

Python Basics!

operators, expressions, computing

CS101 Lecture #2

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 gobble
- C a byte
- D a bite

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

Question #4

Python is:

A *an interpreted language*

B a compiled language

Interpreted vs Compiled

A *compiled* language has a compiler to compile its code into machine instructions, e.g., C, C++
A *interpreted* language executes its program directly – one line at a time, e.g., python, matlab

Elements of Programming

What is a literal?

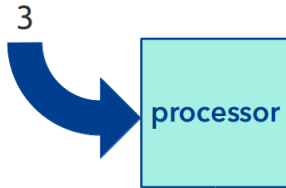
What is a literal?

A fixed value, e.g. 5, 'apple'

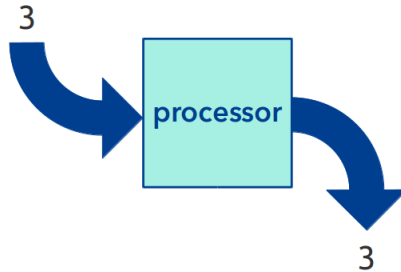
Executing a literal?



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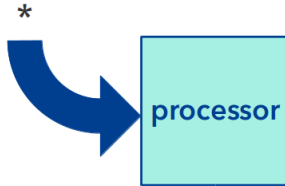
Executing a literal?



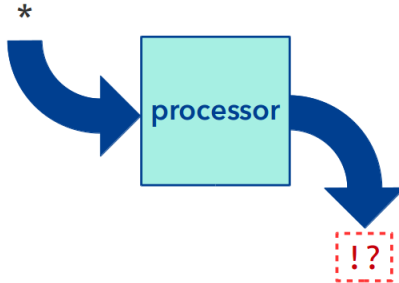
What is an *operator*?

- ❖ Manipulates data (verb)
- ❖ $+, -, *, /$

Executing an operator?



It needs operands to make sense!



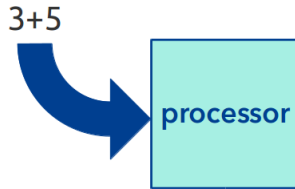
*What is an **expression**?*

- ✦ The combination of operands and operators

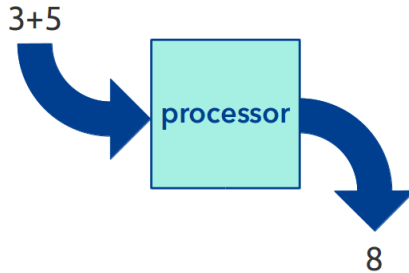
What is an *expression*?

- ❖ The combination of operands and operators
- ❖ Produce a new value (another literal)
 - ❑ $3 * 5$
 - ❑ $100 - 23$

Executing an expression?



Executing an expression?



What is an *expression*?

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

Order of Operator

(also called: Operator Precedence)

$$1 + 1 * 2 \stackrel{?}{=}$$

A 4

B 3

C Something else

Change order of operator by parentheses

$$(1 + 1) * 2 \stackrel{?}{=}$$

A 4

B 3

C Something else

Question

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

A 22

B -1

C 35

D Something else

Use parentheses!

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

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- ❖ floor division, `//`
 - ❑ $5//2 = 2$
 - ❑ $(-5)//2 = ?$

What are some other operators?

- ❖ bitwise OR, |
- ❖ bitwise AND, &
- ❖ bitwise XOR, ^

OR	0	1
0	0	1
1	1	1

AND	0	1
0	0	0
1	0	1

XOR	0	1
0	0	1
1	1	0

Example

$$1 \wedge 2 \stackrel{?}{=}$$

A 0

B 1

C 2

D 3

What are some other operators?

- ❖ bitwise left shift, <<
- ❖ bitwise right shift, >>

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`00001111 << 1 = 00011110`

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`00001111 << 1 = 00011110`

`00011110 >> 2 = 00000111`

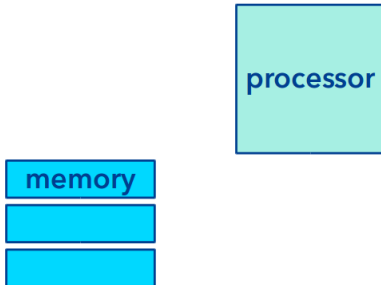
So what?

- ✦ The machine state hasn't changed.

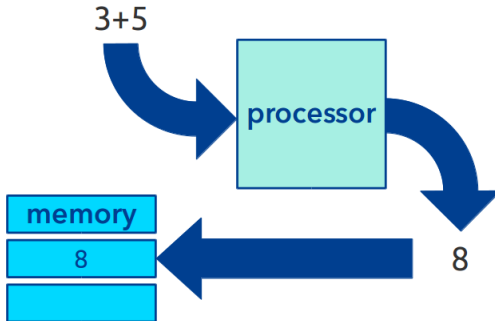
So what?

- ❖ 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?



What is a *variable*?

- The solution: name memory locations!

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

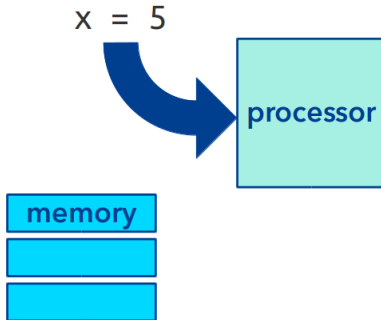
What is a *variable*?

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

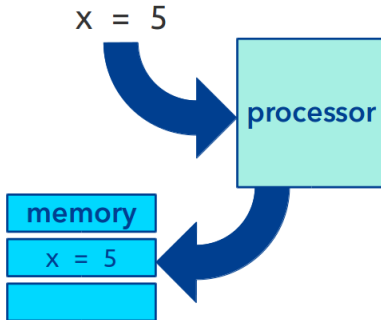
What new operator do we need?

- ✦ assignment, = (single equals sign)

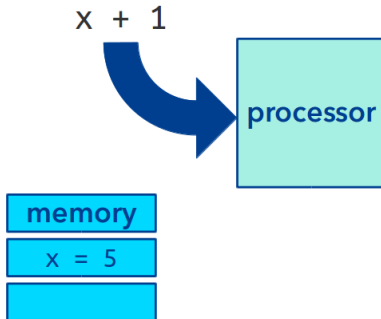
How do we reuse values?



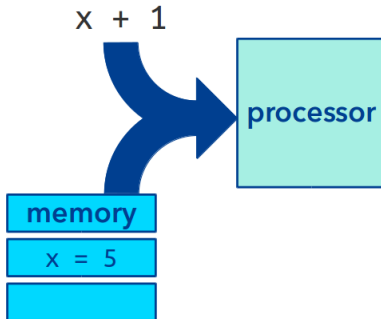
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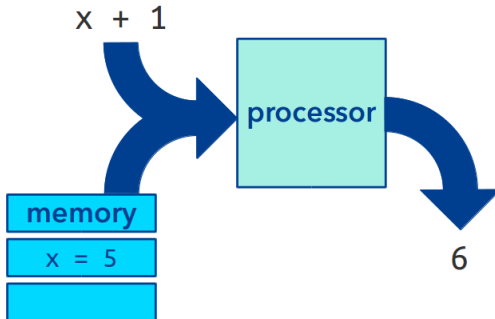
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How do we reuse values?



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 1

B 3

C 6

D Something Else

Example

What value is stored in the variable x?

x = 17 + 7*9

x = 3

x + 3

A 1

B 3

C 6

D Something Else

What is a *statement*?

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- ❖ A *statement* changes the state of the computer (sentence)
- ❖ Example: an assignment

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What is a *program*?

- ❖ Programs consist of series of statements:
 - A series of python statements is also called a python *script*.
 - A python script is stored in text that you can edit (there's no magic, just text).
- ❖ Each statement is executed in order from top to bottom by the python interpreter – together, these statements form a program.

Our first program

```
x = 10  
y = x ** 2  
y = y + y
```

Our first program

```
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y = x ** 2  
y = y + y
```

Save the code to file: `my_first_script.py`

Run from your command line window (Linux or iOS, Windows also OK):

» `python my_first_script.py`

Reminders

Reminders

Homework #1 due Monday, Sep. 25, 6:00 p.m.