Python Basics!

operators, expressions, computing

CS101 Lecture #2

2016-09-28

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

Literal

What is a literal?

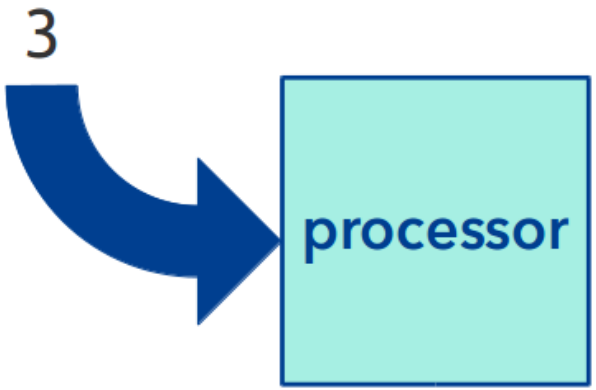
Literal

What is a literal?

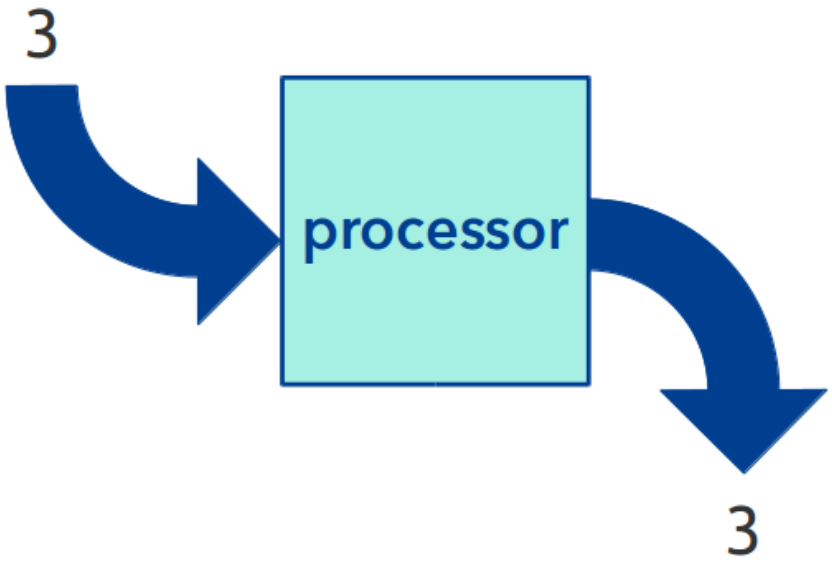
A fixed value, e.g. 5, 'apple'

Executing a literal?

Executing a literal?



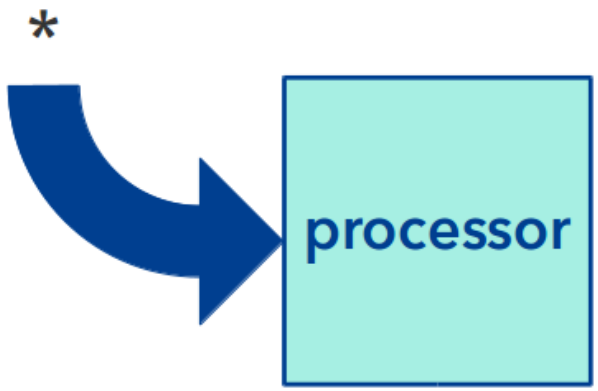
Executing a literal?



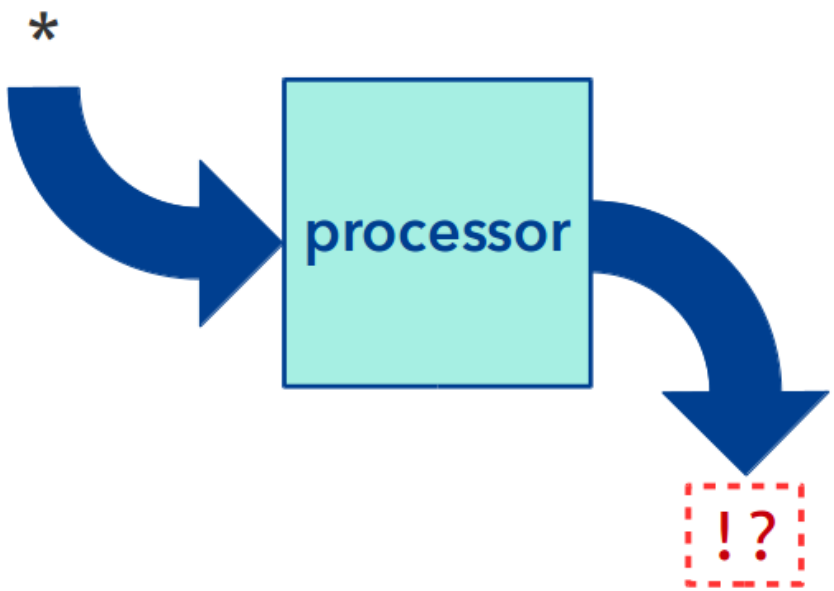
What is an ***operator****?*

- Manipulates data (verb)
- +,−,∗,/

Executing an operator?



It needs operands to make sense!



*What is an **expression**?*

- The combination of operands and operators

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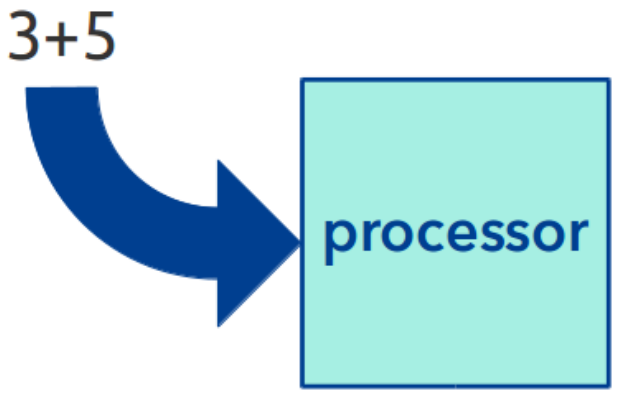
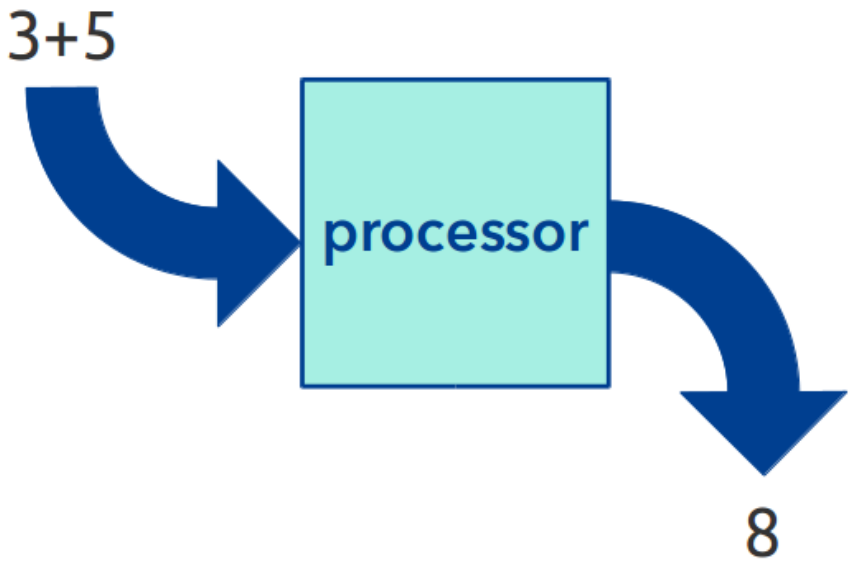
- The combination of operands and operators
- Produce a new value (another literal)
  - `3 * 5`
  - `100 - 23`

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.

What are some other operators?

- exponentiation, **

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  - $5\%2 = 1$
- 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

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

A 0
B 1
C 2
D 3

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- bitwise left shift, <<
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$$00001111 << 1 = 00011110$$

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$$00001111 << 1 = 00011110$$
$$00011110 >> 2 = 00000111$$

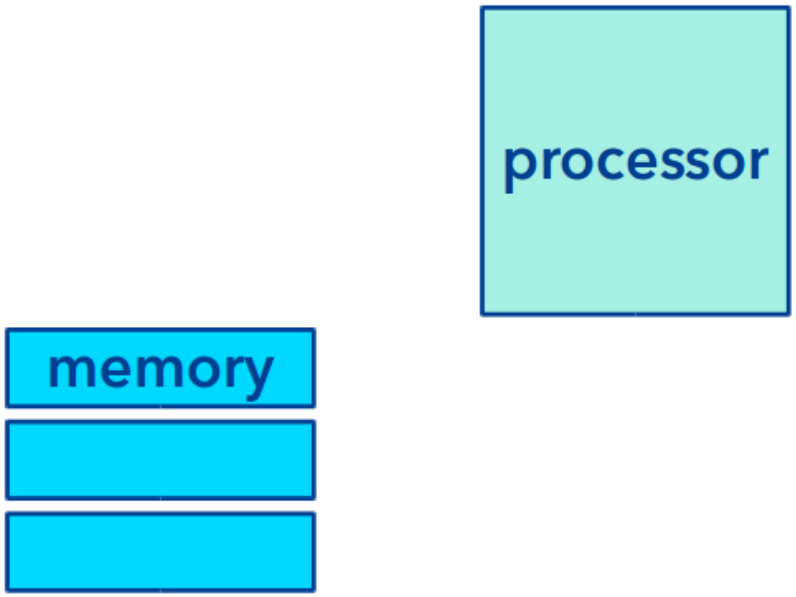
So what?

- 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?



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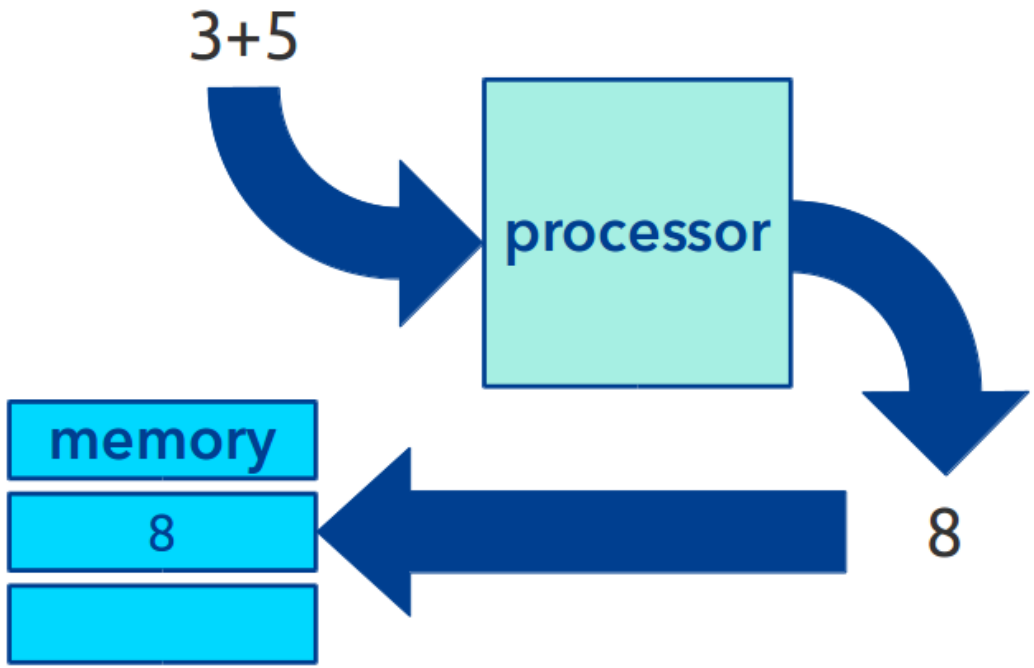

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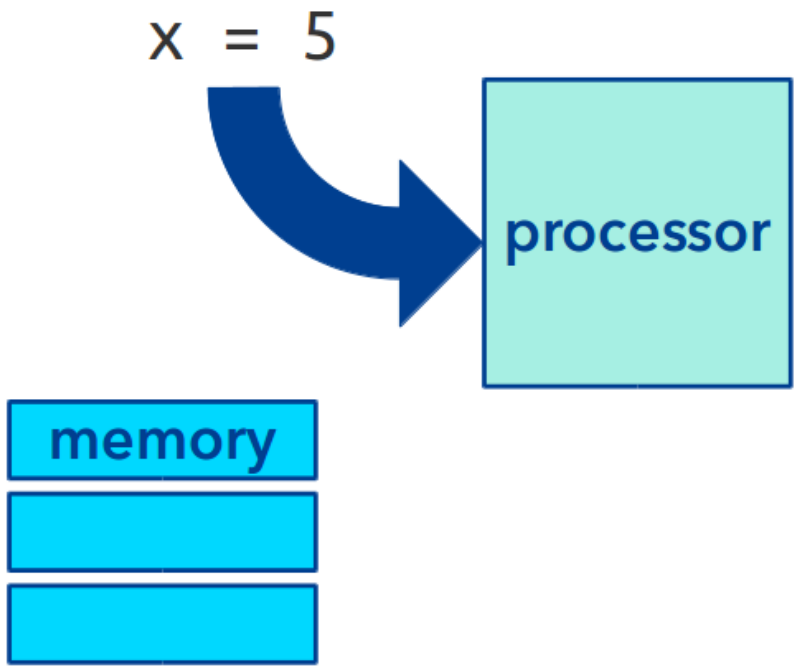
*What is a **variable**?*

- 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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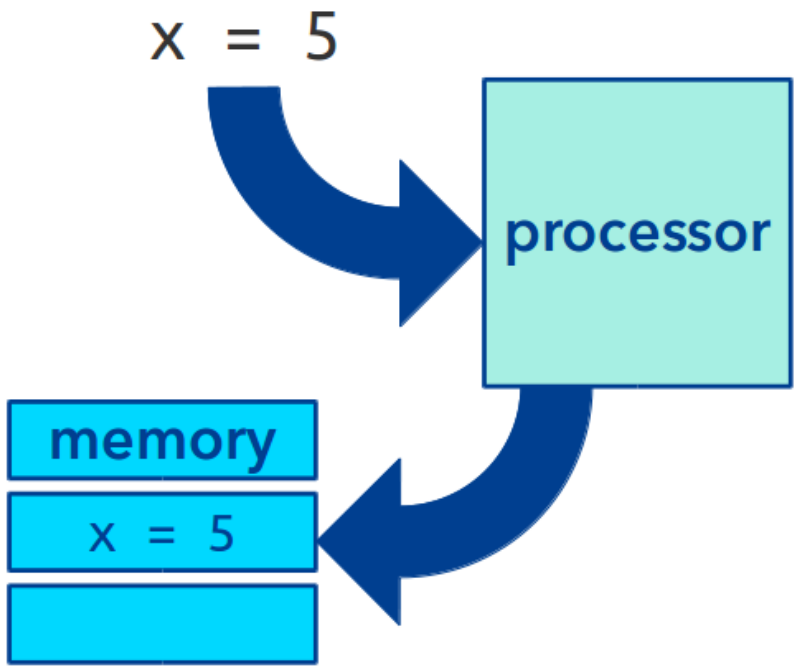

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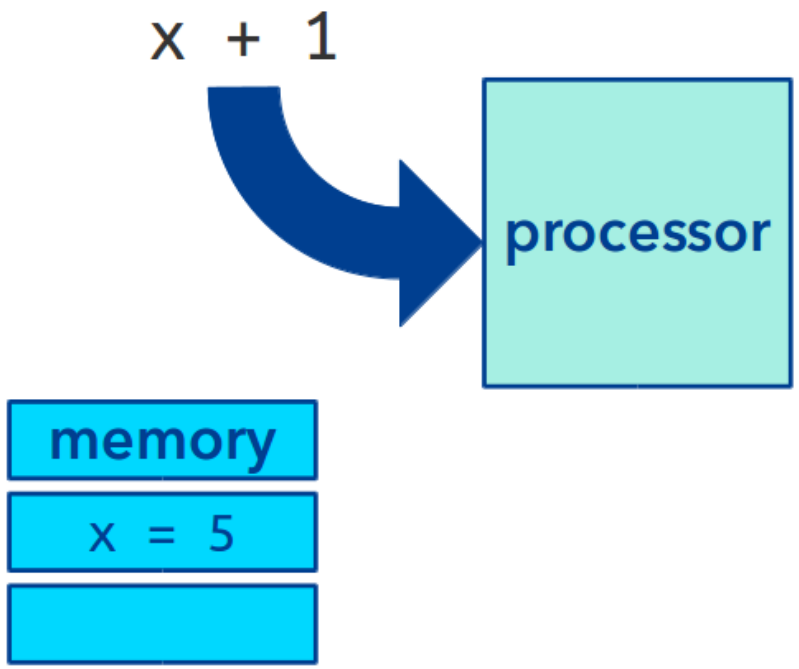

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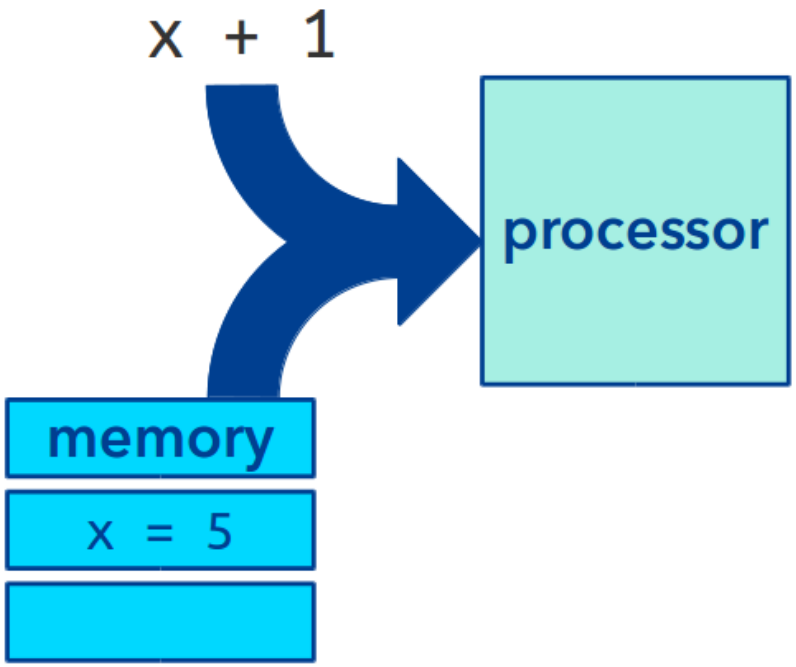

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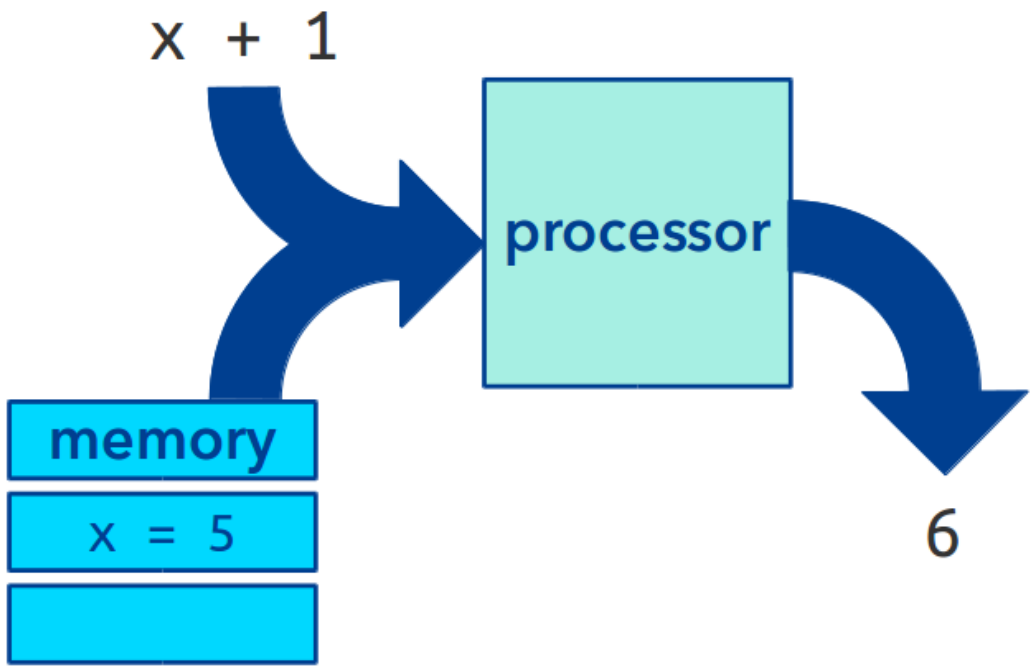

Example

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
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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

`x + 3` is a literal
The execution of a literal does not change machine state

What is a ***statement****?*

- A *statement* changes the state of the computer (sentence)

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

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- 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
```

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

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.