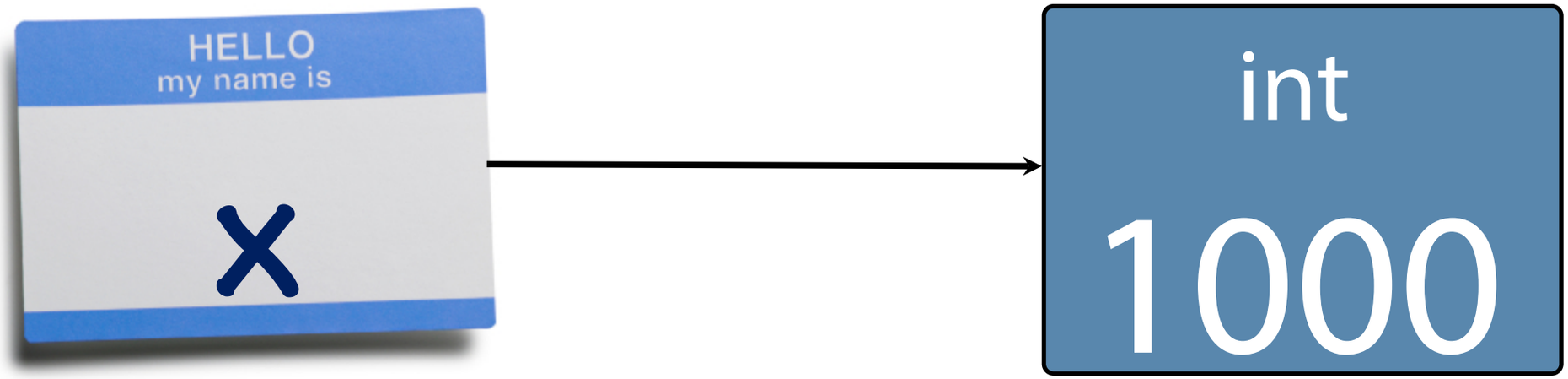
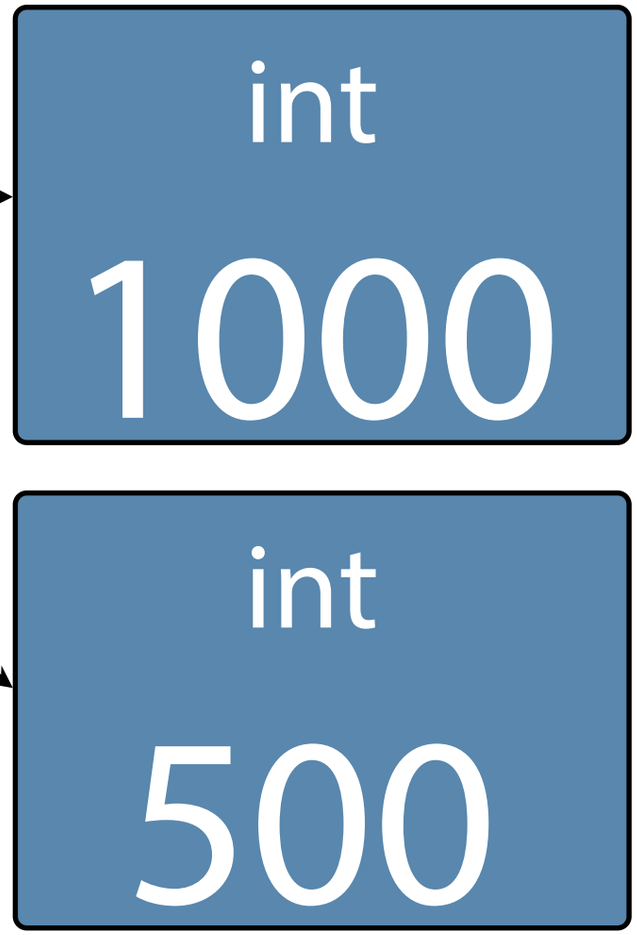
References to objects

x = 1000

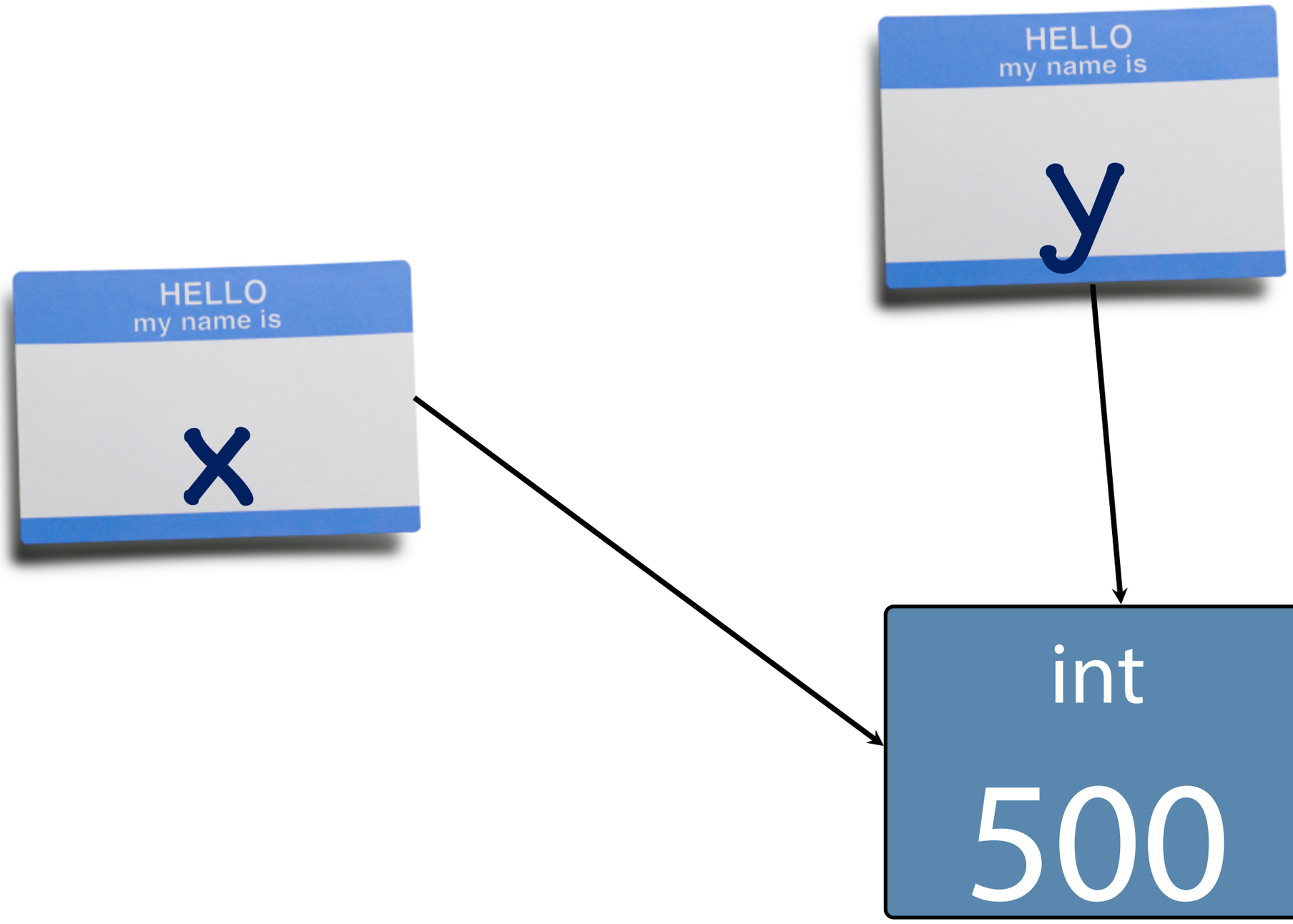
x = 1000



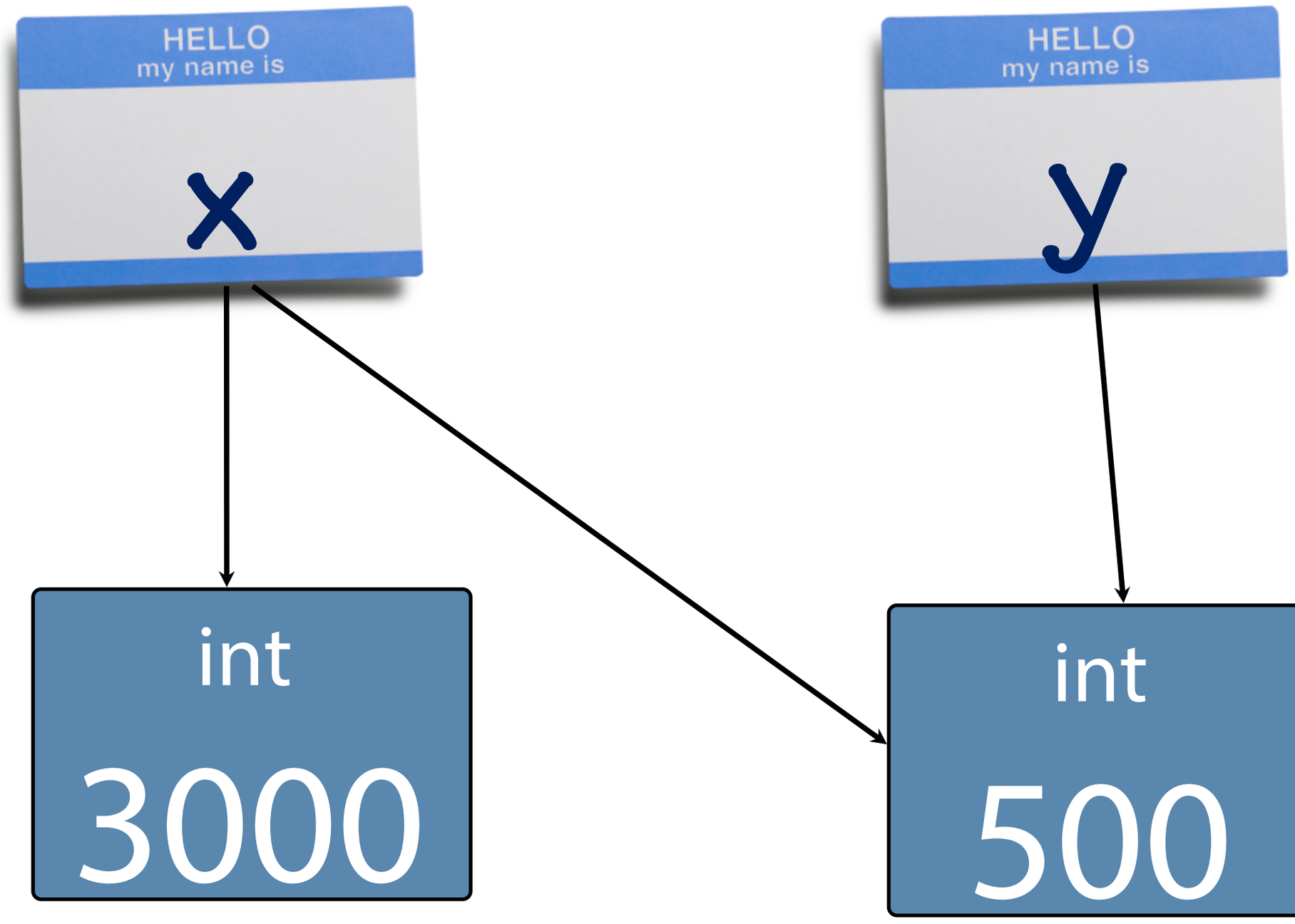
x = 500



y = x

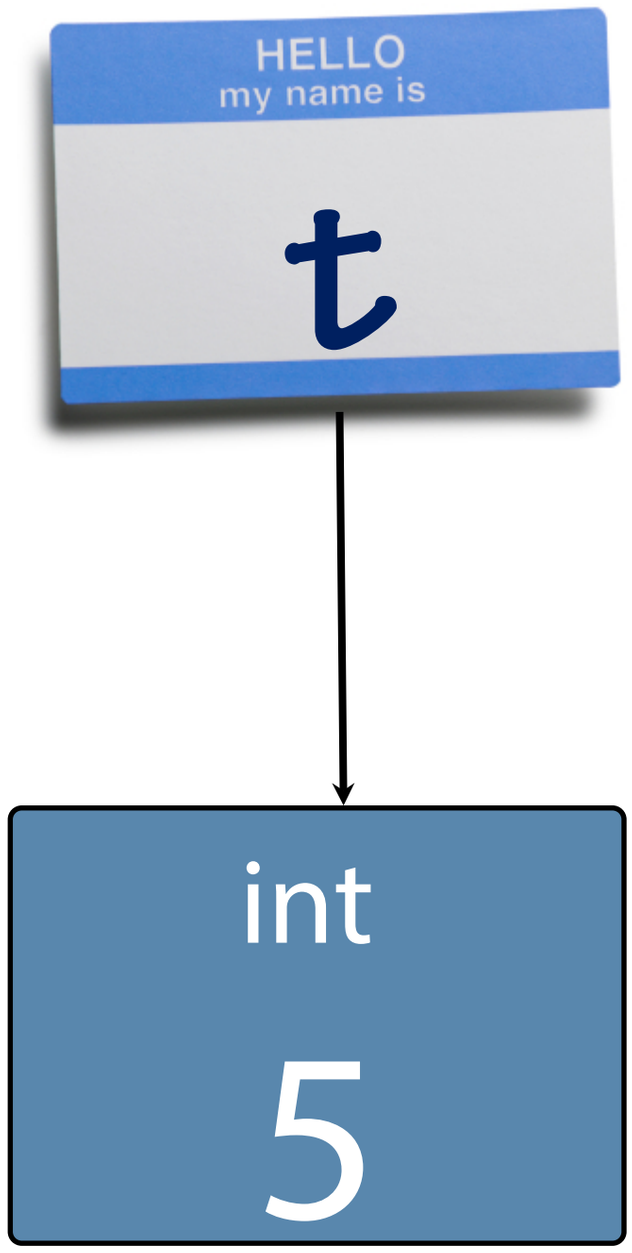


x = 3000



id()

returns a unique identifier for an object


HELLO
my name is
t
int
5

int
5

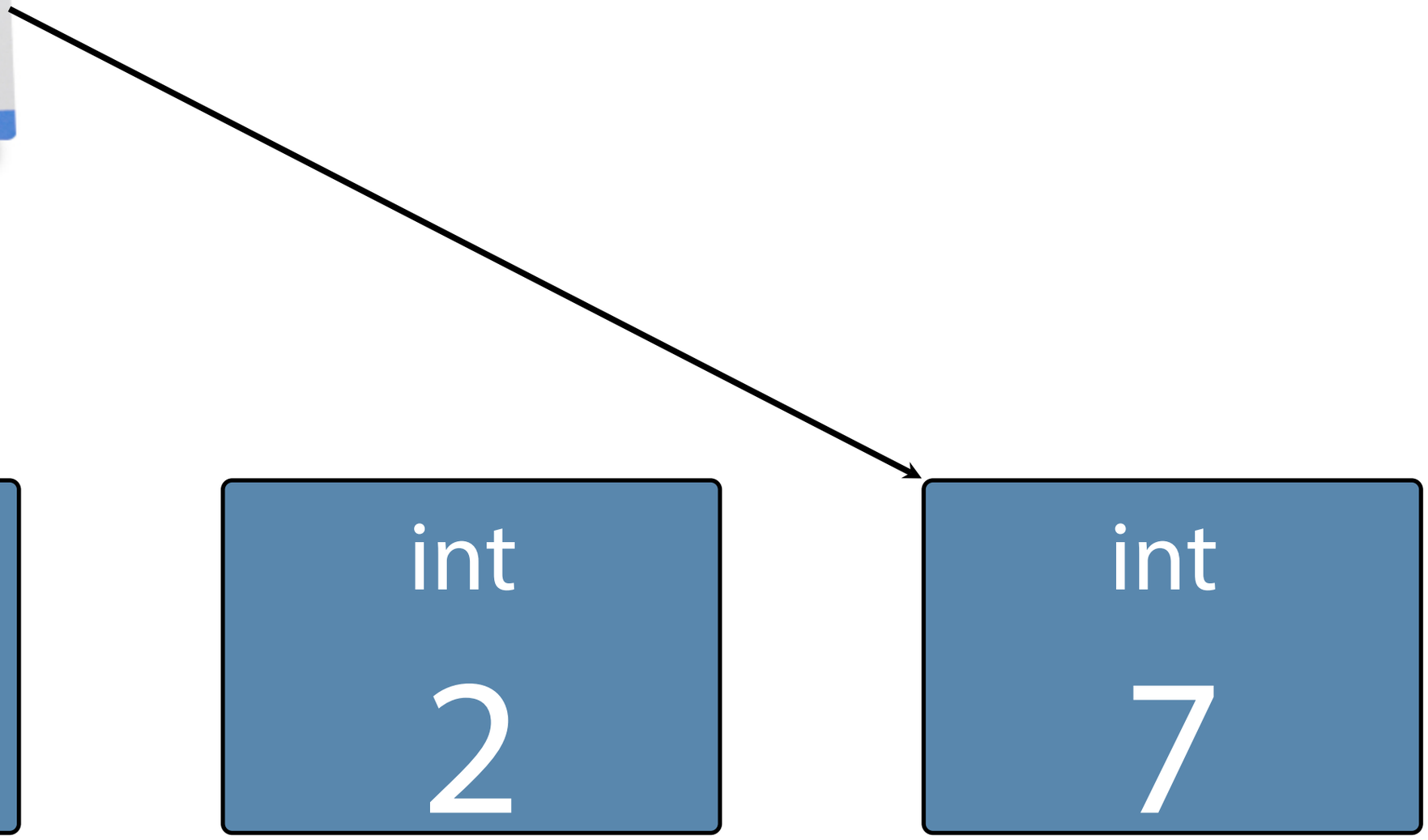
+

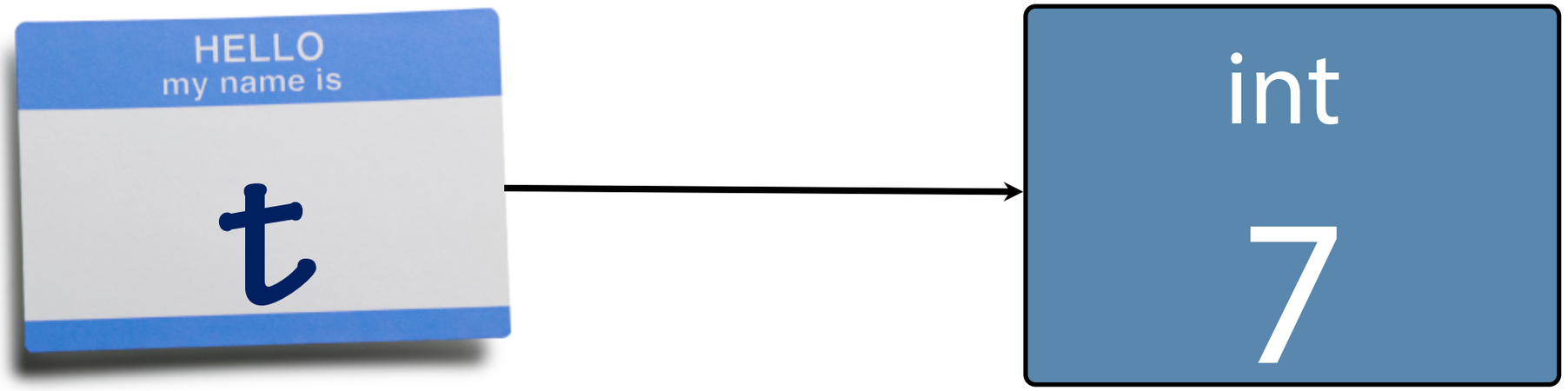
int
2

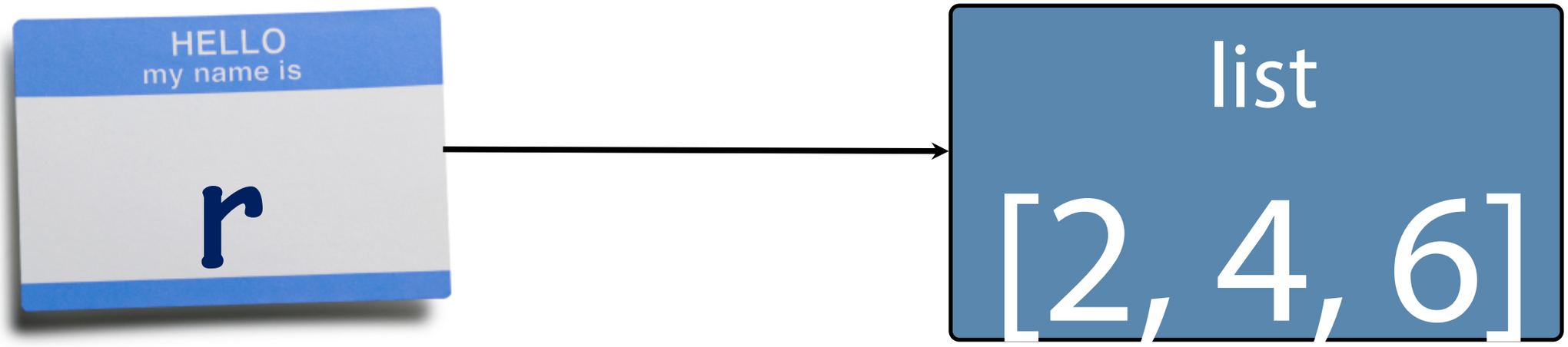
=

int
7


HELLO
my name is
t

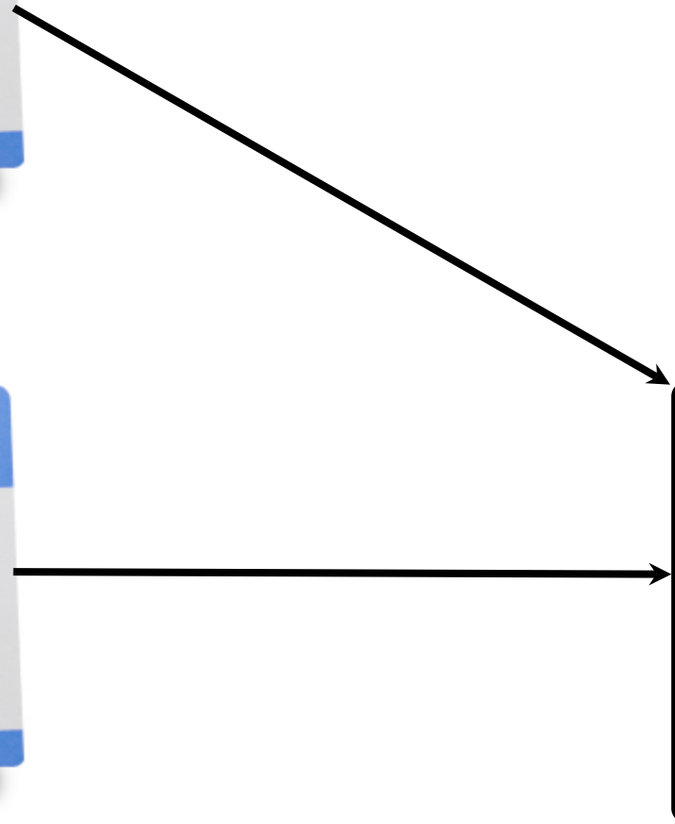

int
5
int
2
int
7


HELLO
my name is
t
int
7


HELLO
my name is
r
list
[2, 4, 6]


HELLO
my name is
s

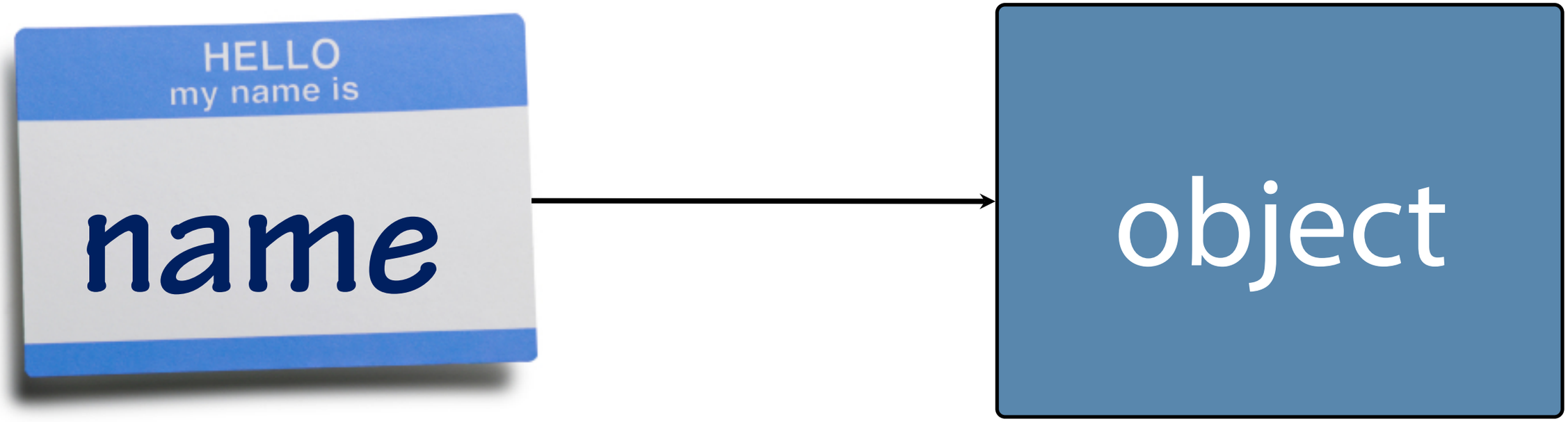

HELLO
my name is
r

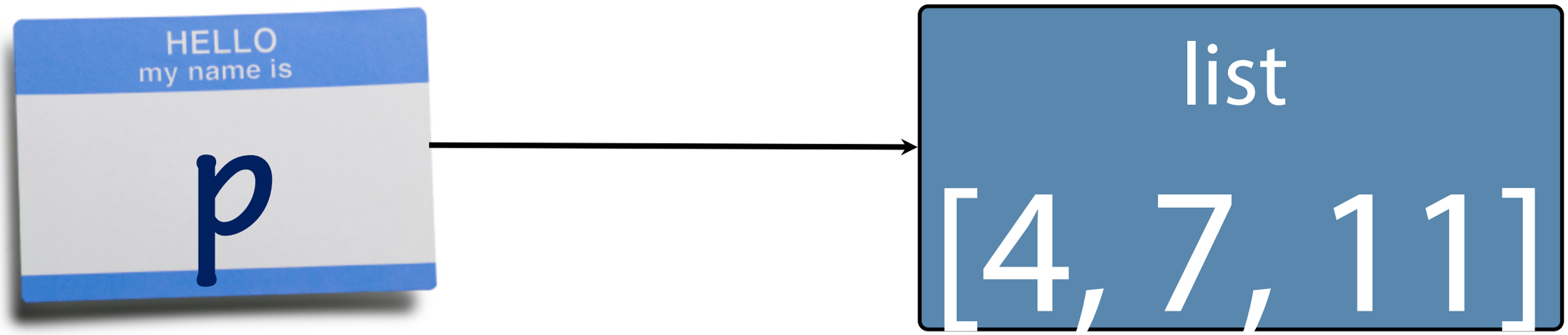

list
[2, 4, 6]

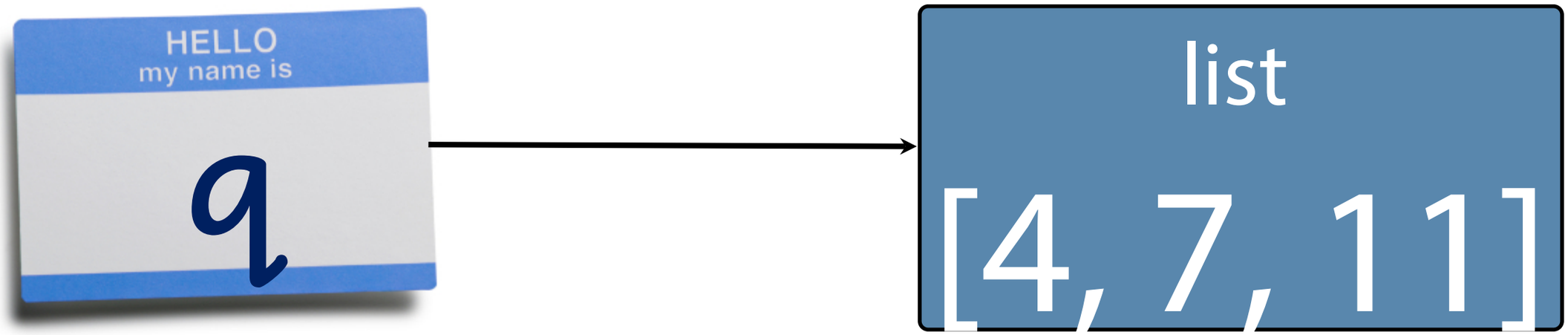
id() deals with the object, not the reference

~~Variables~~

Named references to objects




HELLO
my name is
p
list
[4, 7, 11]

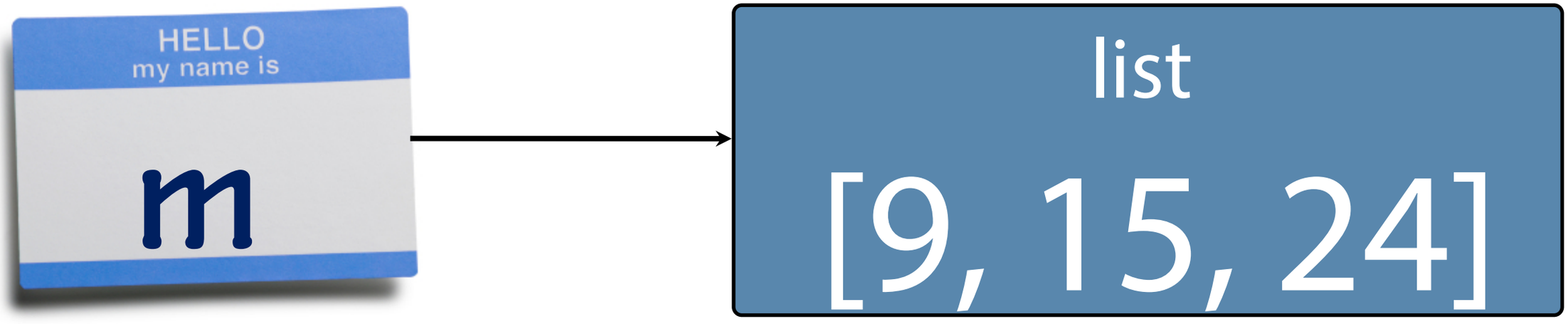

HELLO
my name is
q
list
[4, 7, 11]

Value equality vs. identity

- Value - equivalent “contents”

Identity - same object

Value comparison can be controlled programatically.


HELLO
my name is
m
list
[9, 15, 24]

list

[9, 15, 24]

modify(k):

list

[9, 15, 24]

modify(k):

list

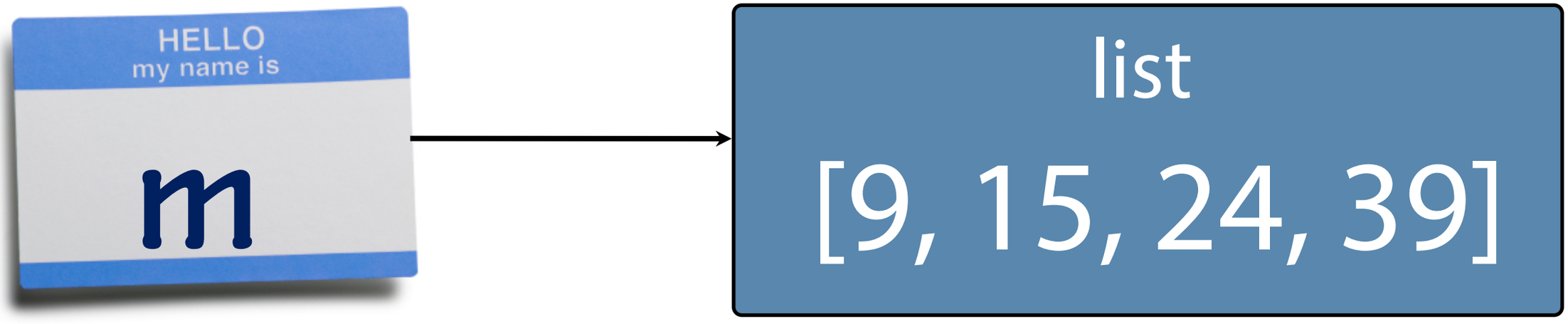
[9, 15, 24]

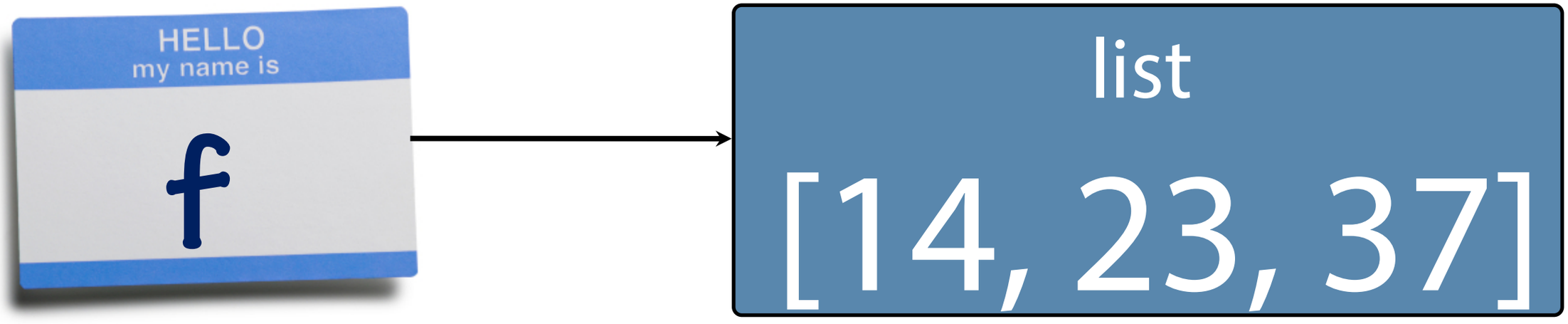
modify(k):

list

[9, 15, 24, 39]

modify(k):


HELLO
my name is
m
list
[9, 15, 24, 39]


HELLO
my name is
f
list
[14, 23, 37]

list

[14, 23, 37]

replace(g):

list

[14, 23, 37]

list

[17, 28, 45]

replace(g):

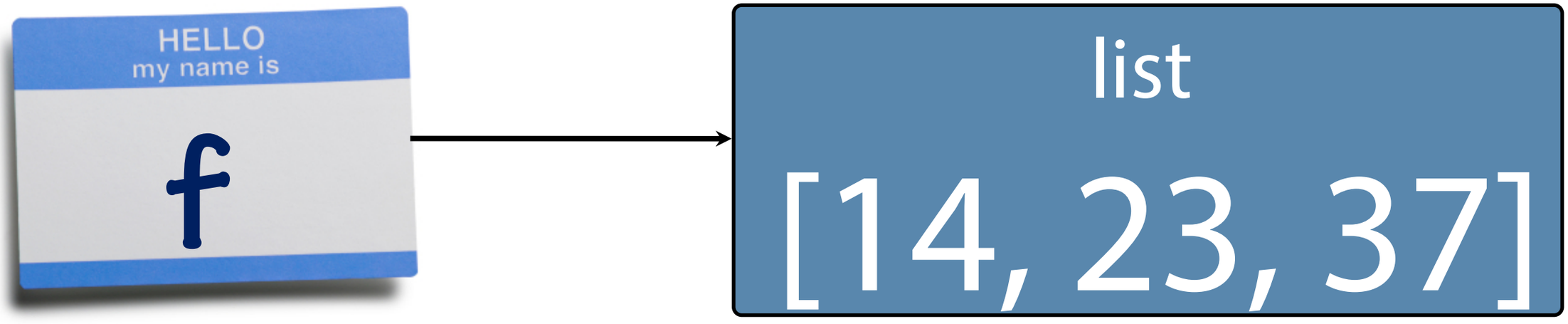
list

[14, 23, 37]

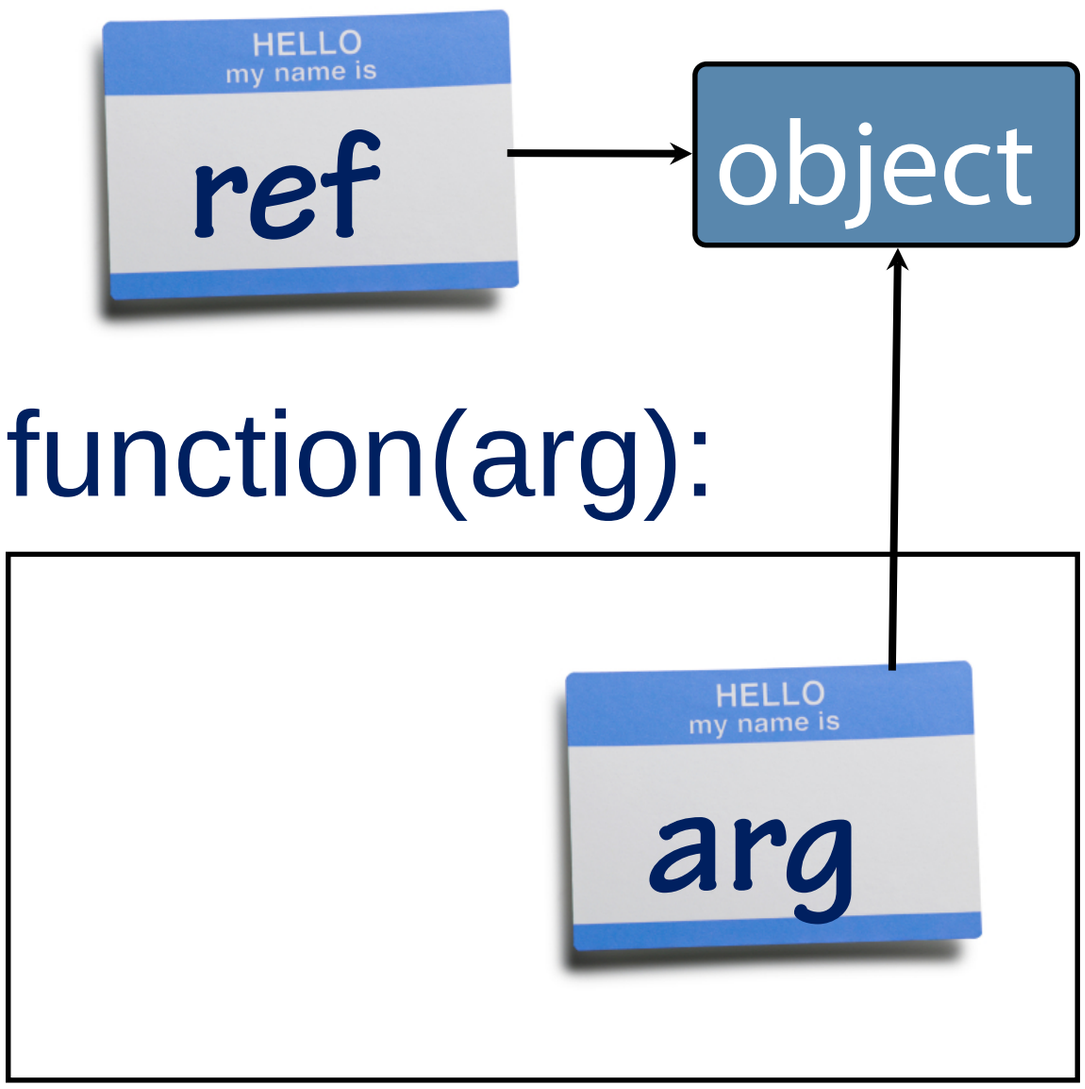
list

[17, 28, 45]

replace(g):


HELLO
my name is
f
list
[14, 23, 37]

Pass By Object Reference



- The value of the reference is copied, not the value of the object.

Default Arguments

```
def function(a, b=value)
```

Default value for ‘b’

Default Argument Evaluation

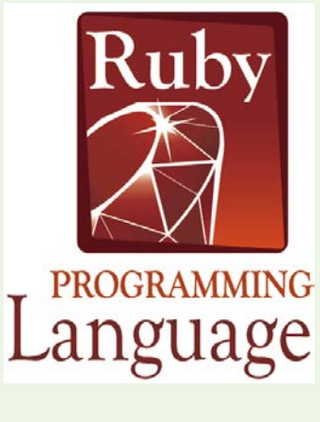
- Default argument values are evaluated when def is evaluated.
- They can be modified like any other object.

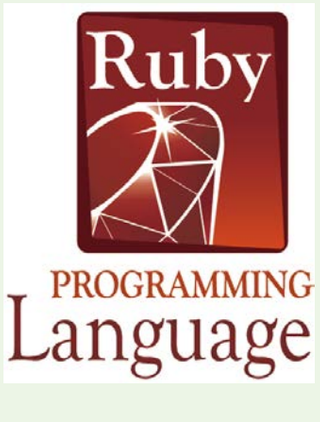
```
def add_spam(menu=
):
```

```
def add_spam(menu=
):
```

```
def add_spam(menu=
):
```

```
def add_spam(menu=
):
```

	Static	Dynamic
Strong	 Haskell C++	 
Weak		 

	Static	Dynamic
Strong	 Haskell C++	 
Weak		 

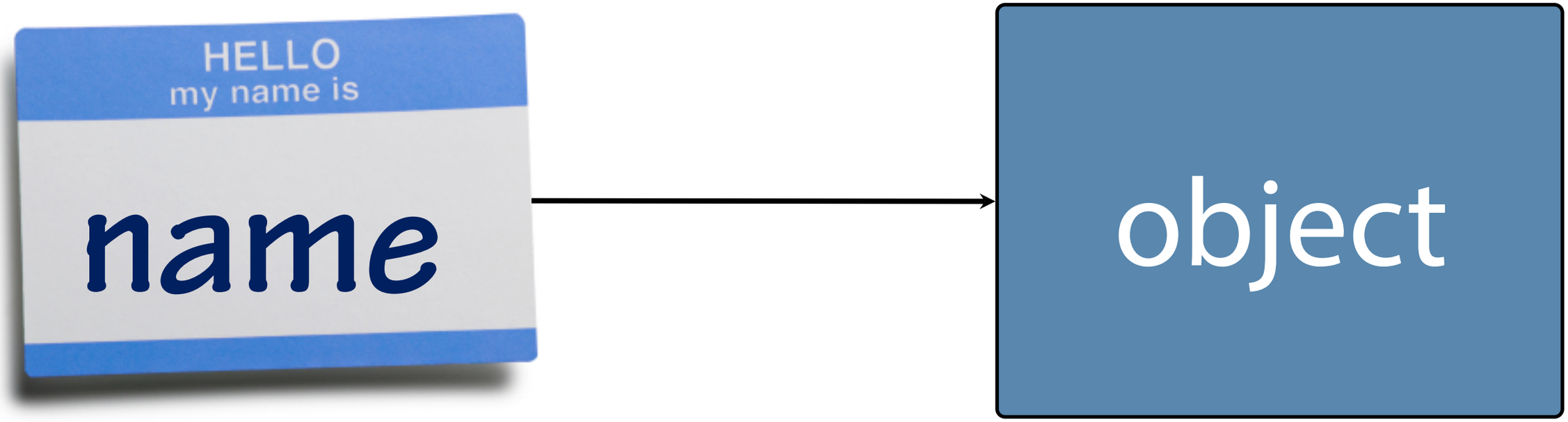
Dynamic Type System

- In a dynamic type system object types are only resolved at runtime.

Strong Type System

- In a strong type system there is no implicit type conversion.

Object References Have No Type



Python Name Scopes

Scopes are contexts in which named references can be looked up.

Python Name Scopes

Local — Inside the current function

Python Name Scopes

Local — Inside the current function

Enclosing — Any and all enclosing functions

Python Name Scopes

Local	Inside the current function
Enclosing	Any and all enclosing functions
Global	Top-level of module

Python Name Scopes

Local	Inside the current function
Enclosing	Any and all enclosing functions
Global	Top-level of module
Built-in	Provided by the builtins module

Python Name Scopes

Local

Enclosing

Global

Built-in

```
#!/usr/bin/env python3
"""Retrieve and print words from a URL.

Tools to read a UTF-8 text document from a URL which
will be split into its component words for printing.

Script usage:

  python3 words.py <URL>
"""

import sys
from urllib.request import urlopen


def fetch_words(url):
    """Fetch a list of words from a URL.

    Args:
        url: The URL of a UTF-8 text document.

    Returns:
        A list of strings containing the words from
        the document.
    """
    with urlopen(url) as story:
        story_words = []
        for line in story:
            line_words = line.decode('utf8').split()
            for word in line_words:
                story_words.append(word)
    print(locals())
    return story_words


def print_items(items):
    """Print items one per line.

    Args:
        An iterable series of printable items.
    """
    for item in items:
        print(item)


def main(url):
    """Print each word from a text document from at a URL.

    Args:
        url: The URL of a UTF-8 text document.
    """
    words = fetch_words(url)
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if __name__ == '__main__':
    main(sys.argv[1])  # The 0th arg is the module filename.
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```

python™

global

rebinds a global name at module scope

```
"""Demonstrate scoping."""

count = 0

def show_count():
    print("count = ", count)

def set_count(c):
    count = c
```

```
"""Demonstrate scoping."""

count = 0

def show_count():
    print("count = ", count)

def set_count(c):
    global count
    count = c
```

Moment of Zen

Special cases aren't special enough to break the rules

We follow patterns
Not to kill complexity
But to master it

Everything is an object

Objects – Summary

Objects – Summary

- Think of named references to objects rather than variables
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- Everything in Python is an object
  - This includes modules and functions
  - They can be treated just like other objects

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- Use len() to measure the length of a stringYou can multiple a string by an integer
  - Produces a new string with multiple copies of the operand
  - This is called the "repetition" operation