Kerry Ojakian's CSI 35 Class
Due Date: TBA

HW #2

General Instructions: Homework is to be handed in at the beginning of class. While you may work with others from class, you may not copy. For details on working with others, see the Class Contract (available at the web page), which you have signed.

The Assignment

Do all the programming questions in SageMath, and save them to Dropbox. Make a folder with a name like HW2 where all of these programs will go. Label your programs by the problem number.

1. Consider the following two propositions (notice that they are converses). One is true and the other is false. Prove the true one and find a counter-example to the false one.

   (a) If $ab|c$ then both $a|c$ and $b|c$.

   (b) If both $a|c$ and $b|c$, then $ab|c$.

2. For integers m and n, if $m+n$ is even then m and n are both even or m and n are both odd.

3. From Wells, do exercise 83.2.2.

4. Prove or disprove that you can use dominoes to tile the standard checkerboard with two adjacent corners removed (that is, corners that are not opposite).

5.

   (a) Write a program in SathMath called isPrime: it takes a single positive integer as input and returns the boolean True if the integer is prime and false otherwise. Just use the basic Python language (i.e. do not use anything like Primes() from SathMath).

   (b) Do Wells, exercise 81.2.4.

   (c) Modify your program for isPrime to be more efficient, using the result of the last exercise (e.g. 81.2.4).

6. Make up your own conjecture! It must be a clearly and precisely stated mathematical proposition, which is clearly either true or false. Then write a program in SageMath to thoroughly test your conjecture. The evidence should come out in favor of your conjecture! (if you find your conjecture to be false, come up with a new conjecture).

7. (**Extra Credit**) Do exercise 46 from 1.8 in Rosen (p.109)

8. (Uses Induction) Prove that $n^2 + n$ is even for all positive integers n.

9. (Uses Induction) From Wells, do exercise 103.4.9, part (b).