CS666 Assignment 3

DOM and CPA Attack

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CS666 : Hardware Security and IOT

DOM Attack

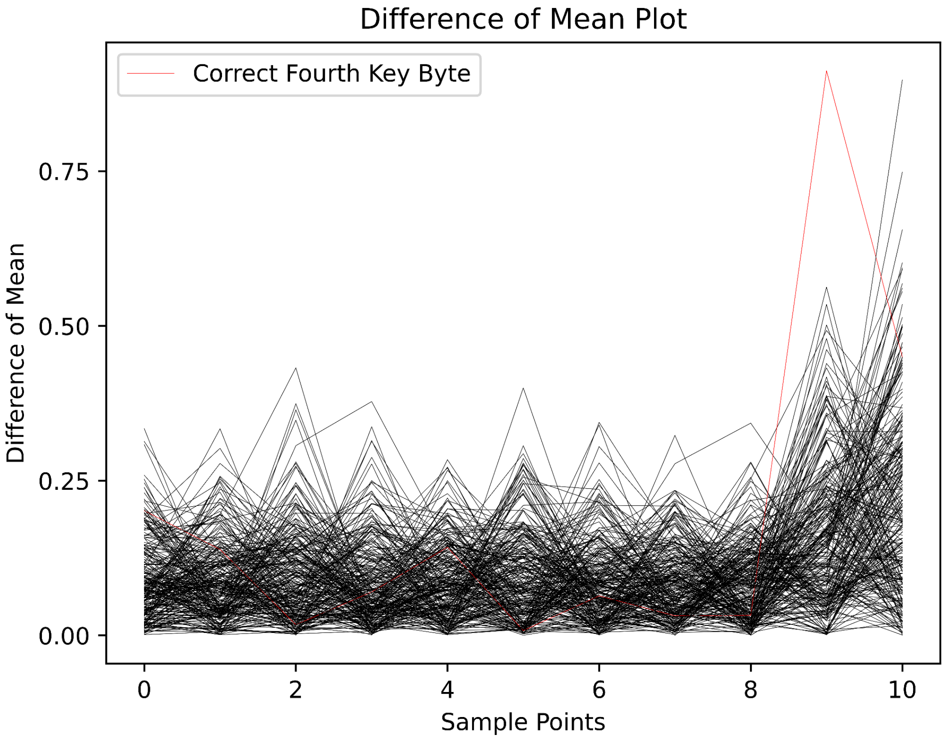
Introduction

This assignment required the group to find the 4th and 5th bytes of the key in AES using the Difference of Means (DOM) attack. A sample code for finding the 0th byte of the key of the AES was provided as a reference, which we modified to implement the DOM attack on the 4th and 5th bytes.

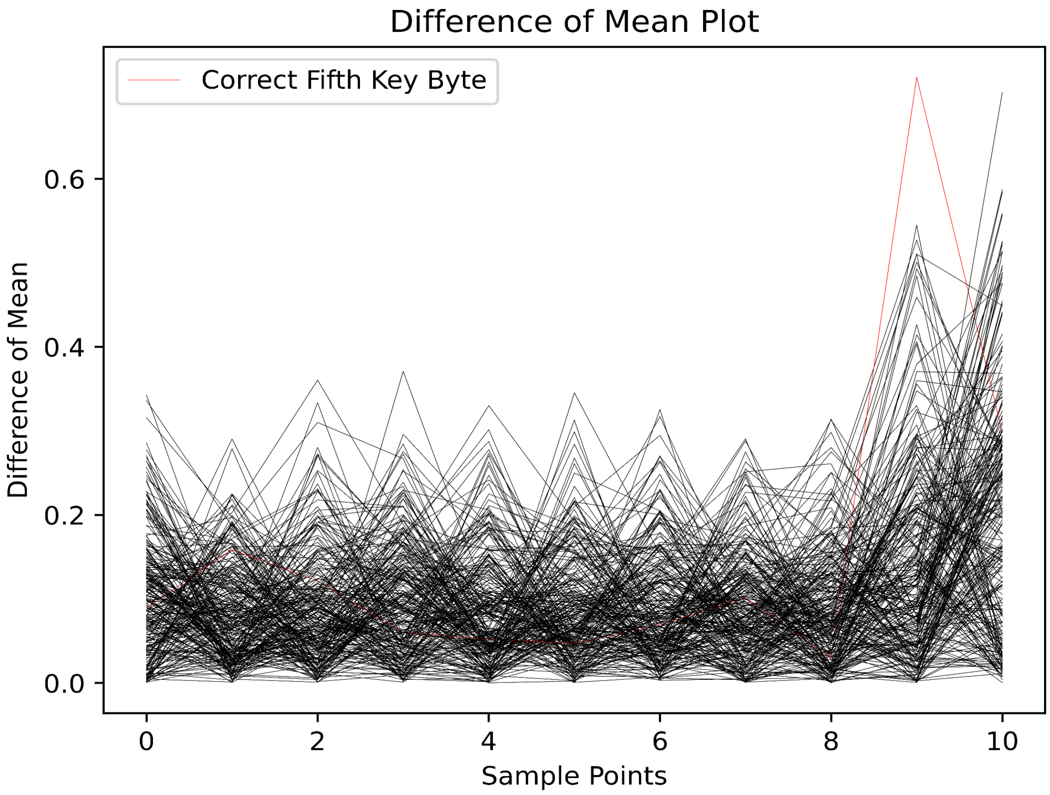
- We assumed that power consumption was correlated with the 0th bit of the S-Box.
- We disregarded the inverse shift row operation since we are concerned with a particular byte of the key.

This report summarises the results obtained for the 4th and 5th byte among all possible key-value pairs.

Plot for the 4th byte



Plot for the 5th byte



Conclusions

We can conclude from the plots for the 4th byte that the key value is **0xE3**. In the same way, the key value for the 5th byte is **0x94**. The peak in the DOM plot has been shown in red.

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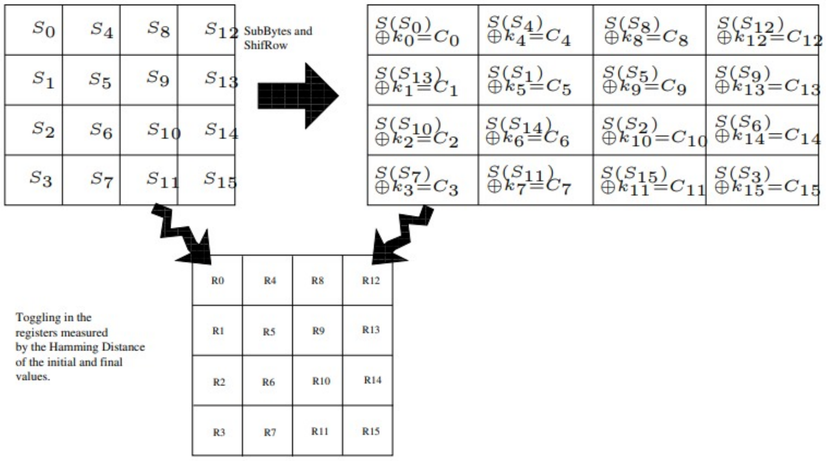
CPA Attack

Introduction

In this assignment, we were given the power consumption of the last round of AES. A CSV file containing the power traces is provided. The group was required to write a code for Correlation Power Attack and use that code on the given power trace to recover the 1st byte (Assigned to Group 1). A sample code for finding the 0th byte of the key of the AES was provided as a re ference, which we modified to implement the CPA attack on 1st byte.



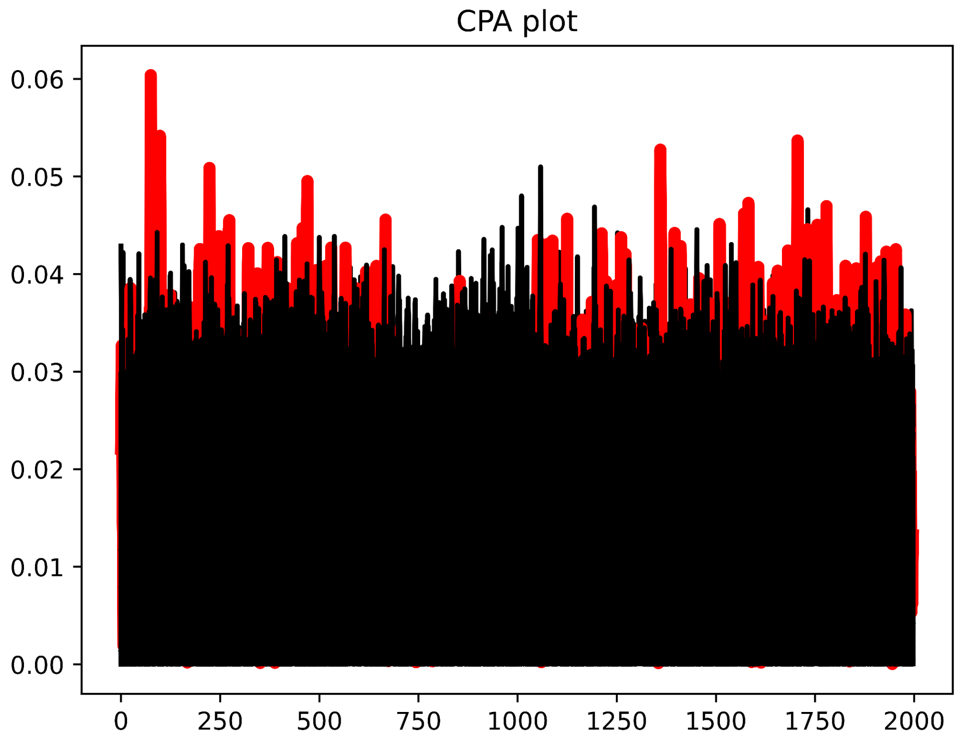
s0 s4 s8 s12
s1 s5 s9 s13
s2 s6 s10 s14
s3 s7 s11 s15
SubBytes and ShifRow
S(S0)⊕k0=C0 S(S4)⊕k4=C4 S(S8)⊕k8=C8 S(S12)⊕k12=C12
S(S13)⊕k1=C1 S(S1)⊕k5=C5 S(S5)⊕k9=C9 S(S9)⊕k13=C13
S(S10)⊕k2=C2 S(S14)⊕k6=C6 S(S2)⊕k10=C10 S(S6)⊕k14=C14
S(S7)⊕k3=C3 S(S11)⊕k7=C7 S(S15)⊕k11=C11 S(S3)⊕k15=C15
R0 R4 R8 R12
R1 R5 R9 R13
R2 R6 R10 R14
R3 R7 R11 R15
Toggling in the registers measured by the Hamming Distance of the initial and final values.

From the above figure, it can be seen that the first key byte involves 13th byte of the S box input (S13). We hence generate the following equation for hypothetical power involving change in value of register 13 using Hamming Distance Model:

$$HD(C_{13}, S_{13}) = HD(C_{13}, S^{-1}(C_1 \oplus K_1))$$

So if our guess for first key byte is correct, according to the above equation, we must obtain a peak in correlation between hypothetical power trace and given power trace for all points, as is visible in the plot ahead.

The results obtained for the 1st byte among all possible key-value pairs:



Conclusions

We can conclude from the plots and our modified code for the 1st byte that the key value upon a successful CPA attack is **0x8C.**