

Objectives

- Strings

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Motivation: Text Processing

- Mostly focused on numbers so far
 - A little on graphics
- We can manipulate strings to do useful work
 - Web search: finding most relevant documents to a query
 - Analyzing web logs (who is looking at my web page?)
 - Many, many others
- **Today's Focus:** the **str** data type and what you can do with them

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String Comparisons

- Same operations as with numbers:
 - ==, !=
 - <, <=
 - >, >= } Alphabetical comparison
- Use in conditions for **if** statements and **while** loops

```
if userpick == pick4num:
    print "We have a winner!"
else:
    print "You lose."
```

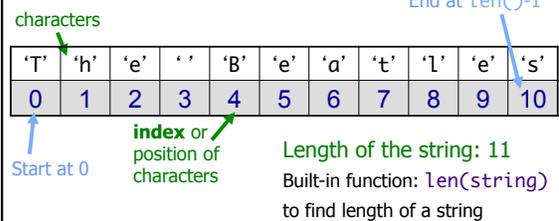
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Strings

- A *sequence* of characters

➢ Example:
band = "The Beatles"



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Iterating Through a String

- Use a **for** loop to iterate through *characters* in a string

string of length 1

```
for char in string:
    print char
```

➢ Read as "for each character in the string"

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Substrings Operator: []

- Look at a particular character in the string

➢ Syntax: str[<integer_expression>]

➢ [Positive value]: index of character

➢ [Negative value]: count backwards from end

- Examples:

➢ <sequence>[0] returns the first element/char

➢ <sequence>[-1] returns the last element/char

We will deal with sequences beyond strings later.

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Examples in shell

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Substrings Operator: []

- Look at a particular character in the string
 - Syntax: `string[<integer_expression>]`
- Examples with `string = "The Beatles"`

T	h	e		B	e	a	t	l	e	s
0	1	2	3	4	5	6	7	8	9	10

Expression	Result
<code>string[0]</code>	
<code>string[3]</code>	
<code>string[len(string)]</code>	
<code>string[len(string)-1]</code>	
<code>string[-1]</code>	

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Substrings Operator: []

- Look at a particular character in the string
 - Syntax: `string[<integer expression>]`
- Examples with `string = "The Beatles"`

T	h	e		B	e	a	t	l	e	s
0	1	2	3	4	5	6	7	8	9	10

Expression	Result
<code>string[0]</code>	"T"
<code>string[3]</code>	" "
<code>string[len(str)]</code>	IndexError
<code>string[len(str)-1]</code>	"s"
<code>string[-1]</code>	"s"

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Iterating Through a String

- Alternatively, can iterate through the *positions* in a string
 - Could write as a **while** loop as well

An integer

```
for pos in xrange(len(string)):
    print string[pos]
```

Index into the string

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Summary: Iterating Through a String

- For each character in the string

string of length 1

```
for char in string:
    print char
```

Determines loop's behavior

- For each position in the string

An integer

```
for pos in xrange(len(string)):
    print string[pos]
```

Index into the string

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Substrings Operator: [:]

- Select a substring (zero or more characters) using the `[]` and `:`
- `<sequence>[<start>:<end>]`
 - returns the subsequence from **start** up to and **not** including **end**
- `<sequence>[<start>:]`
 - returns the subsequence from **start** to the end of the sequence
- `<sequence>[:<end>]`
 - returns the subsequence from the first element up to and **not** including **end**
- `<sequence>[::]`
 - returns a copy of the entire sequence

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Substrings Operator: [:]

- Select a substring (one or more characters) using the `[]` and `:`
- Examples: `file = "program.py"`

p	r	o	g	r	a	m	.	p	y
0	1	2	3	4	5	6	7	8	9

Expression	Result
<code>file[:]</code>	
<code>file[0:2]</code>	
<code>file[:3]</code>	
<code>file[8:]</code>	
<code>file[-2:]</code>	

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Substrings Operator: [:]

- Select a substring (one or more characters) using the [] and :
- Examples: file = "program.py"

p	r	o	g	r	a	m	.	p	y
0	1	2	3	4	5	6	7	8	9

Expression	Result
file[0:]	"program.py"
file[0:2]	"pr"
file[:3]	"pro"
file[8:]	"py"
file[-2:]	"py"

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Testing for Substrings

- Using the **in** operator
 - Used **in** before in **for** loops
- Syntax:

```
substring in string:
```

- Evaluates to True or False

- Example:

```
if "cat" in name:
    print name, "contains 'cat'"
```

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String Search Comparison

- What do the two **if** statements test for?

```
PYTHON_EXT = ".py"
filename = raw_input("Enter a filename: ")
if filename[-(len(PYTHON_EXT)):] == PYTHON_EXT:
    # Appropriate output
if PYTHON_EXT in filename:
    # Appropriate output
```

- How would the program execution change if it were an **if-elif**?

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search.py

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Strings are Immutable

You cannot change the value of strings

- For example, you **cannot** change a character in a string

```
➤ str[0] = 'S'
```

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Practice: Revised Pick4 Numbers

- Tell the user how many numbers they got right
 - Get prizes for having some numbers right
- Examples:

Pick4 Num	User's Pick	Num Correct
"7737"	"1234"	1
"0204"	"1234"	2
"1234"	"1234"	4

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pick4num_places.py

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USING THE STR API

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str Methods

- **str** is a *class* or a *type*
- **Methods**: available operations to perform on **str** objects
 - Provide common functionality
- To see all methods available for **str** class
 - `help(str)`

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str Methods

- Example method: **find(substring)**
 - Finds the index where substring is in string
 - Returns -1 if substring isn't found

- To call a method:
 - `<string>.methodname([arguments])`
 - Example: `filename.find(".py")`

Executed on this string

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Common str Methods

Method	Operation
<code>center(width)</code>	Returns a copy of string centered within the given number of columns
<code>count(sub[, start [, end]])</code>	Return # of non-overlapping occurrences of substring <code>sub</code> in the string.
<code>endswith(sub), startswith(sub)</code>	Return <code>True</code> iff string ends with/starts with <code>sub</code>
<code>find(sub[, start [, end]])</code>	Return first index where substring <code>sub</code> is found
<code>isalpha(), isdigit(), isspace()</code>	Returns <code>True</code> iff string contains letters/digits/whitespace only
<code>lower(), upper()</code>	Return a copy of string converted to lowercase/lowercase

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Sprenkle - CSCI111 `string_methods.py`

Common str Methods

Method	Operation
<code>replace(old, new[, count])</code>	Returns a copy of string with all occurrences of substring <code>old</code> replaced by substring <code>new</code> . If <code>count</code> given, only replaces first <code>count</code> instances.
<code>split([sep])</code>	Return a list of the words in the string, using <code>sep</code> as the delimiter string. If <code>sep</code> is not specified or is <code>None</code> , any whitespace string is a separator.
<code>strip()</code>	Return a copy of the string with the leading and trailing whitespace removed
<code>join(<sequence>)</code>	Return a string which is the concatenation of the strings in the sequence with the string this is called on as the separator
<code>swapcase()</code>	Return a copy of the string with uppercase characters converted to lowercase and vice versa.

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String Methods vs. Functions

Functions

- All "input" as arguments/parameters
- Example: `len` is a built-in function
 - Called as `len(string)`

Methods

- "Input" are argument/parameters **and** the string the method was called on
- Example:
 - `string.upper()`

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Looking Ahead

- Tuesday: Lab
- Friday: Broader Issue: BUGS!
- Today – Wednesday
 - Jeopardy! Challenge
 - Answer questions on Sakai

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