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# IT430 Project: Mode of Operation

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Submission  
  
Part 2 submission: \_\_ On time \_\_ Late (-5 pts)

Full submission: \_\_ Early (+5 pts) \_\_ On time \_\_ Late (-10 pts)

Overall penalty/reward: \_\_\_\_\_\_\_\_ pts

Honor

I didn’t discuss the project with any other student.

I didn’t help any other student.

I didn’t show my code to any other student.

I didn’t copy another other student’s code.

I didn’t look at the online resources directly related to the project solutions.

Initial: \_\_\_TOP\_\_\_\_

External source   
(E.g., I referred to this site for xxx)

[Error Propagation](https://en.wikipedia.org/wiki/Block_cipher_mode_of_operation#Error_propagation)

Class Notes

[AES](https://www.pycryptodome.org/src/cipher/aes)

Stack overflow for basic python syntax

Challenges

(E.g., it was difficult to figure out how to xxx)

Part 3 was challenging to figure out how to check if bit errors occurred in the padding.

Part 4 was challenging to understand what to xor together to get the plaintext message.

What I learned

(E.g., I learned that xxx.)

I learned how vulnerable CTR becomes when the CTR is reused. It was actually very simple to decrypt another message that was encrypted with the same CTR. Additionally, I learned about error propagation in different AES modes.

Feedback to the instructor

(E.g., This was cool. This was too much. It would have been better if …)

I think this project was useful and helped me gain a better understanding of different AES modes.

# Part 1

Code on submit server

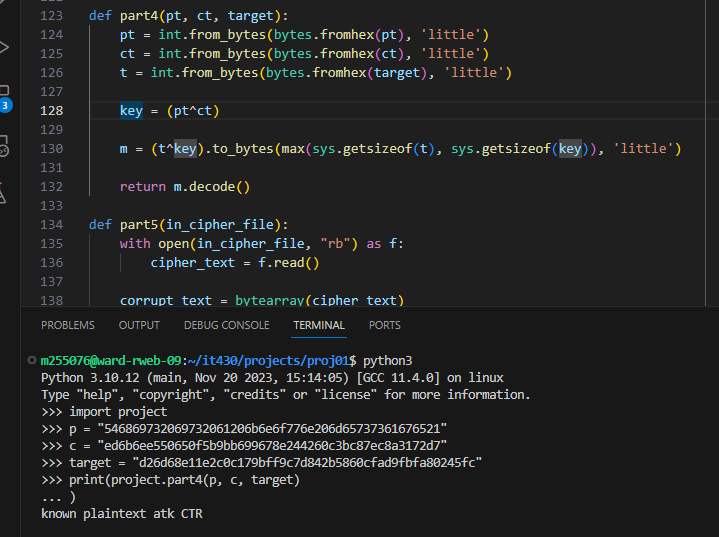
# Part 2

Code on submit server

# Part 3

Code on submit server

# Part 4

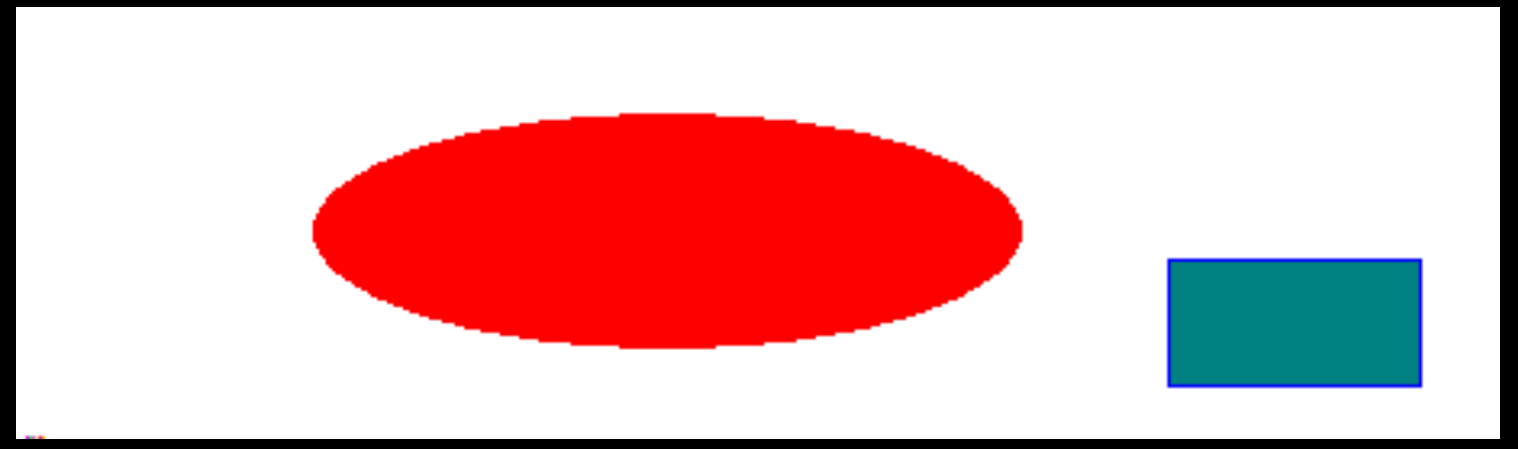


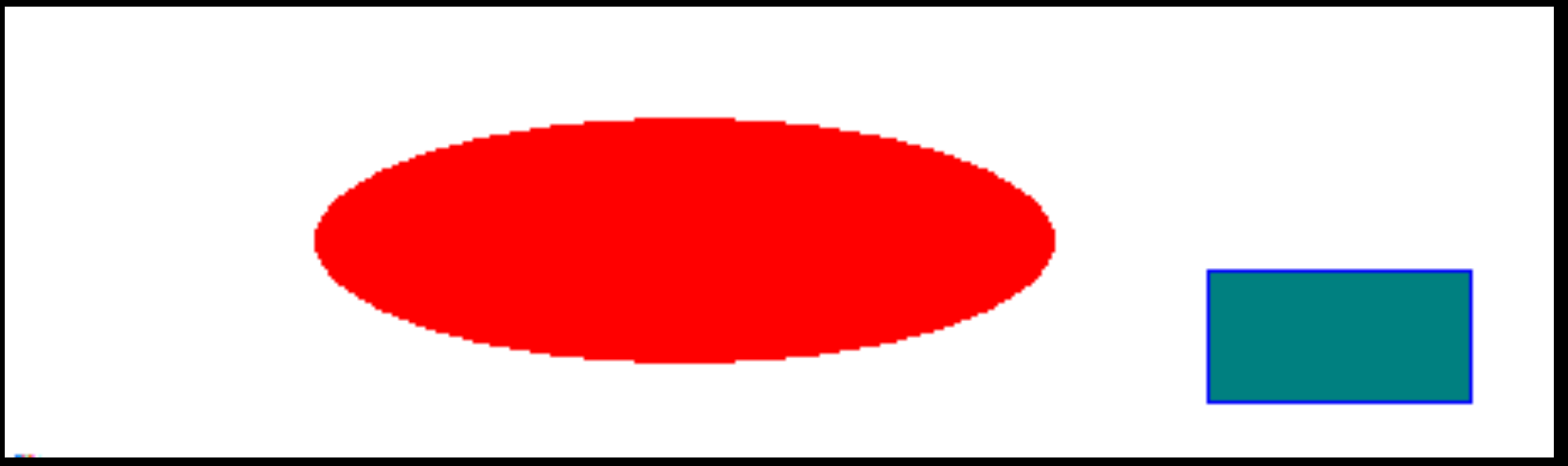
The phrase is “known plaintext atk CTR”

# Part 5

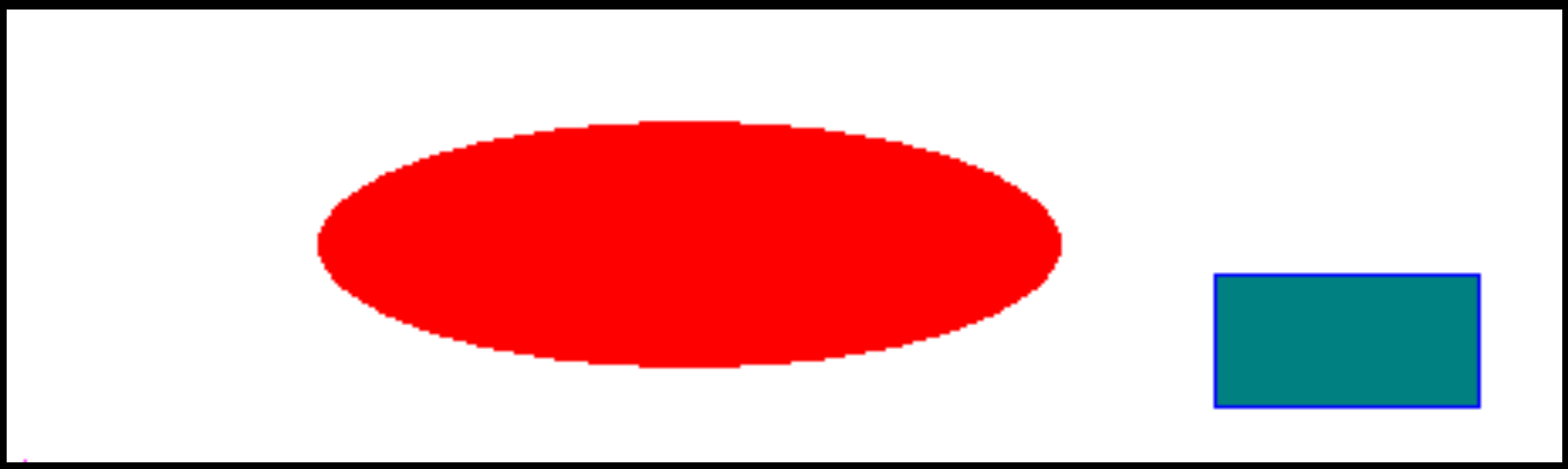
# Part 6

Q1: How much information can you recover by decrypting the corrupted file, if the encryption mode is ECB, CBC, or CTR, respectively?

ECB: Since ECB encrypts and decrypts each block separately, most of the information would be recovered except for the block that contains the corrupted byte. 

CBC: The one byte change of the ciphertext would corrupt the corresponding block of plaintext and since the ciphertext is used to decrypt the following the plaintext block, those bits would be flipped. Since we changed one byte, there will two specific byte errors in two plaintext blocks. Most of the information will be recoverable. 

CTR: The byte change of the ciphertext would lead to a specific byte error in the corresponding plaintext. Since we only changed one byte, most of the information will be still recovered because error propagation does not carry throughout CTR.



Discussion: My original answers were pretty much correct. You can see how the CBC encrypted image has more corruption than CTR and ECB because it corrupts two blocks of plaintext compared to one. Since CTR and ECB decryptions do not depend on previous blocks, bit errors in the ciphertext are in the same position in the plaintext. For CBC, bit errors will effect the corresponding block and the one following it.

# Part 7

For my attack, I made another cipher text (ct’) that is the exact same as ct except the first bit was different. I then decrypted it using the same iv and was able to determine which message was originally encrypted.

