Python Review Session

CS109 Autumn 2019

Today's questions

How does Python compare to other programming languages?

How can I use Python to solve problems in CS109?

Today's topics

1. Python vs. other languages
2. Features of Python
3. Python in action!

How does Python compare to other programming languages?

Other programming languages: Java

```
ArrayList<Integer> evens = new ArrayList<Integer>();
for(int i = 0; i < 100; i++) {
    if(i % 2 == 0) {
        evens.add(i);
    }
}
System.out.println(evens);
```

Other programming languages: C++

```
using namespace std;
vector<int> evens;
for(int i = 0; i < 100; i++) {
    if(i % 2 == 0) {
        evens.push_back(i);
    }
}
cout << evens << endl;
```

Other programming languages: JavaScript

```
var evens = [];
for(var i = 0; i < 100; i++) {
    if(i % 2 === 0) {
        evens.push(i);
    }
}
console.log(evens);
```

Python

```
evens = []
for i in range(100):
    if i % 2 == 0:
        evens.append(i)
print(evens)
```

Python

```
evens = []
for i in range(100):
    if i % 2 == 0:
        evens.append(i)
print(evens)

# With a list comprehension instead
print([i for i in range(100) if i % 2 == 0])
```

Python Basics

(adapted from Sam Redmond's CS41)

Python Interpreter

- If you have Python 3 installed:
  - Type **`python3`** on the command line
    - Instantly in the interactive interpreter!
      - Sandbox for experimenting with Python
      - Great for learning about how Python works!

Comments

```
# single line comments use a ‘#’
# what the cool kids use these days #relevant

"""
Multiline comments written in between a pair of three
"s
"""
```

Variables

Java vs. Python

```
int x = 0;
```

- semicolons
- statically-typed

```
x = 0
```

- no semicolons
- dynamically-typed
  - not declared with explicit type
  - but every object still has a type (so Python knows, even if you don't!)

Numbers and Math

```
# Python has 2 numeric types: ints and floats

3             # 3 (int)
3.0           # 3.0 (float)
5 / 2         # 2.5 (float division)
5 // 2        # 2 (integer division)
5 % 2         # 1 (integer modulus)
5 ** 2        # 25 (exponentiation)
```

Boolean + Other Operators

```
not          # instead of !
or           # instead of ||
and          # instead of &&
==           # like ==
is           # same Python object (same address)
```

Booleans + Operators

```
# note that True and False start with capital letters

2 * 3 == 6          # True
not True            # False
True and False      # False
True or False       # True
3 < 2               # False
1 < 2 < 3           # True (1 < 2 and 2 < 3)
```

Strings

```
# no char in Python
# '' and "" both create string literals

greeting = 'Hello'
audience = "world"

greeting + " " + audience + "!"  # 'Hello world!'
```

Indexing


```
s[0] == 'A'
s[1] == 'r'
s[4] == 'u'
s[6] # Bad!
```

Slides courtesy of Sam Redmond, CS41

Negative Indexing


```
s[-1] == 'r'
s[-2] == 'u'
s[-4] == 't'
s[-6] == 'A'
```

Slides courtesy of Sam Redmond, CS41

Slicing

Slides courtesy of Sam Redmond, CS41

Slicing

Slides courtesy of Sam Redmond, CS41

Slicing


```
s[0:2] ==  'Ar'
```

Slides courtesy of Sam Redmond, CS41

Slicing


```
s[0:2] ==  'Ar'
```

Slides courtesy of Sam Redmond, CS41

Slicing


```
s[0:2] ==  'Ar'
s[3:6] == 'hur'
```

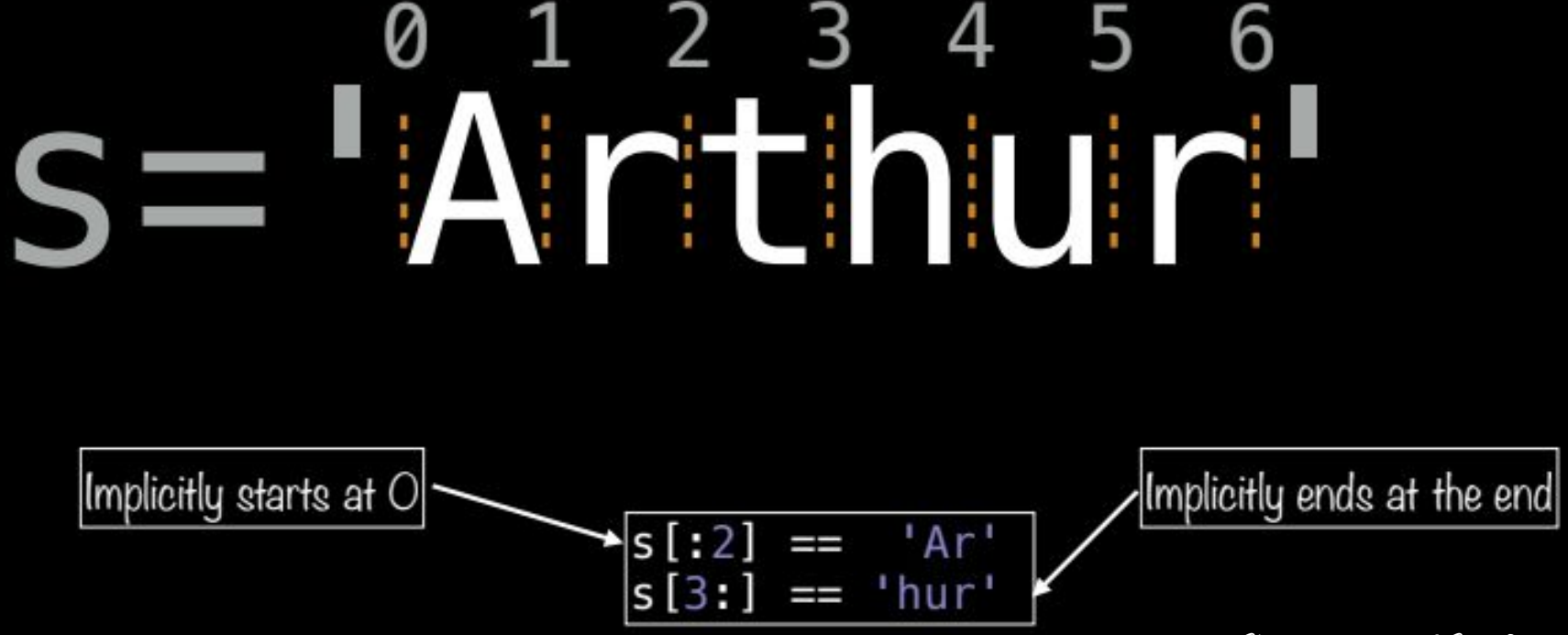
Slides courtesy of Sam Redmond, CS41

Slicing


```
s[0:2] ==  'Ar'
s[3:6] == 'hur'
s[1:4] == 'rth'
```

Slides courtesy of Sam Redmond, CS41

Strings



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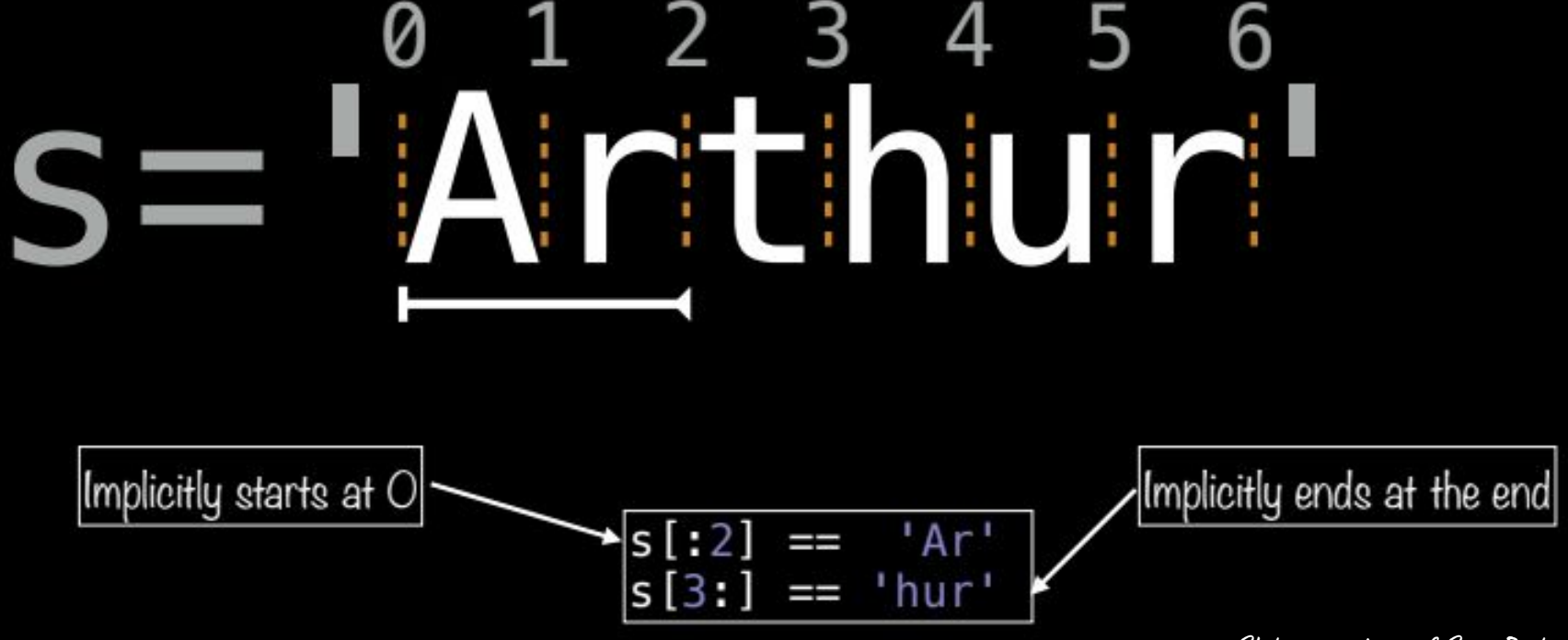
Strings



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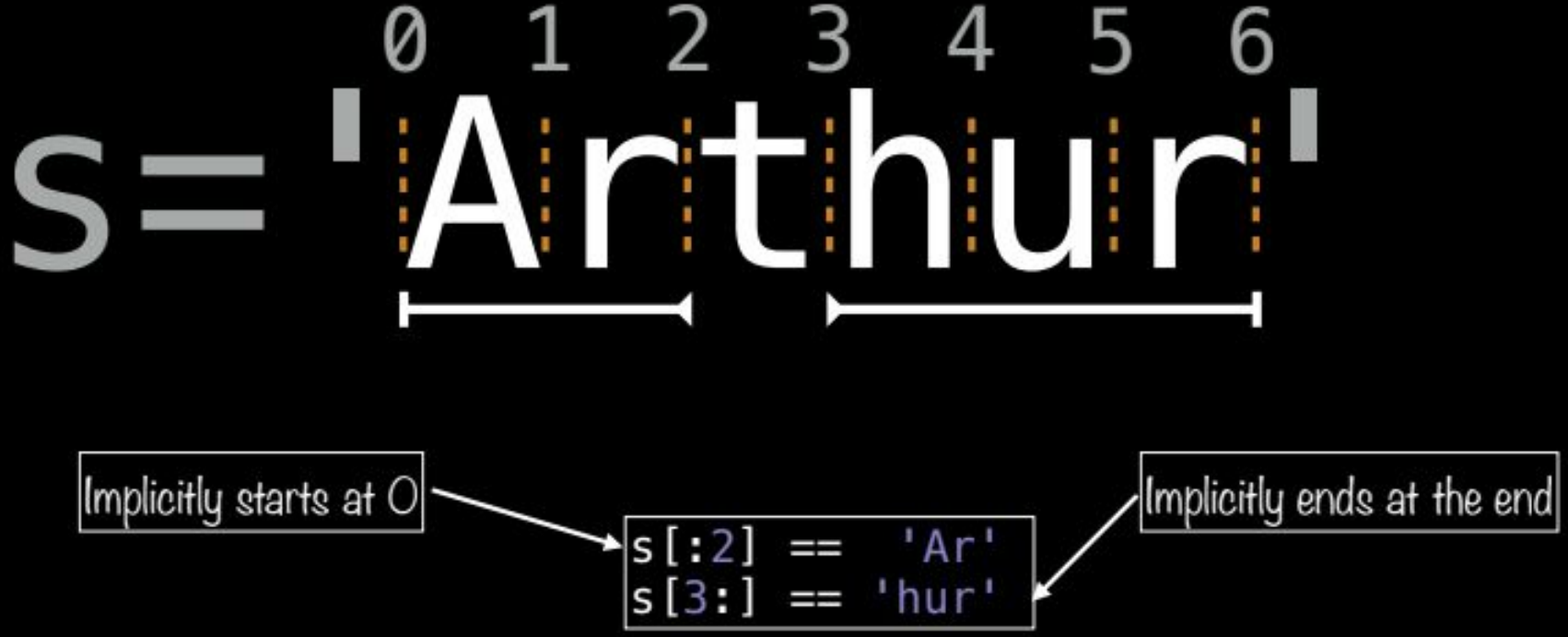
Strings



Slides courtesy of Sam Redmond, CS41

Strings

Can also pass a step size

One way to reverse a string

```
s[1:5:2] == 'rh'
s[4::-2] == 'utA'
 s[::-1] == 'ruhtrA'
```

Slides courtesy of Sam Redmond, CS41

Lists

```
[1, 2, 3, 4, 5]

['a', 'b', 'b', 'd']

[True]

[1, 'a', 2, 'b', True]

[]          # empty list
```

Definition

List
A data type for storing values in a linear collection.

Similar to ArrayList/Vector
Common and versatile

Inspecting list elements

```
>>> letters = ['a', 'b', 'c', 'd']

>>> letters[0]

'a'

>>> letters[1:]

['b', 'c', 'd']
```

Len() built-in

```
>>> letters = [‘a’, ‘b’, ‘c’, ‘d’]

>>> len(letters)

4
```

Adding elements

```
>>> lst = [1, 2, 3, 4, 5]

>>> lst.append(6)

>>> lst

[1, 2, 3, 4, 5, 6]

>>> lst += [7, 8]

[1, 2, 3, 4, 5, 6, 7, 8]
```

Removing elements

```
>>> lst = [1, 2, 3, 4, 5]
>>> last_elem = lst.pop()
>>> last_elem
5
```

pop() removes the last element in a list and returns it. You can also pass an index into pop().

Membership queries

```
>>> fruits = [‘apple’, ‘banana’, ‘mango’, ‘kiwi’]

>>> ‘mango’ in fruits

True

>>> ‘broccoli’ in fruits

False

>>> ‘broccoli’ not in fruits

True
```

For loops – foreach

```
>>> fruits = ['apple', 'banana', 'mango']
>>> for fruit in fruits:
...     print(fruit)
apple
banana
mango
```

For loops – for (range)

```
>>> fruits = ['apple', 'banana', 'mango']
>>> for i in range(len(fruits)):
...     print(fruits[i])
apple
banana
mango
```

for(int i = 0; i < fruits.length; i++)

Range

```
# range(start_i, end_i, step)

range(3)                # generates 0, 1, 2

range(5, 10)            # generates 5, 6, 7, 8, 9

range(2, 12, 3)         # generates 2, 5, 8, 11

range(-7, -11, -1)      # generates -7, -8, -9, -10
```

For loops — enumerate

```
>>> fruits = [‘apple’, ‘banana’, ‘mango’]
>>> for i, fruit in enumerate(fruits):
...     print(i, fruit)
0 apple
1 banana
2 mango
```

Control flow

```
if cs109 == 'awesome':

    print('I love this class!')
```

- No parentheses needed for boolean expression
- Colon
- No curly braces
- 4 spaces for indentation

Control flow

```
if some_condition:
    print('Some condition holds')
elif other_condition:
    print('Other condition holds')
else:
    print('Neither condition holds')
# No switch statement in Python!
```

Writing functions

```
def function_name(param1, param2):
    result = do_something()
    return result
```

- **`def`** keyword defines a function
- no explicit types for parameters

Functions can return multiple values!

```
def function_name(param1, param2):
    result1 = do_something()
    result2 = do_something_else()
    return result1, result2
```

- Returns a tuple
  - tuples are an immutable type
  - can be packed/unpacked

Other important topics we'll cover more in the demo:

- Getting set up with Python
  - using Jupyter notebooks
- Dictionaries
- Sets
- Tuples
- Other libraries
- File reading

Other resources

CS 41 lectures/slides: https://stanfordpython.com/

Resource list from summer CS106AP:
https://web.stanford.edu/class/cs106ap/handouts/additional-resources.html

Demo Time!

https://github.com/sjohnsonyu/cs109_python_tutorial