

1. (a) Determine if 47926604011360239564841396850097037136147792462081470765850620608254600242962538241103577593832827168316517749431671346111566262615233254763 is prime or composite. If its composite, 100 bonus points for factoring it
(b) Determine if 71010145669062079361837615245649296537167359451962669355265941080442296877793133883899901260768331286021292143402001356374854706252148239743 is prime or composite. If its composite, 100 bonus points for factoring it
2. Suppose you recover the following message fragment: 90359150710987029216059475803720194418604292924796009919812237308750139866010824573928230977616078127469509866663044741521027158290402361241487600252 from Alice to you. Decipher it knowing it was enciphered with RSA and enciphering key $e = 45061164981584307995706243649675700039293800199449471620205059124381613435758960085286642956819423529996813116103548515695409956242694200258637570129$ and private keys: $p = 632710520630213936671031442756795348123278772352933761111573745866006659603$ and $q = 259967071749488599318293302277139285363032838474245368989829711984531540617$.
3. You and I set up a Diffie-Hellman key exchange with prime $p = 25274235495250156943210167216567864322639$, and primitive root $a = 7$. You choose as your private key, $x_{\text{you}} = 366160056359506464231967015121191732656$. You look up my public key it is: $\alpha_{\text{my}} = 11873028803229125378210046389683436328978$.
 - (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.