Math 110 Math Apps Art, Fall 2018
Assignment 1   Name: _____
Due: Thursday, September 13, 2018

Your work can be submitted on this paper, or you may use a separate sheet if you prefer.

1. Your first assignment is to familiarize yourself with a website called The Online Encyclopedia of Integer Sequences. Recall that an **integer** is a positive or negative whole number, or zero. An integer **sequence** is an ordered list of integers called **terms**, such as the famous Fibonacci sequence

$$1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, \ldots$$

created by starting with $1, 1$ and then getting the next term by adding the two terms before it. There are thousands of other important sequences, and the OEIS website is attempting to catalogue all of them in an easy to search database.

(a) Go to the website `oeis.org`, and look for the search bar (which will already contain a sequence). Delete this sequence, and enter the first five terms of the Fibonacci sequence, separated by commas:

$$\texttt{1,1,2,3,5}$$

Then click Search. You should see the Fibonnaci sequence returned as your first result. Choose another page of results (from the yellow toolbar below the search input) and find the name of another sequence that also contains the sequence `1,1,2,3,5`. Write the name of the sequence below.

(b) Make up your own sequence! Start with any number (or two numbers) and invent your own formula for finding the next term of your sequence. Explain your sequence below, and write the first 5 terms of it. For instance, I could begin a sequence with the number 3, and find the next term by multiplying the previous term by 2. Doing so results in the sequence `3, 6, 12, 24, 48, ....`.

(c) Enter your sequence into the OEIS search bar. Did you find a description of it? If so, write the name and sequence ID below. The sequence ID is the the left of the sequence name, and will look something like `A000045` (that's the ID for Fibonacci). If nothing is returned, write that below - you may have discovered a new sequence!

(d) You can also search for a sequence by its name, author, or formula. Try this feature by searching for the name `Catalan`. Write down the first five terms of the sequence of Catalan numbers, and read through the comments. Select one description of the sequence (there are hundreds to pick from!). For instance, one possible description is "The solution to Schroder's first problem" (you should choose a different one).

2. Using the technique described in class and in the slides for Euclidean Geometry, use a straight edge (this does not have to be a ruler) to find and mark the center of the circle below. You can leave all lines drawn to "show your work".
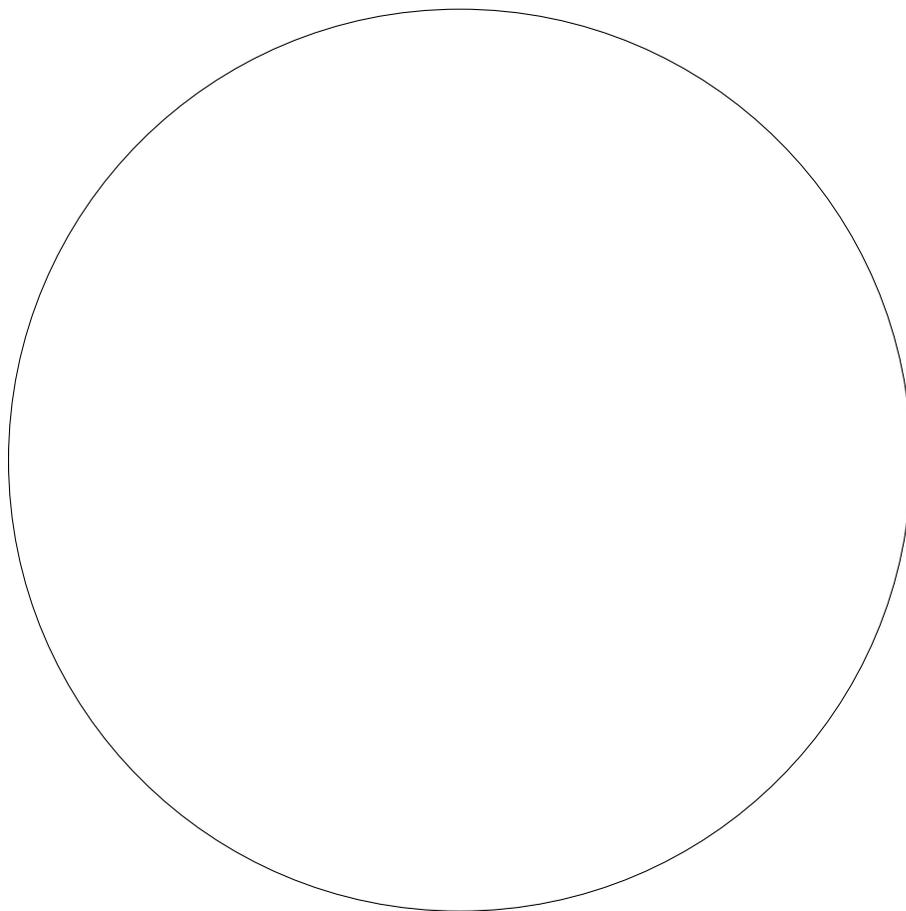
3. Now, you'll draw an equilateral triangle using a "ruler and compass" construction. If you have a compass, set it to a radius of about 1.5 to 2 inches. If not, find any circular object with a width (diameter) of about 3 to 4 inches.

- Draw or trace your circle below, leaving some room to the right of your circle.
- Using the technique in the last problem, find and mark the center of your circle.
- Draw another circle (with the same size) overlapping the first, so that it passes through the center of the last circle.
- Find and mark the center of this new circle, which should fall on the first circle.
- Draw three lines: one connecting the centers of the two circles, and one going from each center to one of the points where the circles intersect. This should be an equilateral triangle.

The idea is to have something like this when you're done, but hand drawn: