



Image Encryption

SINE - MAP

Group - 4

Cryptography Project Class

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Laode Alif Ma'sum -

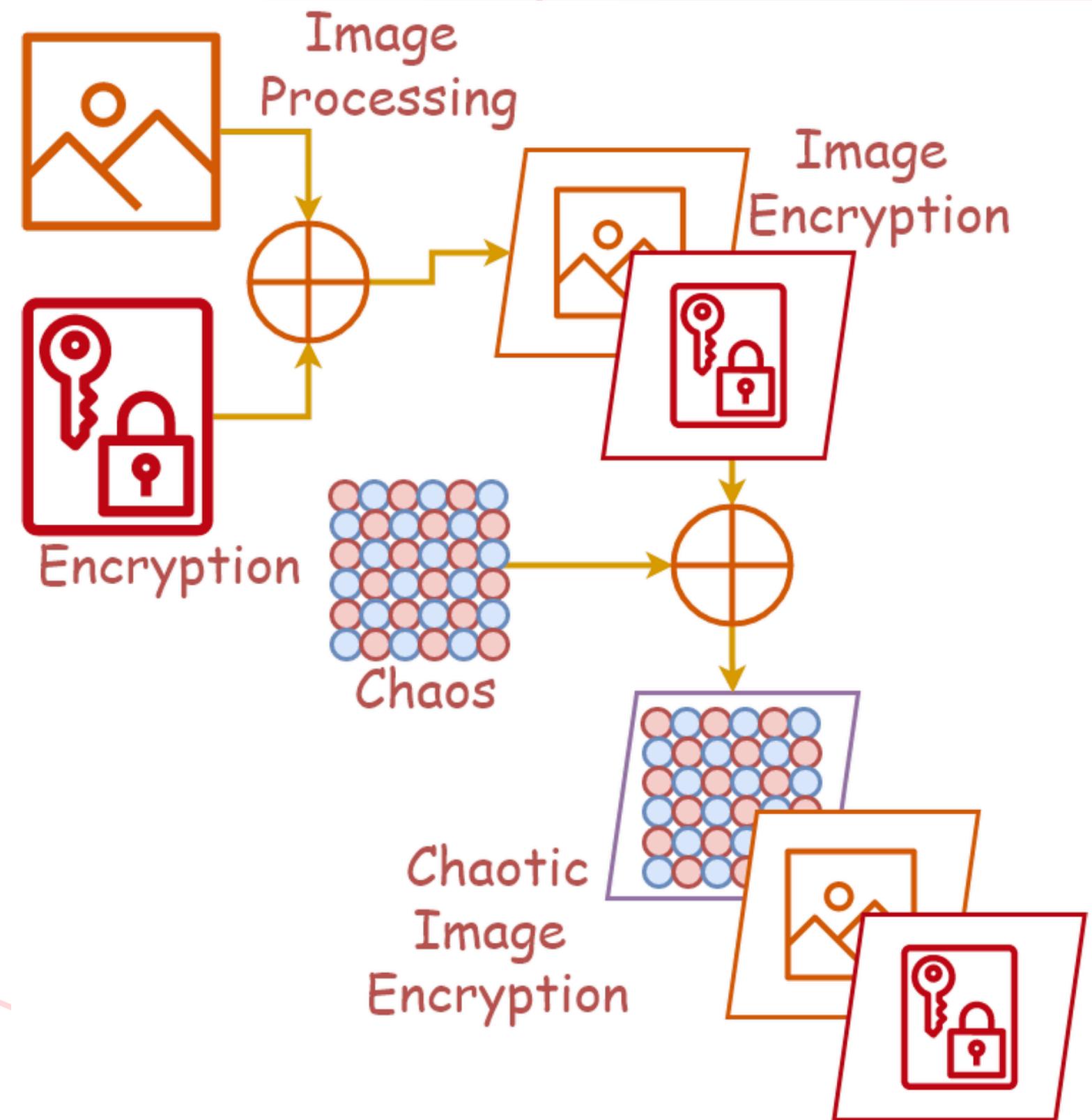




Apa itu Enkripsi Image??

Enkripsi image dengan menggunakan fungsi chaos adalah teknik kriptografi yang digunakan untuk mengamankan citra digital. Proses ini melibatkan penggunaan algoritma chaos, yang dikenal karena sifatnya yang sangat sensitif terhadap kondisi awal, untuk mengacak atau mengubah citra asli menjadi bentuk yang tidak dapat dikenali atau "blur".

Fungsi chaos digunakan untuk menentukan urutan pengacakan piksel pada citra. Piksel-piksel dalam citra asli diacak berdasarkan urutan yang dihasilkan oleh algoritma chaos, sehingga citra tersebut menjadi tidak dapat dikenali.



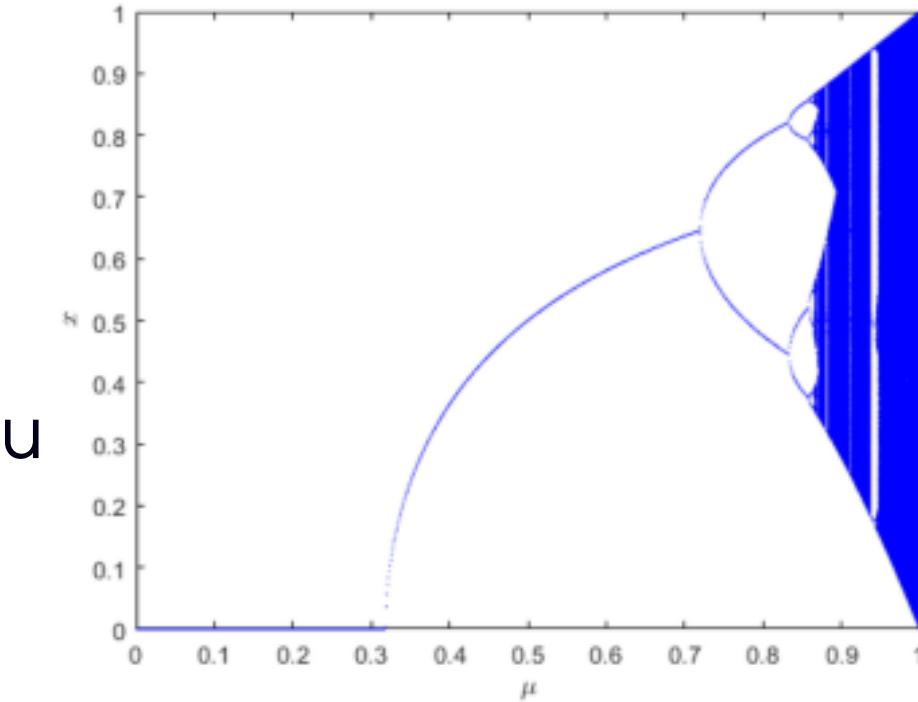
Apa itu SINE MAP??

Fungsi ini adalah jenis peta iteratif yang menunjukkan sifat chaos, di mana hasil dari satu iterasi digunakan sebagai input untuk iterasi berikutnya.

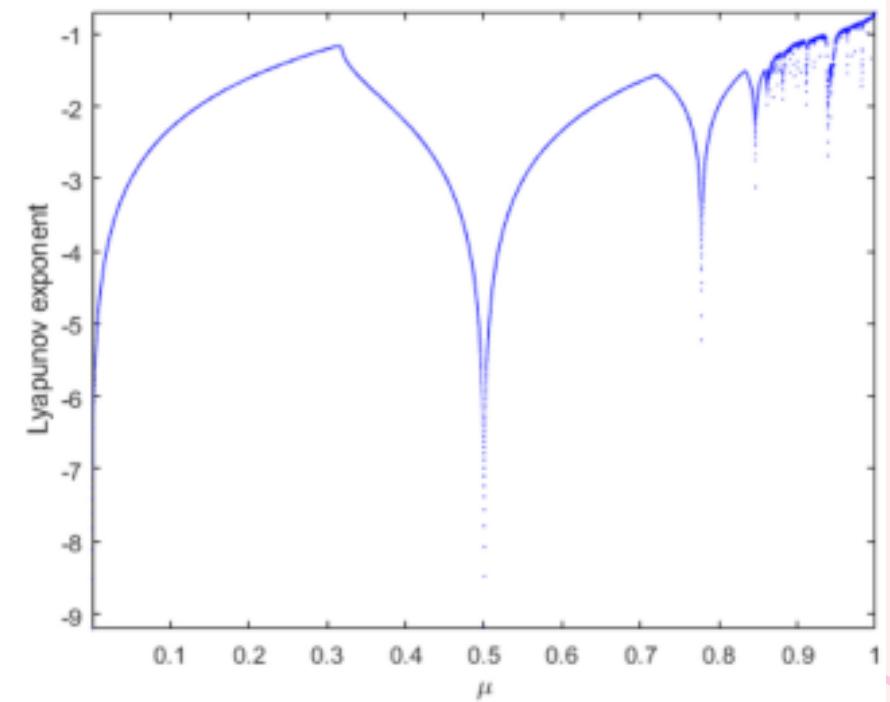
$$x_{n+1} = \sin(\pi a(y_n + 3)x_n(1 - x_n))$$

$$y_{n+1} = \sin(\pi a(x_n + 1 + 3)y_n(1 - y_n))$$

dimana nilai $a \in [0,1]$, x_n , y_n merupakan output sequence yang akan digunakan pada key. Nilai I dan x pada fungsi sine map digunakan sebagai key dalam proses enkripsi dan dekripsi.



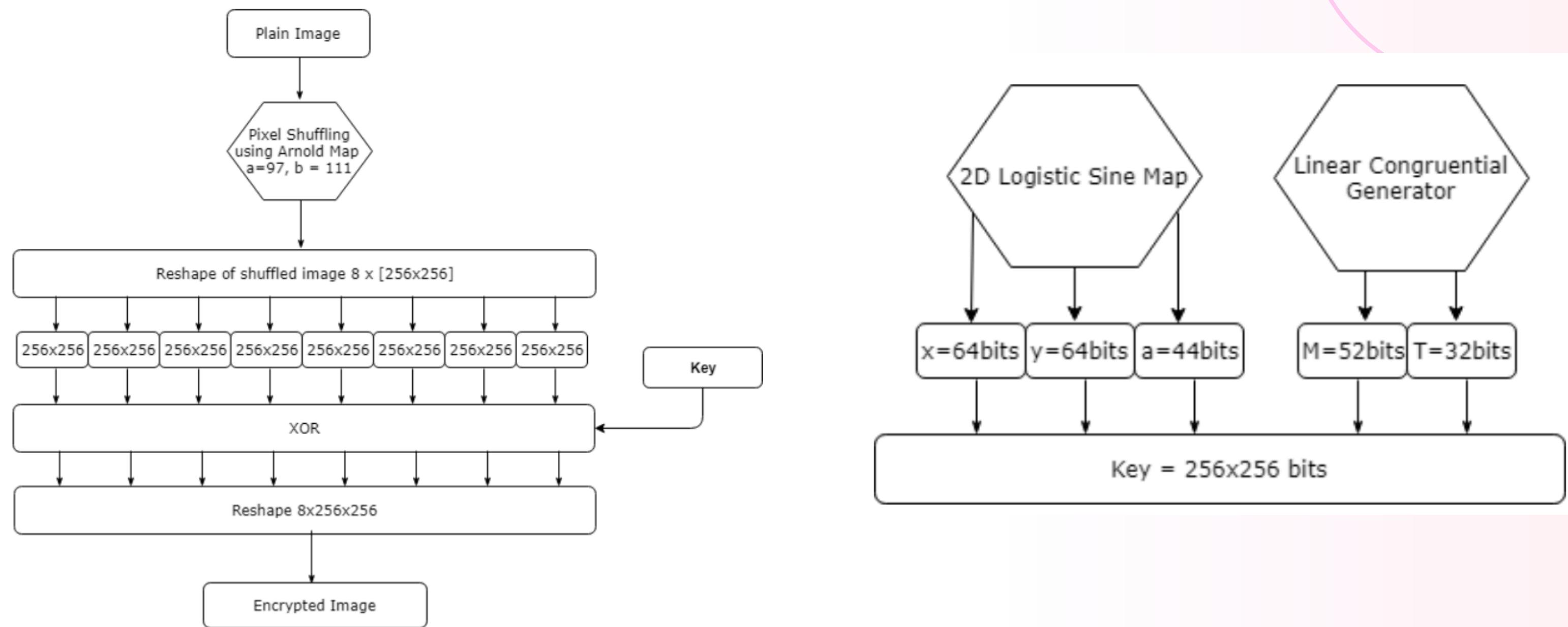
(a) Bifurcation Diagram



(b) Lyapunov exponent

- **Pemilihan Kondisi Awal:** Nilai awal $x_0=0$ dan parameter kontrol $r=3$ dipilih sebagai bagian dari kunci enkripsi.
- **Iterasi Sine Map:** Sine map diiterasikan untuk menghasilkan urutan nilai yang tampak acak.
- **Pengacakan Piksel:** Urutan nilai ini digunakan untuk mengacak posisi atau nilai piksel dalam citra, menghasilkan citra yang terenkripsi.

Proses Enkripsi & Dekripsi

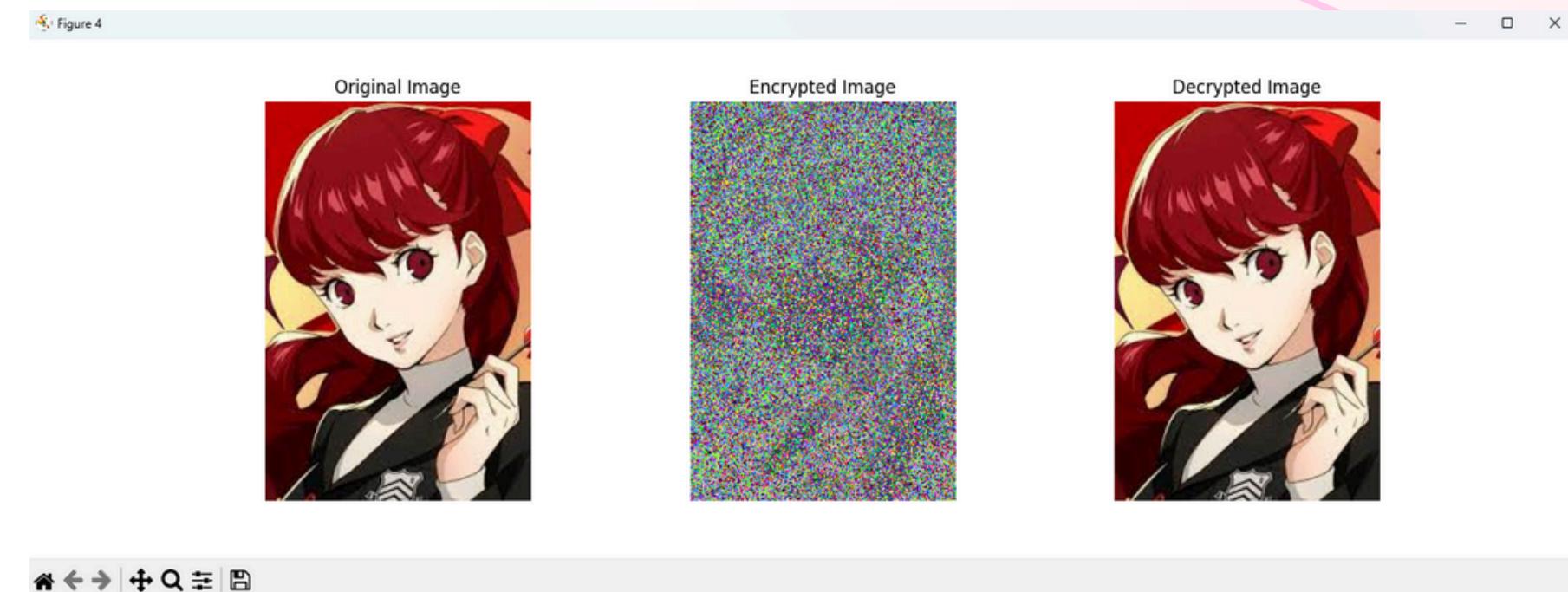
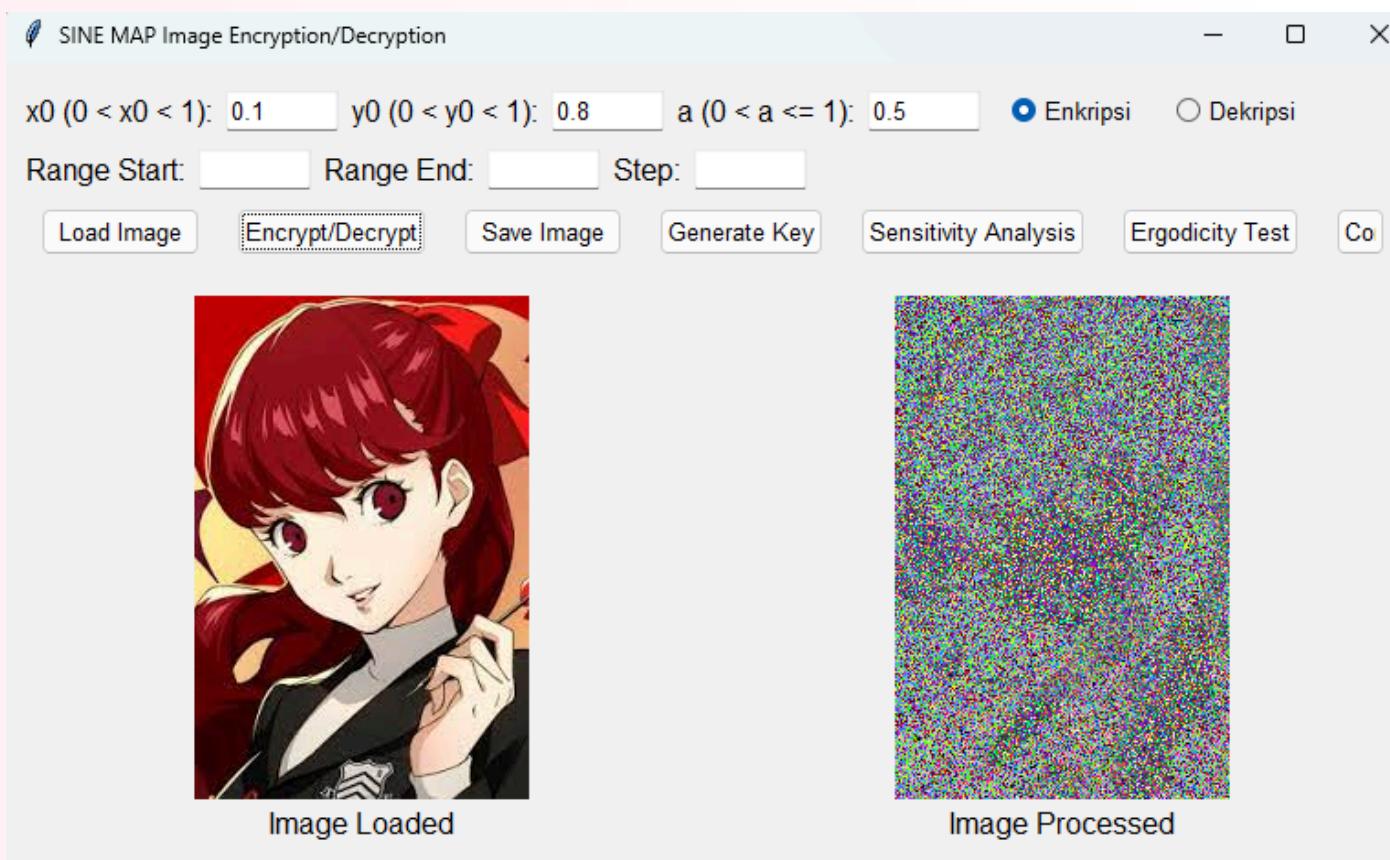


Algoritma Enkripsi

Key Generation



Hasil GUI Aplikasi





Analisis [Uji keacakan stream : NIST]

```
key.txt      +  
File Edit View  
  
110010010000111110110100  
1010001000100001011010001  
1000010001101001100010011  
0001100110001010001011100  
000001101100000111001101  
0001001010010000001001001  
1100000100010001010011001  
111001100011101000000001  
000001011101111010100110  
001101100010011100110110  
0100010010001000101000000  
0010000111000100001110001  
10100000010010101101110  
111100101010001100110110  
011100110100111010010000  
11000110110001100000010101  
1000010100110101111001010  
01011110001010000101110  
100111111000010011010101  
101101011010101010001110  
0001001000101110001001000  
01011011010111011001100  
010010111100111110110001  
10111101000100110000100001  
0111010011010011000110111  
1110110101101011000010111  
111111010111001011011011  
11010000000110101111111  
0110111101110001110000110  
  
Ln 17, Col 26 1.165.667 characters
```

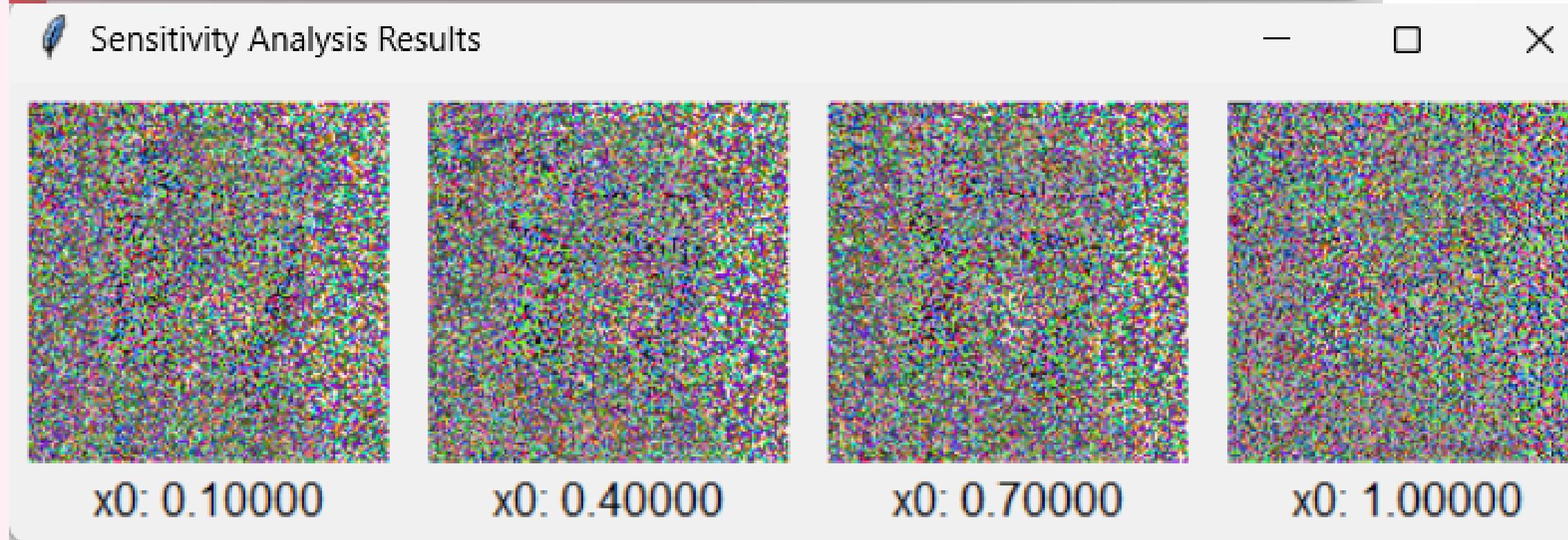
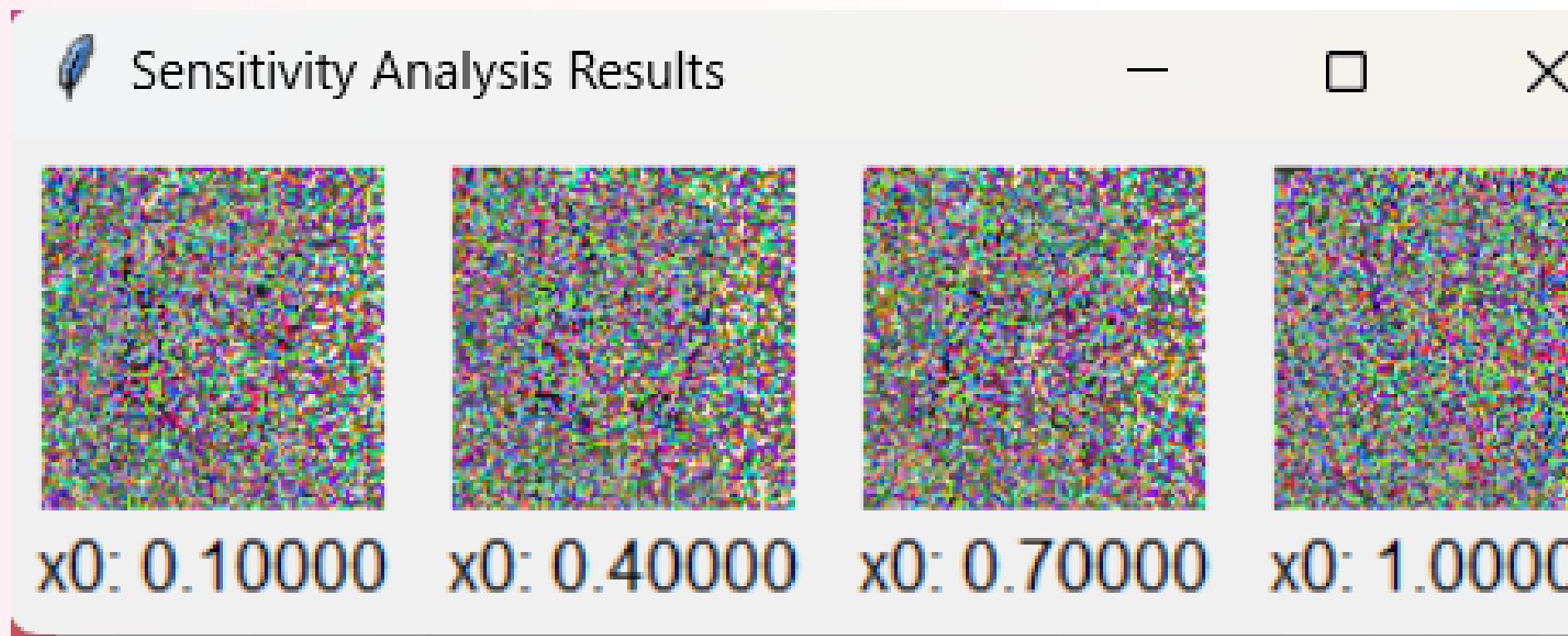
```
alif5@DESKTOP-J6UP6T5 /cygdrive/c/Users/alif5/Documents/Kuliah/Semester 6/Kripto/sts-2.1.  
2  
$ ./assess 10000  
G E N E R A T O R S E L E C T I O N  
  
[0] Input File [1] Linear Congruential  
[2] Quadratic Congruential I [3] Quadratic Congruential II  
[4] Cubic Congruential [5] XOR  
[6] Modular Exponentiation [7] Blum-Blum-Shub  
[8] Micali-Schnorr [9] G Using SHA-1  
  
Enter Choice: 0  
  
User Prescribed Input File: key.txt  
S T A T I S T I C A L T E S T S  
  
[01] Frequency [02] Block Frequency  
[03] Cumulative Sums [04] Runs  
[05] Longest Run of Ones [06] Rank  
[07] Discrete Fourier Transform [08] Nonperiodic Template Matchings  
[09] Overlapping Template Matchings [10] Universal Statistical  
[11] Approximate Entropy [12] Random Excursions  
[13] Random Excursions Variant [14] Serial  
[15] Linear Complexity  
  
I N S T R U C T I O N S  
Enter 0 if you DO NOT want to apply all of the  
statistical tests to each sequence and 1 if you DO.  
  
Enter Choice: 1  
P a r a m e t e r A d j u s t m e n t s  
  
[1] Block Frequency Test - block length(M): 128  
[2] NonOverlapping Template Test - block length(m): 9  
[3] Overlapping Template Test - block length(m): 9  
[4] Approximate Entropy Test - block length(m): 10  
[5] Serial Test - block length(m): 16  
[6] Linear Complexity Test - block length(M): 500  
  
Select Test (0 to continue): 0  
  
How many bitstreams? 25  
  
Input File Format:  
[0] ASCII - A sequence of ASCII 0's and 1's  
[1] Binary - Each byte in data file contains 8 bits of data  
  
Select input mode: 0  
  
Statistical Testing In Progress.....  
Statistical Testing Complete!!!!!!
```

RESULTS FOR THE UNIFORMITY OF P-VALUES AND THE PROPORTION OF PASSING SEQUENCES												
generator is <key.txt>												
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	P-VALUE	PROPORTION	STATISTICAL TEST
4	1	4	4	1	2	1	5	1	2	0.186566	24/25	Frequency
1	3	3	2	2	8	2	3	0	1	0.007422	25/25	BlockFrequency
5	1	3	1	4	4	0	0	2	5	0.029796	25/25	CumulativeSums
4	2	2	1	1	2	4	1	3	5	0.311542	24/25	CumulativeSums
4	1	4	0	1	4	2	5	3	1	0.105618	25/25	Runs
1	3	0	3	2	4	3	1	3	5	0.242986	25/25	LongestRun
4	3	1	7	3	1	0	1	3	2	0.021262	25/25	Rank
2	2	3	2	3	4	2	3	0	4	0.585209	25/25	FFT

if P-value > 0.01 --> Random sequence

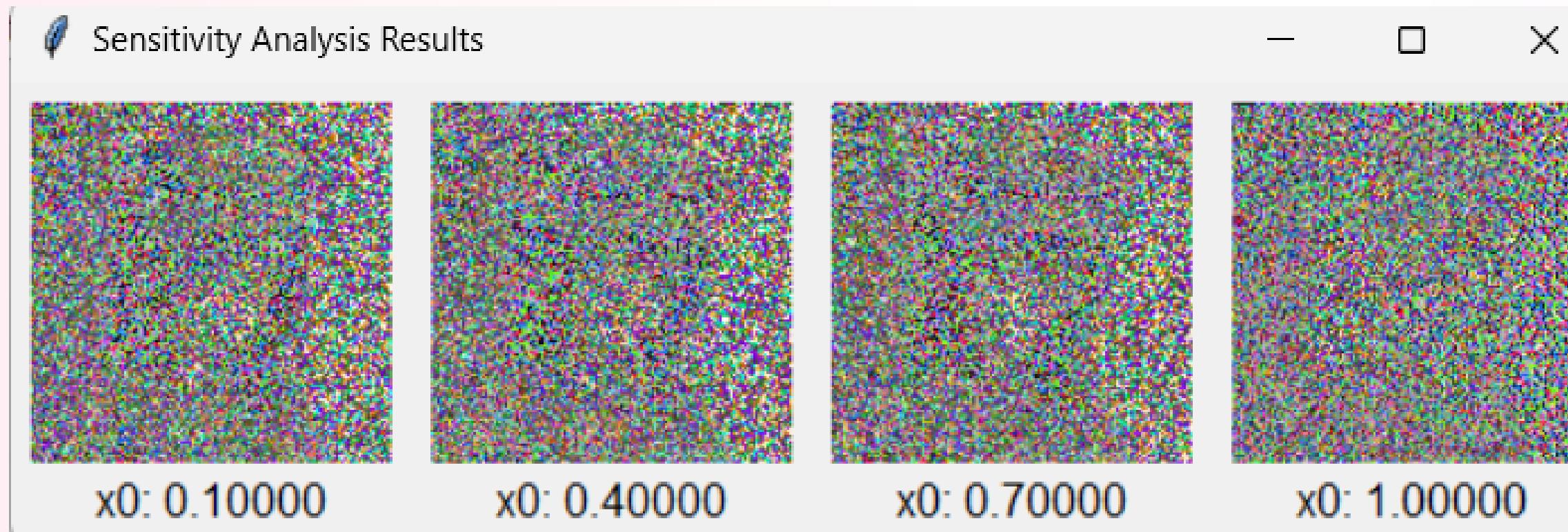


Analisis [Uji sensitivitas nilai awal = 1]

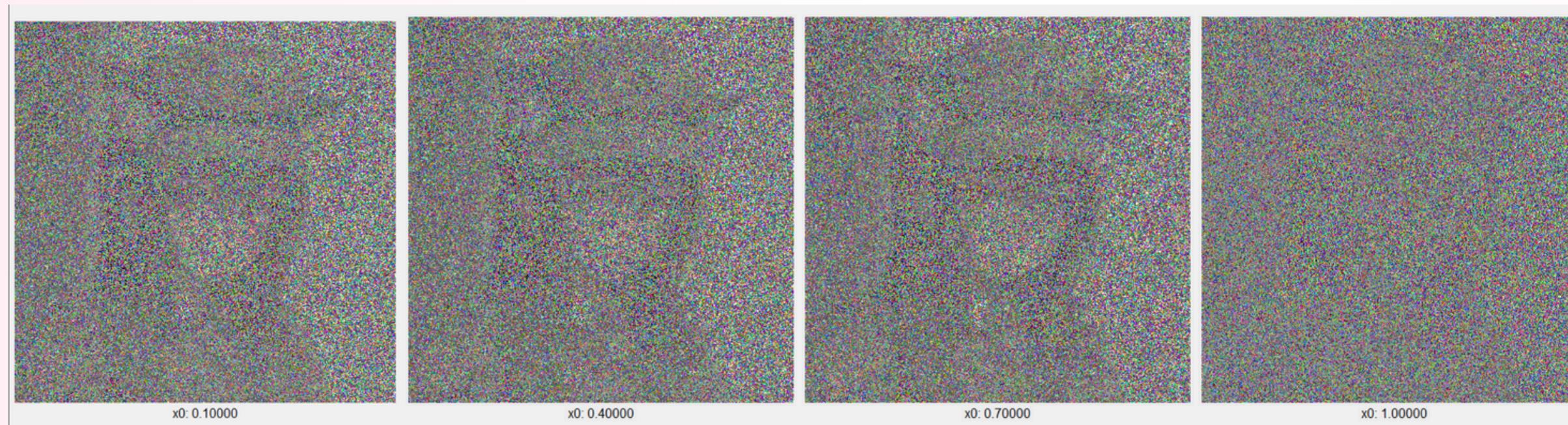




Analisis [Uji sensitivitas nilai awal = 1]



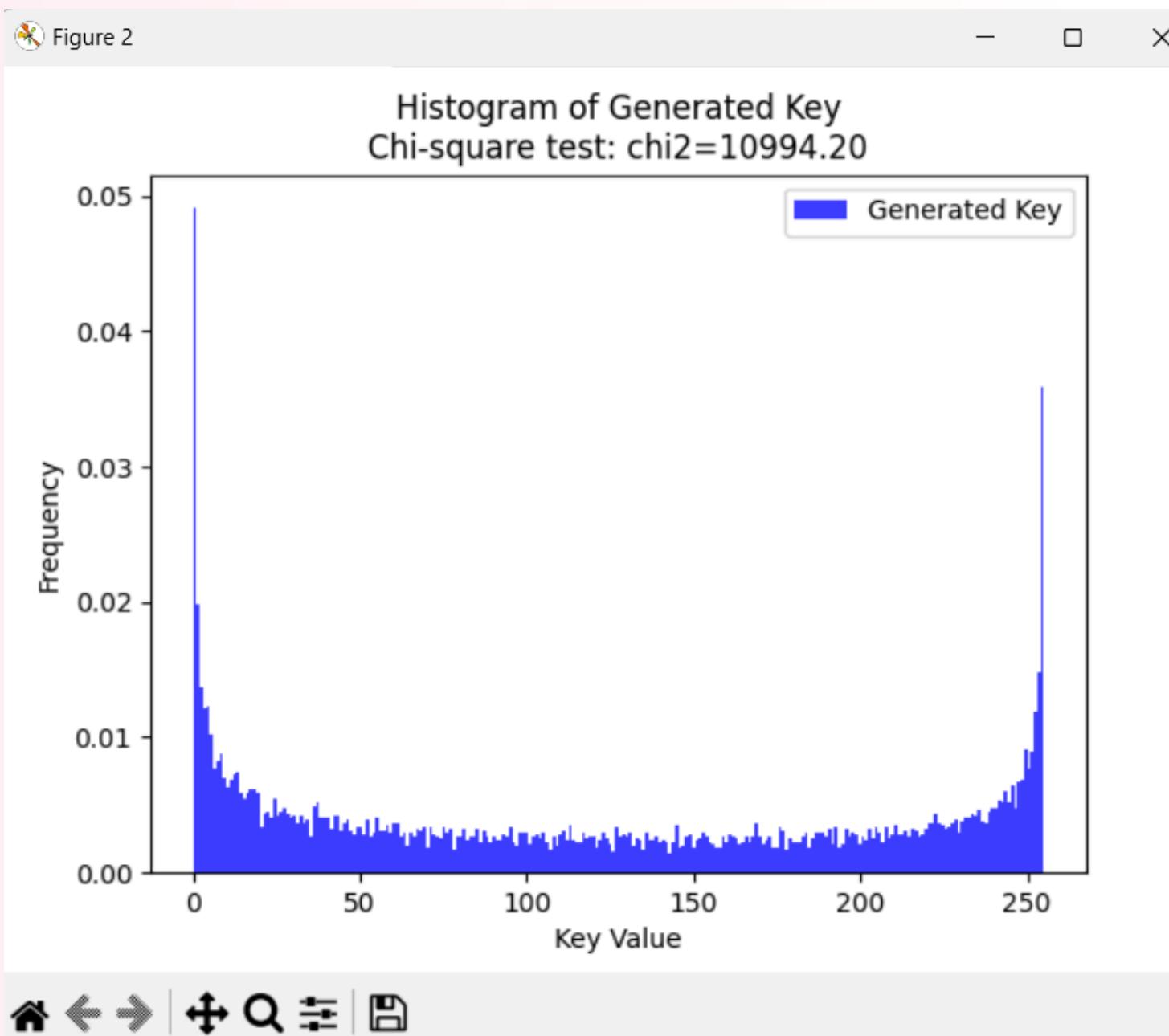
Pixel : 480 x 480



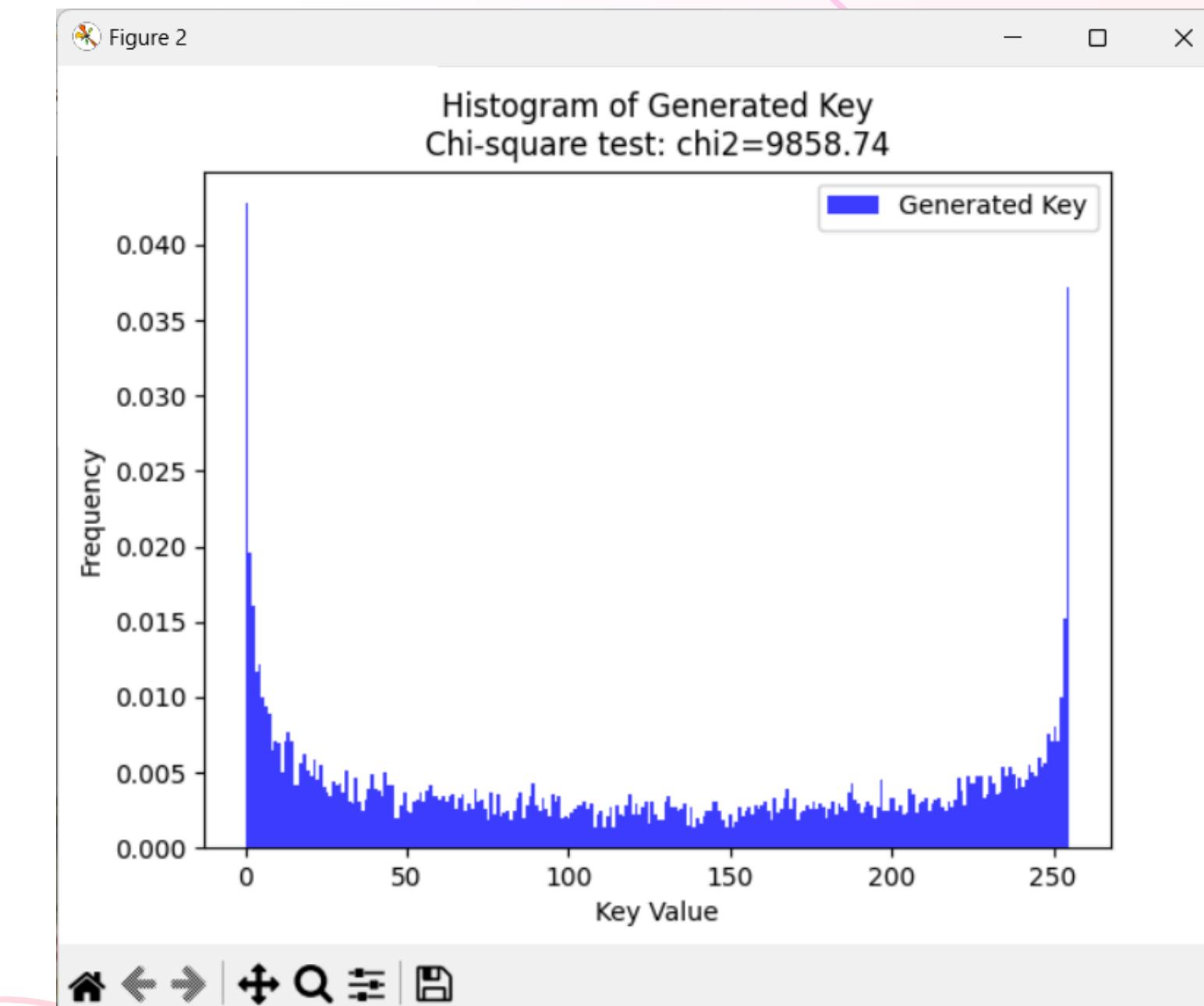
Pixel : 720 x 720



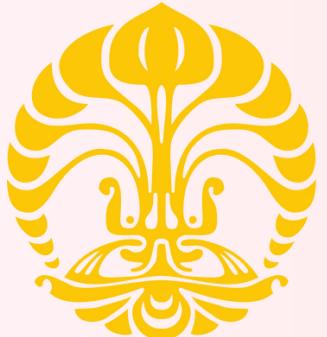
Analisis [Uji ergodisity a = 1]



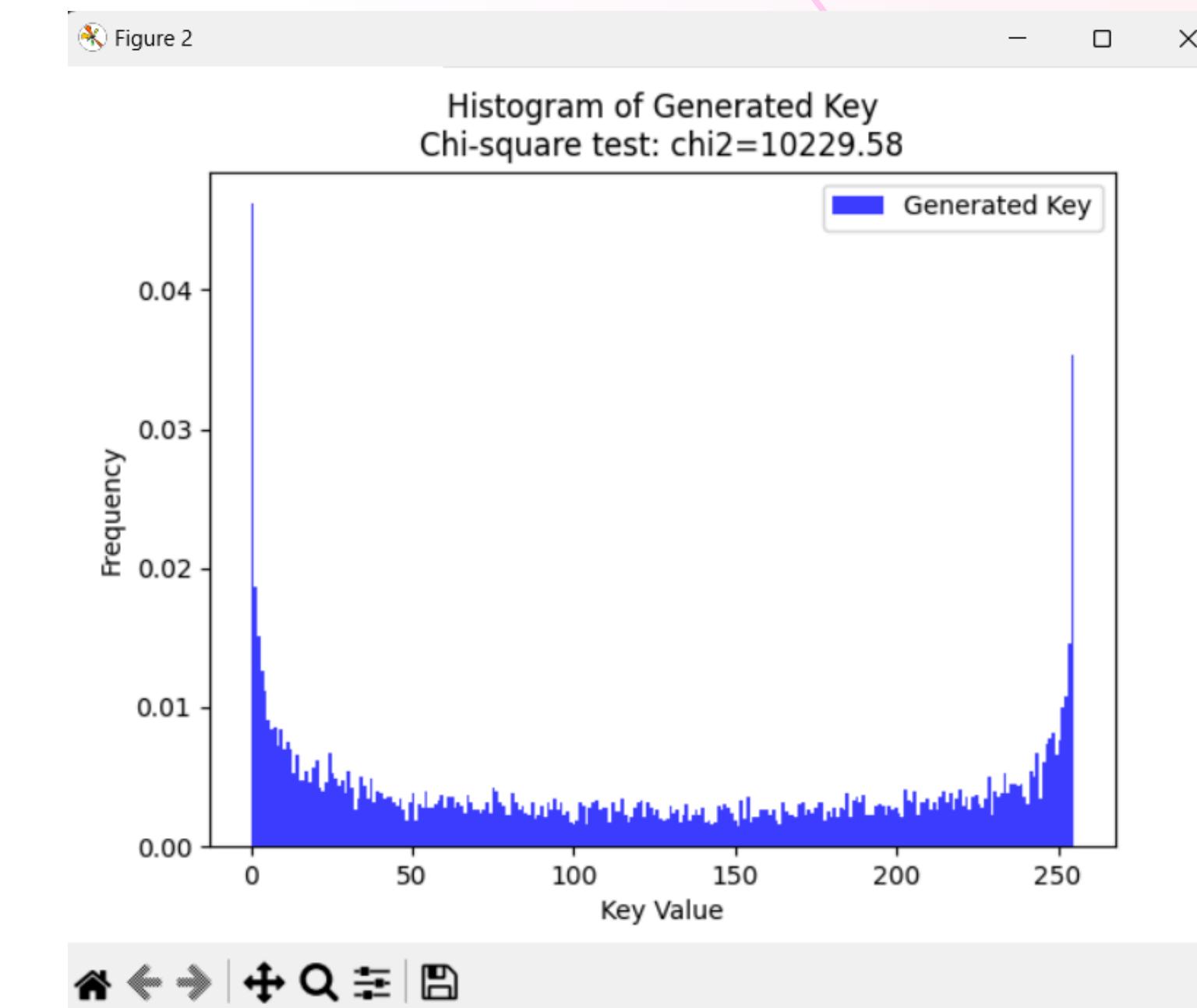
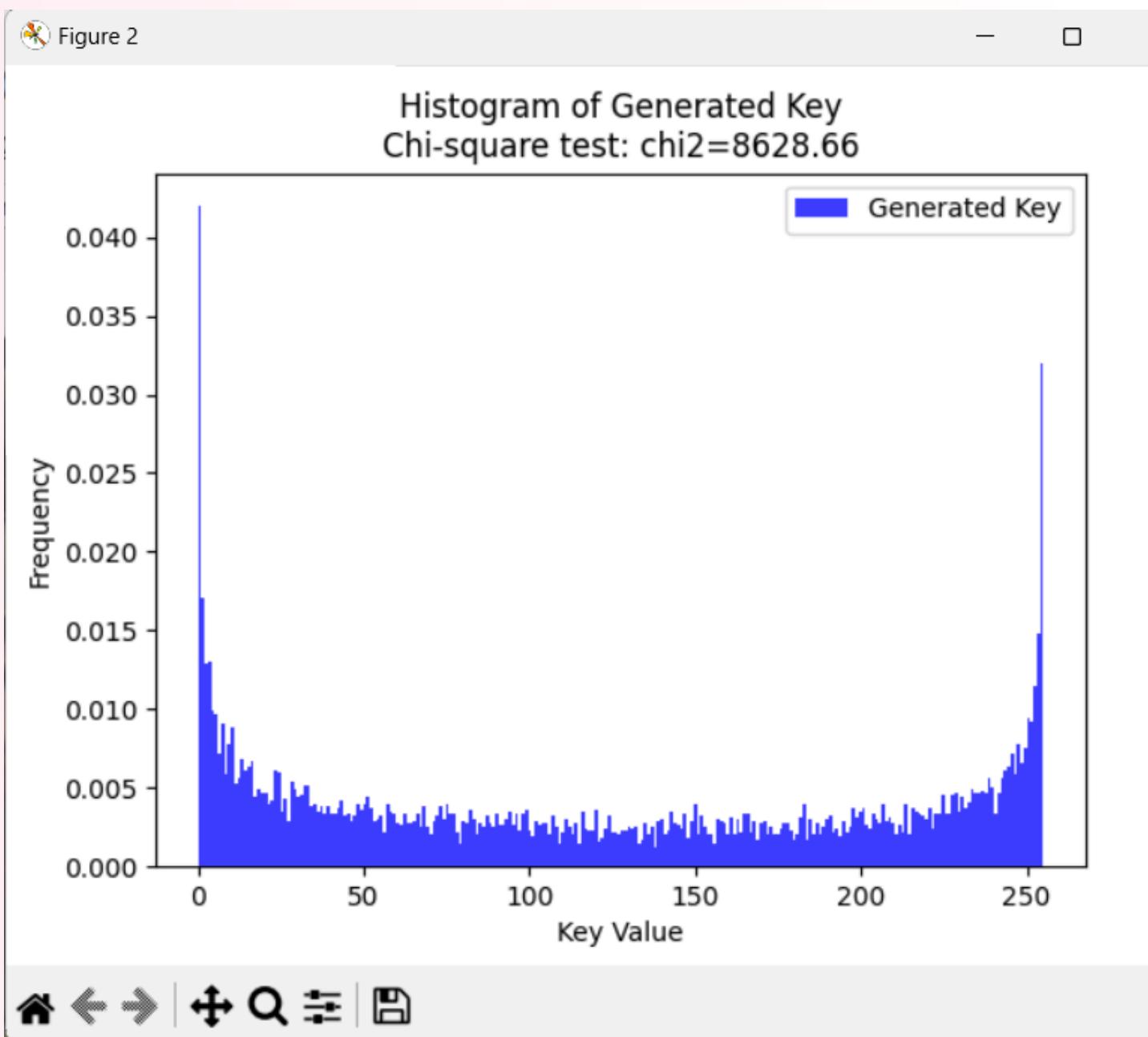
$X_0 = 0.1$



$X_0 = 0.4$

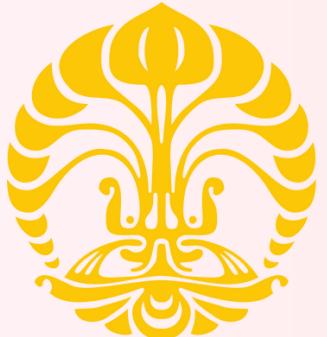


Analisis [Uji ergodisity a = 1]

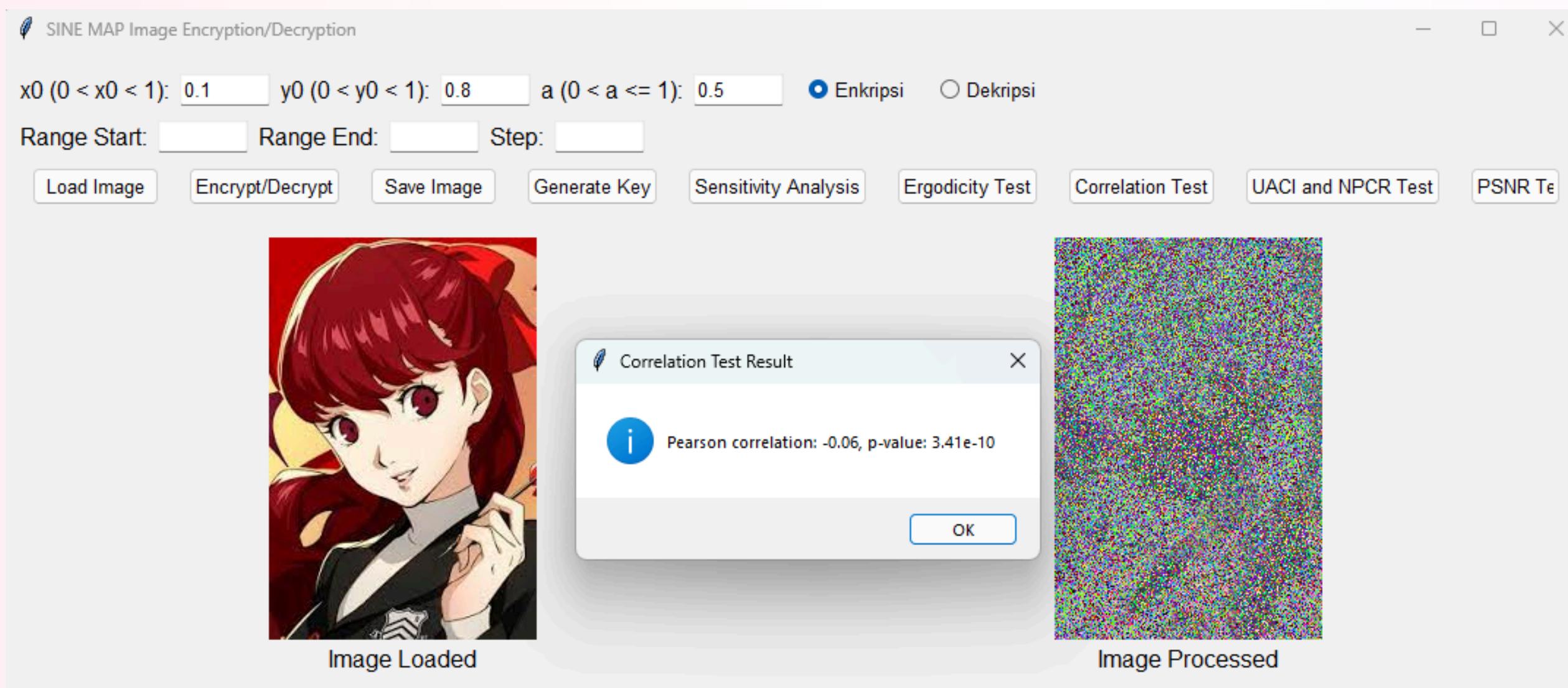


$X_0 = 0.7$

$X_0 = 1$



Analisis [Uji korelasi]





Analisis [Uji UACI dan NPCR]

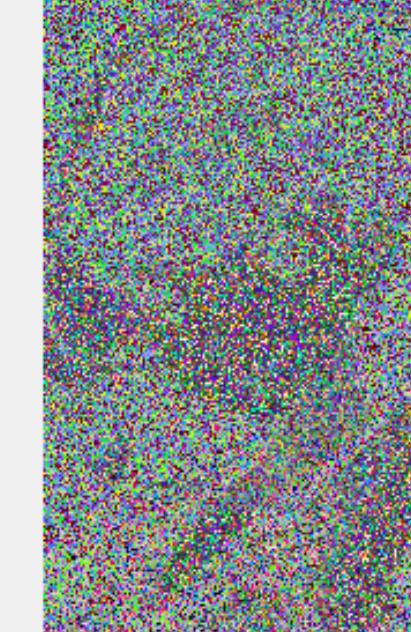
SINE MAP Image Encryption/Decryption

x0 (0 < x0 < 1): y0 (0 < y0 < 1): a (0 < a <= 1): Enkripsi Dekripsi

Range Start: Range End: Step:

[Load Image](#) [Encrypt/Decrypt](#) [Save Image](#) [Generate Key](#) [Sensitivity Analysis](#) [Ergodicity Test](#) [Correlation Test](#) [UACI and NPCR Test](#) [PSNR Test](#)

 Image Loaded

 Image Processed

UACI and NPCR Test Results

NPCR: 95.53%
UACI: 40.18%

Elapsed time: 0.32 seconds

Analisis [Rata-Rata Waktu Proses]



No	Pixel	Waktu Enkripsi (s)	Waktu Dekripsi (s)
1	80 x 80	0.03	0.03
2	128 x 128	0.07	0.07
3	480 x 480	1.05	1.05
4	720 x 720	2.16	2.13
5	1080x 1080	4.56	4.69
6	1920 x 1920	13.92	14.15



Get protected today!

Link Github:

**[https://github.com/Abdfikih/Sine-Map-
Encryption.git](https://github.com/Abdfikih/Sine-Map-Encryption.git)**

