal information of the files. This algorithm unlike its sister program (Powerhouse Heavy) it can encrypt and decrypt every data type even audio files .

### GUI.py – Powerhouse Lite



### UML diagram – Powerhouse Lite

|  |
| --- |
| Mainwindow |
| + Dialog |
| + \_\_init\_\_( self )  + browsefiles( self )  + encryptfiles( self )  + decryptfiles(self) |

### GUI Explained – Powerhouse Lite

The Graphical user interface contains the class Mainwindow with the 4 methods shown in the UML diagram above.  
The GUI contains 2 buttons namely Encrypt, Decrypt.  
The encrypt button initializes encryption on a file chosen by the user using the GUI, the decrypt button decrypts the encrypted file. Both buttons open a file dialog whereby they’ll choose a file to encrypt and decrypt. This allows for fast and easy access  
There is a line edit where the user will be allowed to enter their own 12 character encryption key.  
The GUI also has two (2) list widgets.   
The first list widget is used to display files chosen by the user to encrypted and second list widget displays a message to the user to inform them that the file has bee encrypted or decrypted. The second list widget also gives the user an error message whenever something goes wrong in the encryption and decryption process.

*def* browsefiles(*self*):

        fname = QFileDialog.getOpenFileName(self, "open file")

        self.lstFile.addItem(fname[0])

        self.files.append(fname[0])

*return*

*def* encryptfiles(*self*):

        self.browsefiles()

        print(self.files[0])

        self.filename.setMaxLength(12)

        key = self.filename.text()

        print("[key] ->", key)

        self.encrypt(self.files[0], key)

        key = self.filename.clear()

*def* encrypt(*self*, *filePath*, *key*):

        fileDataArray = []

        head, fileName = os.path.split(filePath)

        file = open(filePath, "rb")

        fileData = file.read()

        file.close()

        fileDataArray = bytearray(fileData)

        print("[head] -> ", head)

        print("[fileName] -> ", fileName.split("."))

*# print("[fileDataArray] -> ", fileDataArray)*

        export\_data = Encrptor()

        encryptedData = export\_data.powerhouse(fileDataArray, key, fileName)

        reverse\_arrays, final\_text\_data = encryptedData

*with* open(*f*"endpool/{fileName.split('.')[0]}.ph", "w") *as* outfile:

            file\_content = json.dumps(

                {

                    "reverse\_arrays": reverse\_arrays,

                    "final\_text\_data": final\_text\_data,

                    "file\_name": fileName,

                }

            )

            outfile.write(file\_content)

            print("encryption completed")

Code explanation:

    def browsefiles(self):

This function allows for files opened through file dialog to be returned in list widget (lstFile) and appended.

    def encryptfiles(self):

This function opens file dialog and sets key length to 12 characters then clears the line edit once encryption is complete after the encrypt button is pressed

    def encrypt(self, filePath, key):

encrypt takes the file path, and the key created from encryptfiles. This is given to function encrypt, encrypt opens and reads the bytes (“rb”) and sends it to FileDataArray. This is then given to Powerhouse to be encrypted.

Once encryption is complete the decryption process can commence which is the opposite of the powerhouse encryption algorithm .

The variable array contains the reverse\_arrays and array of the file information and the original file name with are assigned to the variables final\_text\_data ,reverse\_arrays, file\_name and self.file[0](is an array with the file to be decrypted )and then those variables are sent to the function decrypt().

*def* decryptfiles(*self*):

        self.browsefiles()

        print(self.files[0])

        self.filename.setMaxLength(12)

        key = self.filename.text()

        print("[key] ->", key)

*with* open(self.files[0], "r") *as* file:

            text\_file = file.read()

            data = json.loads(text\_file)

            final\_text\_data = data["final\_text\_data"]

            reverse\_arrays = data["reverse\_arrays"]

            file\_name = data["file\_name"]

            self.decrypt(self.files[0], final\_text\_data, reverse\_arrays, key, file\_name)

            key = self.filename.clear()

*def* decrypt(*self*, *filePath*, *data\_array*, *final\_text\_data*, *key*, *tail*):

        head, fileName = os.path.split(filePath)

        export\_data = Decrptor()

        decryptedDataArray = export\_data.powerhouse\_reverse(

            data\_array, final\_text\_data, key, tail

        )

A instance of Decrptor() is made and then the if of final\_text\_data and the other variables is then sent to be powerhouse\_decrypt for decryption.

# MAIN ENCRYPTION CALCULATION CORE

# powerhouse\_encrypt:

Encrptor **has method powerhouse**

### UML Diagram for Encrptor:

|  |
| --- |
| Encrptor |
| + powerhouse ( bytearray1(array), key(string), file\_name(string)) |
|  |

**Parameters and arguments:** bytearray1(array) and key(string), file\_name(string)

**What it returns**: final\_data\_array

final\_data\_array is a variable that will receive the encrypted arrays of values of the file and return it to the GUI.py

    final\_data\_array = step\_two(lpt,rpt,fixed\_key)

        print("powerhouse\_final\_array-->",final\_data\_array)

*return* final\_data\_array

**Explanation:**

**final\_data\_array = holds two array with are the reverse\_arrays( calculation log that is dictionaries ) and final\_text\_data(which is the encrypted information of the file that was given )**

fixed\_key = is variable that calls and receives the more refined version of the key that will be used in calculations using encryption\_key\_refine() function.

byte\_array1 =is the array of data needs to be encrypted

Calculation :

byte\_array1 is modulated by two to determine if the array of data is even or uneven.

-If even the array is split into equal array’s that will then be known as LPT and RPT

-If uneven the array will be split in to two uneven LPT and RPT arrays in which one in all cases LPT will be smaller and RPT will be bigger . The RPT will always take longer to be encrypted

Once LPT and RPT are made they are given to step\_two to be encrypted and the returned arrays are stored in **final\_data\_array**

*def* powerhouse(*self*,*bytearray1*,*key*,*file\_name*):

*try* :

            lpt = []

            rpt = []

            print("Now in Powerhouse Heavy Encrypt\_Core ")

            final\_data\_array =[]

            fixed\_key  = encryption\_key\_refine(key)

*# uneven number array*

*if* len(bytearray1)% 2 == 1:

                print("Uneven")

                extra\_value = len(bytearray1)

                x = len(bytearray1)

                max = int(x/2)

                print("max -->",max)

*for* i *in* range(max):

                    lpt.append(bytearray1[i])

*for* i *in* range (max,len(bytearray1)):

                    rpt.append (bytearray1[i])

                print("reverse\_third\_step lpt>>>:",lpt)

                print("reverse\_third\_step rpt>>>:",rpt)

                final\_data\_array = step\_two(lpt,rpt,fixed\_key,file\_name)

*elif* len(bytearray1)% 2 == 0:

                print("Even")

                max = int(len(bytearray1)/2)

*for* i *in* range (0,max):

                    lpt.append(bytearray1[i])

*for* i *in* range (max,len(bytearray1)):

                    rpt.append(bytearray1[i])

                print("reverse\_third\_step lpt>>>:",lpt)

                print("reverse\_third\_step rpt>>>:",rpt)

                final\_data\_array = step\_two(lpt,rpt,fixed\_key,file\_name)

*return* (final\_data\_array)

**encryption\_key\_refine():  
Parameters and arguments:** encrypt\_key

def encryption\_key\_refine(encrypt\_key)

**What function returns:** true\_key\_array

  return true\_key\_array

**Explanation:** has two local arrays : true\_key\_array and temp\_storage(array ) and variable temp\_value (int). Function iterates through encryption\_key and values are stored in temp\_storage array, the fourth value of temp\_storage is orded and multiplied by 12 and saved into variable i and the same is done for the 8th value and saved into the variable y. After that 2 Boolean values are declared i\_big and y\_big, they remain true, while i\_big is true i is divided by 20 if i is greater than 50 and if i is not a decimal after being divided by 20 it is saved as temp\_value and added to the true\_key\_array and the same is done for variable y. If i is no an integer 10 is added to it and it is turned into an integer using int and added to true\_key\_array after i\_big is made false then the loop is broken. And true\_key\_array is returned to calling point

*def* encryption\_key\_refine(*encrypt\_key*):

*try* :

        true\_key\_array = []

        temp\_value  = 0

        temp\_storage =[]

*for* i *in* encrypt\_key:

            temp\_storage.append(i)

        i = ord(temp\_storage[3])\*3

        y = ord(temp\_storage[7])\*3

        i\_big = True

        y\_big = True

        z\_big = True

*while*(  i\_big ):

*if* i > 50:

                i= i/20

*if* isinstance(i, int)==True:

                temp\_value = i

                true\_key\_array.append(temp\_value)

                i\_big  = False

*elif* isinstance(i, int)==False:

                temp\_value = int(i + 10)

                true\_key\_array.append(temp\_value)

                i\_big  = False

*while*(y\_big ):

*if* y > 50:

                y= y/20

*if* isinstance(y, int)==True:

                temp\_value = y

                true\_key\_array.append(temp\_value)

                y\_big  = False

*elif* isinstance(y, int)==False:

                temp\_value = int(y + 10)

                true\_key\_array.append(temp\_value)

                y\_big  = False

*return* true\_key\_array

*except* Exception *as* e:

        print("ERROR-in->encryption\_key\_refine>>>:", e)

**step\_two**

**Parameters and arguments:** lpt, rpt and encrypty\_number

**What the function returns:**

*return* final\_data\_array

**Explanation:**This is the core of the encryption which comprises of random selection of operation on each individual array(LPT and RPT) by utilizing the random function mainly the rand int and XOR operator in a three section calculation on the individual values of LPT and RPT .

True\_operation = is a random number created using the randint() function and is limited to a range of 1 to 3 to by the used to reverence a invisible order of operators

*if* true\_operation == 1 :

                value = i - round\_encryption\_number2

*elif* true\_operation  == 2:

                value= i + round\_encryption\_number2

*elif* true\_operation == 3:

                value = i \* round\_encryption\_number2

**Local functions variables :**

round\_control\_number\_lpt  = 0

        cal1lpt = []

        cal2lpt = []

**How :**

1. encrypt\_number is a array of int value .Those values of encrypt\_number are assigned to three variables which are containers that will be used in the round calculations **:**

        round\_encryption\_number1 = encrypt\_key[0]

        round\_encryption\_number2 = encrypt\_key[1]

2) The LPT array, RPT array are accessed and each value is put through three sections of calculations .LPT is calculated first and RPT is calculated after :

\*Note the code For LPT and RPT calculation is similar in the Example below LPT is the array that is being accessed but same processes is done on RPT

cal1lpt = []

        cal2lpt = []

        print("lpt data receiving check")

*#round one*

        round\_control\_number\_lpt += 1

*for* i *in* lpt:

*# XOR calculation*

            value = 0

            value = i ^ round\_encryption\_number1

            cal1lpt.append(value)

        round\_control\_number\_lpt += 1

*for* i *in* cal1lpt:

            true\_operation = randint(1,2)

            reverse\_encryption\_key\_lpt.append(true\_operation)

            value = 0

*if* true\_operation == 1 :

                value = i + round\_encryption\_number2

*elif* true\_operation  == 2:

                value= i \* round\_encryption\_number2

*elif* true\_operation == 3:

                value = i - round\_encryption\_number2

            cal2lpt.append(value)

- First section the LPT array is accessed and each value is XOR with the round\_encryption\_number1 and the value are saved in the cal1 array

- Second section the cal1 array is accessed and the a random number is created for each accessed value and that value passes through nested Boolean to determine what operator will be used for its calculation so each value has a different micro calculation done to it and the true\_operation number is save into the reverse\_encryption\_key\_lpt array and that array will later be added to the new dictioctionary called reverse\_arrays reverse\_arrays will have 2 keys and 2 values, first key being lpt\_reverse\_array and second key rpt\_reverse\_array, values being: the reverse\_encryption\_key\_lpt array value lpt, rpt are then sent to third\_step and are returned back to the variable final\_text\_data which will be returned back and then saved in the .ph file for representing an encrypted file.

  reverse\_arrays  = {}

        reverse\_arrays = {

            "lpt\_reverse\_array":reverse\_encryption\_key\_lpt,

            "rpt\_reverse\_array":reverse\_encryption\_key\_rpt

        }

        final\_text\_data = third\_step(cal2lpt,cal2rpt)

        print("Round LPT: ",round\_control\_number\_lpt," :")

        print("Round RPT: ",round\_control\_number\_rpt," :")

*return* (reverse\_arrays, final\_text\_data)

### Libraries used:

**Random**  
The random library was used to generate random numbers between 1 and 5 for unpredictability, if a normal sequence of numbers from 1 to 5 was used the encryption would have been more predictable.  
**Seed -** Seed is used to initialize random numbers so that the same random numbers are generated on multiple execution of the code for use in decryption.

**third\_step:**

*def* third\_step(*lpt*, *rpt* ):

*try*:

*if* lpt !=[]:

            print("lpt recived ")

*if* rpt !=[]:

            print("rpt recived ")

        textdata\_array = []

*for* i *in* lpt:

            textdata\_array.append(i)

*for* j *in* rpt:

            textdata\_array.append(j)

*# print("third step array -->", textdata\_array)*

*return* textdata\_array

        print ("Encryption has been completed")

*except* Exception *as* e:

        print("ERROR-in->third\_step>>>:", e)

**Parameters and arguments: LPT and RPT**

**What function returns: textdata\_array (a combination of the LPT and RPT)**

**Explanation: T**he LPT and RPT arrays are joined by being added to the textdata\_array and then the textdata\_array is returned to calling statement

### Libraries used:

**PYQT5**Is a python binding of the cross-platform GUI toolkit Qt, implemented as a python plug-in.

**Sys –** a module in python that provides various functions and variables that are used to manipulate different parts of the python runtime environment.

**Os –** provides function for interacting with the operating system.

# 

# References

Abdullah, A., 2017. Advanced encryption standard (aes) algorithm to encrypt and decrypt data. Cryptography and Network Security, 16.

Wallen D, 2020, 26 May. AES Encryption: a Closer Look at advanced Encryption Standards [online] Available at: <https://spanning.com/blog/aes-encryption/>. Date of access: 15 March 2021.

John Carl Villanueva, 2015, 19 May. *What is AES Encryption and How does it work?* [online] : <https://www.jscape.com/blog/aes-encryption> .Date of access: 15 March, 2021.

Cobb M. 2020, April. *Advanced Encryption Standard (AES)*. [online] : <https://searchsecurity.techtarget.com/definition/Advanced-Encryption-Standard> . Date of Access: 15 March, 2021.

by NDTV Correspondent. 2014, 3 Jun. How to open rar and zip files on MAC, PC, or Mobile device, : <https://gadgets.ndtv.com/apps/features/how-to-open-rar-and-zip-files-on-a-pc-mac-or-mobile-device-534872> Date of Access: 2 May, 2021.

Gibb, T. 2017, 6 Sep. How to Extract .RAR Files for free on Windows and Mac [Blog post]: <https://www.howtogeek.com/73904/beginner-how-to-extract-.rar-files-on-windows-7-and-mac-os-x/> .Date of Access: 2 May 2021

Fisher T. 2020, 2 Dec. What is a RAR file? ,Available at: <https://www.lifewire.com/rar-file-2622216> . Date of access: 2 May. 2021.