Objectives

- Continuing text processing, manipulation
  - String operations, processing, methods

Review

- How do we represent text?
  - How can we represent really long text?
- How can we combine strings?
  - How can we combine strings multiple times?
- How can you tell which string comes first alphabetically?
  - What are some limitations to that approach?
- How can you find out how long a string is?
- How do we find the character at a particular position of a string?
- How do we iterate over the characters in a string? (two ways)

Review: String Comparisons

- Same operations as with numbers:
  - ==, !=
  - <, <=
  - >, >=

  } Alphabetical comparison

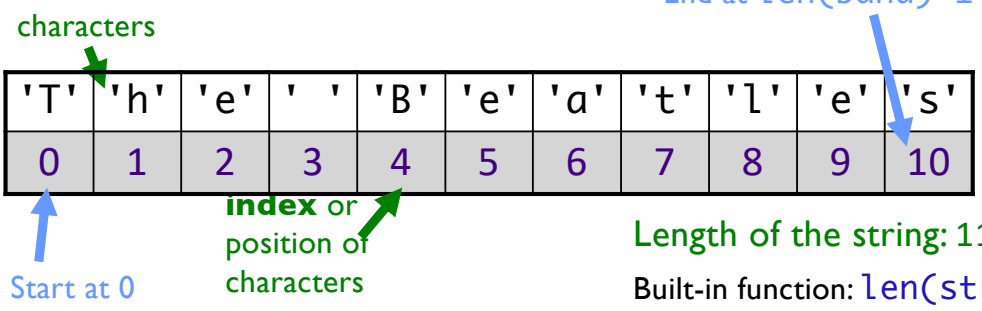
- Use in conditions in `if` statements

```
if courseChoice == "CSCI111":
    print("Good choice!")
else:
    print("Maybe next semester")
```


Review: Strings

- A ***sequence*** of one-character strings
  - Example:

```
band = "The Beatles"
```



Length of the string: 11

Built-in function: `len(string)` to find length of a string

Review: Substrings Operator: []

- Look at a particular character in the string
  - Syntax: `string[<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 use sequences beyond strings later.

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Review: Substrings Operator: []

- Look at a particular character in the string
  - Syntax: `string[<integer_expression>]`
- Examples with `band = "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
band[0]	"T"
band[3]	" "
band[len(band)]	IndexError
band[len(band)-1]	"s"
band[-1]	"s"

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Review: Iterating Through a String

- For each *character* in the string

string of length 1

```
for char in mystring:
    print(char)
```

- For each *position* in the string

What comes after `in` determines loop's behavior

An integer

```
for pos in range(len(mystring)):
    print(mystring[pos])
```

Index into the string

Review: Substrings Operator: [:]

- Select a substring (zero or more characters) using **[ ]** 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

Review: Substrings Operator: [:]

- Select a substring (one or more characters)
- Examples: `filename = "program.py"`

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

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

Testing for Substrings

- Using the `in` operator
  - Used `in` before in `for` loops
- Syntax: `substring in string`
  - Evaluates to `True` or `False`
- Example: simple Web search

```
if searchTerm in documentText:
      print(documentText, "contains", searchTerm)
```

String Search Comparison

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

```
PYTHON_EXT = ".py"

filename = input("Enter a filename: ")

if filename[-(len(PYTHON_EXT)):] == PYTHON_EXT:
        # Appropriate output 1
if PYTHON_EXT in filename:
        # Appropriate output 2
```

Provide some examples for `filename` and state how code would execute

String Search Comparison

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

```
PYTHON_EXT = ".py"

filename = 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**?

Strings are Immutable

You cannot change the value of strings

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

~~str[0] = 'S'~~

USING THE STR API

Review

- What is an API?
- What are methods?
- How do we call methods on an object?

`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)`

`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:
  - `<str_obj>.methodname([arguments])`
  - Example: `filename.find(".py")`

Executed on this string

Common `str` Methods

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

Common `str` Methods

What do the square brackets in APIs mean?

Method	Operation
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Common `str` Methods

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

String Methods vs. Functions

Functions

- All input comes from arguments/parameters
- Example: `len` is a built-in function
  - Called as `len(strobj)`

Methods

- Input comes from arguments ***and*** the string the method was called on
- Example:
  - `strobj.upper()`

How to Use APIs

- Given a problem, break down the problem
  - Can any of the parts of the problem be solved using a method in the API?

Wheel of Fortune

- Determine how many of a certain letter are in a given phrase
- How would we solve this, regardless of case?

```
def getNumberOfLetters( phrase, letter ):
```

Example Test Cases:

```
test.testEqual( getNumberOfLetters("abracadabra", "a"), 5)
test.testEqual( getNumberOfLetters("Abracadabra", "a"), 5)
```


Escape Sequences

- Escape character: \
- Escape sequences:
  - newline character (carriage return) → \n
  - tab → \t
  - quote → \" or \'
  - backslash → \\
- Example:
  - `print("To print a \\, you must use \"\\\\\"")`
    - What does this display?

Interactive demonstration

Practice

- Display To print a tab, you must use '\t'.
- Display I said, "How are you?"

escape_sequence.py

Revised Pick4 Game

- To play: pick 4 numbers between 0 and 9
- To win: select the numbers that are selected by the magic ping-pong ball machine
- Previously: Simulated the magic ping-pong ball machines
- Additional Functionality:
  - Determine if the user picks the winning number
    - Why couldn't we solve this before?
      - What are valid choices for numbers?

 pick4winner.py

Looking Ahead

- Lab 6 Prep due tomorrow
- Lab 6 tomorrow!
- Broader Issue Friday