Homework 1, due September 8
Introduction to Sage

Many of your homework assignments will require the use of a computer to complete. Some basic skills with mathematical software will be helpful. Sage can be used for numerical computations, symbolic computations, creating plots, etc. It has many built in functions, but can also be extended by using standard programming techniques. Other mathematical packages include Maple, Mathematica, Matlab, etc.

Only parts #4 and #5 of this assignment are required. You may complete part #4 using any software package you choose. Parts #1 through #3 will introduce you to Sage and help you set up an account on the CoCalc server. Once you set up an account, send me the email address you used to create your account and I will add you to the class group, which will give you access to course examples and servers with less traffic. You can complete the assignment before being added to the group, but you may find the servers are frustratingly slow at times.

(1) In a web browser, go to `https://cocalc.com/`. This will take you to a public Cocalc/Sage server. You can create an account or log in using a Google account. Send me the email address associated to your account.

(2) Go to the web site `http://www.sagemath.org/help-video.html` and watch the video "Sage Introduction, Episode 1". It is the third video down. Don't worry if you don't understand everything mentioned in the video.

(3) Look at some of the topics on the webpages
   `http://www.sagemath.org/doc/tutorial/tour.html`
   `http://www.sagemath.org/help.html`.

(4) Create a Sage worksheet in which you do the following:
   (a) Calculate the greatest common divisor of 23456 and 987654.
   (b) Calculate the first 100 digits of π and 2π. One way to do this is to use the `N` command. Another way to do this is to use the command `R=RealField(334)` to create a field R with 334 bits of precision. Then, for example, `R(e)` should give you the number e to 100 decimal places.
   (c) Factor 2233648339787271680000 into primes.
   (d) Find the inverse of the matrix

$$M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{bmatrix}$$

   and multiply it by M to check that this is actually the inverse. In Sage, the command `M=Matrix([[a, b], [c, d]])` will create a 2 by 2 matrix M with entries a, b, c, d. You can use the command `M.inverse()`.
   (e) Find the smallest prime larger than 10^{30}.

(5) Send me (either by email, learning suite, or on your homework) the card color and number you received in class.

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DEAR VARIOUS PARENTS, GRANDPARENTS, CO-WORKERS,
AND OTHER "NOT COMPUTER PEOPLE."

WE DON'T MAGICALLY KNOW HOW TO DO EVERYTHING IN EVERY
PROGRAM. WHEN WE HELP YOU, WE'RE USUALLY JUST DOING THIS:
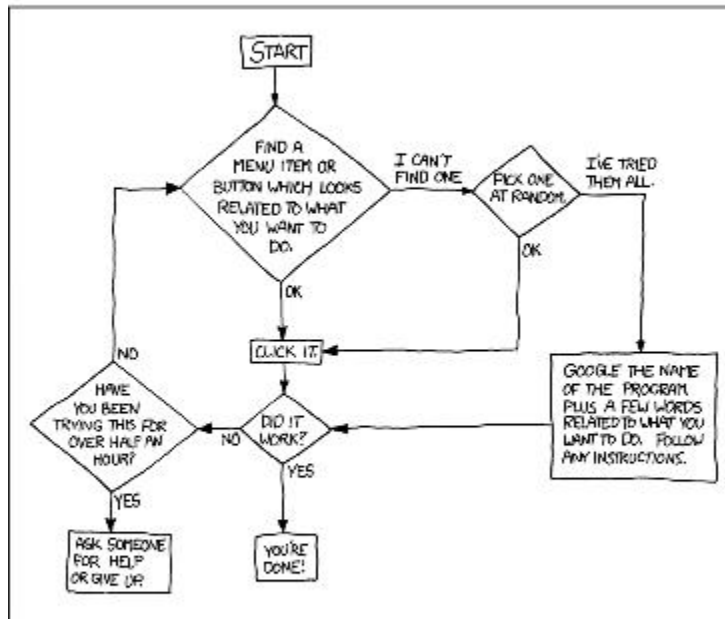
PLEASE PRINT THIS FLOWCHART OUT AND TAPE IT NEAR YOUR SCREEN.
CONGRATULATIONS; YOU'RE NOW THE LOCAL COMPUTER EXPERT!