

Assignments and Loops

Rose-Hulman Institute of Technology

Computer Science and Software Engineering

Outline

- Basic number types: **int** and **float**
- Variables and assignments
- Definite loops
- Math library
- Accumulator problem

Check out 03-AssignmentsAndLoops

- Go to SVN Repository view at bottom of the workbench
 - Missing? Add it back:
Window→**Show View**→**Other**→**SVN** → **SVN Repositories**
- Browse SVN Repository view for **03-AssignmentsAndLoops**
- Right-click it and choose **Checkout**
- Accept defaults in the dialog
- Expand the **03-AssignmentsAndLoops** project that appears in **Package Explorer** (on the left-hand-side)

PyDev Interpreter Console

The image shows a sequence of steps to set up and use the PyDev Interpreter Console in Eclipse. Red boxes with numbers 1 through 5 point to specific UI elements:

- 1**: Points to the 'Console' tab in the Eclipse IDE's top toolbar.
- 2**: Points to the 'New Console View' option in the context menu.
- 3**: Points to the 'PyDev Console' option in the context menu.
- 4**: Points to the 'Python console' option in the 'New Console View' dialog box.
- 5**: Points to the 'OK' button in the 'New Console View' dialog box.

The resulting PyDev Console window shows the following output:

```
PyDev Console [1]
>>> import sys; print('%s %s' % (sys.executable or sys.platform, sys.version))
/Library/Frameworks/Python.framework/Versions/3.1/Resources/Python
[GCC 4.0.1 (Apple Inc. build 5493)]
>>> print("hello!")
hello!
>>> |
```

A red box with the text "Woot! Interpreter Shell" is positioned below the console output.

Some numeric operations

Operator	Operation
+	Addition
-	Subtraction
*	Multiplication
/	Division
**	Exponentiation
%	Remainder
//	Integer division

Function	Operation
abs(x)	Absolute value of x
round(x, y)	Round x to y decimal places
int(x)	Convert x to the int data type
float(x)	Convert x to the float data type

Variables

- Identifiers (i.e.names) that refer to values stored in memory
- Values can be of any type

```
width = 4
```

```
temperature = 98.6
```

```
dogName = "fido"
```

```
lost = [4, 8, 15, 16, 23, 42]
```

```
triangleArea = width * height / 2
```

```
xyPoint = (r * cos(theta), r * sin(theta))
```

Variables and Assignment

- Assignment gives a variable a value

$$x = 6 * 7$$

- Python evaluates right-hand side (42)
- Then variable on left “gets” the value

- “Gets” not “Equals”

- $x = 3.9 * x * (1 - x)$

How to Think About Variables

- Variables as sticky notes
- Example on board...

$$x = 10$$

$$x = x + 1$$

Three Kinds of Assignment

- Simple
- Compound
- Multiple (or simultaneous)

Simple Assignment

- `<variable> = <expr>`
- Note:
 - `input(<string>)` is an expression
 - input statements are a kind of assignment statement

Q1,2

Compound Assignment

- **<var> <op=> <expr>** means
<var> = <var> <op> <expr>
 - where **<op=>** is **+=**, **-=**, ***=**, **/=**, **//=**, or **%=**
- **Example:**
 - **total += 5** is the same as
total = total + 5

Simultaneous Assignment

- $\langle \text{var} \rangle, \langle \text{var} \rangle, \dots = \langle \text{expr} \rangle, \langle \text{expr} \rangle, \dots$
- Example:
 - $\text{sum}, \text{diff} = x + y, x - y$

Assignment Assignment

- See `assignmentsAndLoops.py` module
- Do the TODOs inside the `assignmentStatements()` function

Summary: Assignment Statements

- Simple assignments: **<variable> = <expr>**
- Compound assignments
 - **<var> <op=> <expr>** means
<var> = <var> <op> <expr>
where **<op=>** is **+=**, **-=**, ***=**, **/=**, **//=**, or **%=**
- Simultaneous (multiple) assignments
 - **<var>, <var>, ... = <expr>, <expr>, ...**

Sequence

- A list of things
- For example:
 - [2, 3, 5, 7]
 - [“My”, “dog”, “has”, “fleas”]
- Every **for** loop uses a list

Definite Loops

- *Loop*: a control structure for executing a portion of a program multiple times
- *Definite loop*: Python knows beforehand how many times to repeat the body of the loop
- Syntax:
 for <var> in <sequence> :
 <body>
- Semantics: Executes <body> once for every element of <sequence>, with <var> set to that element.

Some Definite Loops

The diagram illustrates two Python for loops. The first loop, `for i in [0, 1, 2, 3, 4, 5]:`, has a callout 'Loop index' pointing to the variable `i` and a callout 'Loop sequence' pointing to the list `[0, 1, 2, 3, 4, 5]`. The second loop, `for b in ["John", "Paul", "George", "Ringo"]:`, has a callout 'Loop body' pointing to the `print` statement. The code is presented in a white box on a dark background.

```
for i in [0, 1, 2, 3, 4, 5]:  
    print(2**i)  
  
for b in ["John", "Paul", "George", "Ringo"]:  
    print(b, "was a Beatle")
```

The range Function

- Creates a list that is an *arithmetic sequence*
- General formats for range function:
 - `range(<expr>)`
 - `range(<expr>, <expr>)`
 - `range(<expr>, <expr>, <expr>)`

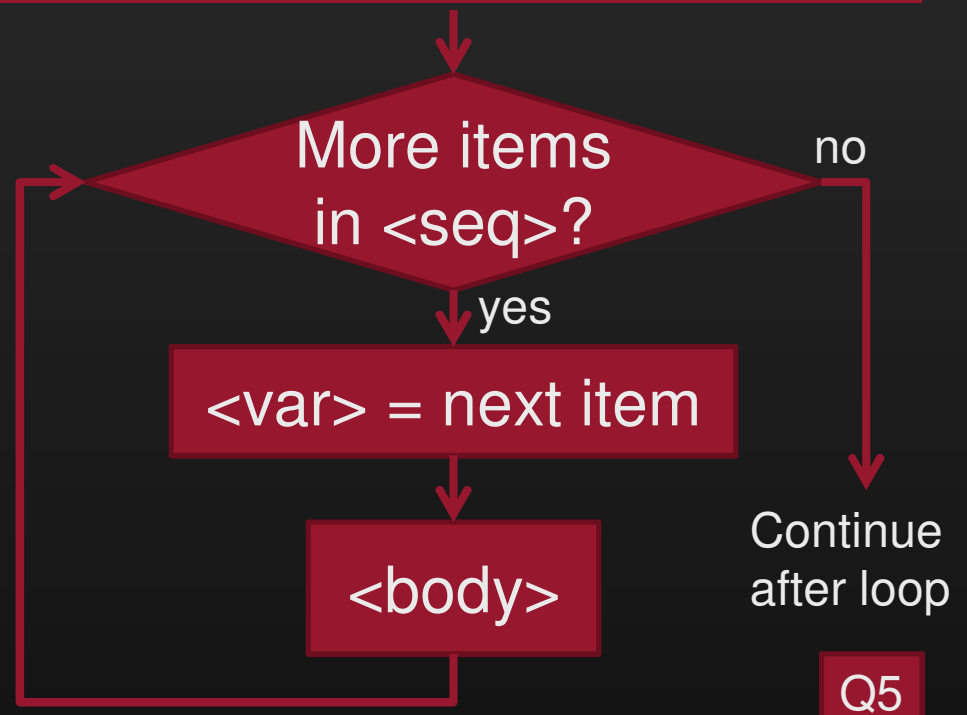
- Consider:

```
list(range(8))  
list(range(1, 7))  
list(range(3, 18, 2))  
list(range(4, 10, -1))  
list(range(17, -5, -3))
```

Accumulator Loop

- Accumulator combines parts of a list
- Common technique!
- Consider:

```
a = 0
for j in [1, 2, 3, 4]:
    a = a + j
    print(a)
```



Q5

Another loop with an accumulator

- Find the sum of all of the positive odd numbers that are ≤ 13
- Do it together as a class, in function **sumOddPositiveLessThan()**

More math library components

Python	Mathematics	English
pi	π	Approximation of pi
e	e	Approximation of e
sin(x)	sin x	The sine of x
cos(x)	cos x	The cosine of x
tan(x)	tan x	The tangent of x
atan2(y, x)	$\tan^{-1} y/x$	Arc tangent of angle of line from (0,0) to (x, y)
log(x)	ln x	The natural (base e) log of x
log10(x)	$\log_{10}x$	The base 10 log of x
exp(x)	e^x	The exponential of x



Reference!

Math library functions

- Quadratic formula to find real roots for quadratic equations of the form $ax^2 + bx + c = 0$

- Solution:

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

- Write out the Python expression for the first formula.
- If time permits, test it in Eclipse

Q6

Work Time

**HW2 due Wednesday at 8:00 AM,
HW3 due Thursday at 8:00 AM**