Register your i>clickers on the course Compass page.

Complete homework before NEXT Wednesday at 5:00 p.m.
A set of instructions executed by a computer to achieve a goal is called:

A. a process
B. a program
C. a procedure
D. an algorithm
A group of eight bits is called:
A a nybble
B a chomp
C a byte
D a gobble
Question #3

Python is:
A a high-level language
B a low-level language
Python is:
A an interpreted language  
B a compiled language
Elements of Programming
What is a **literal**?

- Fixed value (noun)
- Represents data that doesn’t change (3 or ‘firefly’)
Executing a literal?

**processor**
Executing a literal?

3 → processor
Executing a literal?
What is an operator?

- Manipulates data (verb)
Executing an operator?
It needs a statement to make sense!
What is an **expression**?

- Combines literals and operators (phrase)
What is an expression?

- Combines literals and operators (phrase)
- Produce a new value
  - $3 \times 5$
  - $100 - 23$
Executing an expression?

3+5

processor
Executing an expression?

3 + 5 → processor → 8
What is an expression?

- Can be arbitrarily complicated
  - $3 + 8 \times 5 + 4 - 7/100$
$1 + 1 \times 2 = ?$

A 4

B 3

C Something else
Question

$23 + 6/2 - 4 \equiv ?$

A 22
B 18
C -9
D Something else
Use parentheses!

23 + (6/2) − 4 is always clearer.
What are some other operators?

- exponentiation, **
What are some other operators?

- exponentiation, **
- modulus, % (important)
What are some other operators?

- exponentiation, **
- modulus, % (important)
- floor division, //
What are some other operators?

- bitwise OR, |  
- bitwise XOR, ^  
- bitwise AND, &  
- bitwise left shift, <<  
- bitwise right shift, >>
Example

\[ 1^2 \equiv ? \]

A 0
B 1
C 2
D 3
The machine state hasn’t changed.
- The machine state hasn’t changed.
- Programs are complex, and we need to remember results.
How do we keep values around?

memory

processor
How do we keep values around?

Elements of Programming
How do we reuse values?

- Low-level languages refer directly to memory address:
  
  ```
  ADD DATA AT 10101101 11010100
  TO DATA AT 11010100 01001001
  STORE RESULT AT 00001101 01001110
  ```
What is a **variable**?

- The solution: *name memory locations!*

Elements of Programming
What is a **variable**?

- The solution: **name memory locations**!
- Variables name a memory location
What is a **variable**?

- The solution: *name memory locations!*
- Variables name a memory location
- Variables store a value
What is a **variable**?

- The solution: *name memory locations!*
- Variables name a memory location
- Variables store a value
- This value can change over time—it is a placeholder.
What new operator do we need?

- assignment, \( = \) (single equals sign)
How do we reuse values?

\[ x = 5 \]

memory

processor
How do we reuse values?

\[
x = 5
\]

memory

x = 5

processor
How do we reuse values?

```
x + 1
```

processor

memory

x = 5
How do we reuse values?

\[ x + 1 \]

memory

\[ x = 5 \]

processor
How do we reuse values?

$x + 1$

memory
$x = 5$

processor

6
What value is stored in the variable \( x \)?

\[
x = 17 + 7 \times 9
\]

A 3
B 31
C 55
D 78
What value is stored in the variable $x$?

$x = 17 + 7*9$
$x = 3$

A 0
B 1
C 2
D 3
What is a **statement**?

- A statement changes the state of the computer (sentence)
What is a statement?

- A statement changes the state of the computer (sentence)
- Example: an assignment
What is a program?

- Programs consist of series of statements:
What is a program?

- Programs consist of series of statements:
  - A script is a file containing a series of Python statement.
What is a **program**?

- Programs consist of series of statements:
  - A script is a file containing a series of Python statements.
  - A notebook (as we use in the lab) also collects series of Python statements.
What is a program?

- Programs consist of series of statements:
  - A script is a file containing a series of Python statement.
  - A notebook (as we use in the lab) also collects series of Python statements.
  - These are stored in text (there’s no magic, just text).
What is a **program**?

- Programs consist of series of statements:
  - A script is a file containing a series of Python statement.
  - A notebook (as we use in the lab) also collects series of Python statements.
  - These are stored in text (there’s no magic, just text).
- Each instruction is executed in order from top to bottom—together, these statements make up a program.
Our first program

\[
x = 10 \\
y = x ** 2 \\
y = y + y
\]
Register your i>clicker on Compass.
Homework #1 due Wednesday, Aug. 31, 5:00 p.m.