

1. (a) Determine if 62024941828887301412483855088866510901579561246996043764078417299129565038719535592588764015714508582562382097745934407001141333547598902901 is prime or composite. If its composite, 100 bonus points for factoring it
(b) Determine if 16275494639501891342619653636323609818989831045426424711303101790075221643552707190875612236993517993607860664582224898420511714153882594501 is prime or composite. If its composite, 100 bonus points for factoring it
2. Suppose you recover the following message fragment: 166563014670967255828285996166825095446584446434242342148898941253218576726475195250610371186478351697015522808696620325489445242712671673835784642388 from Alice to you. Decipher it knowing it was enciphered with RSA and enciphering key $e = 152252501679516837819131002254927649772031163493195211939201358652237655519538570133275087958099716292497097721547465284667491397809483009042027257523$ and private keys: $p = 285632421431015391891750052184580507856539340249282343481766547661786909401$ and $q = 990211041505307266174708693770896462052428366027912684252995527026273006729$.
3. You and I set up a Diffie-Hellman key exchange with prime $p = 73888460760732855220575748218259432075703$, and primitive root $a = 5$. You choose as your private key, $x_{\text{you}} = 31998752428785327999490898137463074570473$. You look up my public key it is: $\alpha_{\text{my}} = 28421046789545810507262346173943046491742$.
 - (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.