Week 2

expressions, variables, for loops

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Expressions

- Arithmetic is very similar to Java
  - Operators: + - * / %
  - Precedence: * / % before + -
  - Integers vs. real numbers

```
>>> 1 + 1
2
>>> 1 + 3 * 4 - 2
11
>>> 7 / 2
3
>>> 7.0 / 2
3.5
```

Variables

- Declaring
  - no type is written; same syntax as assignment
- Operators
  - no ++ or -- operators (must manually adjust by 1)

Java	Python

`int x = 2;`
`x++;`
`System.out.println(x);`
 	
`x = x * 8;`
`System.out.println(x);`
 	
`double d = 3.2;`
`d = d / 2;`
`System.out.println(d);`
	`x = 2`
	`x = x + 1`
	`print x`
	
	`x = x * 8`
	`print x`
	
	`d = 3.2`
	`d = d / 2`
	`print d`

Types

- Python is looser about types than Java
  - Variables' types do not need to be declared
  - Variables can change types as a program is running

Value	Java type	Python type
`42`	`int`	`int`
`3.14`	`double`	`float`
`"ni!"`	`String`	`str`

String Concatenation

- Integers and strings cannot be concatenated in Python.
  - Workarounds:

`str(`**value**`)`	- converts a value into a string
`print` **expression**`,`	- prints but does not go to next line

```
>>> x = 4
>>> print "Thou shalt not count to " + x + "."
TypeError: cannot concatenate 'str' and 'int' objects

>>> print "Thou shalt not count to " + str(x) + "."
Thou shalt not count to 4.

>>> print x + 1, "is out of the question."
5 is out of the question.
```

String Multiplication

- Python strings can be multiplied by an integer.
  - The result is many copies of the string concatenated together.

```
>>> "hello" * 3
"hellohellohello"

>>> print 10 * "yo "
yo yo yo yo yo yo yo yo yo yo

>>> print 2 * 3 * "4"
444444
```

The for Loop

```
for name in range(max):
    statements
```

– Repeats for values 0 (inclusive) to **max** (exclusive)

```
>>> for i in range(5):
...     print i
0
1
2
3
4
```

for Loop Variations

```
for name in range(min, max):
    statements

for name in range(min, max, step):
    statements
```

– Can specify a minimum other than 0, and a step other than 1

```
>>> for i in range(2, 6):
...     print i
2
3
4
5
>>> for i in range(15, 0, -5):
...     print i
15
10
5
```

python

Nested Loops

- Nested loops are often replaced by string * and +

```
....1
...2
..3
.4
5
```

Java

```java
for (int line = 1; line <= 5; line++) {
    for (int j = 1; j <= (5 - line); j++) {
        System.out.print(".");
    }
    System.out.println(line);
}
```

Python

```python
for line in range(1, 6):
    print (5 - line) * "." + str(line)
```

Constants

- Python doesn't really have constants.
  - Instead, declare a variable at the top of your code.
  - All methods will be able to use this "constant" value.

constant.py

```
MAX_VALUE = 3

def printTop():
    for i in range(MAX_VALUE):
        for j in range(i):
            print j
        print

def printBottom():
    for i in range(MAX_VALUE, 0, -1):
        for j in range(i, 0, -1):
            print MAX_VALUE
        print
```

Exercise

- Rewrite the Mirror lecture program in Python. Its output:

```
#================#
|      <><>      |
|    <>....<>    |
|  <>........<>  |
|<>............<>|
|<>............<>|
|  <>........<>  |
|    <>....<>    |
|      <><>      |
#================#
```

  - Make the mirror resizable by using a "constant."

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Exercise Solution

```python
SIZE = 4

def bar():
    print "#" + 4 * SIZE * "=" + "#"

def top():
    for line in range(1, SIZE + 1):
        # split a long line by ending it with \
        print "|" + (-2 * line + 2 * SIZE) * " " + \
              "<>" + (4 * line - 4) * "." + "<>" + \
              (-2 * line + 2 * SIZE) * " " + "|"

def bottom():
    for line in range(SIZE, 0, -1):
        print "|" + (-2 * line + 2 * SIZE) * " " + \
              "<>" + (4 * line - 4) * "." + "<>" + \
              (-2 * line + 2 * SIZE) * " " + "|"

# main
bar()
top()
bottom()
bar()
```

Concatenating Ranges

- Ranges can be concatenated with +
  - Can be used to loop over a disjoint range of numbers

```
>>> range(1, 5) + range(10, 15)
[1, 2, 3, 4, 10, 11, 12, 13, 14]

>>> for i in range(4) + range(10, 7, -1):
...     print i
0
1
2
3
10
9
8
```

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Exercise Solution 2

```
SIZE = 4

def bar():
    print "#" + 4 * SIZE * "=" + "#"

def mirror():
    for line in range(1, SIZE + 1) + range(SIZE, 0, -1):
        print "|" + (-2 * line + 2 * SIZE) * " " + \
              "<>" + (4 * line - 4) * "." + "<>" + \
              (-2 * line + 2 * SIZE) * " " + "|"

# main
bar()
mirror()
bar()
```