ASSIGNMENT, LOOPS, AND BASIC TYPES

CSSE 120 – Rose-Hulman Institute of Technology

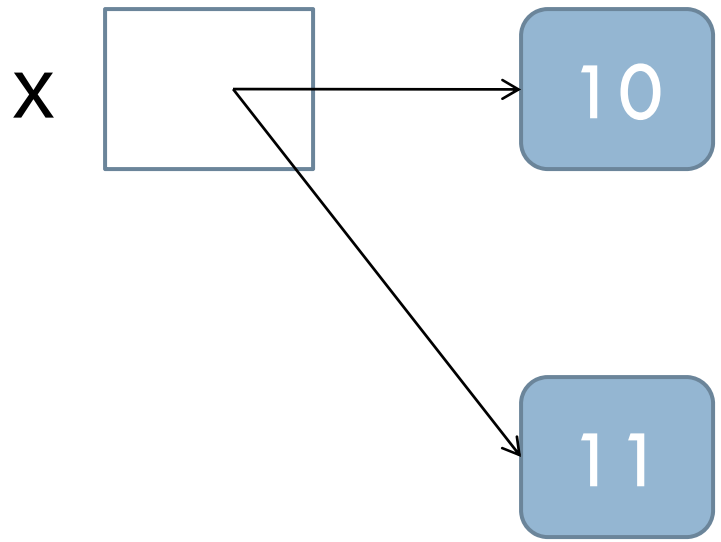
Outline

- 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
  - Uses = (equal sign)
    - x = 0.25
    - x = 3.9 * x * (1 – x)

Variables as sticky notes



x = 10

x = x + 1

Assignment Statements

- Simple assignments
  - <variable> = <expr>
- Input assignments
  - <variable> = input(<prompt>)
    - temp = input("Enter high temperature for today")
- 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”]
- Can be generated by the range function
  - range(<expr>)
  - range(<expr>, <expr>)
  - range(<expr>, <expr>, <expr>)

Definite loops

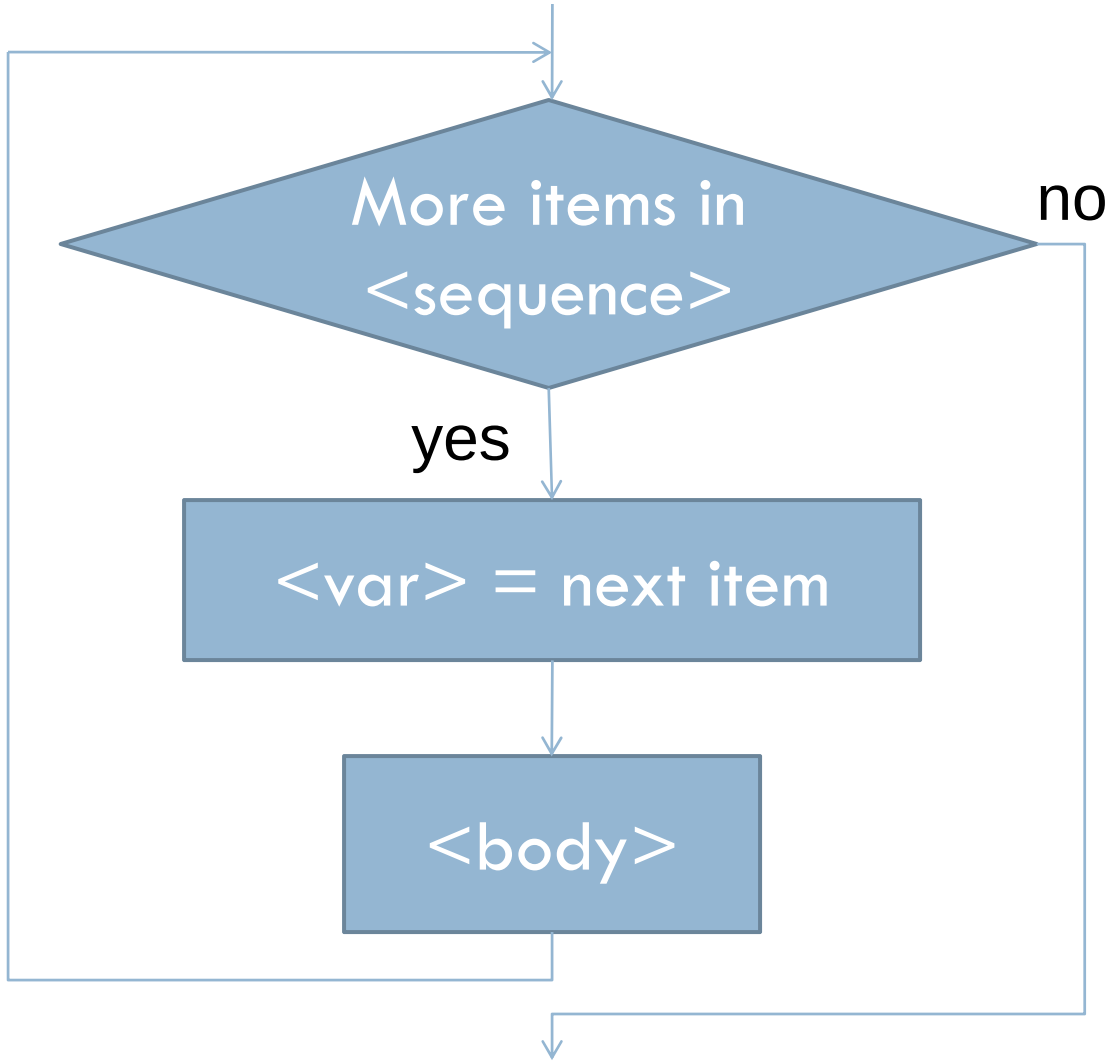
- Definition
  - Loop: a control structure for executing a portion of a program multiple times
  - Definite: Python **knows** how many times to iterate the body of the loop
- Syntax:

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

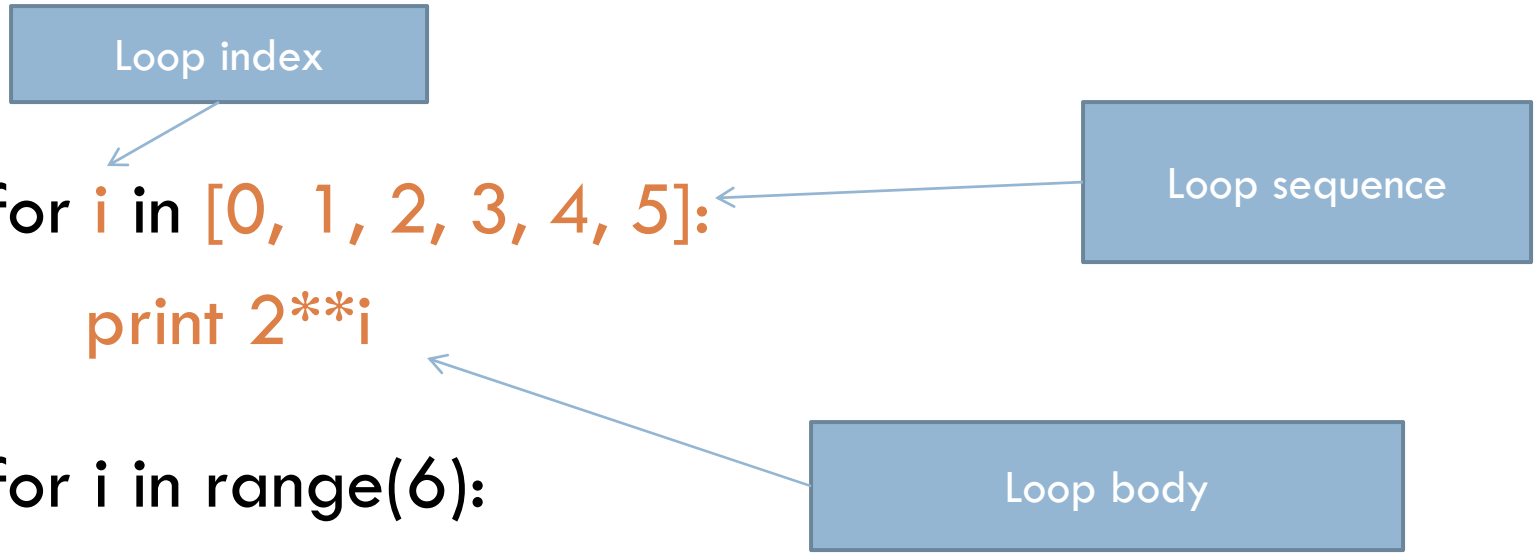
Counted Loops

- A definite loop whose sequence can be generated with range(…)
- Example counted loop:
  - for x in range(2,4):
    print x
- Example definite loop that isn't a counted loop:
  - for p in [2, 3, 5, 7, 11]:
    print p, "is prime"

Flowchart for a for loop



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"
```

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

- From Angel copy the content of the following file and place it in a new Python window:
  Lessons → Modules to Download in Class→
  Session 3 → change.py
- Save as myChange.py

- Numeric types
  - Whole numbers int
  - Fractional numbers float

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

Some Numeric Operations

Operator	Operation
+	addition
-	subtraction
*	multiplication
/	division
**	exponentiation
%	remainder
//	Do 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 an int data type
float(n)	Convert n to a float data type

Math library functions

From Angel copy the content of the following file and place it in a new Python window:

Lessons → Modules to Download in Class → Session 3 → quadratic.py

Save as myQuadratic.py

- Finds real roots for quadratic equations of the form

  $ax^2 + bx + c = 0$

- Solution

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

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
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

Built-in Help

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

EXPLORING WITH PYTHON

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 the technique:
  - Reduces number of errors
  - Saves time in the long run

Problem 1

- 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 one person to drive and the other to navigate
  - If you have programmed before, try to find a partner who has also done so
- In groups of 2 write a Python program that
  - Prompts the user for an integer
  - Calculates the factorial of the integer
    - $n! = n\ (n - 1)\ (n - 2)\ \ldots\ (1)$
  - Outputs the result to the screen

Submitting your program

- Meet before next class to finish it
- You'll also want to meet to work on the robot part of the HW
- Driver: email the code to your partner (so each has the program for the open-computer parts of exams)
- Log into to Angel and go to the class's webpage
- Click on the lessons tab then go to the In-class Exercise Drop Boxes
  - Submit the factorial program in the Factorial Drop Box
- The robot dropbox is in the Homework 3 folder