Problem set 9
(Assigned on November 13)

1. Can you decrypt the following message if the shift in Caesar cipher is A to R?
Riddle: Why was the math book sad?
Answer: ZK YRU KFF DREP GIFSCVDJ

2. What if you find a secret message on the floor, and you don't know the "key" of how to shift the alphabet? Can you still crack the secret message? Give it a try! Hint: If you see a one letter word, what could it be? The following websites might be useful (clickable links):

Caesar cipher

Decryption of ciphers.

Secret Message: Q VQHCUH YD JXU VYUBT MYJX XYI SEMI SEKDJUT DYDUJO EV JXUC, RKJ MXUD XU HEKDTUT JXUC KF XU XQT EDU XKDTHUT.

3. Build a grid of integers such that each row contains 4 numbers (the same as we did in our session on Sunday). If a number is last in the row, the next one starts starts as the first one in the next row. The table should start like

$$0 \quad 1 \quad 2 \quad 3$$
$$4 \quad 5 \quad 6 \quad 7$$

If you extended the grid to 1000 rows, would the integer 3713 be in the same column as 0, 1, 2, or 3?

4. Imagine you built a grid like before, but with 7 columns instead of 4 (starting at 0).

1. How does the first row look like?

2. How many of the 100 smallest numbers $(0, 1, \cdots, 99)$ numbers would be in the same column as 0?

3. How many of the 100 smallest numbers $(0, 1, \cdots, 99)$ numbers would be in the same column as 3?

4. How many of the 100 smallest numbers $(0, 1, \cdots, 99)$ numbers would be in the same column as 6?

5. Color the triangle on the next page according to the following rules:

1. Color all hexagons on left and right side of the triangle (not the bottom one) with your first color, we chose blue.

2. Continue row by row. For each hexagon look at the two hexagons above it (touching by side):

   - if the two hexagons above have different colors, color the hexagon with your first color (blue).
   - if the two hexagons above have the same color, color the hexagon with your second color (we chose red).