Math 115F Fall 2014 – Problem Set 1

1. Decipher the following message *and* identify the method used to construct the cipher alphabet. You should assume it was enciphered using a monoalphabetic substitution cipher.

UZ GOEOYHOI OUDBKOOZ KBUIKR-ZUZO, CAO UJJMOG T EBTXXOZDO KA KBO IOTGOIJ AL KBO

CBUXTGOXCBUT CTCOI TXOQTZGOI'J POOWXR KBTK BO EAMXG JAXNO TZR JUYCXO

JMHJKUKMKUAZ EUCBOI KBOR JMHYUKKOG. BO CIAEOOGOG KA JAXNO TXX AL KBOY,

UZEXMGUZD AZO UZ PBUEB JONOZ GULLOIOZK TXCBTHOKJ POIO MJOG.

2. In a paragraph or two, describe the strategies you used to decipher the message above. How did you start figuring out the cipher alphabet? What patterns in the cipher alphabet did you notice that led you to determine the particular substitution cipher used? What other steps did you take as part of your cryptanalysis?

3. Fill in the blanks in the following table. Some of the blanks can be filled in using more than one number, but the rows of your table should be internally consistent.

x	x MOD 4	x MOD 7	x MOD 12
10			
-15			
	1	3	
	1		5
	1	1	1

4. Find five numbers (three positive, two negative) that, when substituted in the following congruence statement for x, make the statement true.

   $x + 9 \equiv 7 \pmod 8$

5. Suppose that auto license plates in a particular state each consist of four letters. For example, possible license plates are “GHRW” and “RREP” and “FORK.”
   a. How many different license plates are possible?
   b. How many different license plates with no repeated letters are possible?
   c. How many different license plates in which the second letter is D are possible?