Computer Science 135
Introduction to Computer Science, in Python
Lecture #2 (Values and expressions)
February 6

Keywords
comment, expression, float, integer, keyword, precedence, script, string, type, value, variable

We explore the simplest expressions of computation in Python.

1. Basic concepts:
   (a) Python runs in interactive, *script* mode, for basic calculation.
   (b) Python ignores everything after hash-marks: `#`. These are *comments*
   (c) *Variables* are named storage locations. You create new variables by assigning them *expressions* of values.
   (d) Some words in Python are keywords; these words have special meaning. Keywords cannot be used as variable names:

False	class	finally	is	return
None	continue	for	lambda	try
True	def	from	nonlocal	while
and	del	global	not	with
as	elif	if	or	yield
assert	else	import	pass	
break	except	in	raise	

   (e) Python supports many built-in types. Examples: `int`, `float`, `str`.
   (f) Each type supports a wide variety of operations. Where possible, operations act similarly on different types.
2. Playing.
   (a) Thoughts on how to compute the most commonly used finger in typing a text?
   (b) How do we compute the golden ratio, $\phi = \frac{1+\sqrt{5}}{2}$?
   (c) (Belated:) Happy Chinese New Year! How do we calculate the phase of the moon? Here's one method:
   This algorithm is John Conway's mental method for calculating the age of the moon. Assume that the day range is 1-31, month range is 1-12, and year is 1900-2099. This algorithm computes the moon's age in days. The common western description of the moon's phases are:

age	name
0,1,29	new
2,3,4,5,6	waxing crescent
7,8	first quarter
9,10,11,12,13	waxing gibbous
14,15,16	full
17,18,19,20,21	waning gibbous
22,23,	third quarter
24,25,26,27,28	waning crescent

Conway's algorithm involves keeping a running sum that, in the end, modulo 30, is the moon's age.

i. Initialize the sum, `s`, to the sum of the day, the month, and 30. The final 30 is helpful to avoid negative modular arithmetic, later.

ii. If the century digits are 20, subtract 8, otherwise subtract 4.

iii. Assume, now, that the year (yy) is in the form 0-99. Compute the distance, `d`, to the closest multiple of 19 (`m`) as `d=yy-m`. For example, 2014 yields -5, but 1999 gives +4. (Notice that 2000 gives 0, but the century correction avoids a discontinuity here.)

iv. To `d` prepend a ten's digit that is the value of `|d|` mod 3. Thus 2014 will have a final `d` of -25, 1999 generates 14, and 2000 gives 0. Notice that this part of the computation never changes during the year. The value of `d` for 2017 is -22 (or 8, mod 30).

v. Add `d` to `s` modulo 30. That's the age of the moon.

Today is February 6, 2017. The calculation looks like

$$(2+6+30-8-22)\text{mod } 30 \equiv 8$$

It's a first quarter moon.

Moon Unit Zappa was born September 28, 1967. The moon's age would have been

$$(9+28+30-4-9)\text{mod } 30 \equiv 24$$

5 days from new, it's a waning (dimming) crescent moon. Ban Ki-moon (former UN Secretary General) was born on June 13, 1944. The calculation is

$$(6+13+30-4+6)\text{mod } 30 \equiv 21$$

8 days from new, a waning gibbous (mostly lit) moon. The fictional character Sheldon "Moon Pie" Cooper celebrated his 21st birthday on February 26, 2001. The moon was new:

$$(2+26+30-8+11)\text{mod } 30 \equiv 1$$

Moon River was first heard in the debut of *Breakfast at Tiffany's*, released on October 5, 1961 under a waning crescent moon:

$$(10+5+30-4+14)\text{mod } 30 \equiv 25$$

There's never much moonshine at Mardi Gras: February 28, 2017 yields

$$(2+28+30-8-22)\text{mod } 30 \equiv 0$$

A new moon.

$\star$