

1. (a) Determine if 42483124636848975236844752257076215545882265818368771529505594279434836375766865097807033804117681258911499681751033742255088437312498753681 is prime or composite. If its composite, 100 bonus points for factoring it
(b) Determine if 12303479995616638836368608741395445210191895052167863472168713742188371591941698379890016667877990209724940948032524872995530884111641794129 is prime or composite. If its composite, 100 bonus points for factoring it
2. Suppose you recover the following message fragment: 133050904234290935702236539767744257155914455897196444662536188204185349186047971503669042603513750317889180159590609311768420355769091058013407006169 from Alice to you. Decipher it knowing it was enciphered with RSA and enciphering key $e = 64417755069803611734416635490027249152898676214763643182066874043497929250011628624482616997475795738275192178860223508696587247235436353010366284931$ and private keys: $p = 431609003137043731682637074109244794839831041169056238970706338385273971677$ and $q = 488952489322067103331463913649848088131572163272481217779489078529060911373$.
3. You and I set up a Diffie-Hellman key exchange with prime $p = 48552206911536302904121016135787322605743$, and primitive root $a = 5$. You choose as your private key, $x_{\text{you}} = 31820062523448734320440075491189547172163$. You look up my public key it is: $\alpha_{\text{my}} = 20419922764099261193667352752773260358074$.
 - (a) What is your public key?
 - (b) What is our common key?
 - (c) (100 Bonus Points) What is my private key?
 - (d) If you were unable to answer the previous question, what difficult problem were you unable to solve?
4. (a) Make a table of powers of 10 (mod 19).
 - (b) Use that table (you must show you are using the table to get full credit) to find $7^{12} \pmod{19}$.
 - (c) Use that table (you must show you are using the table to get full credit) to find, x such that $12^x \equiv 8 \pmod{19}$.
 - (d) Use the table to find all primitive roots of 19.