

Python Basics!

operators, expressions, computing

CS101 Lecture #2

Administrivia

Complete homework before **THIS** Friday at 6:00 p.m.

Warmup Quiz

Question #1

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

Question #2

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

Question #4

Python is:

A an interpreted language

B a compiled language

Elements of Programming

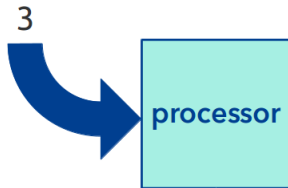
What is a *literal*?

- ❖ Fixed value (noun)
- ❖ Represents data that doesn't change (3 or 'firefly')

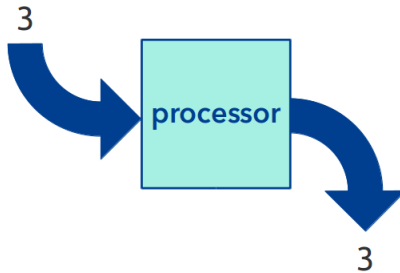
Executing a literal?



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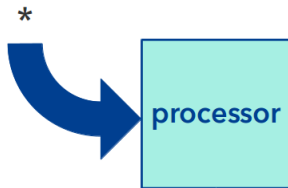
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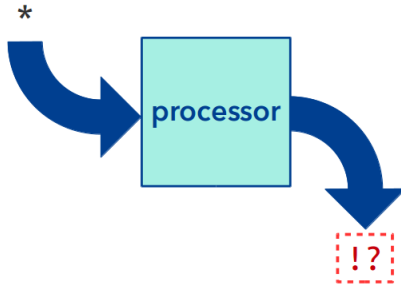
What is an *operator*?

- ❖ Manipulates data (verb)

Executing an operator?



It needs a statement to make sense!



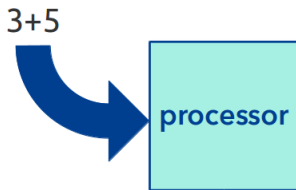
What is an *expression*?

- ▣ Combines literals and operators (phrase)

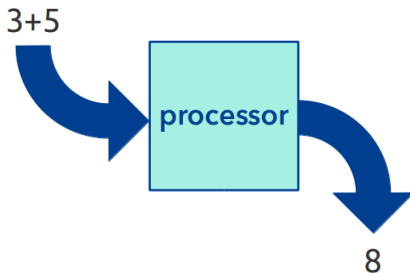
What is an *expression*?

- ❖ Combines literals and operators (phrase)
- ❖ Produce a new value
 - ❖ $3 * 5$
 - ❖ $100 - 23$

Executing an expression?



Executing an expression?



What is an *expression*?

- Can be arbitrarily complicated
 - $3 + 8 * 5 + 4 - 7 / 100$

Question

$$1 + 1 * 2 = ?$$

A 4

B 3

C Something else

Question

$$23 + 6/2 - 4 \stackrel{?}{=}$$

A 22

B 18

C -9

D Something else

Use parentheses!

$23 + (6/2) - 4$ is always clearer.

What are some other operators?

- ▣ exponentiation, `**`

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- ❖ exponentiation, `**`
- ❖ modulus, `%` (important)
- ❖ floor division, `//`

What are some other operators?

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

Example

$$1 \wedge 2 = ?$$

A 0

B 1

C 2

D 3

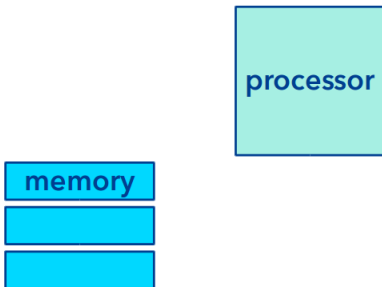
So what?

- ▣ The machine state hasn't changed.

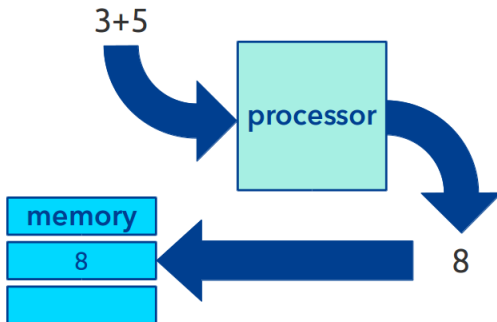
So what?

- ❖ The machine state hasn't changed.
- ❖ Programs are complex, and we need to remember results.

How do we keep values around?



How do we keep values around?



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
```

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- The solution: name memory locations!

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- ❖ The solution: **name memory locations!**
- ❖ Variables name a memory location
- ❖ Variables store a value

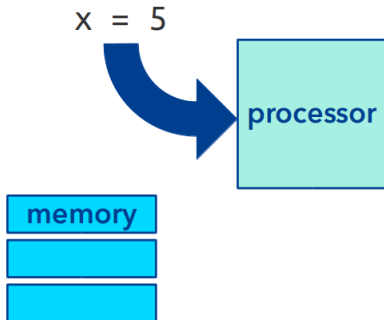
What is a *variable*?

- ❖ The solution: **name memory locations!**
- ❖ Variables name a memory location
- ❖ Variables store a value
- ❖ This value can change over time—it is a placeholder.

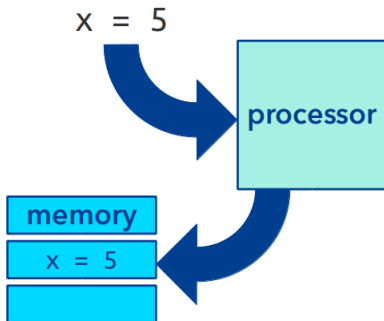
What new operator do we need?

- ❖ assignment, = (single equals sign)

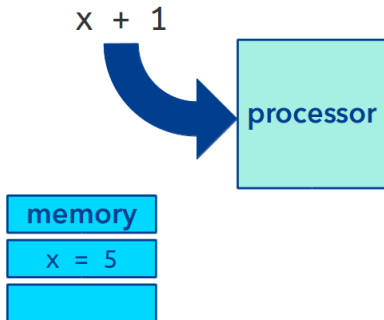
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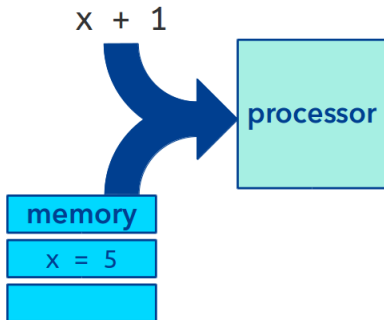
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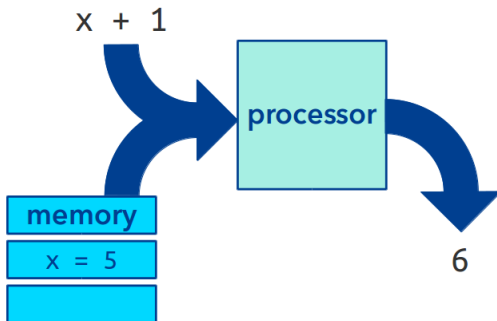
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How do we reuse values?



How do we reuse values?



Example

What value is stored in the variable x?

$x = 17 + 7 * 9$

A 3

B 31

C 55

D 78

Example

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

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 - 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
```

Reminders

Homework #1 due Friday, Sept. 30, 6:00 p.m.