2014-04-11.sagews

April 11, 2014

Contents

1 Math 480b Sage Course

1.1 April 11, 2014

Screencast: `http://youtu.be/ErzCuqsYq1E`

Plan

- Questions?
- SageMathCloud status update
- Reminder
  - homework due at 6pm tonight
  - grading due at 6pm tonight
- Python
  - functions; tuple (un-)packing
  - putting code in files/modules and loading them
  - classes: creating your own data types

```
import os
os.listdir('.')
```

```
['..2014-04-11.sagews.sage-chat.sage-backup', '2014-04-11.sagews', '.2014-04-11.sagews
.sage-chat']
```

```
os.listdir('..')
```

```
['2014-04-09', '2014-04-04', '2014-03-31', '2014-04-07', 'videos.md', '.videos.md.sage-
chat', '2014-04-02', '2014-04-11']
```

```
import shutil
```

```
shutil.[tab key]
```

```
os.unlink  # remove a file
```

```
help(shutil)
```

```
os.makedirs('foobar')
```

```
os.listdir('.')
['..2014-04-11.sagews.sage-chat.sage-backup', '2014-04-11.sagews', 'foobar',
'.2014-04-11.sagews.sage-chat']
```

```
os.makedirs('foobar')
Error in lines 1-1
Traceback (most recent call last):
  File "/projects/74af30b7-ad25-4308-a02e-c71fcd84de6e/.sagemathcloud/sage_server.py",
line 733, in execute
    exec compile(block+'\n', '', 'single') in namespace, locals
  File "", line 1, in <module>
  File "/usr/local/sage/sage-6.2/local/lib/python/os.py", line 157, in makedirs
    mkdir(name, mode)
OSError: [Errno 17] File exists: 'foobar'
```

```
try:
    os.makedirs('foobar')
except:
    print "skipping it"
skipping it
```

1.2 SageMathCloud status update

- Yesterday I made a major backend rewrite live; it was months in the works.
- SMC is faster and much more robust now.
- Fixed issue that resulting in some projects being temporarily lost yesterday as a result of the migration.
- I set all the projects for students in this course to never timeout.

1.3 Functions

- quick review of defining functions
- variable number of arguments or keywords
- returning multiple values and tuple (un-)packing

```
def foo(a, b=4):
    def g(c):
        return c*c
    if a:
        print "a is true"
    return g(a*b)
```

```
foo(5)
```

```
a is true
400
```

```
g(40)
```

```
Error in lines 1-1
Traceback (most recent call last):
  File "/projects/74af30b7-ad25-4308-a02e-c71fcd84de6e/.sagemathcloud/sage_server.py",
line 733, in execute
    exec compile(block+'\n', '', 'single') in namespace, locals
  File "", line 1, in <module>
NameError: name 'g' is not defined
```

```
def multiplier(n):
    """This is a docstring"""
    def f(x):
        return x*n
    return f
```

```
m = multiplier(17)
m
```

```
<function f at 0x85ae578>
```

```
m(3)
```

```
51
```

```
multiplier.func_doc
```

```
'This is a docstring'
```

```
# variable number of arguments
```

```
prod(3,4,5)
```

```
Error in lines 1-1
Traceback (most recent call last):
  File "/projects/74af30b7-ad25-4308-a02e-c71fcd84de6e/.sagemathcloud/sage_server.py",
line 733, in execute
    exec compile(block+'\n', '', 'single') in namespace, locals
  File "", line 1, in <module>
  File "misc_c.pyx", line 131, in sage.misc.misc_c.prod (sage/misc/misc_c.c:1584)
  File "misc_c.pyx", line 211, in sage.misc.misc_c.iterator_prod (sage/misc/misc_c.c:1987)
TypeError: 'sage.rings.integer.Integer' object is not iterable
```

```
def my_prod(a, b, *args, **kwds):
    print a, b, args, kwds
    return prod(args)
```

```
my_prod(3,4,5, 10, 18, xyz=56, abc='hi')
3 4 (5, 10, 18) {'xyz': 56, 'abc': 'hi'}
900

args = (7,5,6,8)
kwds = {'this':'that'}

my_prod(0, *args, **kwds)
0 7 (5, 6, 8) {'this': 'that'}
240

# returning multiple values
# short answer: CAN'T

def powers(n):
    return n^2, n^3, n^4

powers(5)
(25, 125, 625)

a, b, c = powers(5)
print  "a=%s, b=%s, c=%s"%(a,b,c)
a=25, b=125, c=625

(a, b, c) = (25, 125, 625)

a,b,c
(25, 125, 625)

x = powers(5)
x
(25, 125, 625)

v = [powers(2), powers(3), powers(5), powers(7)]
v
[(4, 8, 16), (9, 27, 81), (25, 125, 625), (49, 343, 2401)]

for a,b,c in v:
    print a+b+c
28
117
775
2793

for a in v:
    print a
(4, 8, 16)
(9, 27, 81)
(25, 125, 625)
(49, 343, 2401)

for a,b in v:
```

```
    print a,b
Error in lines 1-2
Traceback (most recent call last):
  File "/projects/74af30b7-ad25-4308-a02e-c71fcd84de6e/.sagemathcloud/sage_server.py",
line 733, in execute
    exec compile(block+'\n', '', 'single') in namespace, locals
  File "", line 1, in <module>
ValueError: too many values to unpack
```

1.4 Putting code into files

- creating and running a .sage file (note:
- creating, importing, reloading a .py Python module
- installing python code from pypi:
  - see https://github.com/sagemath/cloud/wiki/FAQ#-question-i-found-an-awesome-python-package-at-h

```
%load test.sage
```

```
my_prod(2,3,4)
```
```
24
```

```
my_prod?
```
```
   File: /projects/74af30b7-ad25-4308-a02e-
c71fcd84de6e/sage2014/lectures/2014-04-11/<string>
   Docstring:
      This is my_prod in another file...
```

```
%load test.sage
```

```
my_data
```
```
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

```
preparse('my_data = [n^2 for n in range(10)]')
```
```
'my_data = [n**Integer(2) for n in range(Integer(10))]'
```

```
sys.path.append('.')    # so we can import python code in cur dir
```

```
import test2
```

```
test2.my_data
```
```
[2, 3, 0, 1, 6, 7, 4, 5, 10, 11]
```

```
test2.my_prod(3,4,5)
```
```
Error in lines 1-1
Traceback (most recent call last):
  File "/projects/74af30b7-ad25-4308-a02e-c71fcd84de6e/.sagemathcloud/sage_server.py",
line 733, in execute
    exec compile(block+'\n', '', 'single') in namespace, locals
```

```
  File "", line 1, in <module>
  File "./test2.py", line 5, in my_prod
    This is my_prod in another file...
NameError: global name 'prod' is not defined
```

```
reload(test2)
```
```
<module 'test2' from './test2.py'>
```

```
test2.my_data
```
```
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

```
test2.my_prod(3,4,5)
```
```
60
```

1.5 Python classes: creating your own data types

```
class MyNumber:
    def __init__(self, value):
        self._value = value

    def __repr__(self):
        return "My number %s"%self._value

    def __add__(self, other):
        return MyNumber(self._value - other._value)
```

```
a = MyNumber(45)
a
```
```
My number 45
```

```
type(a)
```
```
<type 'instance'>
```

```
b = MyNumber(17)
```

```
b
```
```
My number 17
```

```
a + b
```
```
My number 28
```