

**COMP9337 - Securing Fixed and Wireless Networks**

**T1 2022**

**LAB 1**

**Group: T18B 7**

**Name:** Yuhua Zhao – **ZID:** z5404443

**Name:** Yasin Khan – **ZID:** z5265047

**Environment:**

* **Programming Language:** Python
* **Version:** 3.9.2

## **Part A: DES Encryption and Decryption:**

* **Please run the following argument to test the Outcome**

python tempdes.py fecdba9876543210 0123456789abcdef test.txt mytest.des

**Argument Details:**

* + Argument 1: Initialization Vector (IV)
  + Argument 2: Key to be use for encryption
  + Argument 3: Input file path of the file that will be read
  + Argument 4: Encrypted file will be generated based on the argument 4 name.

### **Part A: Code Explanation:**

Text

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* + DES encryption input should be multiple of 8 bytes. If this is not the case, then we will pad it to satisfy the requirement.
  + Firstly, line 14 will read the file according to argument 3.
  + Secondly, the program will check whether the length of the input is multiple of 8 bytes. If true, will return the input itself unmodified. Else it will detect how many missing bytes are and add the Padding accordingly.

Text

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* + “Encrypt\_DES” function is used to encrypt the plain text
  + “Decrypt\_DES” Function is used to decrypt the Cipher test that encrypt by the Encrypt\_DES function.

Text

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* + Line 47: Detect arguments when this python script is being called and assigned to the Variable respectively.
  + Line 50: Call the Read File to get the text that needs to be encrypted and encode it with the selected Format.
  + Line 53 – 55: Record the time used for DES CBC encryption.
  + Line 57 – 59: Generate a file named by Argument 4 and write Ciphertext in.
  + Line 62 – 64: Record the time used for DES CBC decryption.
  + Line 67 – 73: Print the necessary value for Lab Part B.

## **Part B: Performance Measures for various algorithms:**

### **File and directory structure:**

|  |  |
| --- | --- |
| **File/Directory name:** | **Description:** |
| TestFile | Includes all the Plaintext files with different sizes that are used to examine performance of the various algorithms |
| tempdes.py | DES CBC Algorithm |
| tempaes.py | AES CBC Algorithm |
| temprsa.py | RSA Algorithm |
| tempsha1.py | SHA-1 Algorithm |
| tempHMAC.py | IHMAC Signature Algorithm |
| algPerformance.py | Simple script that runs the above algorithms on the plaintext files, and prints out summary statistics based on timing performance |

### **Code Testing:**

**Please run the following command to test the performance**

**python algPerformance.py**

The command above will run all the encryption algorithms that have specified on the requirement and print out the Encryption time and Decryption according to the Algorithm.

Chart, line chart

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|  |  |  |
| --- | --- | --- |
| **File Size (bytes)** | **Encryption time (µs)** | **Decryption time (µs)** |
| 16 | 23 | 17 |
| 64 | 24 | 19 |
| 512 | 38 | 23 |
| 4096 | 81 | 96 |
| 32768 | 470 | 362 |
| 262144 | 3315 | 2909 |
| 2047152 | 25007 | 22396 |

## Observation notes:

* Both Encryption and Decryption times seem to have a positive trend
* Decryption seems to be slightly faster at times, but times are generally comparable
* Encryption and decryption appear much faster than RSA but slower than AES as well as the HASH algorithms

Chart, line chart

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Description automatically generated

|  |  |  |
| --- | --- | --- |
| **File Size (bytes)** | **Encryption time (µs)** | **Decryption time (µs)** |
| 16 | 7 | 4 |
| 64 | 7 | 5 |
| 512 | 10 | 7 |
| 4096 | 26 | 24 |
| 32768 | 153 | 154 |
| 262144 | 1386 | 1273 |
| 2047152 | 9900 | 10106 |

## Observation notes:

* Both Encryption and Decryption times seem to have a positive trend
* Decryption time is slightly faster than encryption for smaller file sizes and longer for larger
* Encryption and Decryption times faster than RSA, DES but slower than HASH algorithms

Chart, line chart

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Description automatically generated

|  |  |  |
| --- | --- | --- |
| **File Size (bytes)** | **SHA1 Digestion time (µs)** | **HMAC Digestion time (µs)** |
| 16 | 2 | 4 |
| 64 | 5 | 4 |
| 512 | 3 | 4 |
| 4096 | 8 | 4 |
| 32768 | 41 | 4 |
| 262144 | 323 | 6 |
| 2047152 | 1484 | 6 |

## Observation notes:

* SHA1 and HMAC both have a generally positive trend with time vs file size
* It's worth noting that SHA1 shapes better to a linear trend where has HMAC retains similar time for all byte lengths.
* This means HMAC maintains a fast time even for very large file sizes compared to SHA1
* HMAC appears to be the fastest algorithm of them all followed by SHA-1. Overall HASH algorithms outperformed counterparts

Chart, scatter chart

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|  |  |  |
| --- | --- | --- |
| **File Size (bytes)** | **Encryption time (µs)** | **Decryption time (µs)** |
| 2 | 259 | 561 |
| 4 | 260 | 554 |
| 8 | 261 | 532 |
| 16 | 320 | 522 |
| 32 | 314 | 525 |
| 64 | 276 | 551 |

## Observation notes:

* There doesn’t seem to be a trend for RSA encryption
* However one thing that is interesting is that the times are all in a similar range for all the file sizes despite some being much larger than others
* For RSA decryption there doesn’t seem to be any pattern, times look random for file sizes however its clear that decryption takes longer around twice the time of encryption
* RSA looks like the slowest, having a comparable time to others despite having only being tested with small file samples capping at 64 bytes.