

Module 7

Strings, Sequences, Slicing

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Agenda

- Review Strings
- Practice Problems

What is a string again?

What is a string again?

- A data type
- Can be described as a “sequence of characters”
- Characters are arranged in a certain order

String indexing

```
word = "Python"  
word[4] → o  
Word[-2] → o
```

Forward direction indexing

0	1	2	3	4	5
P	y	t	h	o	n
-6	-5	-4	-3	-2	-1

Backward direction indexing

What are the two ways that I can iterate over a string?

```
name = "Emily"
```

```
>> E
```

```
>> M
```

```
>> I
```

```
>> L
```

```
>> Y
```

What are the two ways that I can iterate over a string?

```
for c in "Emily":  
    print(c)
```

```
>> E  
>> M  
>> I  
>> L  
>> Y
```


```
name = "Emily"
```

```
for i in range(5):  
    print(name[i])
```

```
>> E      # name[0]  
>> M      # name[1]  
>> I      # name[2]  
>> L      # name[3]  
>> Y      # name[4]
```

Iterating over a String using Indexing

```
word = "Emily"
for i in range(0, 5):
    print (word[i])

word2 = "Supercalifragilisticexpialidocious"
for i in range(0, ):
    print(word[i])
```


Iterating over a String using Indexing

```
word = "Emily"  
for i in range(0, 5):  
    print (word[i])
```

```
word2 = "Supercalifragilisticexpialidocious"  
for i in range(0, len(word2)):  
    print(word[i])
```

Programming Challenge

Write a function that counts the #'s of vowels in a string
(A,E,I,O,U)

```
# name: countVowels  
# input: a string  
# processing: counts the number of vowels in a word  
# the number of vowels
```

```
vowels = countVowels("Emily")  
print(vowels) # 2
```

```
def countVowels(word):  
    vowelCount = 0  
    for c in word.lower():  
        if c == "a" or c == "e" or c == "i" or c == "o" or c == "u":  
            vowelCount += 1  
    return vowelCount
```

String slicing

Slicing a String

- Sometimes you may find it necessary to extract a portion of a string from another string.
- You can use “slicing” notation in Python to extract a span of characters from a string into a new string. We call this new String a "substring". For example:

```
full_name = "Emily Zhao"
first_name = full_name[0:5]

print (first_name)

>> Emily
```

Slicing a String

```
substring = bigstring[start:end:step]
```

- You must supply at least a start or an ending index value.
- Substrings contain all characters starting at the start value specified and continue up to (but do not include) the ending value.
- Omitting a starting or ending index value will cause Python to assume you want to start at the beginning of the string (if you omit a start value) or you want to continue slicing to the end of the string (if you omit the end value)
- **This should look a lot like the range function!**

String Slicing Notation

What will the following code print?

```
word = "Superman sings in the shower."
```

<code>Print (word[7])</code>	<code>> n</code>
<code>print (word[0:8])</code>	<code>> Superman</code>
<code>print (word[9:14])</code>	<code>> sings</code>
<code>print (word[:5])</code>	<code>> Super</code>
<code>print (word[9:])</code>	<code>> sings in the shower.</code>
<code>print (word[-7:])</code>	<code>> shower.</code>
<code>print (word[0:len(word):3])</code>	<code>> Seasgit or</code>
<code>print (word[30])</code>	<code>> IndexError: string index out of range</code>

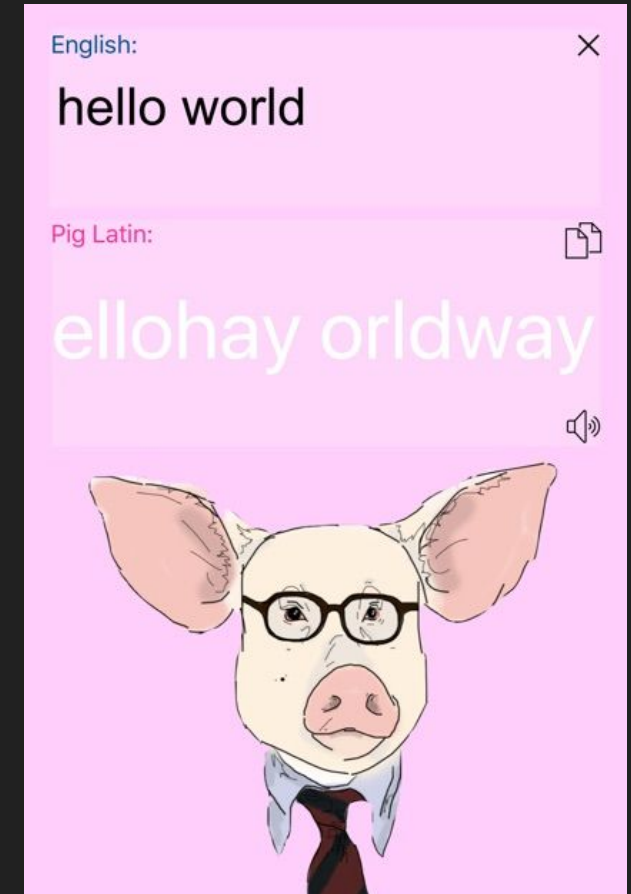
Programming Challenge: Pig Latin Translator

- Write a function that takes a word as an input and returns the pig latin version of that word.

A Pig Latin word can be generated using the following rules:

- Remove the first letter of the word
- Place the first letter of the word at the end of the word
- Add the string "ay" to the end of the word

```
pig_greeting = pigLatinify("hello")  
print(pig_greeting) # ellohay
```




```
def pigLatinify(word):  
    # construct new word through concatenation and slicing  
    pig_word = word[1:] + word[0] + "ay"  
    return pig_word
```

**Strings cannot be changed
once they are created.**

→ True or false?

**Strings cannot be changed
once they are created.**

→ True!

Strings are “Immutable”

- Strings are an **immutable** data type. This means that they cannot be changed once they are created.
- This may seem counter intuitive, since we have been doing the following since the beginning of the semester:

```
word = "superman"
print ("word is", word)
word = "wonder woman"
print ("word is now", word)

>> word is superman
>> word is now wonder woman
```

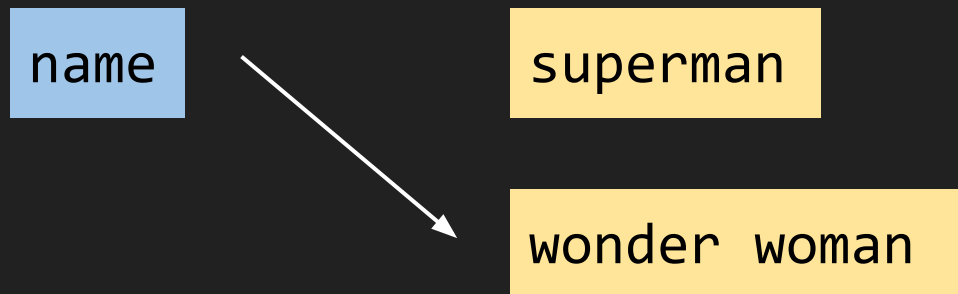
Strings are “Immutable”

- What actually happens “under the hood” is that Python creates a separate string in your computer’s memory and “points” to that string instead of the original one.

```
name = 'superman'
```



```
name = 'wonder woman'
```



Strings are “Immutable”

- This means that you cannot change the individual characters within a string using index notation. You will raise an exception if you attempt to do so.

```
name = "Emily"  
name[4] = "i"  
print(name)
```

```
name[4] = "i"  
TypeError: 'str' object does not  
support item assignment
```

How do you change a string then?

Programming Challenge

Write a function that replaces all vowels in a String with the underscore character (_)

hello → **h_ll_**

Will this work?

```
word = "hello"

for i in range(len(word)):
    # if the letter is a vowel, reassign it to _
    if word[i] in ["a", "e", "i", "o", "u"]:
        word[i] = "_"

print(word)
```

How do you change a string then? → Gotta make a new one!

```
word = "hello"
new_word = ""

for i in range(len(word)):
    # if the letter is a vowel, add _ to new word
    if word[i] in ["a", "e", "i", "o", "u"]:
        new_word += "_"
    # if the letter is a consonant, just add the letter
    else:
        new_word += word[i]

print(new_word)
```

Testing Strings with in and not in

- The "in" operator is a Boolean operator that you can use to test to see if a substring exists inside of another string. Example:

```
word = "Grace Lily John Chris Tom"

if "Chris" in word:
    print ("found him!")
else:
    print ("can't find Chris")
```

- When you construct an expression with the “in” operator the result will evaluate to a Boolean

Programming Challenge: Balance Test

- Write a function to check if two strings are “balanced.”
- For example, strings s1 and s2 are balanced if all the characters in the s1 are present in s2. The character’s position doesn’t matter.

Case 1:

```
s1 = "Ya"
```

```
s2 = "PYnative"
```

```
> True
```

```
outcome = checkBalance("Ya", "PYnative")  
print(outcome) # True
```

Case2:

```
s1 = "Ynf"
```

```
s2 = "PYnative"
```

```
> False
```

```
outcome = checkBalance("Ynf", "PYnative")  
print(outcome) # False
```

```
def checkBalance(word1, word2):  
    flag = True # default assume balanced  
    for c in word1:  
        if c in word2:  
            continue  
        else:  
            flag = False # update with false  
  
    return flag
```

Programming Challenge: Palindrome Tester

- Write a program that asks the user for a word
- Determine whether the supplied word is a palindrome (a word that reads the same backwards and forwards)

RACECAR

```
word = input("Check if a word is a palindrome: ")
backwards_word = ""

for i in range(len(word)-1, -1, -1):
    backwards_word += word[i]

print(backwards_word)
if word == backwards_word:
    print(word, "is a palindrome!")
else:
    print(word, "is not a palindrome.")
```



```
word = input("Check if a word is a palindrome: ")  
  
if word == word[::-1]:  
    print(word, "is a palindrome!")  
else:  
    print(word, "is not a palindrome.")
```

String functions

Getting the largest and smallest character in a string

- You can use two built in Python functions to obtain the maximum and minimum characters in a string (based on their ASCII codes)

```
a = max("python")  
b = min("python")
```

```
print ("max:", a)  
print ("min:", b)
```

```
>> y  
>> h
```

String methods

```
stringvariable.method(arguments)
```

String methods

<code>.isalnum()</code>	True if all characters are alphanumeric
<code>.isalpha()</code>	True if all characters are alphabetic
<code>.isdigit()</code>	True if all characters are digits
<code>.islower()</code>	True if all alpha characters are lower
<code>.isspace()</code>	True if all characters are “whitespace”
<code>.isupper()</code>	True if all alpha characters are upper

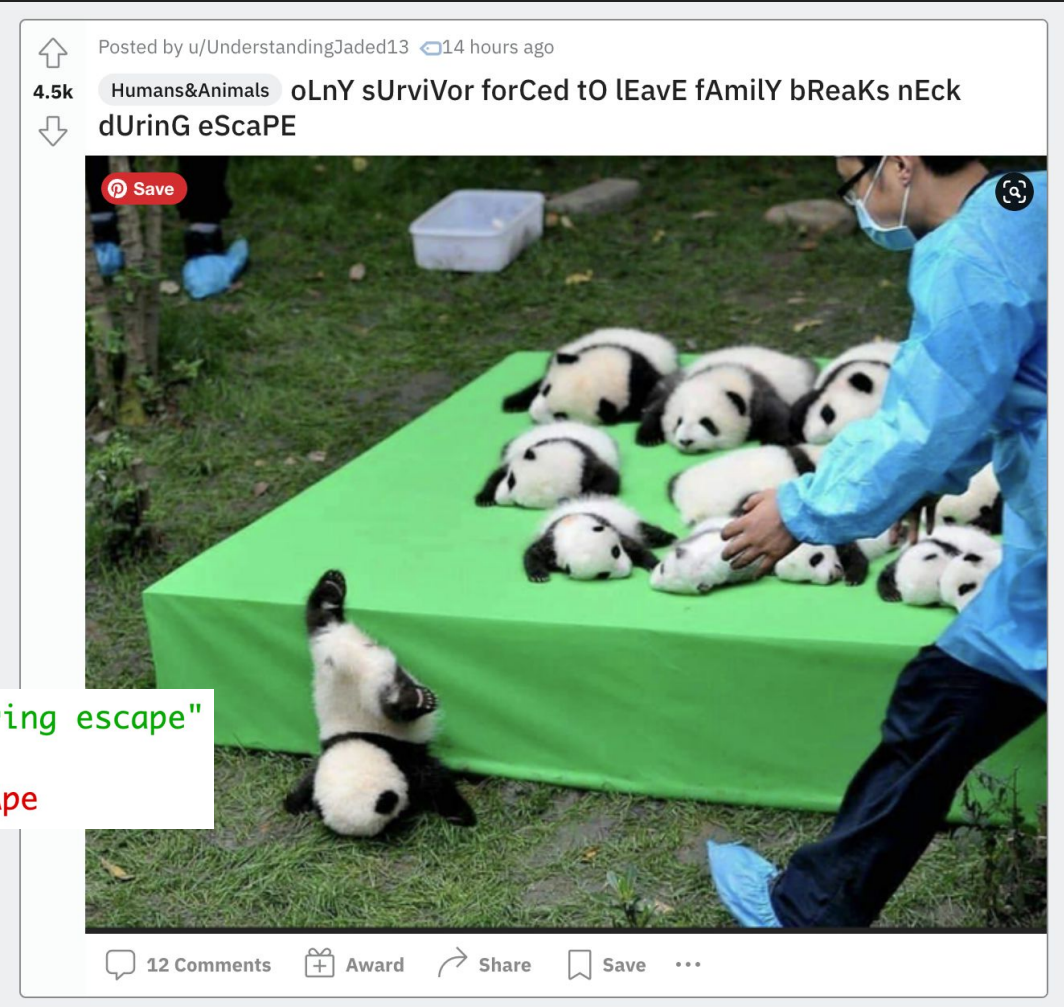
String modifications

<code>.lower()</code>	Returns a lowercase version of the string
<code>.upper()</code>	Returns an uppercase version of the string
<code>.rstrip()</code>	Removes whitespace at end of string
<code>.lstrip()</code>	Removes leading whitespace characters
<code>.capitalize()</code>	Returns a copy of the string with the first character capitalized
<code>.title()</code>	Returns a copy of the string with the first character of each word capitalized
<code>.swapcase()</code>	Returns a copy of the string where case is swapped among all alpha characters

Programming Challenge: Headline Generator

- There's a popular subreddit that likes to write the titles to their posts like such:
- Write a function that takes a string and returns a title that randomly alternates the casing of the text.

```
title = "only survivor forced to leave family breaks neck during escape"  
print(headlineGen(title))  
#oNly SurViVor ForcEd t0 LeavE FaMily bReaKs NeCk DuriNG EscApe
```



```
import random
title = "only survivor forced to leave family breaks neck during escape"

def headlineGen(title):
    new_title = ""

    for i in range(len(title)):
        num = random.randint(0,1)
        if num == 0:
            new_title += title[i].lower()
        else:
            new_title += title[i].upper()

    return new_title

print(headlineGen(title))
```


Finding substrings

- You can find whether a string exists inside another string by using the `find()` method. Example:

```
word = "Like finding a needle in a haystack!"  
location = word.find("needle")  
print (location)
```

- The `find()` method will return the index of the first occurrence of a substring within a string.
- If the `find()` method cannot find the desired substring it will return -1

Searching + Replacing

- Programs often need to perform search and replace functions on data, much like the “find and replace” functionality that exists in your word processor.
- You can have Python replace all occurrences of a substring by using the `replace()` method.

```
text = "Voldemort had one goal in life - to kill Harry Potter."  
newText = text.replace("Voldemort", "He who shall not be named")  
  
print (newText)
```

Getting the ASCII value of a character

- Remember that Python (and all programming languages) use the standard ASCII encoding system to organize individual characters
- You can use the `ord()` function to look up the ASCII value of a character by doing the following:
- The `ord()` function accepts one argument – a single character- and returns an integer that represents the ASCII value of that character

```
value = ord("A")  
>> 65
```

Getting the ASCII value of a character

- You can also reverse the process and turn an integer into its equivalent letter value using the chr() function

```
value = chr(65)
```

```
>> A
```

0	NUL	16	DLE	32	SP	48	0	64	@	80	P	96	`	112	p
1	SOH	17	DC1	33	!	49	1	65	A	81	Q	97	a	113	q
2	STX	18	DC2	34	"	50	2	66	B	82	R	98	b	114	r
3	ETX	19	DC3	35	#	51	3	67	C	83	S	99	c	115	s
4	EOT	20	DC4	36	\$	52	4	68	D	84	T	100	d	116	t
5	ENQ	21	NAK	37	%	53	5	69	E	85	U	101	e	117	u
6	ACK	22	SYN	38	&	54	6	70	F	86	V	102	f	118	v
7	BEL	23	ETB	39	'	55	7	71	G	87	W	103	g	119	w
8	BS	24	CAN	40	(	56	8	72	H	88	X	104	h	120	x
9	HT	25	EM	41	)	57	9	73	I	89	Y	105	i	121	y
10	LF	26	SUB	42	*	58	:	74	J	90	Z	106	j	122	z
11	VT	27	ESC	43	+	59	;	75	K	91	[	107	k	123	{
12	FF	28	FS	44	,	60	<	76	L	92	\	108	l	124	|
13	CR	29	GS	45	-	61	=	77	M	93	]	109	m	125	}
14	SO	30	RS	46	.	62	>	78	N	94	^	110	n	126	~
15	SI	31	US	47	/	63	?	79	O	95	_	111	o	127	DEL

Programming Challenge:

Calculate the sum and average of the digits present in a string.
Also return how many special characters there are.

```
str1 = "PYnative29@###$!#8496"
```

```
> Sum: 38
```

```
> Average: 6.3333333333333333
```

```
> Special character count: 6
```

```
str1 = "PYnative29@###$!#8496"  
special = 0  
nums = 0  
total = 0
```

```
for c in str1:  
    if c.isalnum() == False:  
        special += 1  
    if c.isdigit():  
        nums += 1  
        total += int(c)
```

```
print("Sum:", total)  
print("Average:", total/nums)  
print("Special characters:", special)
```

Homework

- Self-Paced Learning Module #8
- Quiz #8