Date Due: Thursday, April 8 at 5:00

Reading: Chapter 11, page 239-252 Chapter 12, pages 253-260

Problems:

1. Page 177, problem 20

2. Page 178, problem 26

3. Page 178, problem 31

4. Show that for p prime, \((p - 1)! = -1 \pmod p\).
   
   Hint: The first part of your proof should argue that 1 and \(p - 1\) are the only values \(\pmod p\) that are their own inverses. In showing that, the polynomial \(x^2 - 1 = 0 \pmod p\) is important.

5. Is the converse of the previous problem true?
   
   That is, for \(m > 2\), if \((m-1)! = -1 \pmod m\) then \(m\) is prime.

   If it is true prove it, otherwise give a counterexample.


7. Prove that if \(p\) is prime then for any \(e > 0\) \(\phi(p^e) = p^{e-1}(p - 1)\).