ASSIGNMENT, LOOPS, AND BASIC TYPES

CSSE 120 – Rose-Hulman Institute of Technology

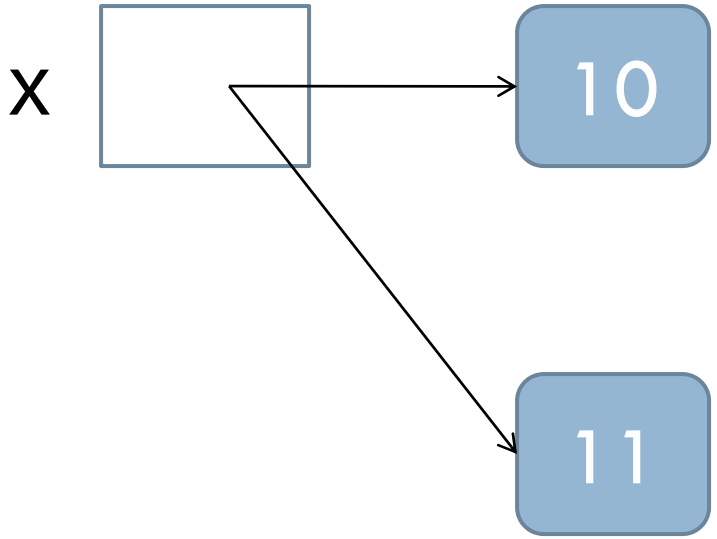
Outline (some of Chapters 2 and 3)

- Variables and assignments
- Definite loops
- Basic types: numbers (int and float)
- Math library
- Accumulator problem

Variables and Assignments

- Variable
  - Identifier that stores a value
  - A value must be *assigned* to the variable
  - <variable> = <expr> (syntax)
- Assignment
  - Process of giving a value to a variable
  - Python uses = (equal sign) for assignment
    - x = 0.25
    - x = 3.9 * x * (1 – x)

Variables as sticky notes



x = 10

x = x + 1

Assignment Statements

1. Simple assignments
   - <variable> = <expr>
2. Input assignments
   - <variable> = input(<prompt>)
     - temp = input("Enter high temperature for today")
3. Compound assignments
   - <var>op=<expr> means <var> = <var> op <expr>
     where op is +, -, *, /,or %
     - Example: total += 5 is the same as total = total + 5
4. Simultaneous assignments
   - <var>, <var>, …, <var> = <expr>, <expr>, …, <expr>
     - sum, diff = x + y, x - y

Sequences

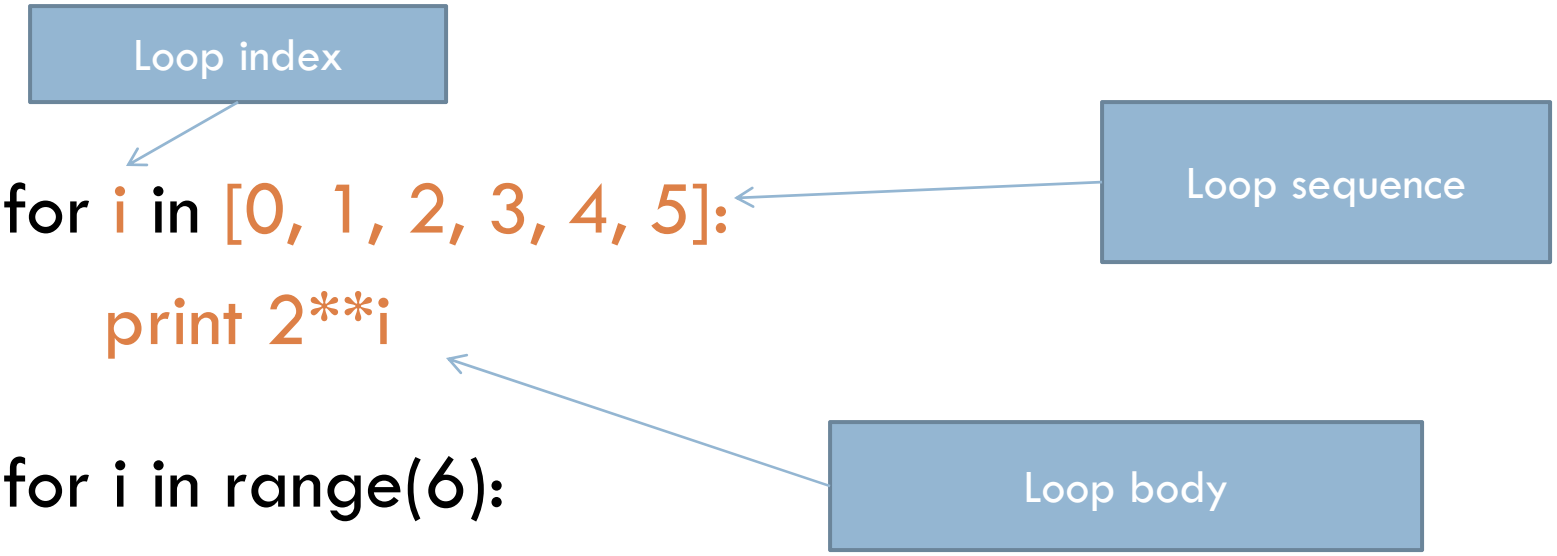
- A list of things
- For example:
  - [2, 3, 5, 7]
  - [“My”, “dog”, “has”, “fleas”]
- Some can be generated by the **range** function:
  - range(<expr>)
  - range(<expr>, <expr>)
  - range(<expr>, <expr>, <expr>)

Definite loops

- Definition
  - Loop: a control structure for executing a portion of a program multiple times
  - Definite: Python **knows** how many times to iterate the body of the loop
- Syntax:

```
for <var> in <sequence> :
    <body>
```

Examples using loops

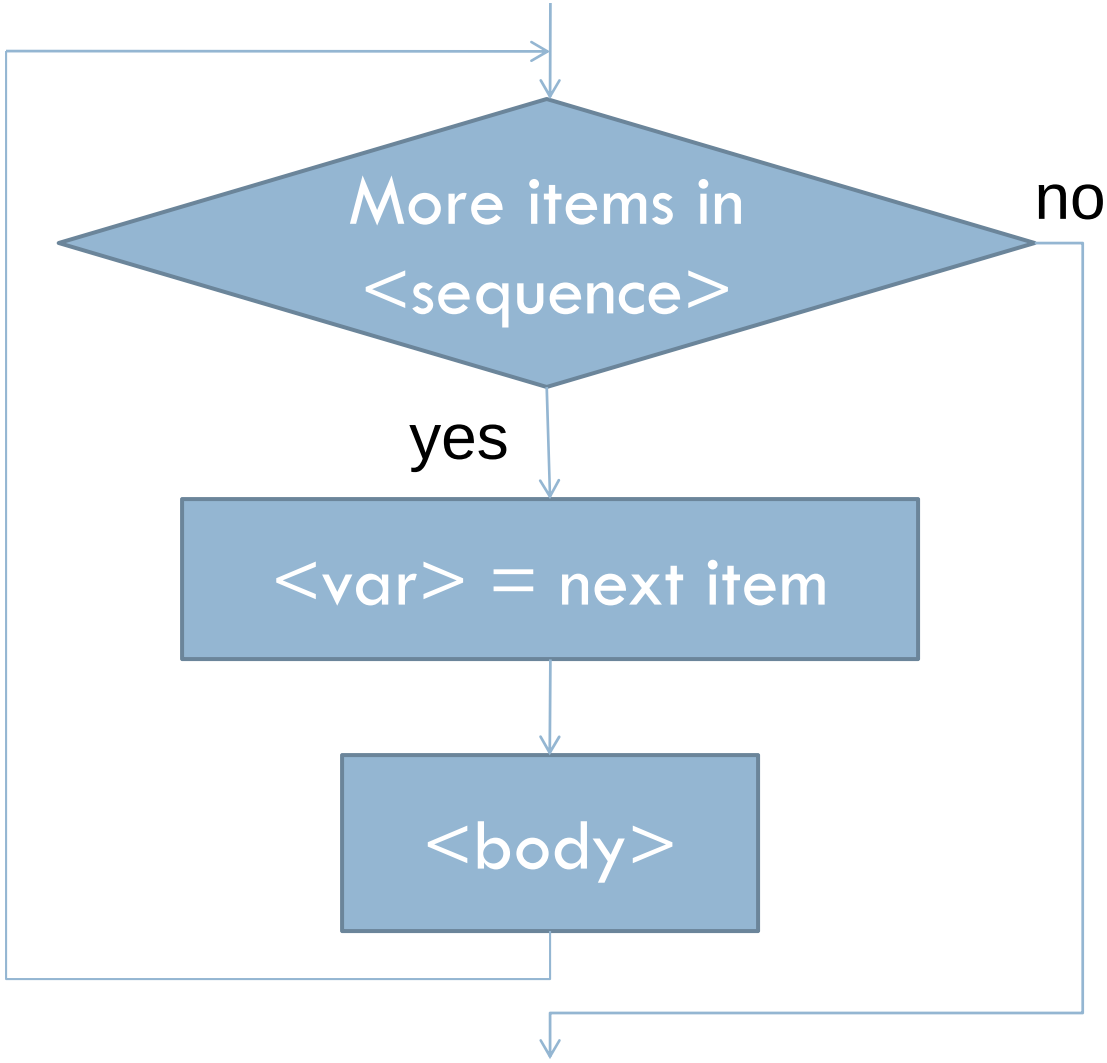



```
>>> for i in [0, 1, 2, 3, 4, 5]:
        print 2**i

>>> for i in range(6):
        print 2**i

>>> for b in ["John", "Paul", "George", "Ringo"]:
        print b, " was a Beatle"
```

Flowchart for a **for** loop



Trace this by hand:

```
a = 0
for i in range(4):
    a = a + i

print a
```

An ***accumulator*** combines parts of a list using looping.

We'll use this idea often this term!

Q5

Data types

- *Data*
  - Information stored and manipulated on a computer
  - Different kinds of data will be stored and manipulated in different ways
- *Data type*
  - A particular way of interpreting bits
  - Determines the possible values an item can have
  - Determines the operations supported on items

Numeric data types

```
print "Please enter the count of each kind of coin."
quarters = input("Quarters: ")
dimes = input("Dimes: ")
nickels = input("Nickels: ")
pennies = input("Pennies: ")
total = quarters * 0.25 + dimes * 0.10 + nickels *
   .05 + pennies * .01
print "The total value of your change is", total
```

Finding the Type of Data

- Built-in function *type(<expr>)* returns the data type of any value
- Find the types of: 3, 3.0, -32, 64.0, “Shrubbery”, [2, 3]
- Why do we need different numerical types?
  - Operations on int are more efficient
    - Compute algorithm for operations on int are simple and fast
  - Counting requires int
  - Floats provide approximate values when we need real numbers

Built-in Help

- dir()
- dir(<identifier>)
- help(<identifier>)

- To see which functions are built-in, type:
  - dir(__builtins__)
- To see how to use them, type:
  - help(__builtins__)

Some Numeric Operations

Operator	Operation
+	Addition
-	Subtraction
*	Multiplication
/	Division
**	Exponentiation
%	Remainder
//	Integer division (even on floats)

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

Q8b,c

Math library functions

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

- Solution:

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

- Write out the Python expression for the first formula.
- If you have time, test it in IDLE

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 (inverse 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

EXPLORING WITH PYTHON

Q10-11

Pair Programming

- Working in pairs on a single computer
  - One person, the *driver*, uses the keyboard
  - The other person, the *navigator*, watches, thinks, and takes notes
- For hard (or new) problems, this technique
  - Reduces number of errors
  - Saves time in the long run
- Works best when partners have similar skill level
- If not, then student with most experience should navigate, while the other student drives.

Food tasting

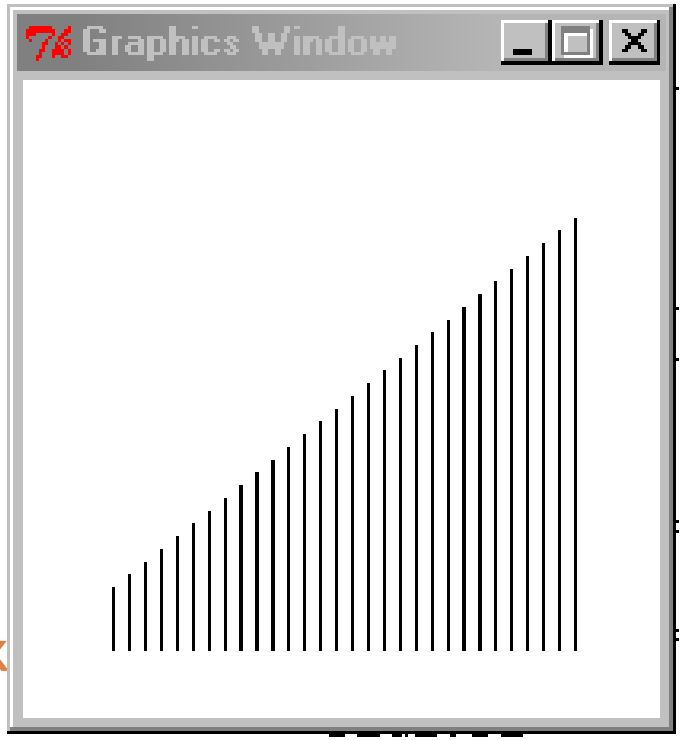
- Suppose you are at food tasting show and are tasting 5 different dishes
- Sampling the dishes in different orders may affect how good they taste
- If you want to try out every possible ordering, how many different orders would there be?
  - That number is the factorial of 5
  - $n! = n\ (n - 1)\ (n - 2)\ \ldots\ (1)$
- What type of problem is this?

Accumulating results: factorial

- Work in groups of two
  - Pick a driver and navigator
- Write a Python program that
  - Prompts the user for an integer
  - Calculates the factorial of the integer
    - n! = n (n – 1) (n – 2) … (1)
  - Outputs the result to the screen
- Driver: email the code to your partner (so each has the program for the open-computer parts of exams)
- Submit one copy of program with both student's names in a program comment.
- Submit it in ANGEL to the Lessons > Homework > Homework 3 > Factorial Drop Box

Graphics Exercise with loops

- Trade roles with partner—new driver, new navigator
- Write a program that draws a figure like this where the lengths of the lines increase by a constant amount
- Use your previous graphics program as a model of how to import graphics functions, create a window, etc.
- You may want to use variables to hold current x-coordinate and current line length, and change the values of those variables each time through the loop
- Homework 3 > Bar Chart Drop Box



If you don't finish Factorial or Bar Chart program

- Meet before next class to finish them
- Reminders:
  - Driver: email the code to your partner (so each has the program for the open-computer parts of exams)
  - Submit one copy of program with both student's names in a program comment.
  - Log into Angel and go to the class's webpage
  - Click on the Lessons tab then go to Homework > Homework 3
  - Submit the factorial program in the Factorial Drop Box
  - Submit the line drawing program in the Bar Chart Drop Box