Math 480a: Sage, Spring 2011, Homework 2

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Due April 13, 2011

Do the following problems, and turn them in by the beginning of class on Wednesday, April 13, 2011. If you get help from a classmate or friend on any homework problem, please explicitly thank them in your write up.

1. Write some code in Sage that does something of interest to you that uses *all* of the following Python features:
   (a) if statement, e.g., `if 1==2:  print "what?!"`
   (b) for loop, e.g., `for i in range(10):  print i`
   (c) while loop, e.g., `while i < 10:`
   (d) function, e.g., `def foo(n,m):`
   (e) comments, e.g., `# this is a comment`
   (f) a class, e.g., `class Foo:`
   (g) a list comprehension, e.g., `[a*a for a in range(10) if a%2 == 0]`.
   (h) exception handling, e.g., `try:  ...  except:`
   (i) a Python function decorator

2. Write some Cython code that uses the following features of Cython. You may use the `%cython` mode of the Sage notebook.
   (a) Declare and work with the following C data types: `int`, `double`, and `long`.
   (b) Create and use a `cdef class`, i.e., a cdef'd class.
   (c) Create and use a `cdef` method of a class.
   (d) Create and use a `cpdef` method of a class.
   (e) Using a function that is defined in the `math.h` standard library. (Hint: you should explicitly declare the function using `cdef extern`.)

3. This question is mainly about the Sage preparser. The Python source code of the preparser (`http://flask.sagenb.org/src/misc/preparser.py`) may be useful. Question: Find 4 valid and different input lines that give *different* output when input to Sage instead of Python. Don't make them trivially different. Example answer: "If I type `4/3` into Sage I get `4/3` out, but if I put `%python` at the top of a cell and type in `4/3` I get `1` out." (Hints: Some things that are different in Sage than Python include the `^` operator, integer literals, and floating point literals.)