# ASSIGNMENT AND LOOPS

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

# Some Numeric Operations

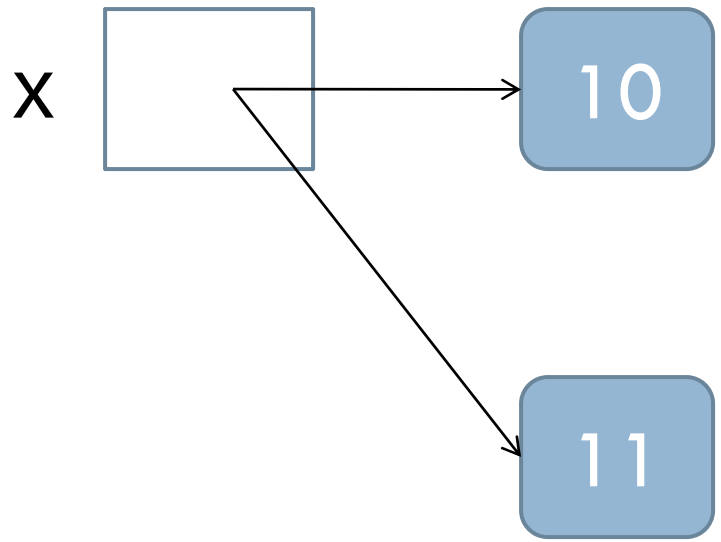
| Operator | Operation |
|---|---|
| + | Addition |
| - | Subtraction |
| * | Multiplication |
| / | Division |
| ** | Exponentiation |
| % | Remainder |
| // | Integer division (even on floats) |

| 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 |

# Variables and Assignments

- Variable
  - Identifier that stores a value
  - A value must be *assigned* to the variable when it is created
  - <variable> = <expr> (assignment syntax)
- Assignment
  - Process of giving a value to a variable
  - Python uses = (equals 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 (multiple) assignments
   - <var>, <var>, …, <var> = <expr>, <expr>, …, <expr>
     - `sum, diff = x + y, x - y`

# Compound Assignment: += and related operators (-=, *=, …)

- a += b is equivalent to a = a + b

```
IDLE 1.2.1
>>> x = 5
>>> x += 6; print x
11
>>> x *= 2; print x
22
>>> x -= 3; print x
19
>>> x %= 7; print x
5
>>> s = "abc"
>>> s += "d"; print s
abcd
```

```
>>> nums = [1,2,3]
>>> nums += [4,5]
>>> print nums
[1,2,3,4,5]
```

# Sequence

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

# Definite loops

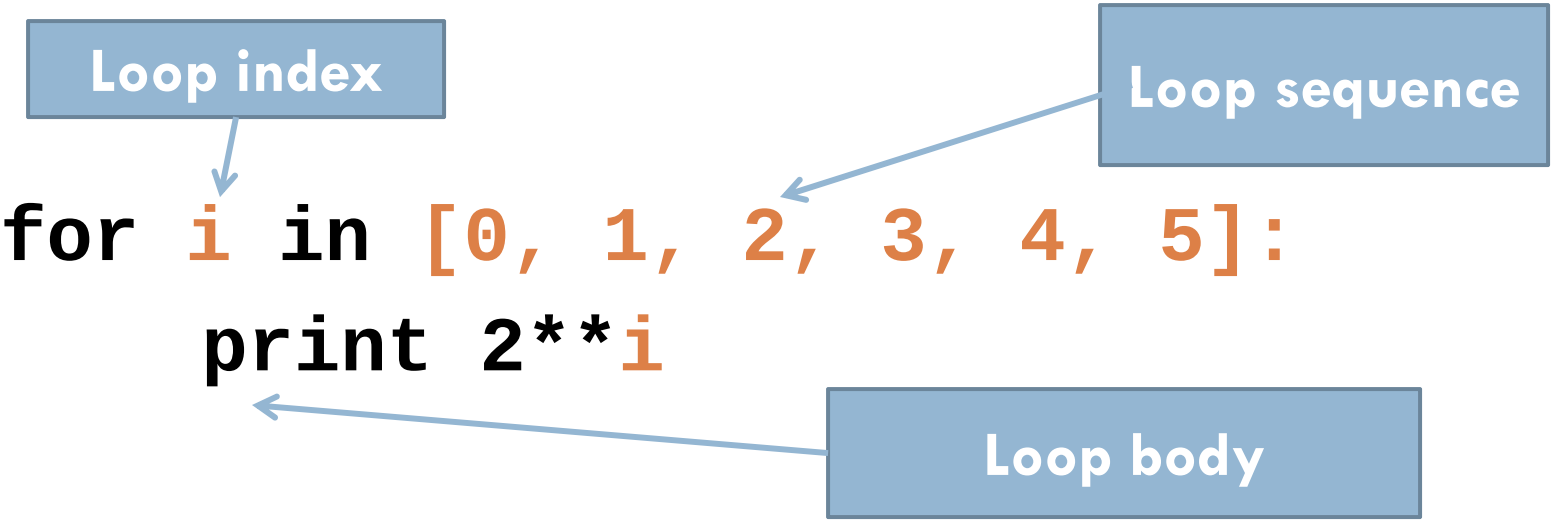
- Definition
  - **Loop:** a **control structure** for executing a portion of a program multiple times
  - **Definite**: Python **knows** how many times to iterate the body of the loop
- Syntax:

  for <var> in <sequence> :

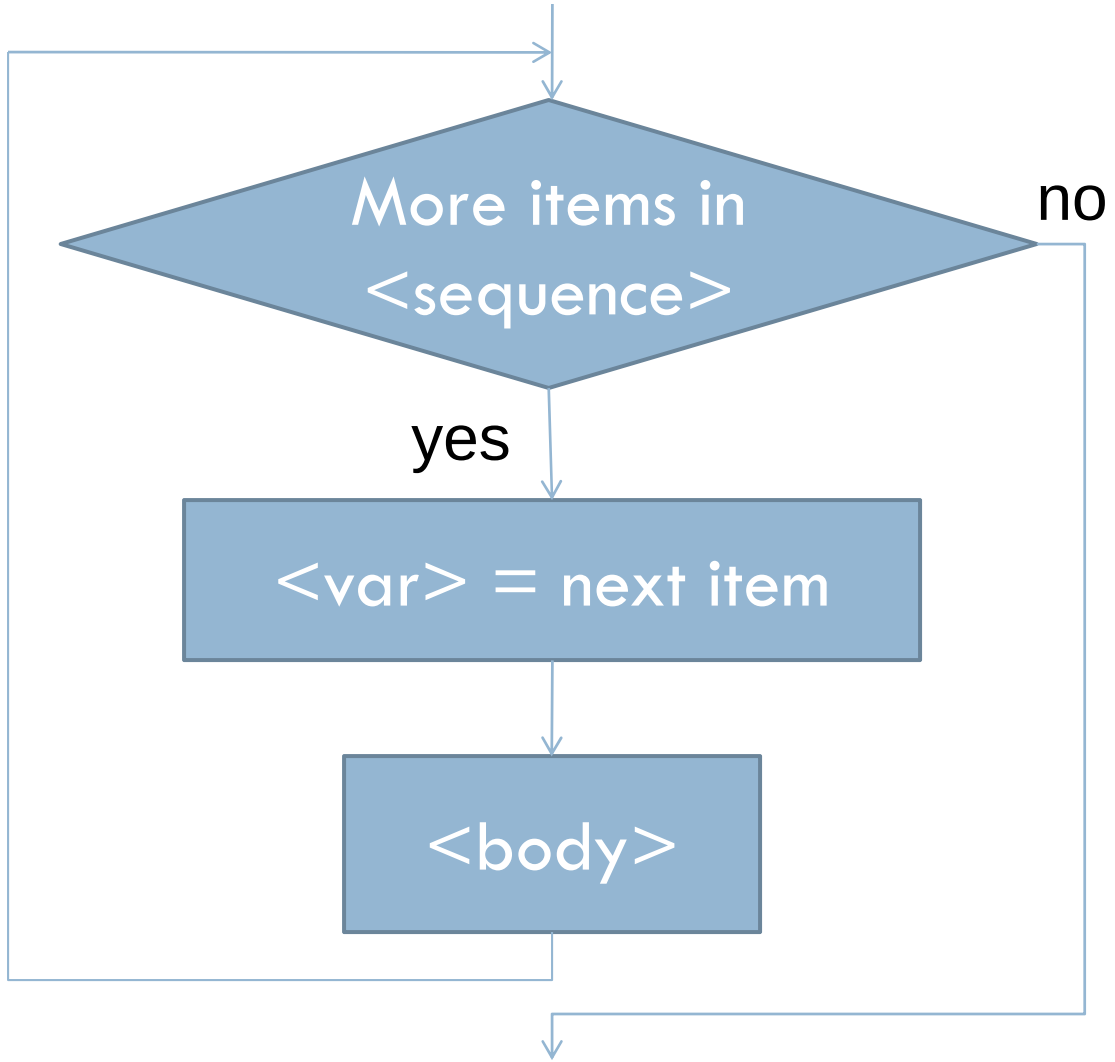
  <body>

  **Executes <body> once for every element of <sequence>, with <var> set to that element.**

# Examples using loops



# Flowchart for a **for** loop




Trace this by hand:

```
a = 0
for i in [1, 2, 3, 4]:
    a = a + I
    print a
```

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

We'll use this idea often this term!

**Q5**

# The range function

- A way to create a list that is an arithmetic sequence
- Useful to generate a list used by a for loop
  - General formats for *range* function:
  - **`range(<expr>)`**
  - **`range(<expr>, <expr>)`**
  - **`range(<expr>, <expr>, <expr>)`**
- What do the following **range** calls do?
- print range(8)
  print range(3, 18, 2)
  print range(17, -5, -3)
  print range(1, 7)
  print range(4, 10, -1)

# Use range to make the list for a loop

```
for i in range(7):
    print i, i*i
for i in range(15, 2, -1):
    print i,
print
```

# Another loop with an accumulator

- Find the sum of the odd numbers that are $\leq 13$
- Do it together as a class, in IDLE

# More math library components

| Python | Mathematics | English |
|---|---|---|
| pi | $\pi$ | 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 |

# 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**

# 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, 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

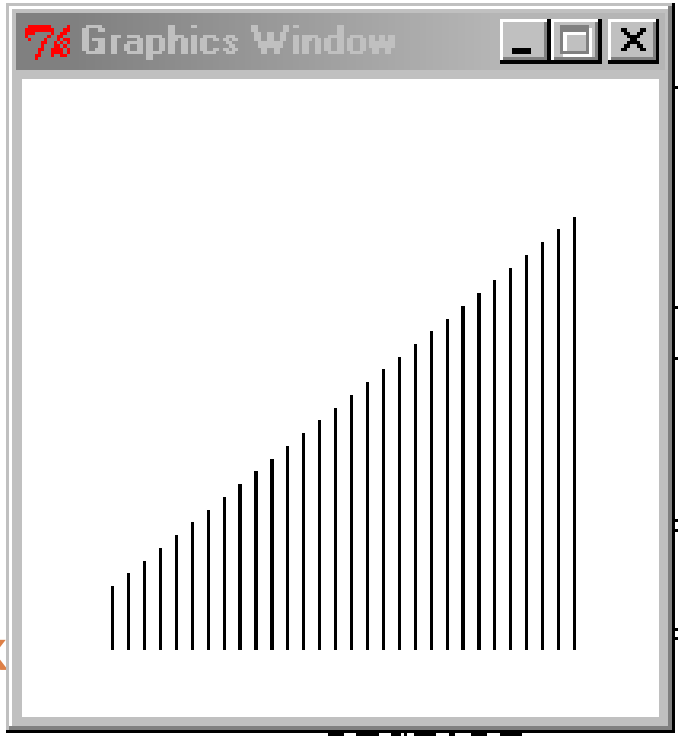
- Suppose you are at food tasting show and are tasting 5 different dishes
- Sampling the dishes in different orders may affect how good they taste
- If you want to try out every possible ordering, how many different orders would there be?
  - That number is the factorial of 5
  - $n! = n\,(n-1)\,(n-2)\,\ldots\,(1)$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