As you arrive:

1. Start up your computer and plug it in
2. ***Log into Angel*** and go to CSSE 120
3. Do the ***Attendance Widget*** – the PIN is on the board
4. Go to the course ***Schedule Page***
   - From your *bookmark*, or from the *Lessons* tab in Angel
5. Open the ***Slides*** for today if you wish

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

Check out project for today

- Go to SVN Repository view, at bottom of the workbench
  - If it is not there,
    Window→Show View→Other→SVN → SVN Repositories
- Browse SVN Repository view for
  03-AssignmentsAndLoops project
- Right-click it, and choose Checkout
  - Accept options as presented
- Expand the 03-AssignmentsAndLoops project that appears in Package Explorer (on the left-hand-side)
  - Browse the modules.
  - We will start with ***intsAndFloats.py*** (next slide)

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

Variables are *identifiers* that refer to *values* stored in *memory.* Case matters – variables `width` and `Width` are independent of each other!

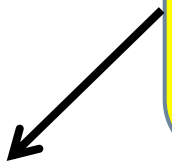
```
width = 4
temperature = 98.6
```

Values can be integers, floating point numbers, strings, lists, and more.

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

Expressions are built from variables, literals and function calls, and can be ***evaluated.***

<variable> = <expr>



```
triangleArea = width * height / 2
xyPoint = (r * cos(theta), r * sin(theta))
```

Variables and assignments

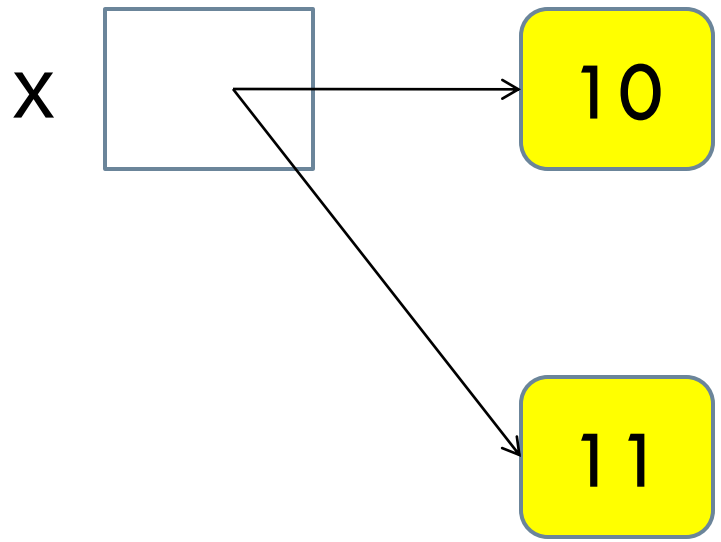
Assignment gives a variable a value, using the <*variable*> = <*value*> notation. Read it as "gets" or "becomes". The right-hand-side is evaluated. The name <*variable*> on the left-hand-side then refers (points to) that <*value*>.

```
x = 0.25
```

Statements like the following, while terrible mathematics, are perfectly sensible in software development. The first one, for example, is read as "*x becomes 3.9 times x was plus times 1 minus what x was.*"

```
x = 3.9 * x * (1 - x)
interestRate = interestRate * 1.5
```

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`

Explore with assignment statements

- Examine the ***assignmentsAndLoops.py*** module in your Eclipse project.
- Do the TODO's in it.
  - I'll demo some of them with you.

Q1-2

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]
```

Q3

Sequence

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

Definite loops

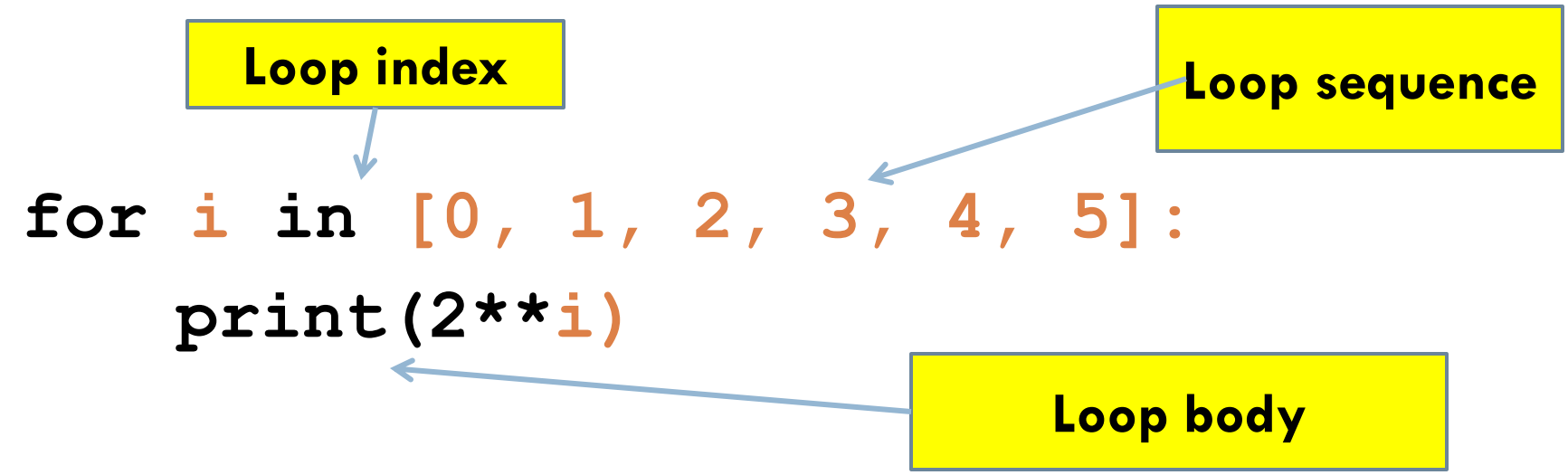
- Definition
  - **Loop:** a **control structure** for executing a portion of a program **multiple times**
  - **Definite**: Python **knows** how many times to iterate the body of the loop
- Syntax:

  for <var> in <sequence> :

  <body>

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

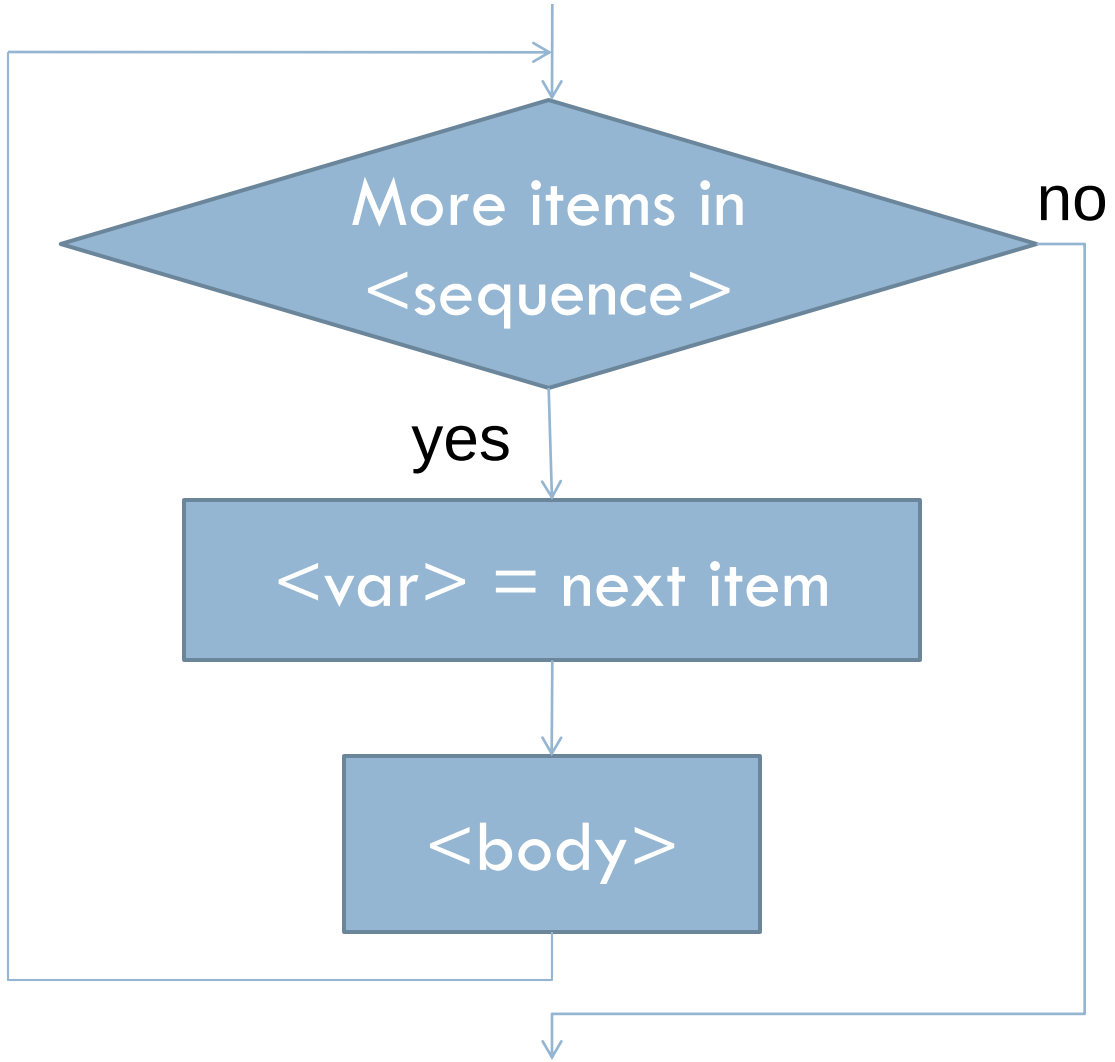
Examples using loops




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

Q4

Flowchart for a **for** loop



Trace this by hand:

```
a = 0
for j in [1, 2, 3, 4]:
    a = a + j
    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(1, 7))
  print(range(3, 18, 2)) print(range(4, 10, -1))
  print(range(17, -5, -3))

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

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

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 time permits, test it in Eclipse**

Q6

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

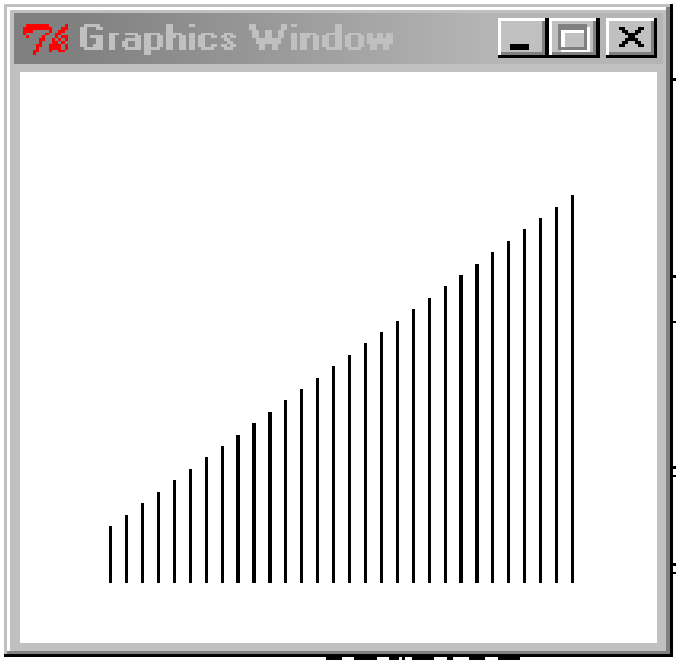
- Suppose you are at food tasting show and are tasting 5 different dishes
- Sampling the dishes in different orders may affect how good they taste
- If you want to try out every possible ordering, how many different orders would there be?
  - That number is the factorial of 5
  - $n! = n\,(n-1)\,(n-2)\,\ldots\,(1)$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

Accumulating results: factorial

- Work with a partner (pick a driver and navigator)
- Write a Python program in **factorial.py** that
  - Prompts the user for an integer
  - Calculates the factorial of the integer
    - n! = n (n – 1) (n – 2) … (1)
  - Does **not** use the built-in `math.factorial` function
  - 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.
- Commit your solution to you SVN repository

Graphics Exercise with loops

- Trade roles with partner—new driver, new navigator
- Write a program in **barChart.py** that draws a figure like this where the lengths of the lines increase by a constant amount
- Use your previous graphics program to model 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
- Commit your solution to SVN.



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
  - Commit the factorial program to your SVN repository
  - Commit the line drawing program to your SVN repository