SI 506: Programming I
Fall 2019
Lecture 12

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UMSI

Slide deck revisions

errata: corrections and other changes

Slide no(s).	Fix ver.	Description
	v1p1	

preliminaries

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Class exercise

open file, read contents, write to file

Canvas Files

`lectures/lecture_12/`

`lecture_12_exercise.py`

`umich_victors_with_title.txt`

Upload to pythonanywhere.com

Place in same directory

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Midterm

topic coverage

- values, types, and variables
- statements and expressions
- operators (select list)
  - arithmetic (`+`, `-`, `*`, `/`, `//`)
  - assignment (`=`, `+=`)
  - comparison (`==`, `!=`, `>`, `<`, `>=`, `<=`)
  - logical (`and`, `or`, `not`)
  - membership (`in`, `not in`)
- built-in functions (`input()`, `int()`, `float()`, `len()`, `open()`, `range()`, `sorted()`, `str()`, `type()`)
- strings, string methods
- lists, list methods
- indexing and slicing
- loops (`for`, `while`)
  - use of counters in loops (`i = 0` … `i +=1`)
  - control statements (`continue`, `break`)
- conditional statements (`if`, `else`)
  - truth value testing (test object for truth value in `if` or `while` statements)
- functions
  - parameters, optional parameters
  - return statements
- reading from and writing to files
  - using the `with` statement

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review

lists, functions, conditional statements

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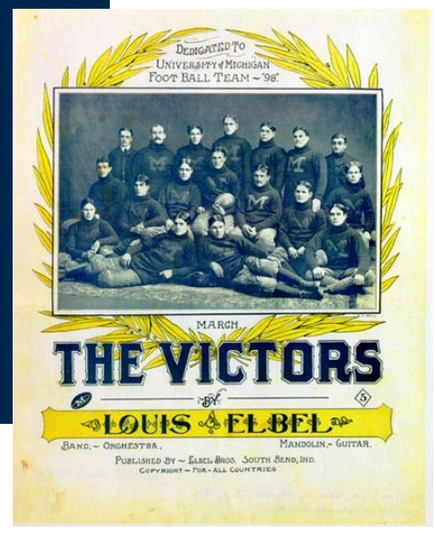
Source file

umich_victors_with_title.txt



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challenge I

Function: open file, read lines, return list

using with statement and built-in open() function

```
source_path = 'umich_victors_with_title.txt'

def read_file(path):
    """Read file line by line, return list."""
    file_lines = []
    with open(path, 'r') as file_obj:
        for file_line in file_obj:
            file_lines.append(file_line.strip())
    return file_lines

# Get file content
lines = read_file(source_path)
print(f"lines = {lines}\n")
```

return list of strings

List: lyrics

get lines from file, work with lyrics only

```
# Get file content
lines = read_file(source_path)

print(f"lines = {lines}\n")

# Get lyrics only
lyrics = lines[0] # Fix me

print(f"lyrics = {lyrics}\n")
```

challenge II

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List: lyrics

list includes blank elements

```
# Potential gotcha (blank elements in list)
lyrics_excerpt = [
    'We hurrah, hurrah, we greet you now,',
    'Hail!',
    '',
    'Far we their praises sing'
]
```

is blank

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Loop: truth value test, counter

return count of non-blank lines

```
# Get file content
lyrics = read_file(source_path)

# Count non-blank lines
num_non_blank_lines = 0
for line in lyrics:
    if line: # truthy (non blank line)
        num_non_blank_lines = ??? # Fix me

print(f"num_non_blank_lines = {num_non_blank_lines}\n")
```

Loop: truth value test, counter

return count of blank lines

```
# Get file content
lyrics = read_file(source_path)

# Total blank lines
num_blank_lines = 0
for line in lyrics:
    if line: # Fix me (fails to identify blank line)
        num_blank_lines += 1

print(f"blank_lines = {num_blank_lines}\n")
```

Loop: if statement, membership operator

return count of lines featuring 'Hail!'

```
# Get file content
lyrics = read_file(source_path)

# Get count of lines featuring 'Hail!'
num_hail_lines = 0
hail = 'Hail!'
for line in lyrics:
    pass # Fix me (add conditional statement, counter)

print(f"num_hail_lines = {num_hail_lines}\n")
```


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Loop: get line lengths

list of line lengths

```
# Get file content
lyrics = read_file(source_path)

# Get length of each line, add to list
line_lengths = []
for line in lyrics:
    line_lengths.append(line)) # Fix me

print(f"line_lengths = {line_lengths}")
print(f"line_lengths_sorted = {sorted(line_lengths)}\n")
```

Loop: if statement, comparison operator

append to list lines 28 characters long

```
# Get file content
lyrics = read_file(source_path)

twenty_eight_chars = []
for line in lyrics:
    pass # Fix me: test for 28 char lines
         # Fix me: add line to list

print(f"twenty_eight_chars = {twenty_eight_chars}\n")
```

challenge III

List: words

nested lists

```
# Word lookup list
# greetings,
# applause
# honorifics (the nouns of winners)
# superlative adjectives
words = [
        ['hail'],
        ['cheer', 'hurrah'],
        ['champions', 'heroes', 'leaders', 'victors'],
        ['best', 'stalwart', 'triumphant', 'valiant']
]
```

Function: count lines with certain words

nested lists; membership check, counter, control statement

```
def count_lines_with_words(lyrics, words):
    """Increment count if any word in word list
    is found in line. If match found, terminate
    inner loop to avoid inflating count."""
    count = 0
    for line in lyrics:
        for word in words:
            if . . . # FIX ME: define condition
                # FIX ME: need counter
                pass # FIX ME terminate on 1st match
    return count
```

Functions: lines with certain words

call function: pass in lyrics and word list

```
# Word lookup list
# greeting
# applause
# honorifics (the nouns of winners)
# superlative adjectives
words = [
    ['hail'],
    ['cheer', 'hurrah'],
    ['champions', 'heroes', 'leaders', 'victors'],
    ['best', 'stalwart', 'triumphant', 'valiant']
]
```

```
# Test 4 (superlatives list)
superlative_lines_count = count_lines_with_words(lyrics, []) # Fix

print(f"superlative_lines_count = {superlative_lines_count}")
print(f"superlative lines/total lines = {round(superlative_lines_count/num_lines, 2)}\n”)

# Test 5 (new list, one element = ‘victors’)
victors_lines_count = count_lines_with_words(lyrics, []) # Fix

print(f"victors_lines_count = {victors_lines_count}\n")
print(f"victors lines/total lines = {round(victors_lines_count/num_lines, 2)}\n")
```


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Function: count lines with certain words

refactor: use built-in function any() [NOT part of midterm]

Built-in any() function returns True if any element of an iterable is true. If the iterable is empty, returns False.

```
def count_lines_with_words(lyrics, words):
    """Increment count if word is found in line.
    If any match found, increment counter."""
    count = 0
    for line in lyrics:
        if any(word in line.lower() for word in words):
            count += 1
    return count
```

challenge IV

Function: frequency count of words

nested loops; count all instances of a particular word

```
# Finally, write 'leaders and best' chorus to target file
# Append 'Go Blue!" to chorus then write to file
# Remember to add trailing newline \n to line string
leaders_chorus = lyrics[17:??] # Fix me
chorus_with_go_blue = ???

print(f"leaders_chorus = {leaders_chorus}")
print(f"go_blue = {go_blue}\n")

# Add counter to print statement (debug friend)
i = 1
with open(target_path, 'w') as target:
    for line in leaders_chorus:
        print(f"line {i} = {line}")
        target.write(f"{line}\n")
        i += 1
```


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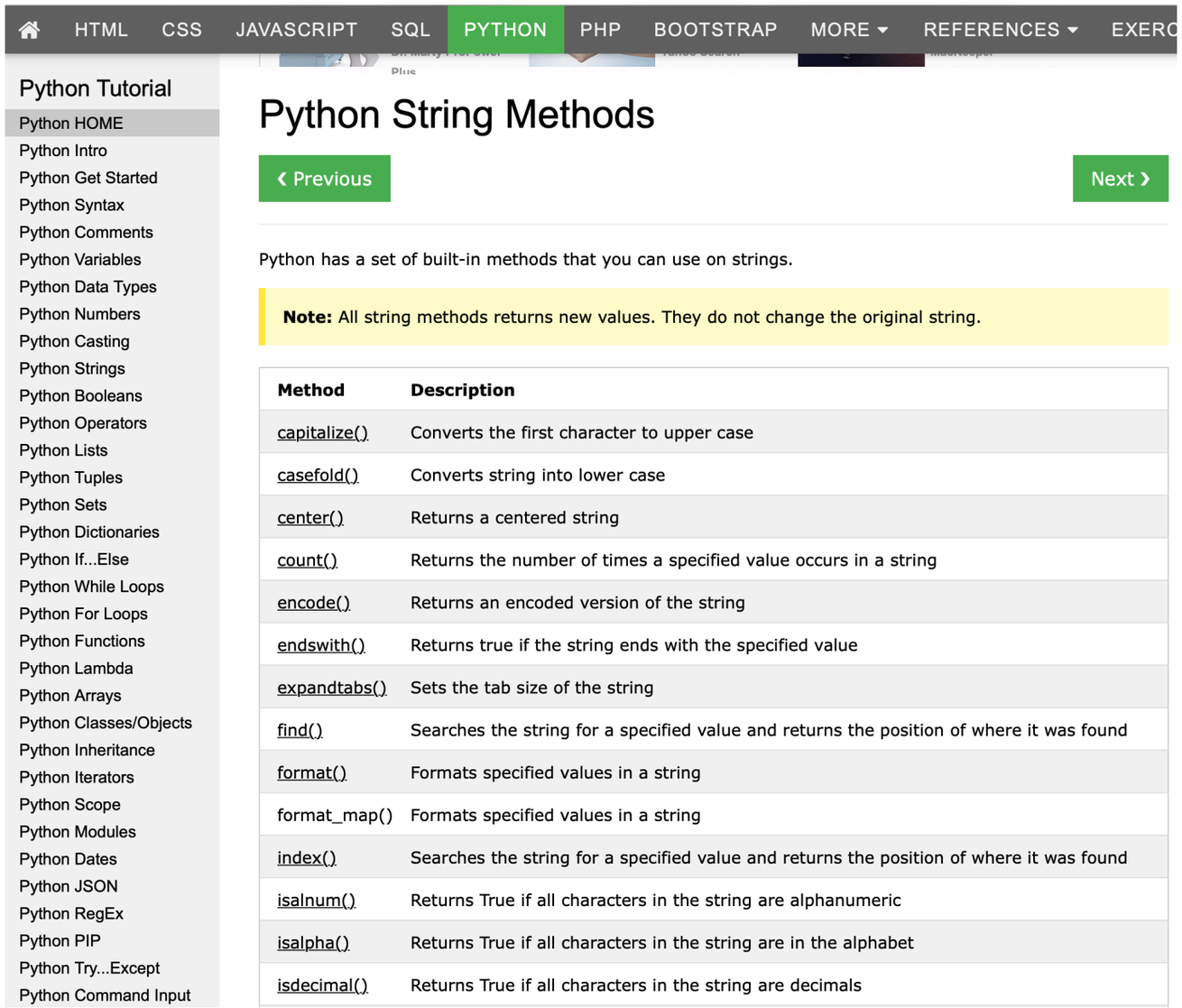
Not sure: search ‘python string methods’

w3schools.com

http://bit.ly/2IxRa9S



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Function: frequency count of words

nested loops; str.count()

```
# Word lookup list
# words[0] greeting
# word[1] applause
# words[2] honorifics (the nouns of winners)
# words[3] superlative adjectives
words = [
    ['hail'],
    ['cheer', 'hurrah'],
    ['champions', 'heroes', 'leaders', 'victors'],
    ['best', 'stalwart', 'triumphant', 'valiant']
]
```

```
# Test 1
hail_count = count_word_in_lyrics(lyrics, '') # Fix me
print(f"hail_count = {hail_count}\n")

# Test 2
cheer_count = count_word_in_lyrics(lyrics, '') # Fix me
print(f"cheer_count = {cheer_count}\n")
```

challenge V

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File: write leaders and best chorus to file

list slicing, insert, append

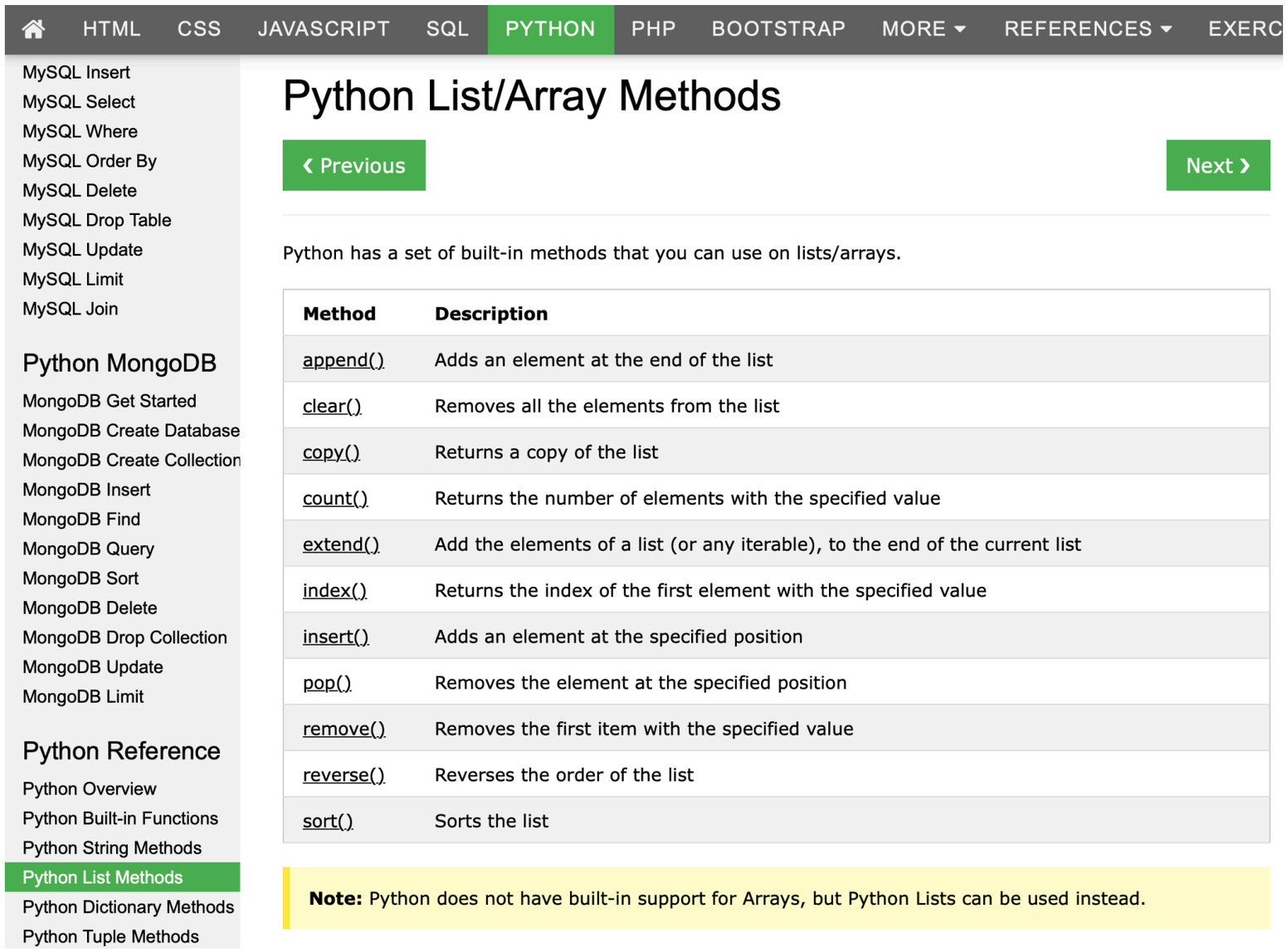
```
target_path = 'umich_victors_leaders_refrain.txt'

# write 'leaders and best' chorus to target file
# First, slice the list to get the 'leaders and best' chorus
# Second, insert the original title and copyright and blank line before
chorus
# Third, append 'Go Blue!" to chorus
# Finally, write to file
# Remember to add trailing newline \n to line string
```

```
leaders_chorus = lyrics[17:0] # Fix me

i = 0
for line in lines[0]: # Fix me
    leaders_chorus.???? # Fix me with a list method
    i += 1
leaders_chorus.append('Go Blue!')

i = 1 # Debug: add line number to print statement
with open(target_path, 'w') as target:
    for line in leaders_chorus:
        print(f"line {i} = {line}”) # Debug line
        target.write(f"{line}\n")
        i += 1
```

Not sure: search ‘python list methods’

w3schools.com

http://bit.ly/2Oytje1



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File: optional parameter modes

open()

```
file_handle = open(path, '<mode>')
```

‘r’: read

‘w’: write

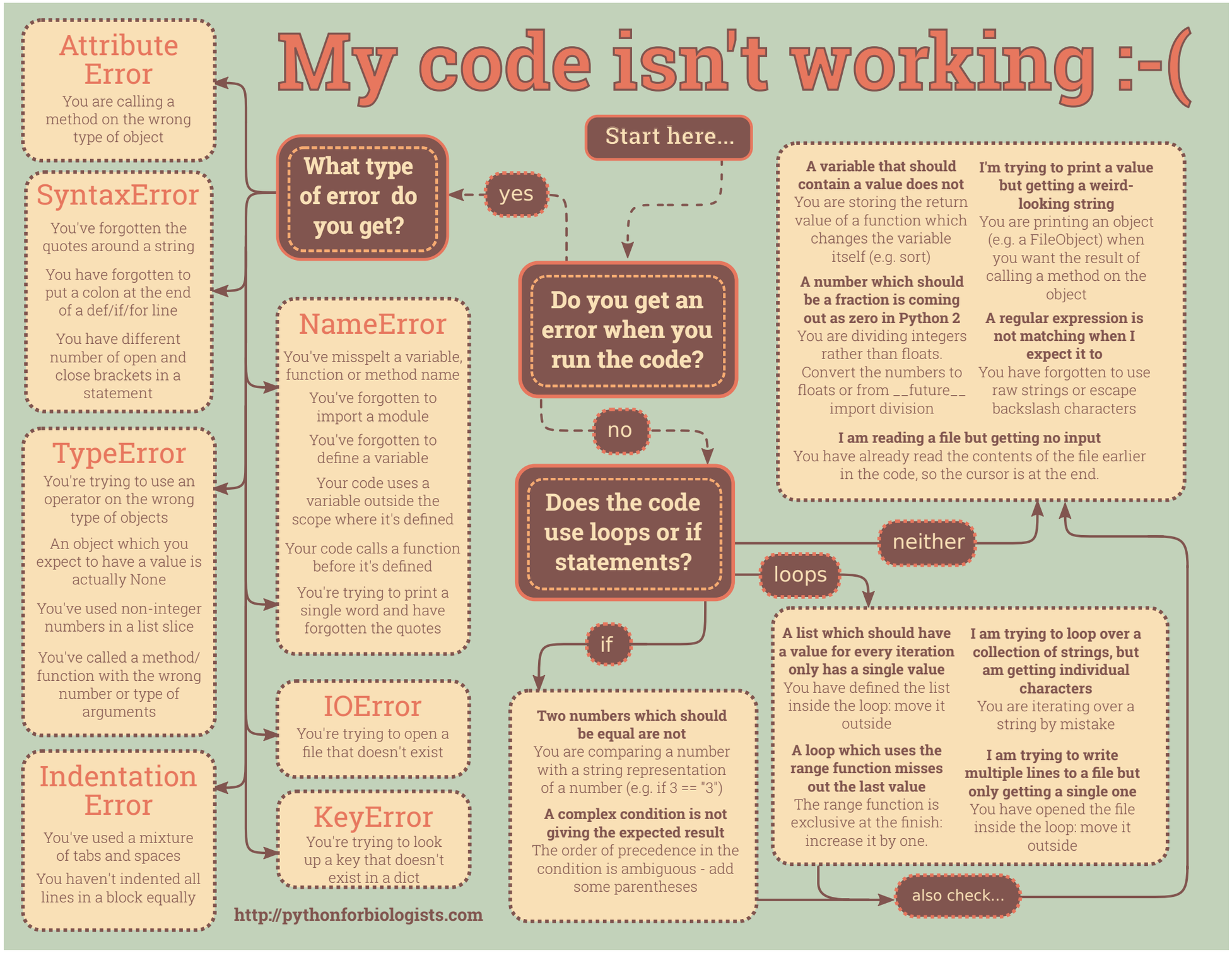
‘x’: create, write (new file)

‘a’: append (existing file)

‘r+’: read, write (same file)

When your code misbehaves

debug flowchart



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Function: open file, read lines, return list

using with statement and built-in open() function

```
source_path = 'umich_victors_with_title.txt'

def read_file(path):
    """Read file line by line, return list."""
    file_lines = []
    with open(path, 'r') as file_obj:
        for file_line in file_obj:
            file_lines.append(file_line.strip())
    return file_lines

# Get file content
lines = read_file(source_path)
print(f"lines = {lines}\n")
```

return list of strings

List: lyrics

get lines from file, work with lyrics only

```
# Get file content
lines = read_file(source_path)

print(f"lines = {lines}\n")

# Get lyrics only
lyrics = lines[3:]

print(f"lyrics = {lyrics}\n")
```

List: lyrics

compute length (count of all lines)

```
# Get file content
lyrics = read_file(source_path)

# Total lines
num_lines = len(lyrics)

print(f"num_lines = {num_lines}\n")
```

Loop: truth value test, counter

return count non blank lines

```
# Get file content
lyrics = read_file(source_path)

# Total non-blank lines
num_non_blank_lines = 0
for line in lyrics:
    if line: # truthy (non blank line)
        num_non_blank_lines += 1

print(f"num_non_blank_lines = {num_non_blank_lines}\n")
```

Loop: truth value test, counter

return count of blank lines

```
# Get file content
lyrics = read_file(source_path)

# Total blank lines
num_blank_lines = 0
for line in lyrics:
    if not line: # falsy (blank line)
        num_blank_lines += 1

print(f"blank_lines = {num_blank_lines}\n")
```

Loop: if statement, membership operator

return count of lines featuring 'Hail!'

```
# Get file content
lyrics = read_file(source_path)

# Get count of lines featuring 'Hail!'
num_hail_lines = 0
hail = 'Hail!'
for line in lyrics:
    if hail in line:
        num_hail_lines += 1

print(f"num_hail_lines = {num_hail_lines}\n")
```

Loop: get line lengths

list of line lengths

```
# Get file content
lyrics = read_file(source_path)

# Get length of each line, add to list
line_lengths = []
for line in lyrics:
    line_lengths.append(len(line))

print(f"line_lengths = {line_lengths}\n")
```

Loop: if statement, comparison operator

append to list lines 28 characters long

```
# Get file content
lyrics = read_file(source_path)

twenty_eight_chars = []
for line in lyrics:
    if len(line) == 28:
        twenty_eight_chars.append(line)

print(f"twenty_eight_chars = {twenty_eight_chars}\n")
```

List: words

nested lists

```
# Word lookup list
# greetings
# applause
# honorifics (the nouns of winners)
# superlative adjectives
words = [
        ['hail'],
        ['cheer', 'hurrah'],
        ['champions', 'heroes', 'leaders', 'victors'],
        ['best', 'stalwart', 'triumphant', 'valiant']
]
```

Function: count lines with certain words

nested lists; membership check, counter, control statement

```
def count_lines_with_words(lyrics, words):
    """Increment count if any word in word list
    is found in line. If match found, terminate
    inner loop to avoid inflating count."""
    count = 0
    for line in lyrics:
        for word in words:
            if word in line.lower():
                count += 1
                break # terminate on 1st match
    return count
```

Function: count lines with certain words

call function: pass in lyrics and word list

```
# Word lookup list
# greetings
# applause
# honorifics (the nouns of winners)
# superlative adjectives
words = [
    ['hail'],
    ['cheer', 'hurrah'],
    ['champions', 'heroes', 'leaders', 'victors'],
    ['best', 'stalwart', 'triumphant', 'valiant']
]
```

```
# Test 4 (superlatives list)
superlative_lines_count = count_lines_with_words(lyrics, words[-1])

print(f"superlative_lines_count = {superlative_lines_count}")
print(f"superlative lines/total lines = {round(superlative_lines_count/num_lines, 2)}\n”)

# Test 5 (new list, one element = ‘victors’)
victors_lines_count = count_lines_with_words(lyrics, [words[2][3]])

print(f"victors_lines_count = {victors_lines_count}\n")
print(f"victors lines/total lines = {round(victors_lines_count/num_lines, 2)}\n”)
```


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Function: count lines with certain words

refactor: use built-in function any() [NOT part of midterm]

Built-in any() function returns True if any element of an iterable is true. If the iterable is empty, returns False.

```
def count_lines_with_words(lyrics, words):
    """Increment count if word is found in line.
    If any match found, increment counter."""
    count = 0
    for line in lyrics:
        if any(word in line.lower() for word in words):
            count += 1
    return count
```

Function: frequency count of words

nested loops; count all instances of a particular word

```
def count_word_in_lyrics(lyrics, word):
    """count number of times word appears in lyrics."""
    count = 0
    for line in lyrics:
        if word in line.lower():
            count += line.lower().count(word)
            # count += 1 (misses multiple instances)
    return count
```

Function: count word in lyrics

nested loops; str.count()

```
# Word lookup list
# words[0] greeting
# word[1] applause
# words[2] honorifics (the nouns of winners)
# words[3] superlative adjectives
words = [
    ['hail'],
    ['cheer', 'hurrah'],
    ['champions', 'heroes', 'leaders', 'victors'],
    ['best', 'stalwart', 'triumphant', 'valiant']
]
```

```
# Test 1
hail_count = count_word_in_lyrics(lyrics, words[0][0])
print(f"hail_count = {hail_count}\n")

# Test 2
cheer_count = count_word_in_lyrics(lyrics, words[1][0])
print(f"cheer_count = {cheer_count}\n")
```

File: write leaders and best chorus to file

list slicing, insert, append

```
target_path = 'umich_victors_leaders_refrain.txt'

# write 'leaders and best' chorus to target file
# First, slice the list to get the 'leaders and best' chorus
# Second, insert the original title and copyright and blank line before
chorus
# Third, append 'Go Blue!" to chorus
# Finally, write to file
# Remember to add trailing newline \n to line string
```

```
leaders_chorus = lyrics[17:21]

i = 0
for line in lines[:3]:
    leaders_chorus.insert(i, line)
    i += 1
leaders_chorus.append('Go Blue!')

i = 1 # Debug: add line number to print statement
with open(target_path, 'w') as target:
    for line in leaders_chorus:
        print(f"line {i} = {line}")
        target.write(f"{line}\n")
        i += 1
```