

1. (a) Determine if 6276064700680510121396517108840981523469005236393341848111343331334401781232002684698356675971332094086952950503645739239910658279125173103 is prime or composite. If its composite, 100 bonus points for factoring it
(b) Determine if 38181296251005924513191569039255113811096404911968661654702459426457996634456418129896409117703960132628462367674260798356350151423636815043 is prime or composite. If its composite, 100 bonus points for factoring it
2. Suppose you recover the following message fragment: 46423360523945777311116029797057321765027071529707919982616074816471702883282364314776153709001993762245148292720456586532452570683473029252501311175 from Alice to you. Decipher it knowing it was enciphered with RSA and enciphering key $e = 46971560913045970869859686711758441394453656974783905267423210774257589394608976948046811332244667395695594016657697714870798481857422344070041644469$ and private keys: $p = 388482449088312770272734067501087971467497862441988341640011156632711899059$ and $q = 250677459759910457821805318672894162302928148644354506009326749855837065177$.
3. You and I set up a Diffie-Hellman key exchange with prime $p = 21774448046944683372720906733991875574147$, and primitive root $a = 2$. You choose as your private key, $x_{\text{you}} = 15225274798915151887311107359933230089396$. You look up my public key it is: $\alpha_{\text{my}} = 20353476177954682856681547088279685861852$.
 - (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.