Lab Report: Secret Key Encryption Lab

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Task 1: Deriving the Private Key

My solution is in `taskone.c`

Let p,q and e be three prime numbers. Let n = p*q. We will use (e, n) as the public key.

Given:

p = F7E75FDC469067FFDC4E847C51F452DF q = E85CED54AF57E53E092113E62F436F4F e = 0D88C3

Calculate the private key d.

First n was calculated to be "n=E103ABD94892E3E74AFD724BF28E78366D9676BCCC70118BD0AA1968DBB143D1"

phi(n) = (p - 1) * (q - 1) phi(n) = D2E88FE4EEB33F597D5F1B0D2D96EDD5156C94EC27065CFB268768CA1738BBC4 d = A90C278677B53385F22D2792D6E3A0FC1D1E537FAF4325779577A6BCA11BE65B

```
vscode ➜ /workspaces/CS487/hw6/6_part2 (hw6/rsa-pub-key-ecryption-and-sig-lab) $ task build
task: [build] gcc taskone.c -o taskone -lcrypto
vscode ➜ /workspaces/CS487/hw6/6_part2 (hw6/rsa-pub-key-ecryption-and-sig-lab) $ task run
task: [run] ./taskone
n= E103ABD94892E3E74AFD724BF28E78366D9676BCCC70118BD0AA1968DBB143D1
phi(n)= D2E88FE4EEB33F597D5F1B0D2D96EDD5156C94EC27065CFB268768CA1738BBC4
d= A90C278677B53385F22D2792D6E3A0FC1D1E537FAF4325779577A6BCA11BE65B
```

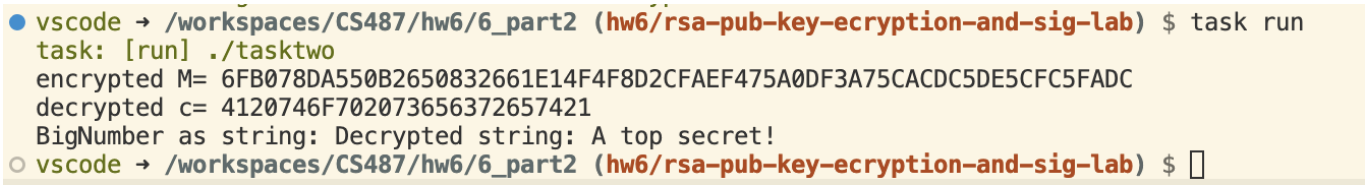
Note: Using Wolfram Alpha, the Decimal value of p was found to be 329520679814142392965336341297134588639 Note: Using Wolfram Alpha, the Decimal value of q was found to be 308863399973593539130925275387286220623 Note: The decimal value of e was small enouch to fit in a programmer's calculator and was found to be 886979 Note: n, phi(n), and d were computed using the <openssl/bn.h>

Task 2: Encrypting a Message

My solution is in `tasktwo.c`

I found the encryped version of the message was "6FB078DA550B2650832661E14F4F8D2CFAEF475A0DF3A75CACDC5DE5CFC5FADC" in hex. I checked that the encryption was correct by decrypting the message.

```
vscode ➜ /workspaces/CS487/hw6/6_part2 (hw6/rsa-pub-key-ecryption-and-sig-lab) $ task run
task: [run] ./tasktwo
encrypted M=
6FB078DA550B2650832661E14F4F8D2CFAEF475A0DF3A75CACDC5DE5CFC5FADC
decrypted c= 4120746F702073656372657421
BigNumber as string: Decrypted string: A top secret!
```

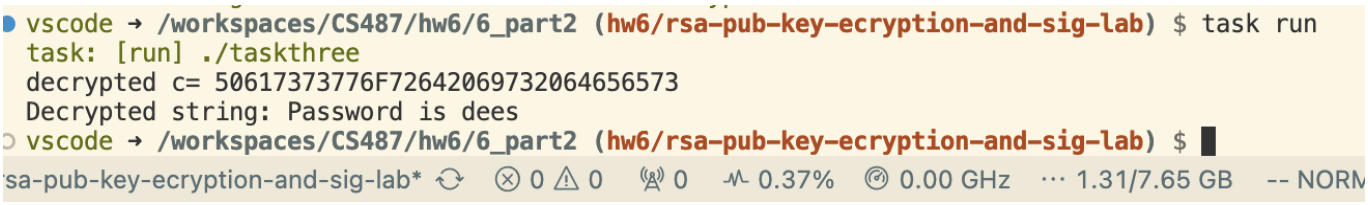


Task 3: Decrypting a Message

Decrypt: C = 8C0F971DF2F3672B28811407E2DABBE1DA0FEBBBDFC7DCB67396567EA1E2493F

My solution is in `taskthree.c` I found the ciphertext to decrypt to "Password is dees"

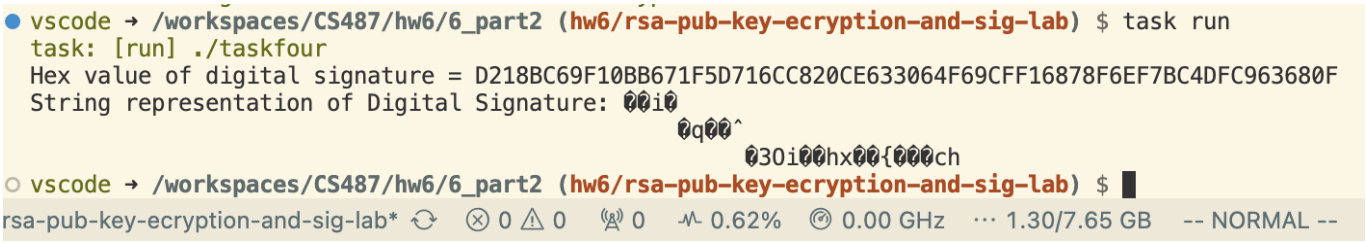
```
vscode ➜ /workspaces/CS487/hw6/6_part2 (hw6/rsa-pub-key-ecryption-and-sig-lab) $ task run
task: [run] ./taskthree
decrypted c= 50617373776F72642069732064656573
Decrypted string: Password is dees
```



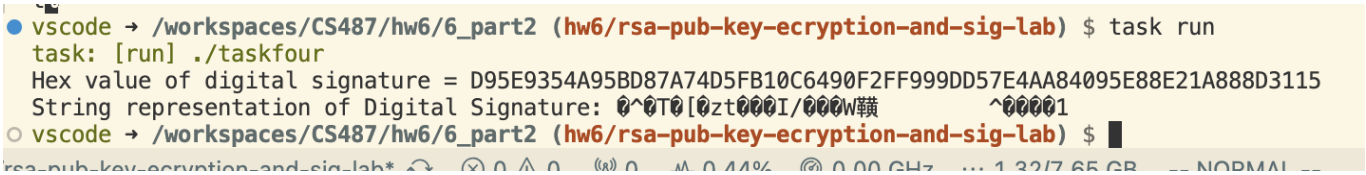
Task 4: Signing a Message

M = I owe you $2000

We know that: Digital Signature = m^d mod n



M = I owe you $3000



Comparing the two digital signatures we can see there is a large difference in the hex value even though we only changed one byte of the input string

Task 5: Verifying a Signature

My solution is in taskfive.c

M = "Launch a missile."

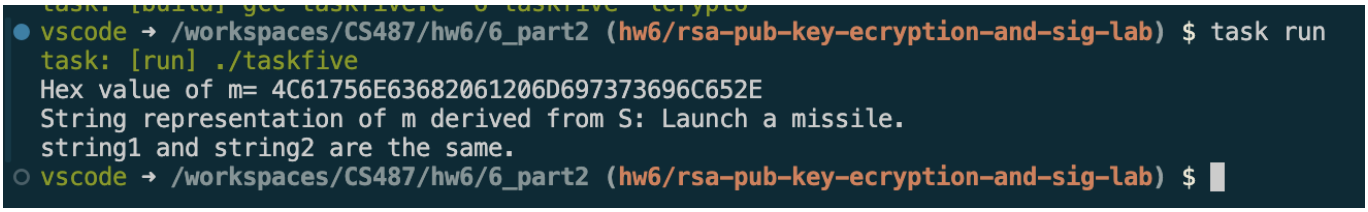
Let pubic key: (e, n)

M = Launch a missile. S = 643D6F34902D9C7EC90CB0B2BCA36C47FA37165C0005CAB026C0542CBDB6802F e = 010001 (this hex value equals to decimal 65537) n = AE1CD4DC432798D933779FBD46C6E1247F0CF1233595113AA51B450F18116115

try retrieve M using

res = S^e mod n

if res = M => verified



5.1:

Task 6:

Task 7: