Lab 2 - Playing with Symmetric Encryption

Team Members:

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Drills

There are four tasks for you to complete. Please give a brief summary of what you did – feel free to include any thoughts / concerns / problems / etc. you encountered during the tasks. Also, include your answers to the questions asked in each task. Save your report as a PDF and submit it to Canvas before the deadline.

Task 1

Task 1: Summary

In this task we encrypted a plaintext using different encryption methods and modes.

1. Blowfish
2. DES
3. DES3
4. ARC4

Task 1: Question Answers

> No Submission

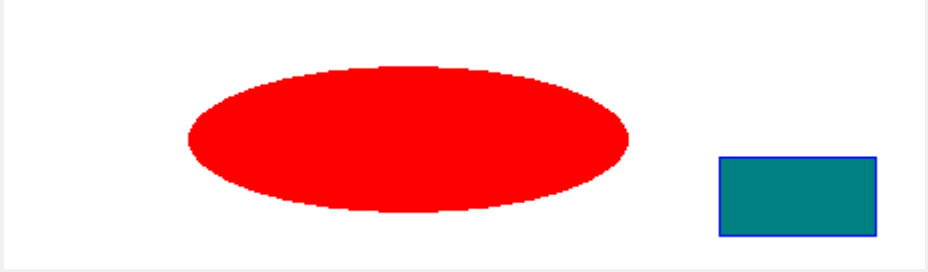
Task 2

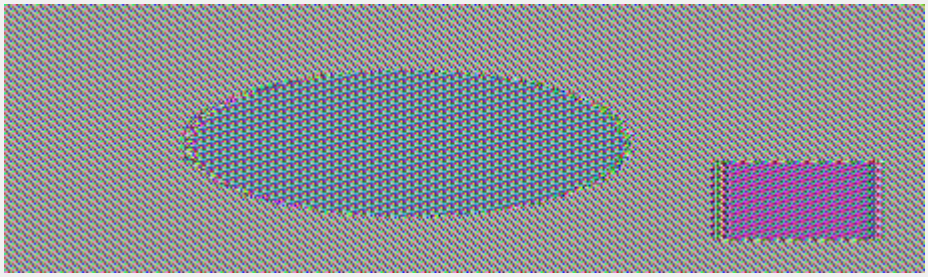
Task 2: Summary

In this task, we encrypted a .bmp image with ECB and CBC modes with AES-128. We can see how in ECB, patterns can still emerge from the encrypted image.

Task 2: Question Answers

> 1. Include both **the original picture** and **two encrypted pictures** in your report.





2. Include the python script in the report.

```
import os
from Crypto.Cipher import AES

inImage = open("original.bmp", "rb").read()
header = inImage[:54]
image = inImage[54:]
ecbOutImage = bytearray(header)
cbcOutImage = bytearray(header)


key = b'itsmysecretimage'

ecbEncryptor = AES.new(key, AES.MODE_ECB)
cbcEncryptor = AES.new(key, AES.MODE_CBC)
for chunkNum in range(0, len(image), 16):
    bytesLeft = len(image) - chunkNum


    if bytesLeft < 16:
        if bytesLeft != 0:
            chunk = image[chunkNum:] + (b' ' * (16 - bytesLeft))
        else:
            break
    else:
        chunk = image[chunkNum:chunkNum + 16]

    ecbOutImage += ecbEncryptor.encrypt(chunk)
    cbcOutImage += cbcEncryptor.encrypt(chunk)
```

```
output = open('ecb_encrypted_image.bmp', "wb")
output.write(ecbOutImage)
output.close()

output = open('cbc_encrypted_image.bmp', "wb")
output.write(cbcOutImage)
output.close()
```

Task 3

Task 3: Summary

In task 3, we test how much information is recoverable from a corrupted file in both ECB and CBC modes.

Task 3: Question Answers

1. How much information can you recover by decrypting the corrupted file, if the encryption mode is ECB, CBC respectively?

The string encrypted in CBC mode had less information that could be recovered. Whether it is significantly less or slightly less is up to chance.

2. Please explain why.

In ECB mode, a corrupted bit will only corrupt the block it is in. However, in CBC mode, a corrupted bit has the chance of corrupting all the blocks after it. This is because during encryption, the previous block is used to encrypt the next block.

Task 4

Task 4: Summary

In task 4, we are asked to find the key used to encrypt a plaintext. We can do this because we are given the plaintext, the cipher text, a dictionary of potential keys, the IV, and rules on how the key and plaintext are padded.

Task 4: Question Answers

1. What is the encryption key?

The encyprtion key is "hack" with 12 spaces after it.

2. Include the python script in the report.

```
import os
from Crypto.Cipher import AES
import binascii

dictFile = open("words.txt", "r")
dictionary = dictFile.read().splitlines()
```

```
plaintext = b"This is a top secret."
ciphertext =
b"3f814d00c3f1047f1dfa879115970472472a17eabdd9ba4fcd667743e1e03674"

def pad(m):
   return bytes(m)+bytes([16-len(m)%16])*(16-len(m)%16)


dictIndex = 0
iv = b'\x00' * 16
paddedPlaintext = pad(plaintext)
print("Padded plaintext: " + str(paddedPlaintext))
print("Ciphertext:" + str(ciphertext))

for dictIndex in range(0, len(dictionary)):
   print()
   key = bytes(dictionary[dictIndex], 'utf-8') + b'\x20' * (16 -
(len(dictionary[dictIndex]) % 16))
   print("Trying : " + str(dictionary[dictIndex]) + " \tPadded key: "
+ str(key))

   encoded = AES.new(key, AES.MODE_CBC, iv).encrypt(paddedPlaintext)
   print("Encoded: " + str(binascii.hexlify(encoded)) + " with key " +
str(binascii.hexlify(key)))
   if str(binascii.hexlify(encoded)) == str(ciphertext):
       print("Found key! -> " + str(dictionary[dictIndex]))
       break
```