Accelerating Information Technology Innovation

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Cali, Colombia
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Lesson 1 – Introduction to Python

MISTI

Google

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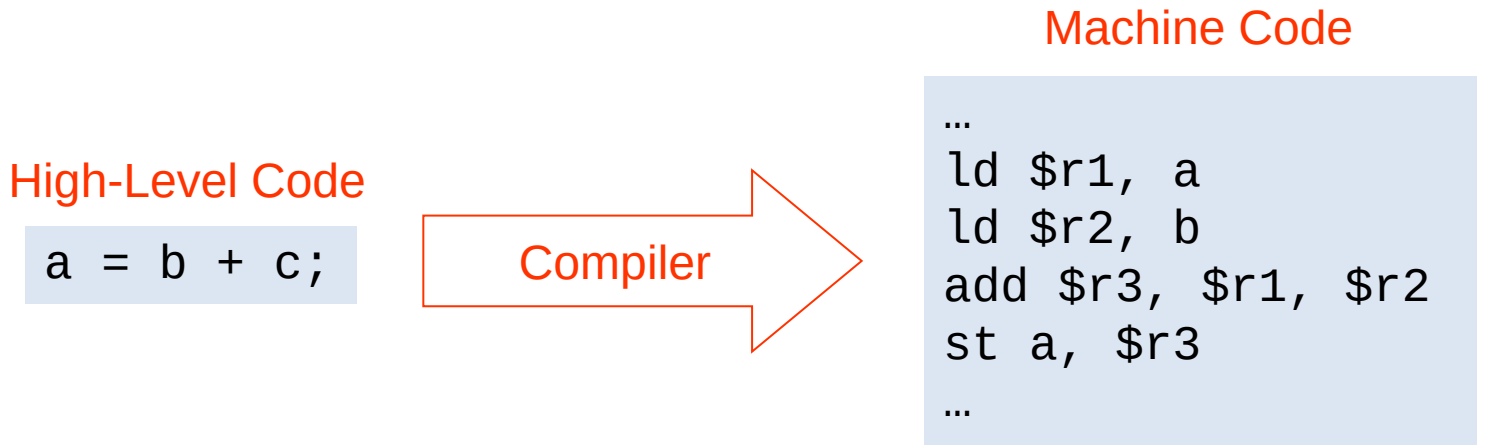
Agenda

- What is Python? and Why Python?
- Basic Syntax
- Strings
- User Input
- Useful Data Structures
- Introduction to Functions

What is Python?

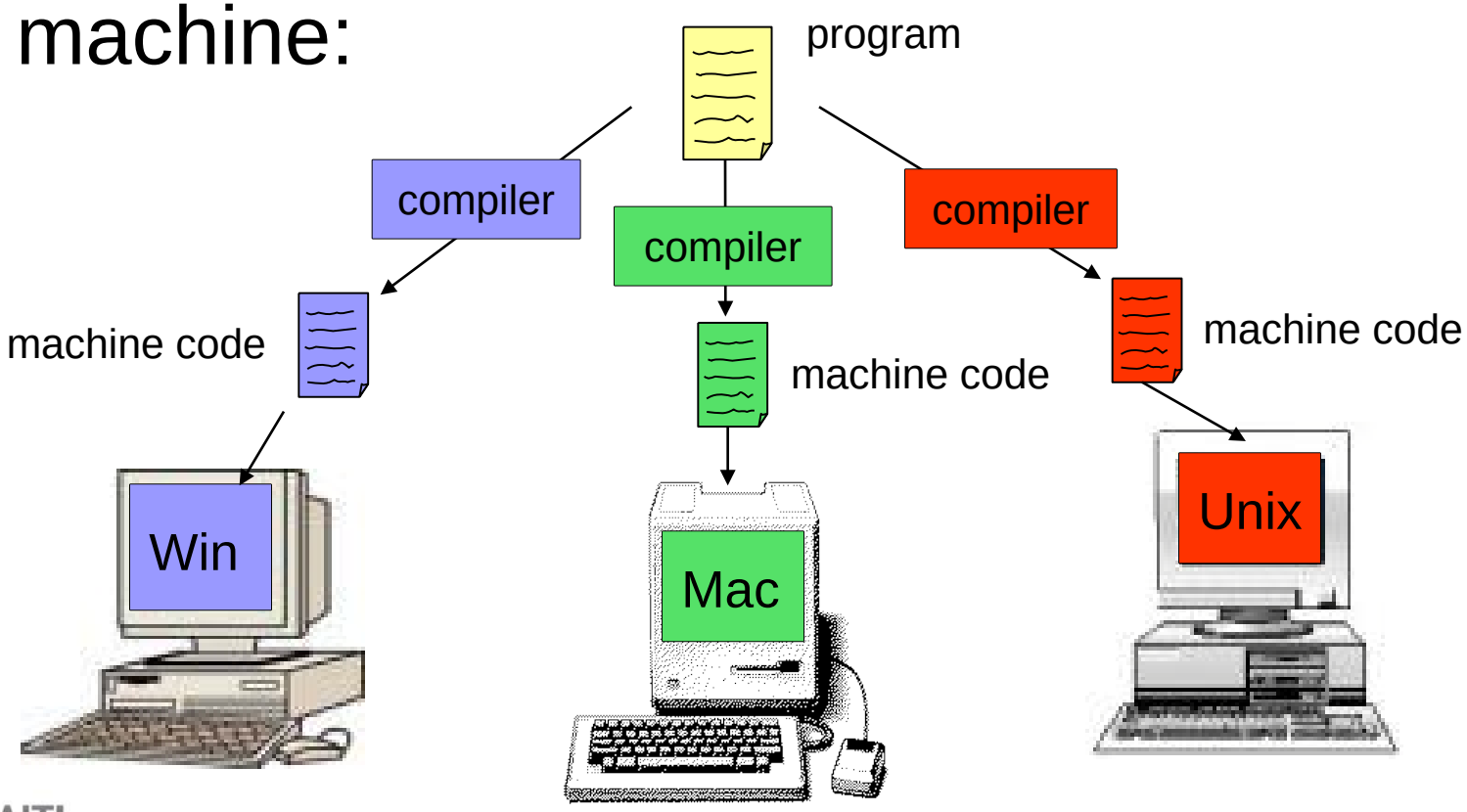
Python is…

- …*interpreted.* Languages like C/C++ need to translate high-level code to machine code…



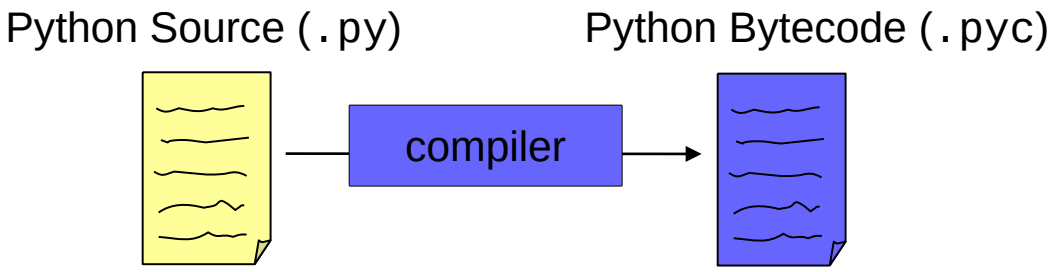
Python is…

- …which means that a program has to be compiled separately for each type of machine:

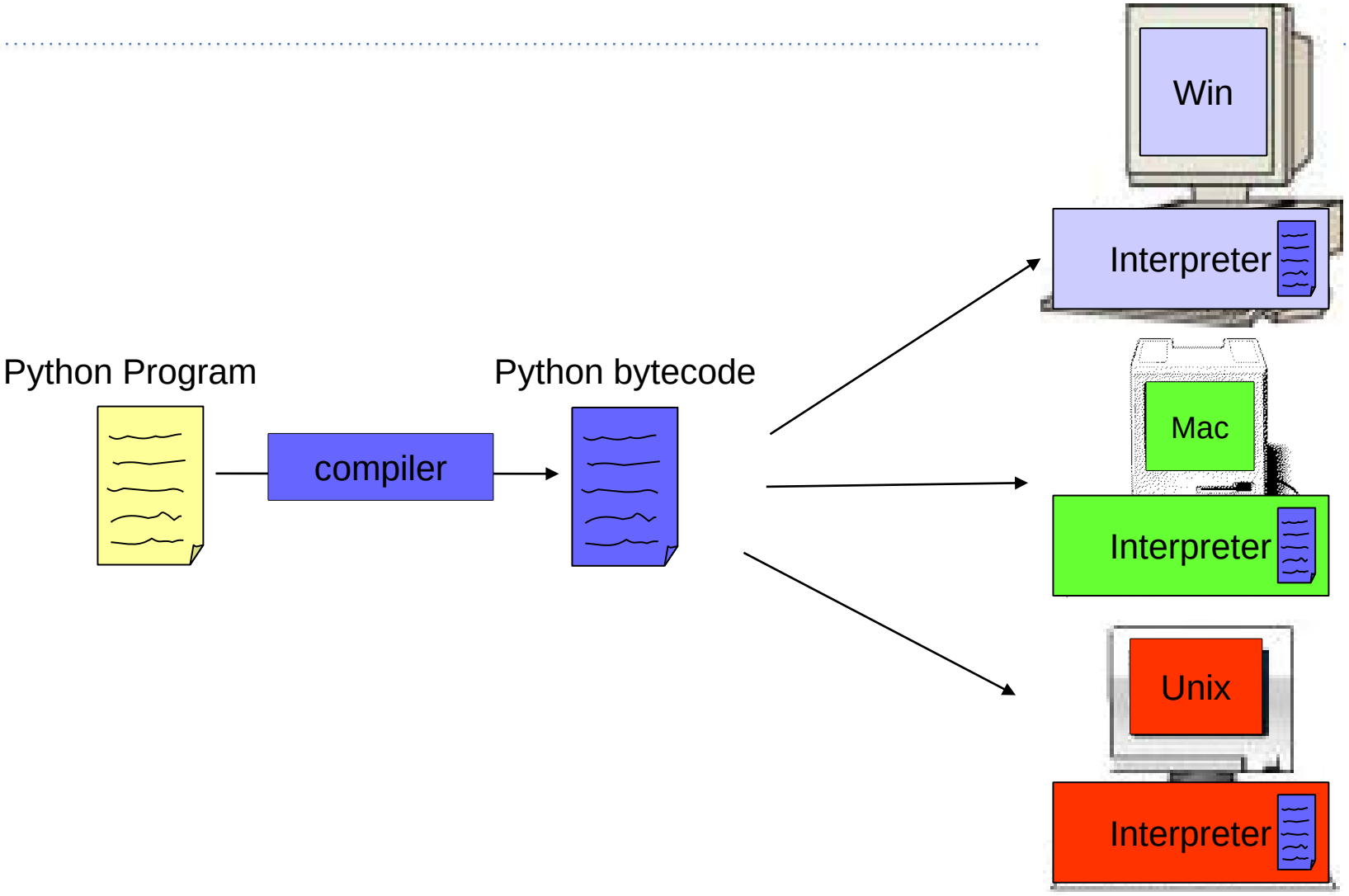


Python is…

- Python code is compiled to an intermediate format called ***bytecode***, which is understood by a *virtual machine/interpreter.*



Python is…


Python Program
compiler
Python bytecode
Win
Interpreter
Mac
Interpreter
Unix
Interpreter

Why Python?

Python because…

- Portable and architecture-agnostic
- Convenient built-in functions and data structures
- Syntax is readable and fast to write

```
if (x)
{
    if (y)
    {
        a();
    }
    b();
}
```



```
if x:
    if y:
        a()
    b()
```

Python because…

- Great for rapid prototyping
  - No separate compile step
  - No need to explicitly specify method argument types beforehand (due to dynamic typing)

Python for us, because…

- We want each of you to reach millions of users, and don't want to waste time building the pipes and plumbing

- Python is supported by a number of good frameworks, led by
  - Django
  - Heroku
  - Google AppEngine

The (Ideal) Development Cycle

- *Clearly* specify the problem:
  - Inputs, input manipulation, outputs
- Design the solution:
  - E.g. what algorithms, data structures
- Implementation
- Test

The (Real) Development Cycle

- As above, but *faster*.
  - Python, as a dynamically typed, programming language is perfect for *rapid* prototyping
- Be prepared to throw away one (or more!) prototypes
  - Often you learn crucial things about the problem as you code which cannot be fixed without starting from scratch.

Basic Syntax

Syntax

- Blocks are delimited with whitespace: specifically, four spaces (and no tabs)

```
if x:
    if y:
        a()
    b()
```

```
count = 0
for i in range(0:5)
    count += i
```

Syntax

- Semicolons are only used to separate multiple statements on the same line, which is discouraged:

```
if (x)
{
    a();
    b();
}
```



```
if x:
    a(); b()
```

No

```
if x:
    a()
    b()
```

Yes

Syntax

- Single line comments are denoted with hash (#), multiline with three quotes """

```
# This is a comment
foo()
```

```
"""
This is a
longer comment
"""
foo()
```

Interaction

- Python has an interactive console which is great for tinkering

```
$ python
Python 2.7.1+ (r271:86832, Apr 11 2011, 18:13:53)
[GCC 4.5.2] on linux2
Type “help”, “copyright”, “credits” or “license” for
more information
>>> a = 1
>>> a
1
>>> type(a)
<type ‘int’>
>>>
```

- …etc

Variables

- Strings
  ```
  >>> x = ‘Hello World’
  ```
- Numerics
  ```
  >>> x = 3.1415
  ```
- Booleans
  ```
  >>> x = True
  ```
- Lists
  ```
  >>> x = [‘Hello’, True, 3.1415]
  ```
- And many more…

Variables

- Python is a “dynamically typed” language
  - A variable’s data type is not declared.
  - “Statically typed” languages like Java must declare a variable’s data type

```
String x = “Hello World”;
```

- Get a variable’s data type with the `type` function

```
>>> x = ‘Hello World’
>>> type(x)
<type 'str'>
```

Strings

Strings

- A string is a piece of text.
- Encase with quotes
  - Single-quotes

    ```
    >>> x = ‘abc’
    ```
  - Double-quotes

    ```
    >>> x = “abc”
    ```
  - Triple single-quotes or triple double-quotes

    ```
    >>> x = ‘‘‘abc’’’
    >>> x = “””abc”””
    ```

Strings

- Use double-quotes to encase text containing single-quotes

```
>>> “It’s a string with a single-quote!”
```

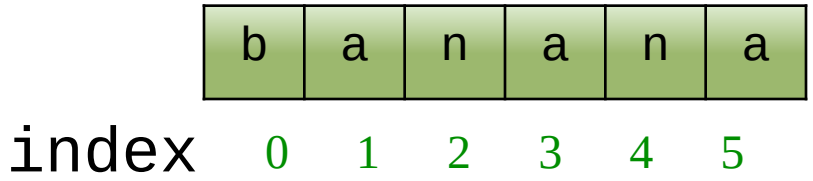
- What is wrong with this statement?

```
>>> x = abc
```

String as a sequence

- You can access the characters one at a time using the bracket [] operator

```
1 fruit = “banana”
2 letter = fruit[1]
3 print letter
```

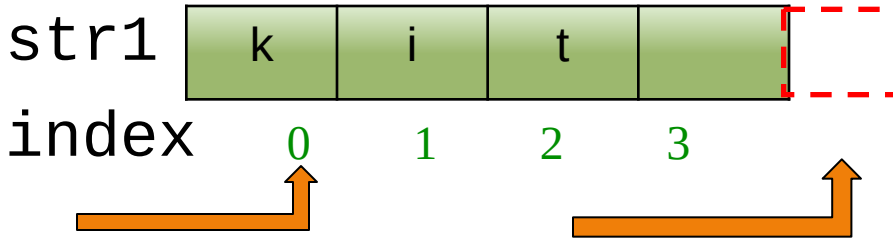


String operators

- Applied to strings, produce strings

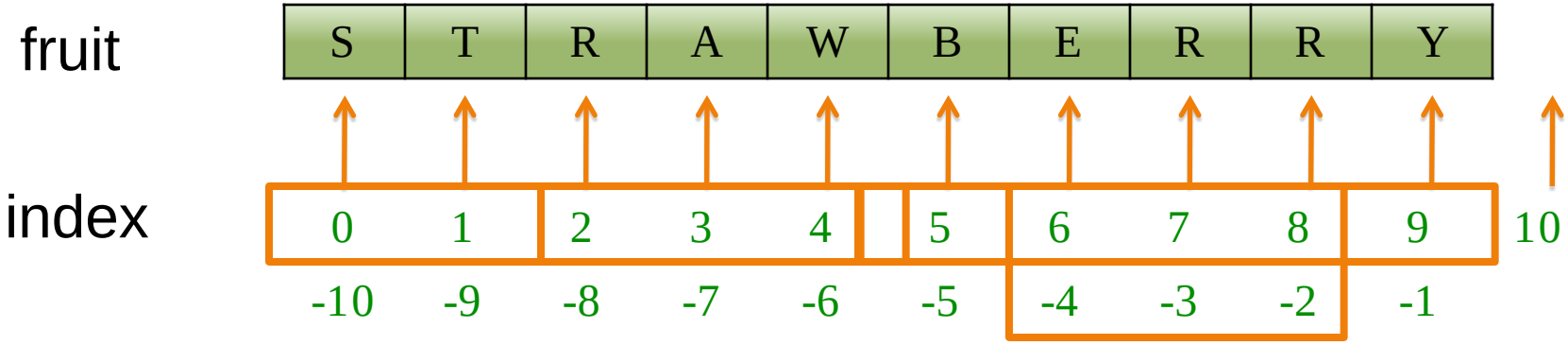
```
1 str1 = 'kit '
2 str2 = 'kat '
3 str3 = str1 + str2
4 str4 = str3 * 2
5 c = str1[0]
6 c = str1[4]
```

```
'kit kat '
'kit kat kit kat '
'k'
IndexError: string index
out of range
```



The slicing operator [m : n]

- Returns the part of the string from the "m-th" character to the "n-th" character, including the first but excluding the last.




```
1 str1 = fruit[2:5]
2 str1 = fruit[:5]
3 str1 = fruit[5:]
4 str1 = fruit[6:-1]
```

```
'RAW'
'STRAW'
'BERRY'
'ERR'
```

User Input

User Input

- raw_input prints a prompt to the user and assigns the input to a variable as a string

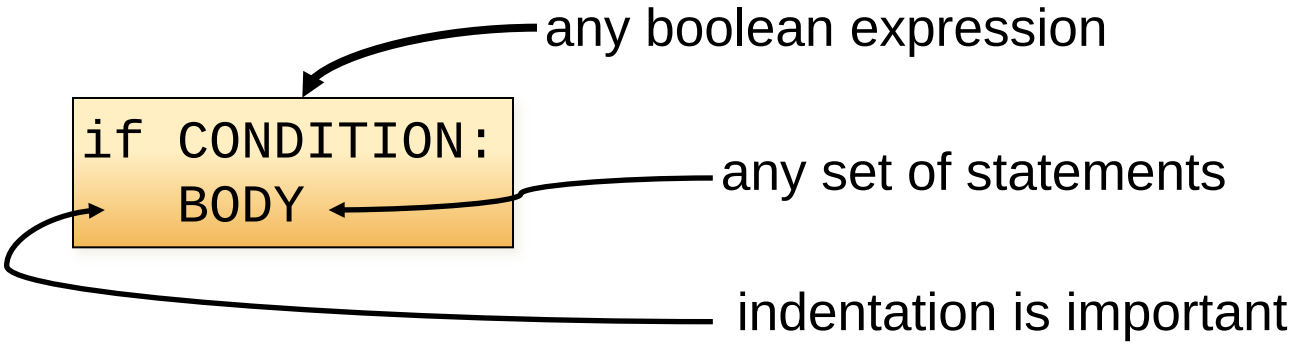
- input can be used when we expect the input to be a number

Control Statements

Control statements

- Conditionals: control which set of statements is executed.
  - if / else
- Iteration: control how many times a set of statements is executed.
  - while loops
  - for loops

The if statement



- If the condition is True, the body gets executed.
- Otherwise, nothing happens.

```
if x < 0:
   print 'x is negative'
```

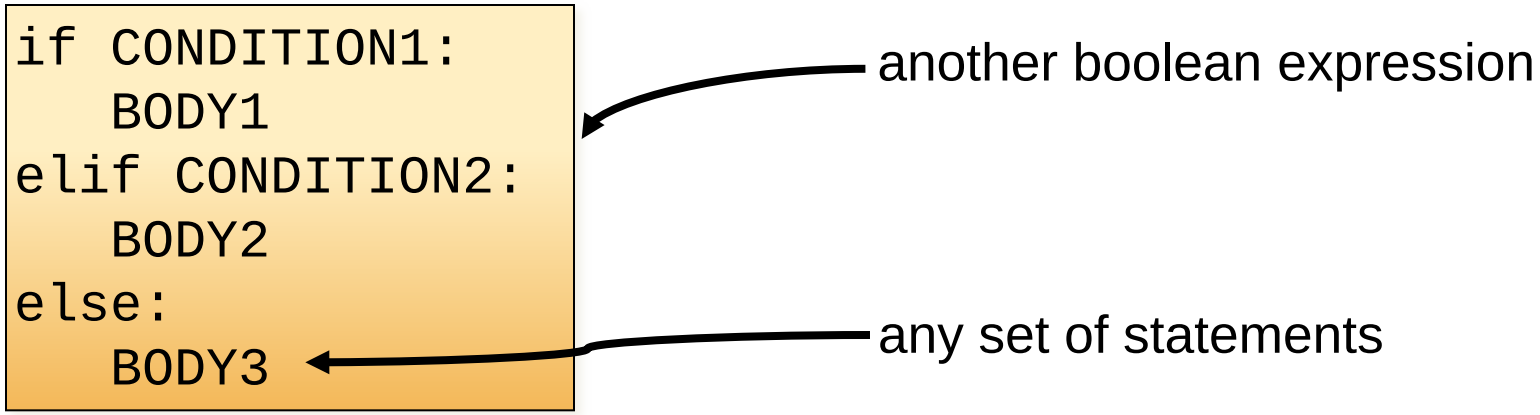
The if/else statement

```
if CONDITION:
   BODY1
else:
   BODY2
```

- If the condition is True, body1 gets executed.
- Otherwise, body2 gets executed.

```
if x < 0:
   print 'x is negative'
else:
   print 'x is positive or zero'
```

Chained conditionals



- If the condition1 is True, body1 gets executed.
- Otherwise, if condition2 is True, body2 gets executed.
- If neither condition is True, body3 gets executed.

An example

```
a = False
b = True
if a and b:
   print 'I love red.'
elif a or b:
   print 'I love green.'
else:
   print 'I love blue.'
   print 'I also love purple.'
```

What does this output? `I love green.`

An example

```
a = False
b = True
if a and b:
   print 'I love red.'
elif a or b:
   print 'I love green.'
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print 'I also love purple.'
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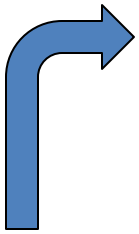


What does this output?

```
I love green.
I also love purple.
```

Nested conditionals

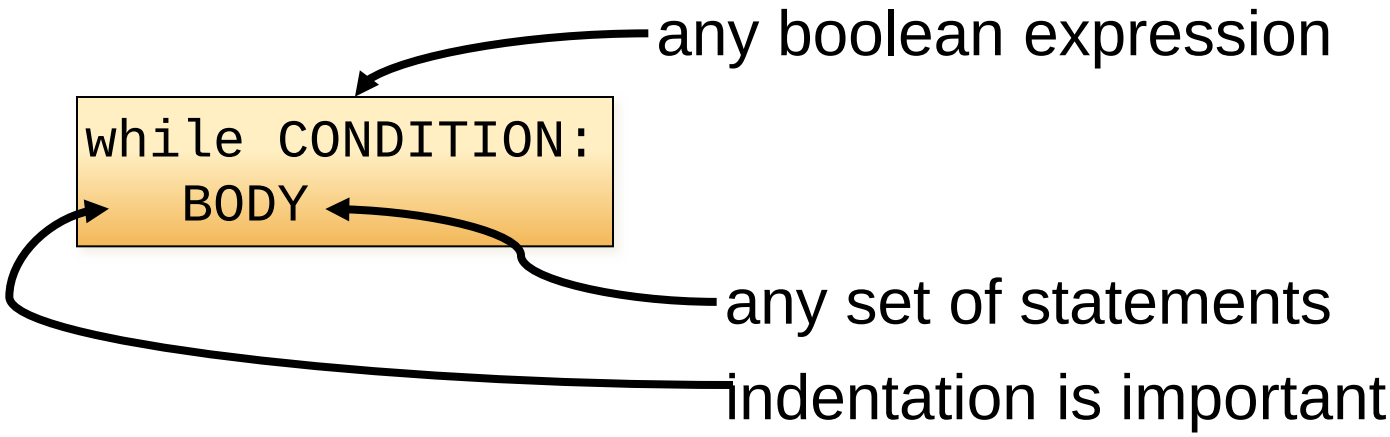
```
if is_adult:
    if is_senior_citizen:
        print 'Admission $2 off.'
    else:
        print 'Full price.'
else:
    print 'Admission $5 off.'
```

outer conditional

inner conditional

- Can get confusing. Indentation helps to keep the code readable and the python interpreter happy!

The while loop



- As long as the condition is true, the body gets executed repeatedly.
- The first time the condition is false, execution ends.

The while loop

```
i = 0
while i < 3:
    print i
    i = i + 1
```

- What does this output?

```
0
1
2
```

The break statement

- Immediately exits the innermost loop.

```
while True:
    line = raw_input('>>> ')
    if line == 'done':
        break
    print line
print 'Done!'
```

```
>>> not done
not done
>>> done
Done!
```

Useful Data Structures

Lists

- A list is a sequence of values.
- Each element (value) is identified by an index.
- The elements of the list can be of any type.

```
tens = [10, 20, 30, 40]
cities= [’Manila', ‘Cebu', ‘Boracay’]
empty = []
```

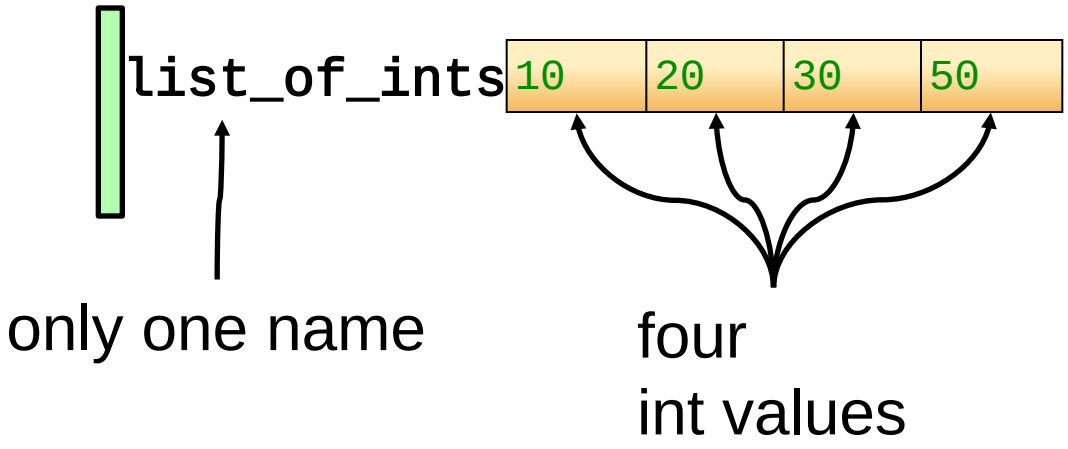
- Lists can have mixed types in them, even other lists (nested).

```
mixed = ['hello', 2.0, 5, [10, 20]]
```

Creating a list

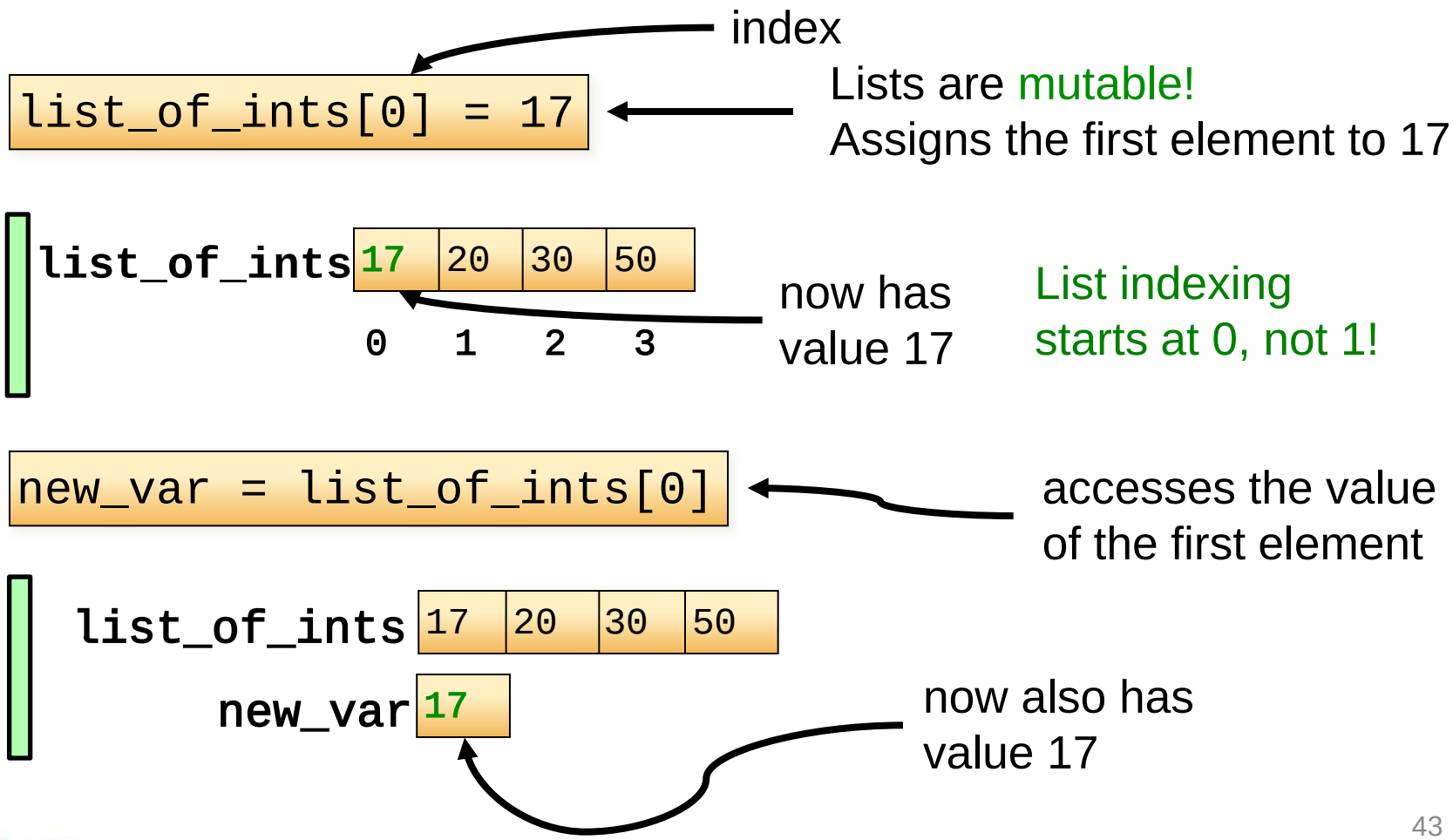
- Use the [] brackets

```
list_of_ints = [10,20,30,50]
```



Accessing list elements

- Individual elements are accessed using the [] operator.



Printing a list

- We can use the print function to output the contents of the list:

```
cities = [’Cali’, ‘Bogotá’, ‘Medellin’]
numbers = [17, 123]
empty = []
print cities, numbers, empty
```

[’Cali’, ’Bogotá’, ’Medellin’] [17, 123] [ ]

Lists vs. Strings

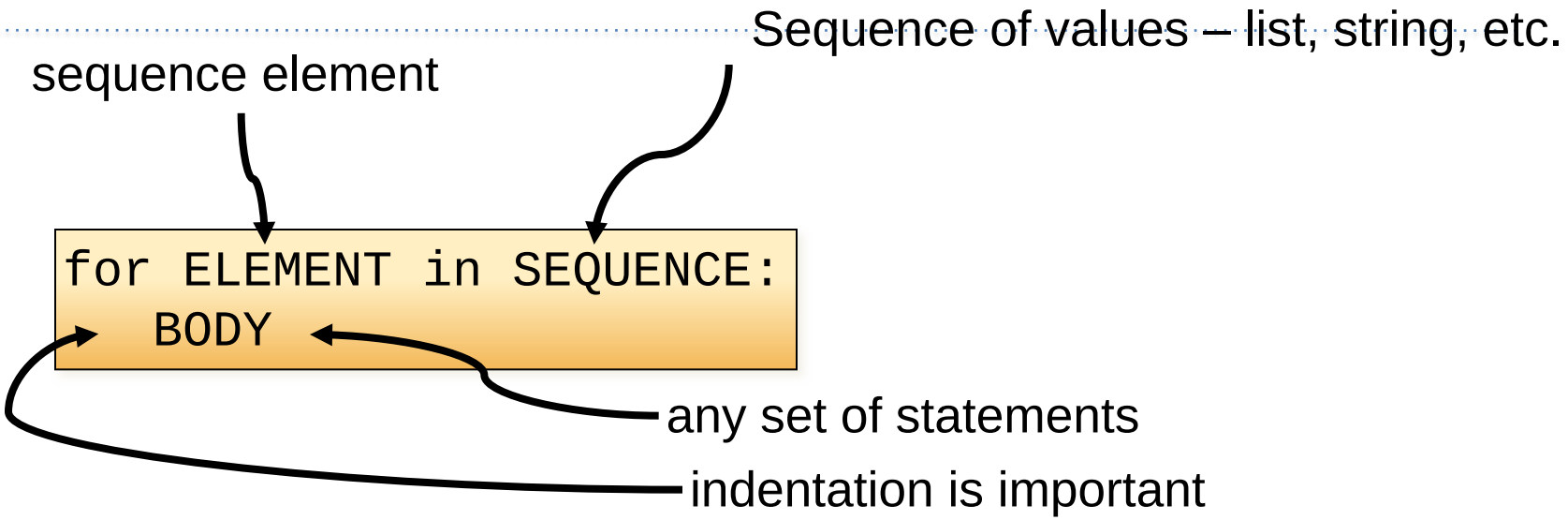
- Lists are mutable - their contents can be modified
- Strings are immutable

```
name = 'Lenny'
name[0] = 'J'
```

```
TypeError: object doesn't support item assignment
```

Control Structures

The for loop

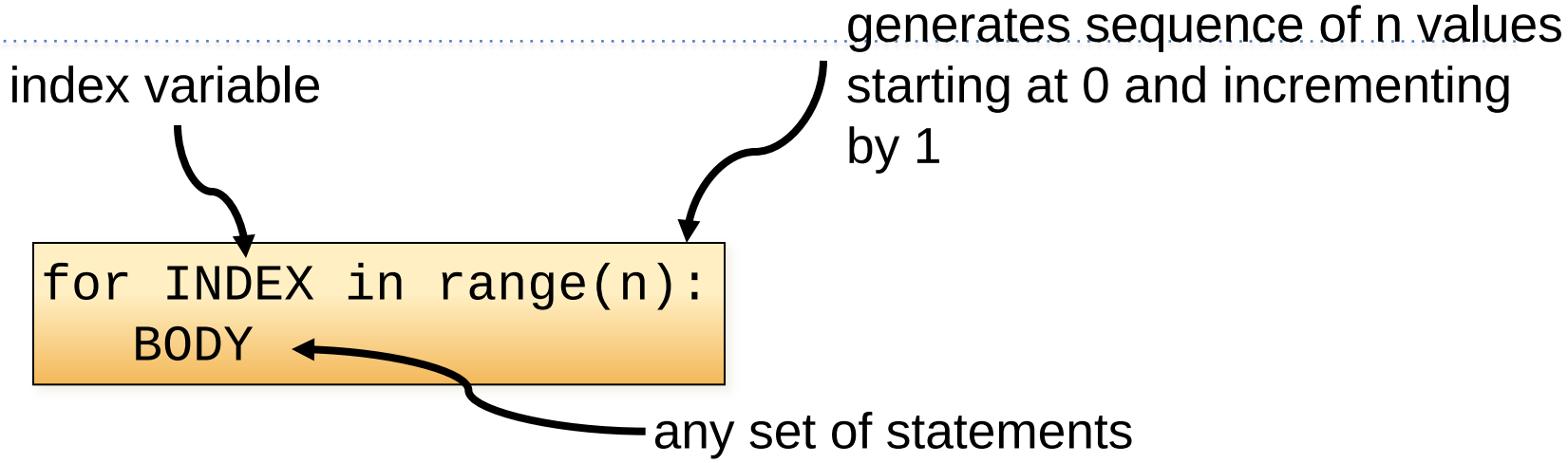


- Example:

```
for i in [0,1,2,3]:
   print i
```

```
0
1
2
3
```

Using range

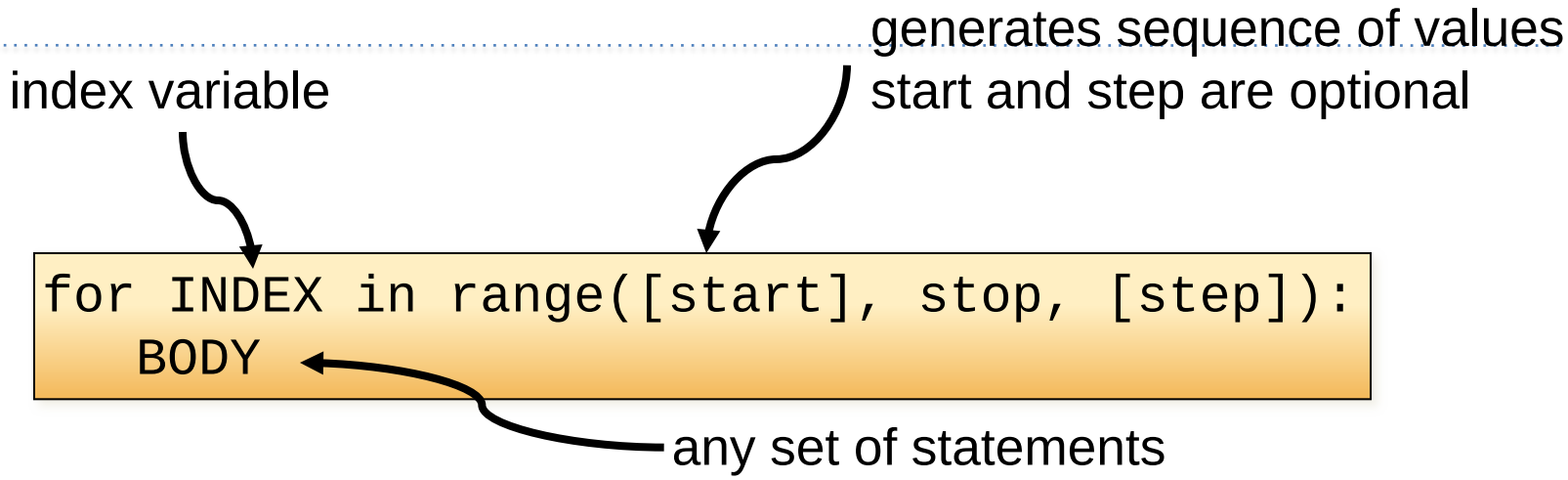


- What does this output?

```
for i in range(4):
    sq = i * i
    print i, sq
```

```
0  0
1  1
2  4
3  9
```

Using range



- What does this output?

```
for i in range(1, 7, 2):
   print i
```

```
1
3
5
```

For loop and strings

- Iterating through the characters of a string

```
str1 = 'stressed'
for c in str1:
    print c,
```

```
s t r e s s e d
```

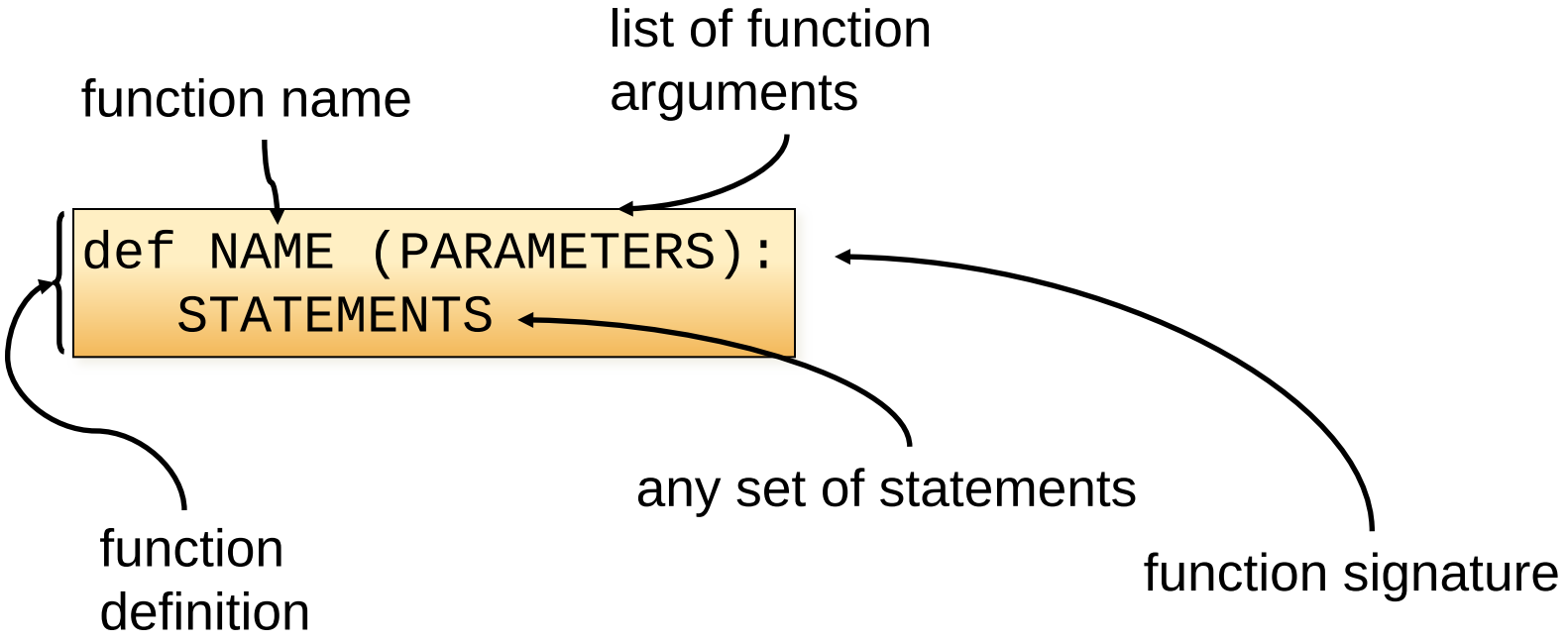
For vs While

- For loop is primarily used
  - for iterating over a sequence of values
  - when we know the number of iterations in advance
- While loop is primarily used
  - when we don't know the number of iterations in advance (they could be controlled by user input)

Introduction to Functions

Functions

- A function is a sequence of statements that has been given a name.



Now you are all set to work on Lab 1! ☺

Lab 1

1. Calculate Fibonacci number

   fib(n)
2. Display the day of the week given a date

   zellers()
3. Implement the Rock Paper Scissors game

   rock_paper_scissors()
4. Encode a given string using the Caesar cipher

   cipher()

Next Class

- More on Functions
- Object Oriented Programming
- Exceptions
- Regular Expressions
- How to be a Python Ninja!