CS65: Introduction to Computer Science

Tuple
String Methods
String Formatting

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Topic

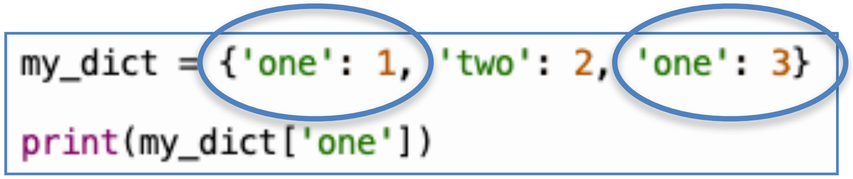
- Recap (from last lecture): Dictionary
- Tuple

- Strings
    - useful methods

- Strings formating
    - with % operator
    - with **.format()**

Review: Dictionary

- Only one entry per key is allowed! When there is a duplicate, the last entry wins



```
my_dict = {'one': 1, 'two': 2, 'one': 3}

print(my_dict['one'])
```

- Lists are not allowed as ***keys***

- No restrictions on ***values***

- Dictionaries do not keep order

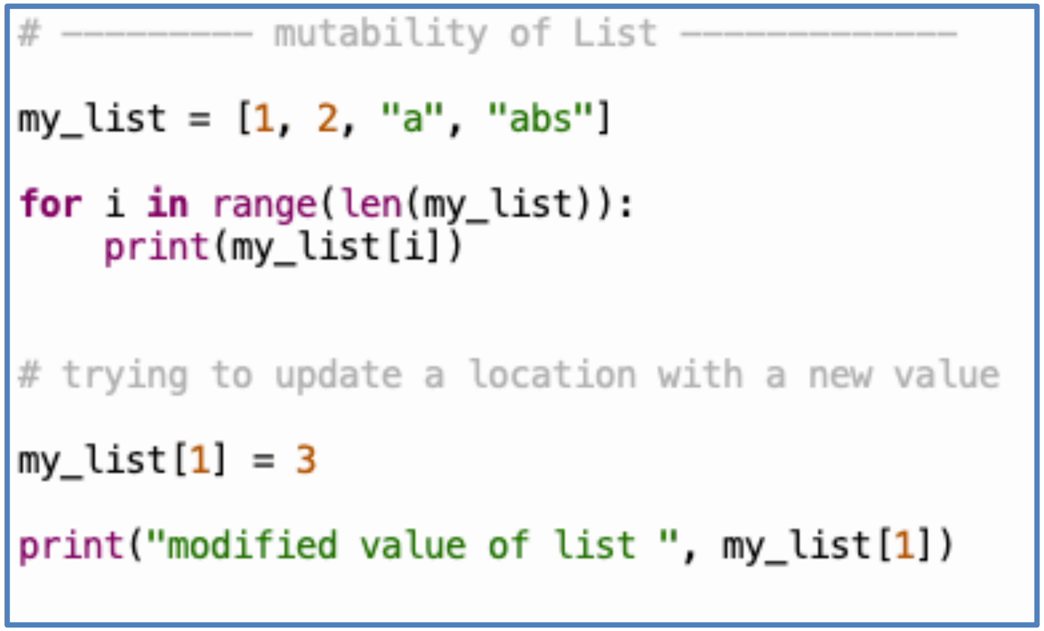
- Keys must be **unique** and **immutable**

Tuple: another type of a sequence

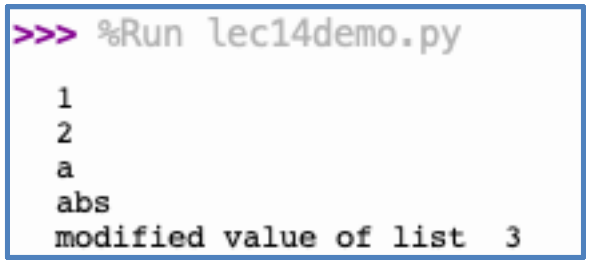
- <u>Cannot change Tuple's items after creation (**immutability**)</u>
- Items are accessed by indices
  - similar to other two sequences **List** and **String**

Sequence	Example	Syntax	Accessing
String	my_str = "My name is walle"	within enclosing quotation marks, ie, " " or ' '	my_str[0] my_str[1]
List	my_list = [1, 2, "a", "abs"]	within enclosing brackets **[ ]** and separated by commas	my_list[0] my_list[1]
Tuple	my_tuple = (1, 2, "a", "abs")	Within enclosing parenthesis **( )** and separated by commas	my_tuple[0] my_tuple[1]

Mutable Property of List

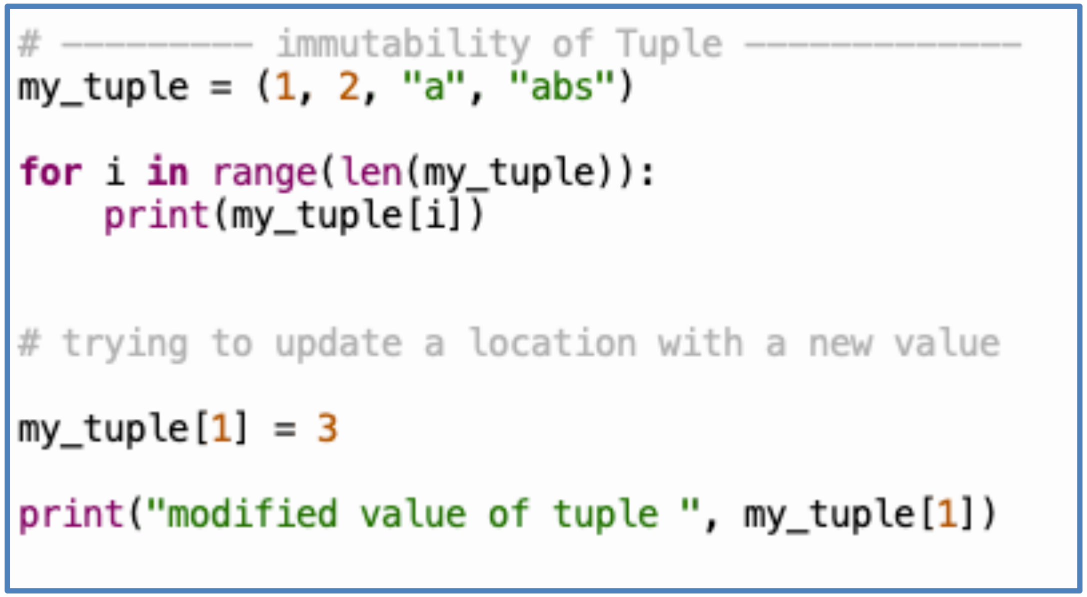


```
# --------- mutability of List ------------

my_list = [1, 2, "a", "abs"]

for i in range(len(my_list)):
    print(my_list[i])


# trying to update a location with a new value

my_list[1] = 3

print("modified value of list ", my_list[1])
```

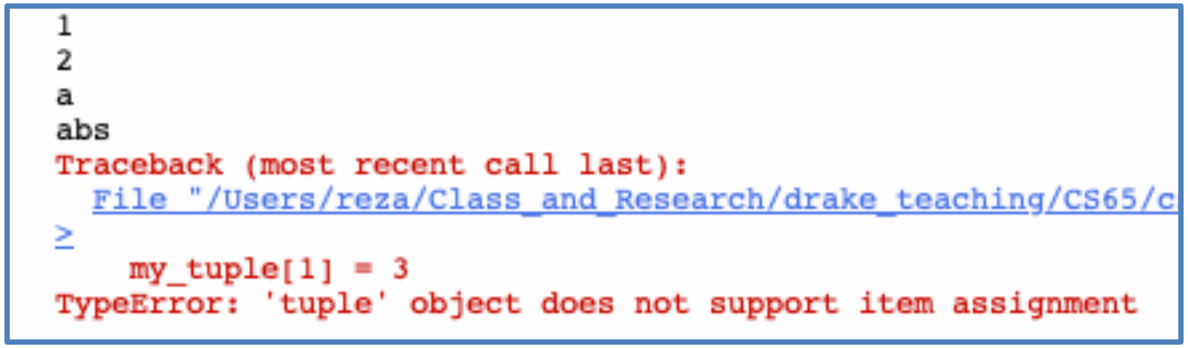


```
>>> %Run lec14demo.py

  1
  2
  a
  abs
  modified value of list  3
```

Immutable Property of Tuple



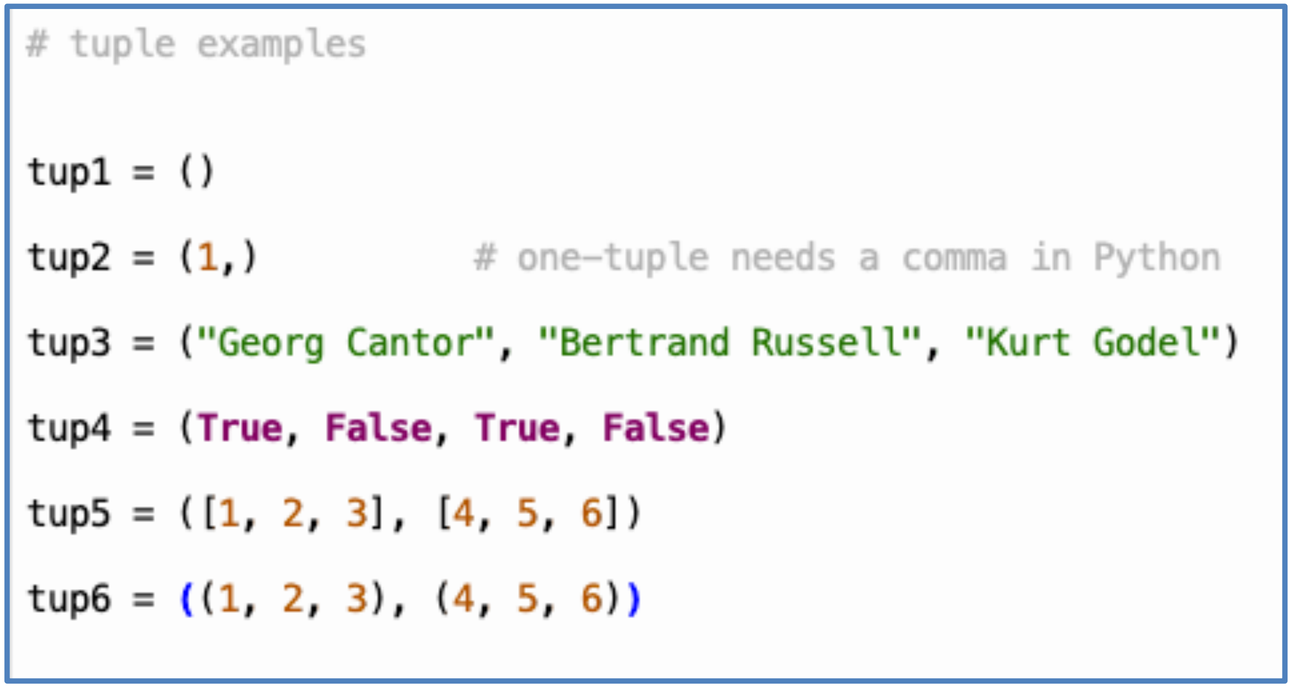
```
# ---------- immutability of Tuple --------------
my_tuple = (1, 2, "a", "abs")

for i in range(len(my_tuple)):
    print(my_tuple[i])


# trying to update a location with a new value

my_tuple[1] = 3

print("modified value of tuple ", my_tuple[1])
```



```
1
2
a
abs
Traceback (most recent call last):
  File "/Users/reza/Class_and_Research/drake_teaching/CS65/c
>
    my_tuple[1] = 3
TypeError: 'tuple' object does not support item assignment
```

Tuple

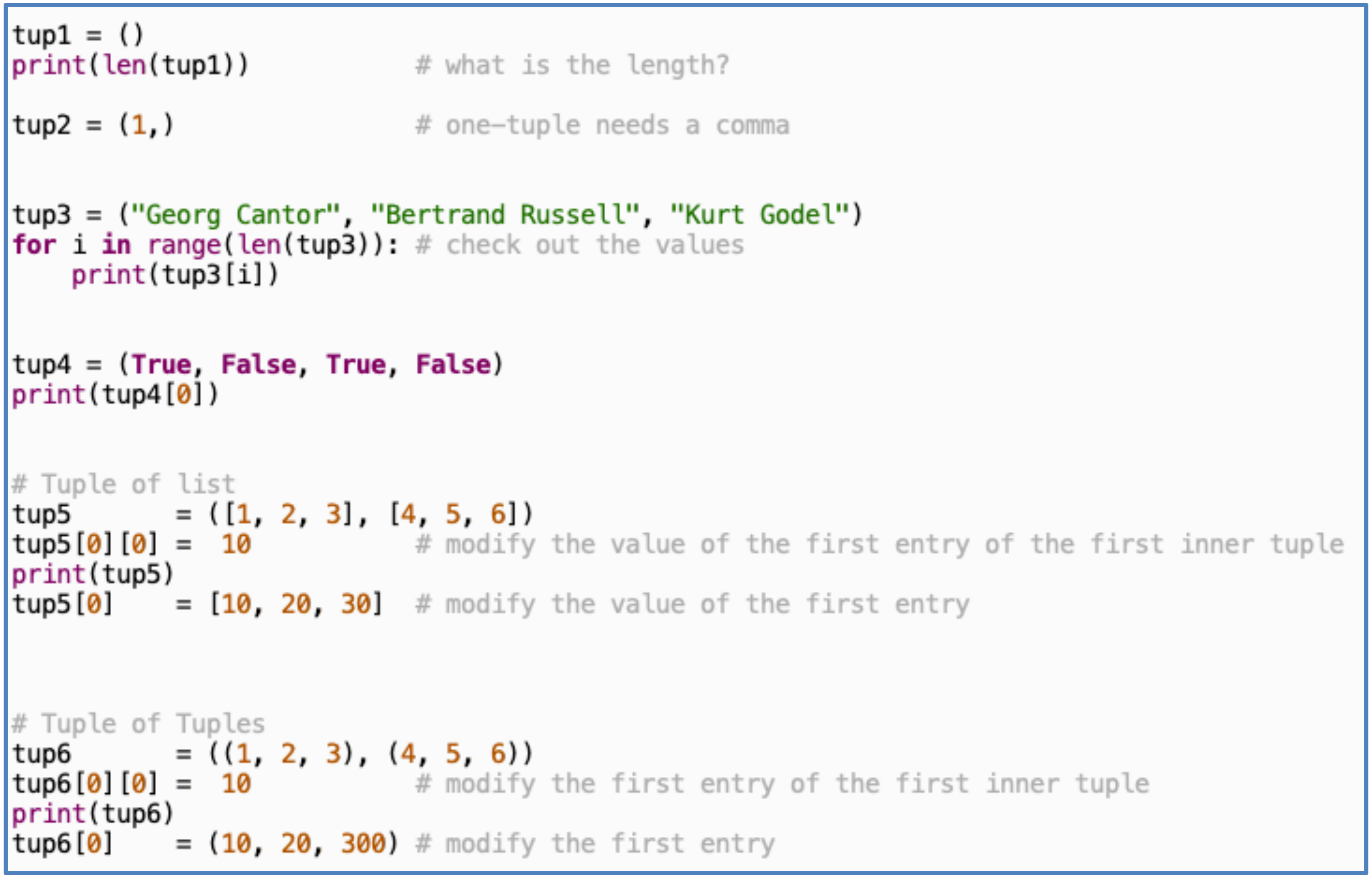
- **Tuple examples**



```python
# tuple examples

tup1 = ()
tup2 = (1,)           # one-tuple needs a comma in Python
tup3 = ("Georg Cantor", "Bertrand Russell", "Kurt Godel")
tup4 = (True, False, True, False)
tup5 = ([1, 2, 3], [4, 5, 6])
tup6 = ((1, 2, 3), (4, 5, 6))
```

- Exercise: Try the examples above in Thonny. Find the items you can modify and which the ones you cannot

Exercise



```
tup1 = ()
print(len(tup1))           # what is the length?

tup2 = (1,)                # one-tuple needs a comma


tup3 = ("Georg Cantor", "Bertrand Russell", "Kurt Godel")
for i in range(len(tup3)): # check out the values
    print(tup3[i])


tup4 = (True, False, True, False)
print(tup4[0])


# Tuple of list
tup5        = ([1, 2, 3], [4, 5, 6])
tup5[0][0] =  10           # modify the value of the first entry of the first inner tuple
print(tup5)
tup5[0]     = [10, 20, 30]  # modify the value of the first entry



# Tuple of Tuples
tup6        = ((1, 2, 3), (4, 5, 6))
tup6[0][0] =  10           # modify the first entry of the first inner tuple
print(tup6)
tup6[0]     = (10, 20, 300) # modify the first entry
```

Topic

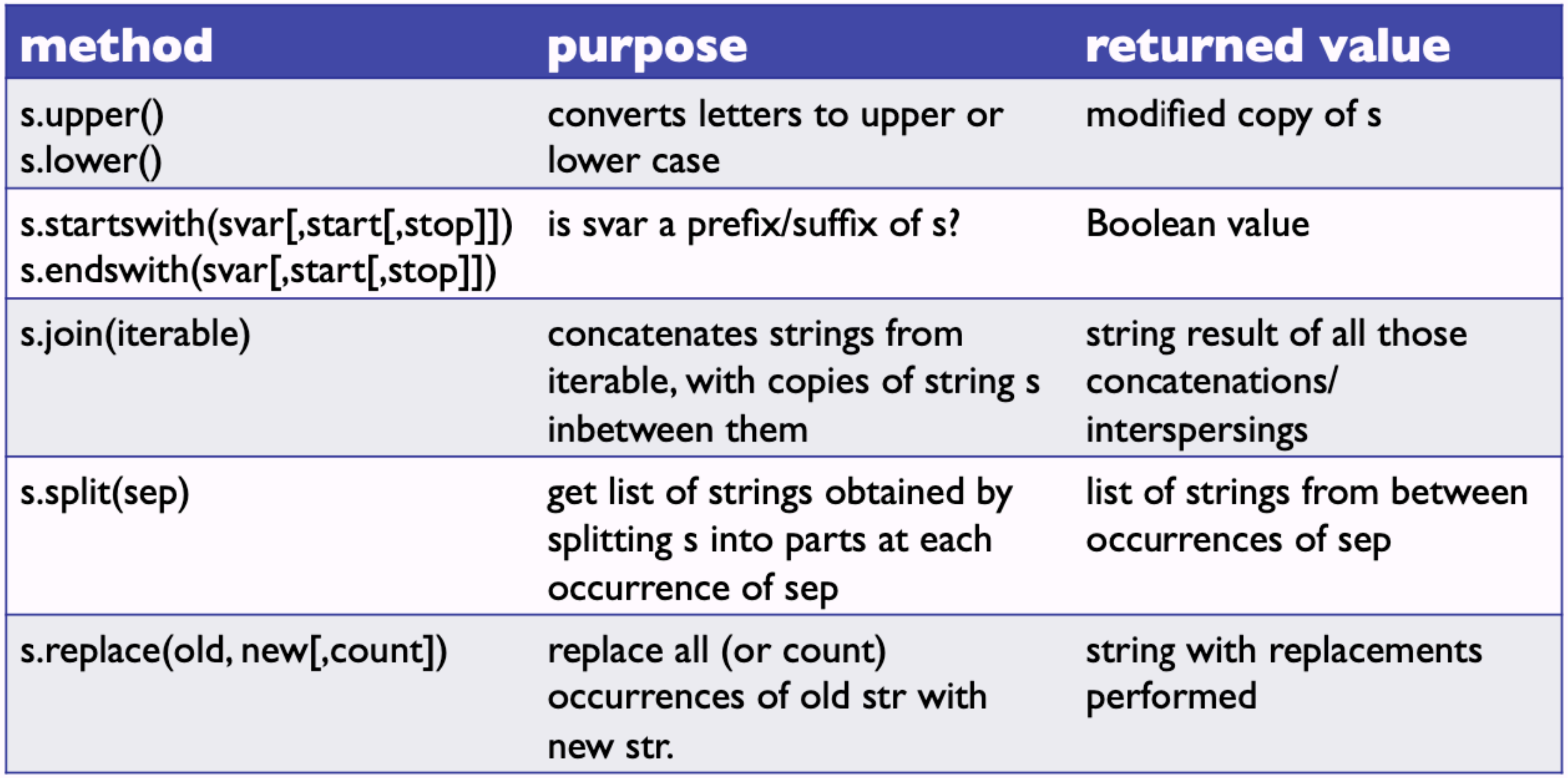
- Recap (from last lecture): Dictionary
- Tuple

- Strings
    - useful methods

- Strings formating
    - with % operator
    - with **.format()**

Useful string methods

- **Syntax:** string_expression.method_name(*argm*$_1$, *argm*$_2$, *argm*$_n$)



method	purpose	returned value

s.upper()
s.lower()
	converts letters to upper or lower case	modified copy of s

s.startswith(svar[,start[,stop]])
s.endswith(svar[,start[,stop]])
	is svar a prefix/suffix of s?	Boolean value

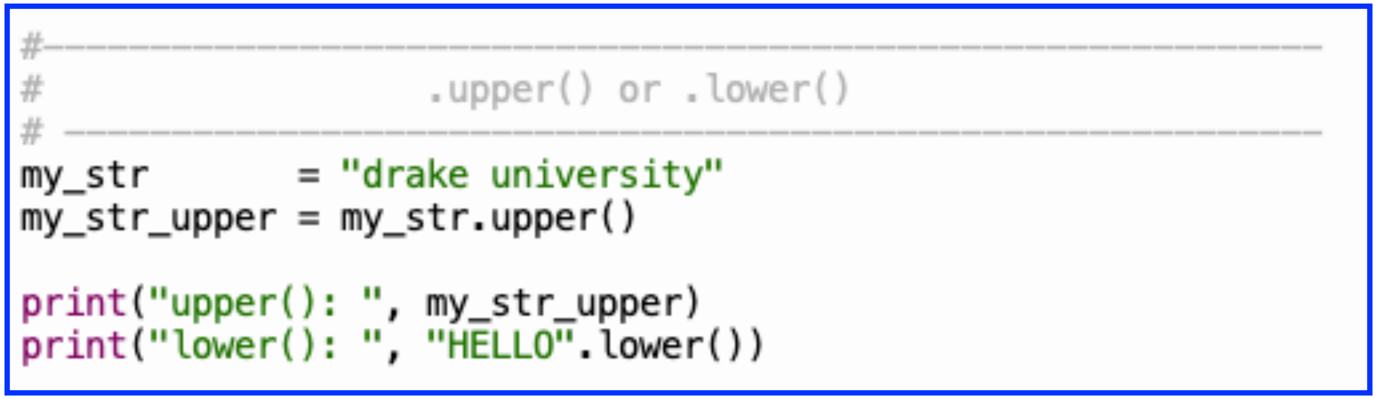
s.join(iterable)	concatenates strings from iterable, with copies of string s inbetween them	string result of all those concatenations/ interspersings
s.split(sep)	get list of strings obtained by splitting s into parts at each occurrence of sep	list of strings from between occurrences of sep
s.replace(old, new[,count])	replace all (or count) occurrences of old str with new str.	string with replacements performed

Useful String Methods: .upper()

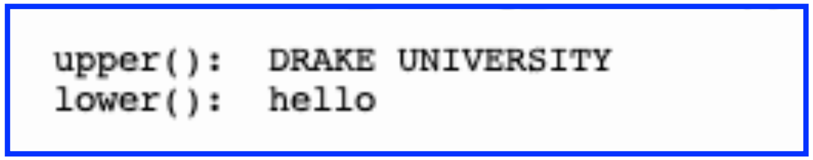
- **Syntax:** string_expression.method_name()

  my_str.upper( )

  my_str.lower( )



```
#------------------------------------------------------------
#                    .upper() or .lower()
# -----------------------------------------------------------
my_str       = "drake university"
my_str_upper = my_str.upper()

print("upper(): ", my_str_upper)
print("lower(): ", "HELLO".lower())
```

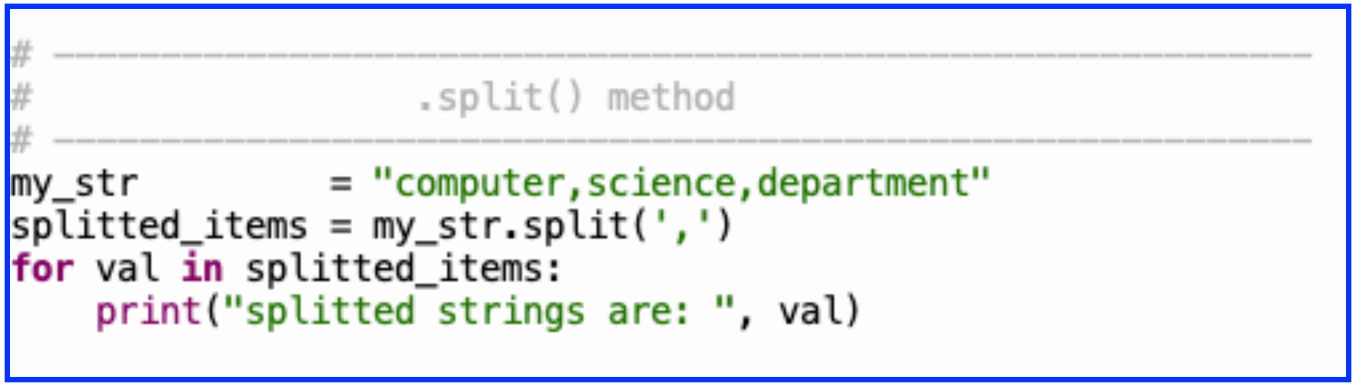


```
upper():   DRAKE UNIVERSITY
lower():   hello
```

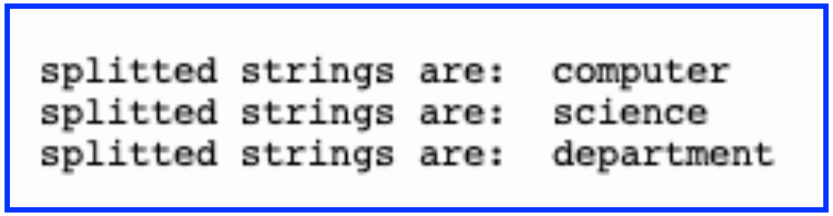
Useful String Methods: .split()

- **Syntax:** string_expression.method_name(*$argm_1$*)

  my_str.upper (*separator*)



```
# -----------------------------------------------------------
#                    .split() method
# -----------------------------------------------------------
my_str         = "computer,science,department"
splitted_items = my_str.split(',')
for val in splitted_items:
    print("splitted strings are: ", val)
```

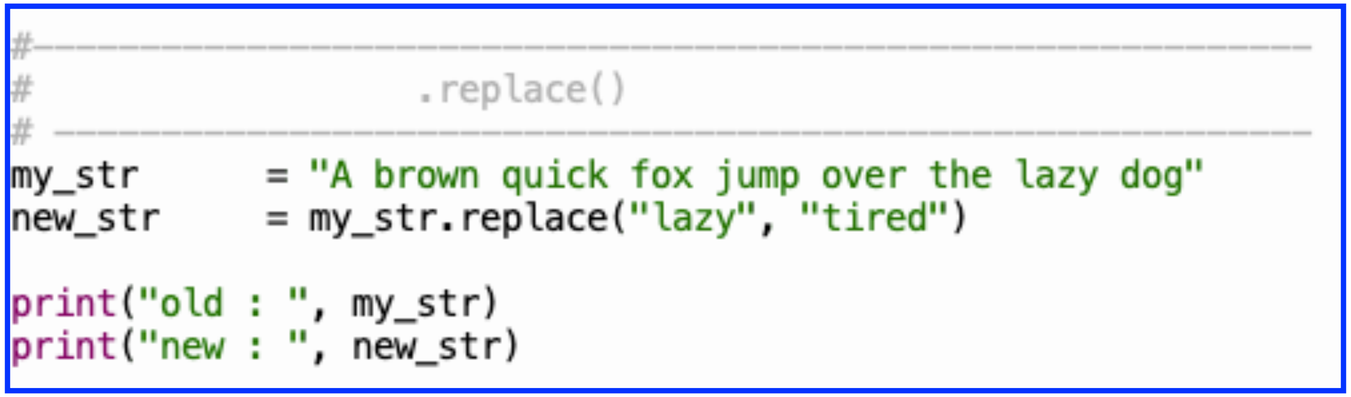


```
splitted strings are:  computer
splitted strings are:  science
splitted strings are:  department
```

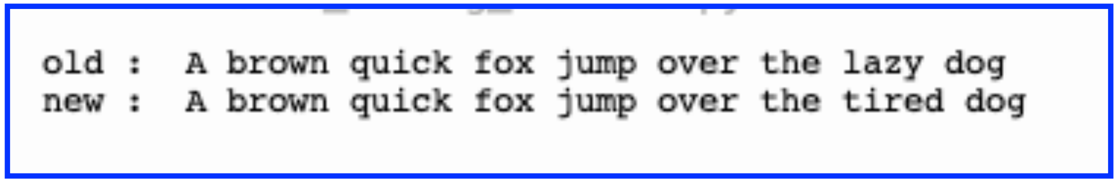
Useful String Methods: .replace()

- **Syntax:** string_expression.method_name(*argm*$_1$, *argm*$_2$)

  my_str.replace (*old*$_{str}$, *new*$_{str}$)



```
#-----------------------------------------------------------
#                   .replace()
# ----------------------------------------------------------
my_str       = "A brown quick fox jump over the lazy dog"
new_str      = my_str.replace("lazy", "tired")

print("old : ", my_str)
print("new : ", new_str)
```

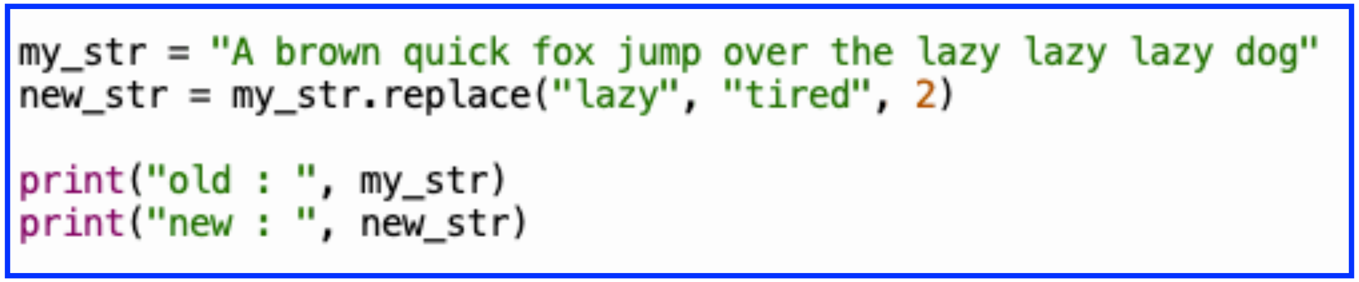


```
old :  A brown quick fox jump over the lazy dog
new :  A brown quick fox jump over the tired dog
```

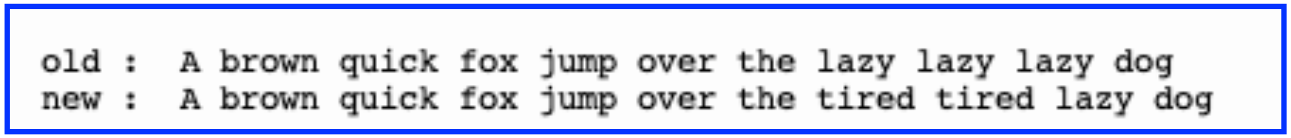
Useful String Methods: .replace()

- **Syntax:** string_expression.method_name($argm_1$, $argm_2$, $argm_3$)

my_str.replace (old_{str} , new_{str} , *how_many_times*)



```python
my_str = "A brown quick fox jump over the lazy lazy lazy dog"
new_str = my_str.replace("lazy", "tired", 2)

print("old : ", my_str)
print("new : ", new_str)
```

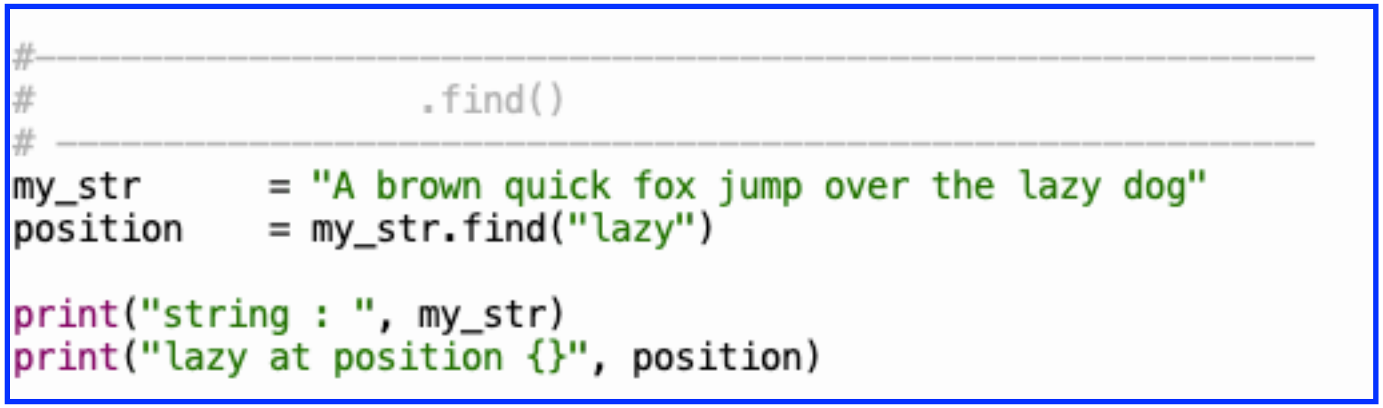


```
old :   A brown quick fox jump over the lazy lazy lazy dog
new :   A brown quick fox jump over the tired tired lazy dog
```

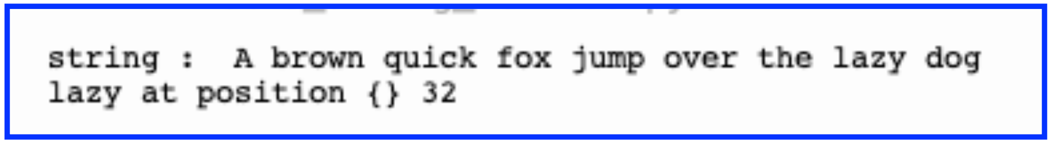
Useful String Methods: .find()

- **Syntax:** string_expression.method_name(*argm*$_1$)

  my_str.find ($str_{you\_are\_looking\_for}$)



```
#-----------------------------------------------------------
#                  .find()
# ----------------------------------------------------------
my_str      = "A brown quick fox jump over the lazy dog"
position    = my_str.find("lazy")

print("string : ", my_str)
print("lazy at position {}", position)
```



```
string :  A brown quick fox jump over the lazy dog
lazy at position {} 32
```

Topic

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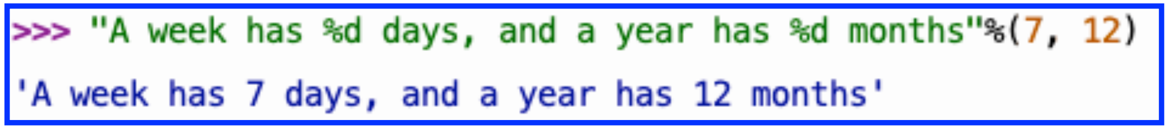
    - with % operator
    - with **.format()**

String Formating

- Two popular approaches:
  - Percent operator **%**
  - **format()** method

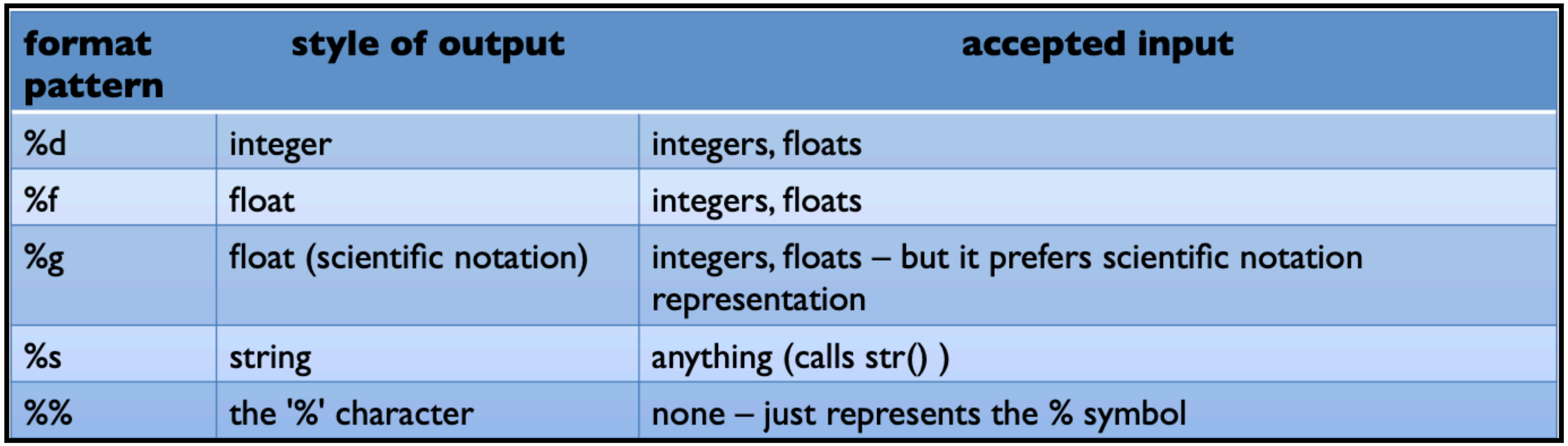
String Formating: Percent Operator %

- Percent operator %
    - describe pattern of string with placeholder with % operator, then supply all substitutions at once
    - string_expression **%** (*tuple_item*$_1$, *tuple_item*$_2$, *tuple_item*$_n$)

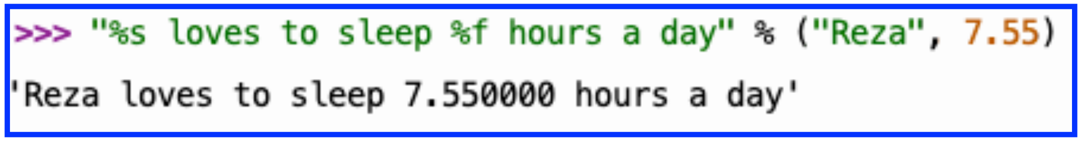


```
>>> "A week has %d days, and a year has %d months"%(7, 12)
'A week has 7 days, and a year has 12 months'
```

String formating: % operator



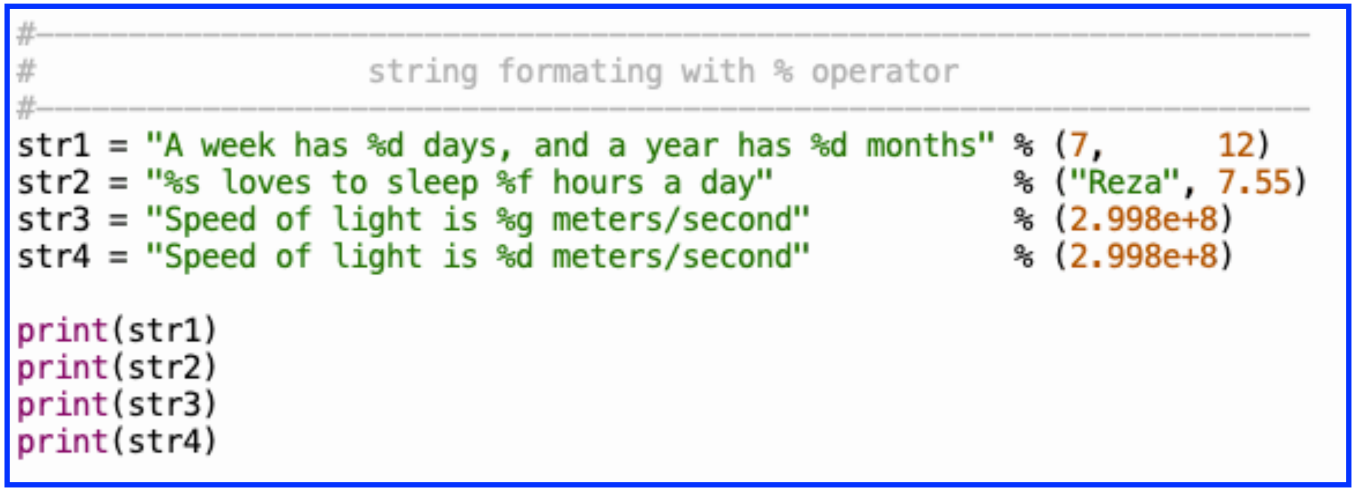
format pattern	style of output	accepted input
%d	integer	integers, floats
%f	float	integers, floats
%g	float (scientific notation)	integers, floats – but it prefers scientific notation representation
%s	string	anything (calls str())
%%	the '%' character	none – just represents the % symbol



```
>>> "%s loves to sleep %f hours a day" % ("Reza", 7.55)
'Reza loves to sleep 7.550000 hours a day'
```

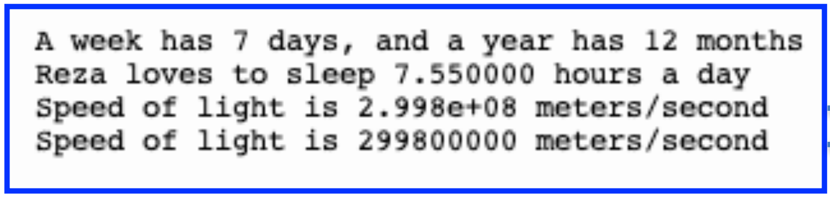
String formating: % operator

format pattern	style of output	accepted input
%d	integer	integers, floats
%f	float	integers, floats
%g	float (scientific notation)	integers, floats – but it prefers scientific notation representation
%s	string	anything (calls str())
%%	the '%' character	none – just represents the % symbol



```
#-------------------------------------------------------------------
#                  string formating with % operator
#-------------------------------------------------------------------
str1 = "A week has %d days, and a year has %d months" % (7,      12)
str2 = "%s loves to sleep %f hours a day"             % ("Reza", 7.55)
str3 = "Speed of light is %g meters/second"           % (2.998e+8)
str4 = "Speed of light is %d meters/second"           % (2.998e+8)

print(str1)
print(str2)
print(str3)
print(str4)
```

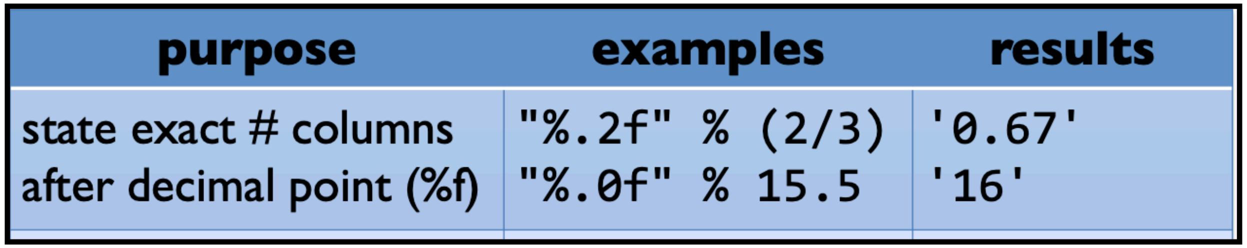


```
A week has 7 days, and a year has 12 months
Reza loves to sleep 7.550000 hours a day
Speed of light is 2.998e+08 meters/second
Speed of light is 299800000 meters/second
```

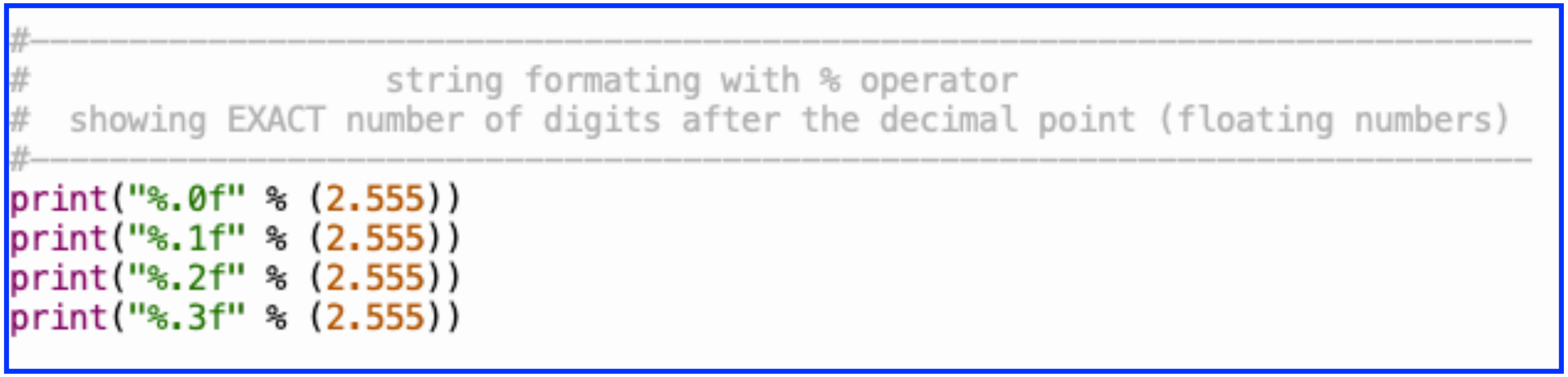
Scientific number

Integer number

String formating: % operator

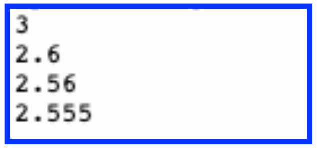


purpose	examples	results
state exact # columns after decimal point (%f)	"%.2f" % (2/3) "%.0f" % 15.5	'0.67' '16'



```
#-------------------------------------------------------------------------------
#                   string formating with % operator
#   showing EXACT number of digits after the decimal point (floating numbers)
#-------------------------------------------------------------------------------
print("%.0f" % (2.555))
print("%.1f" % (2.555))
print("%.2f" % (2.555))
print("%.3f" % (2.555))
```

col1	col2	col3	col4	col5
3				
2	.	6		
2	.	5	6	
2	.	5	5	5

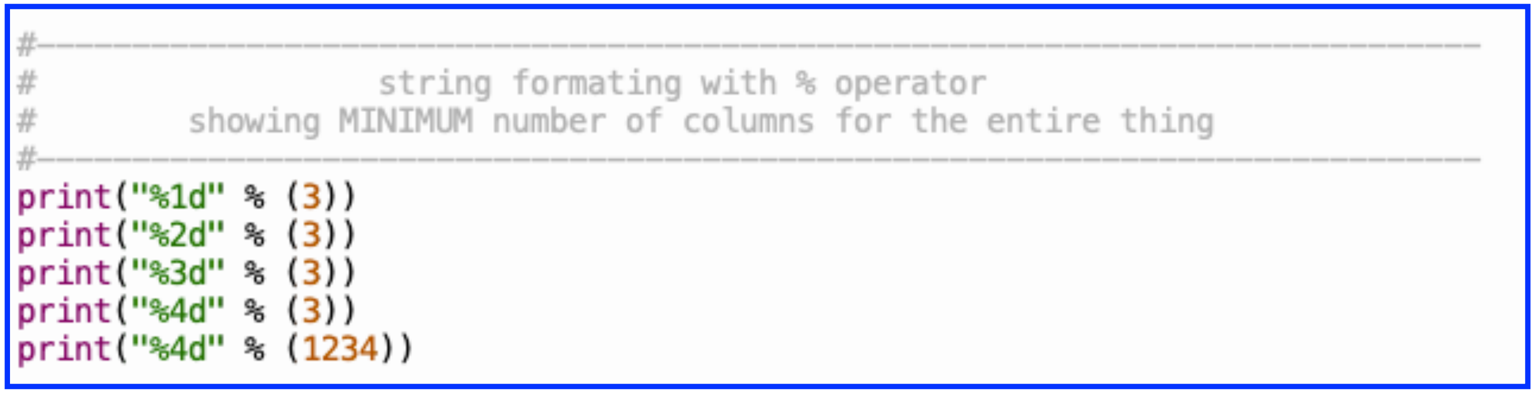


```
3
2.6
2.56
2.555
```

String formating: % operator

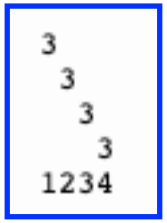
purpose	examples	results

state min. # columns for entire thing	`"%4d"  %  30`
	`"%3d"  %  1234`
		`'  30'`
		`'1234'`



```
#------------------------------------------------------------------------
#                  string formating with % operator
#         showing MINIMUM number of columns for the entire thing
#------------------------------------------------------------------------
print("%1d" % (3))
print("%2d" % (3))
print("%3d" % (3))
print("%4d" % (3))
print("%4d" % (1234))
```

col₁	col₂	col₃	col₄
3			
	3		
		3	
			3
1	2	3	4

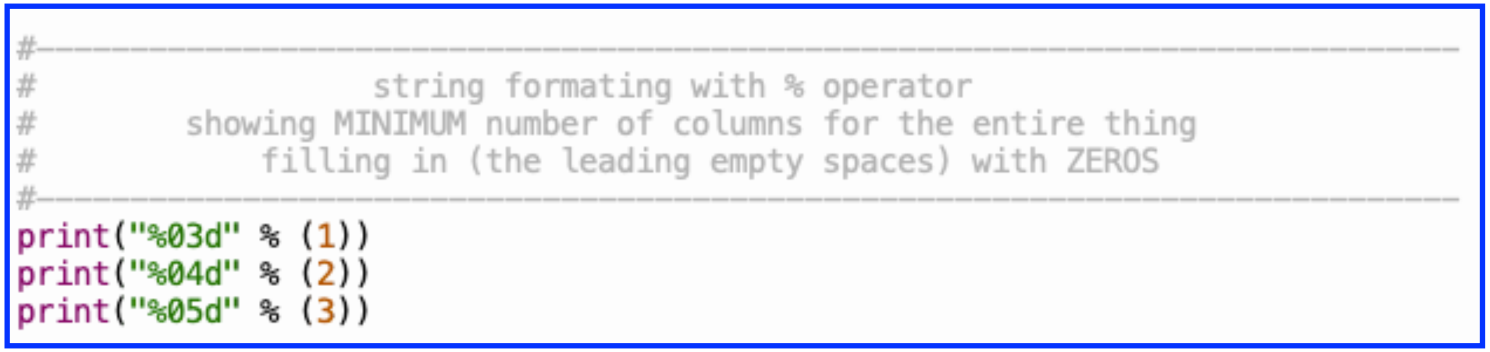


```
3
 3
  3
   3
1234
```

String formating: % operator

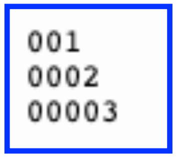
purpose	examples	results

state min. # columns for entire thing	`"%4d" % 30`
	`"%3d" % 1234`
		`'  30'`
		`'1234'`



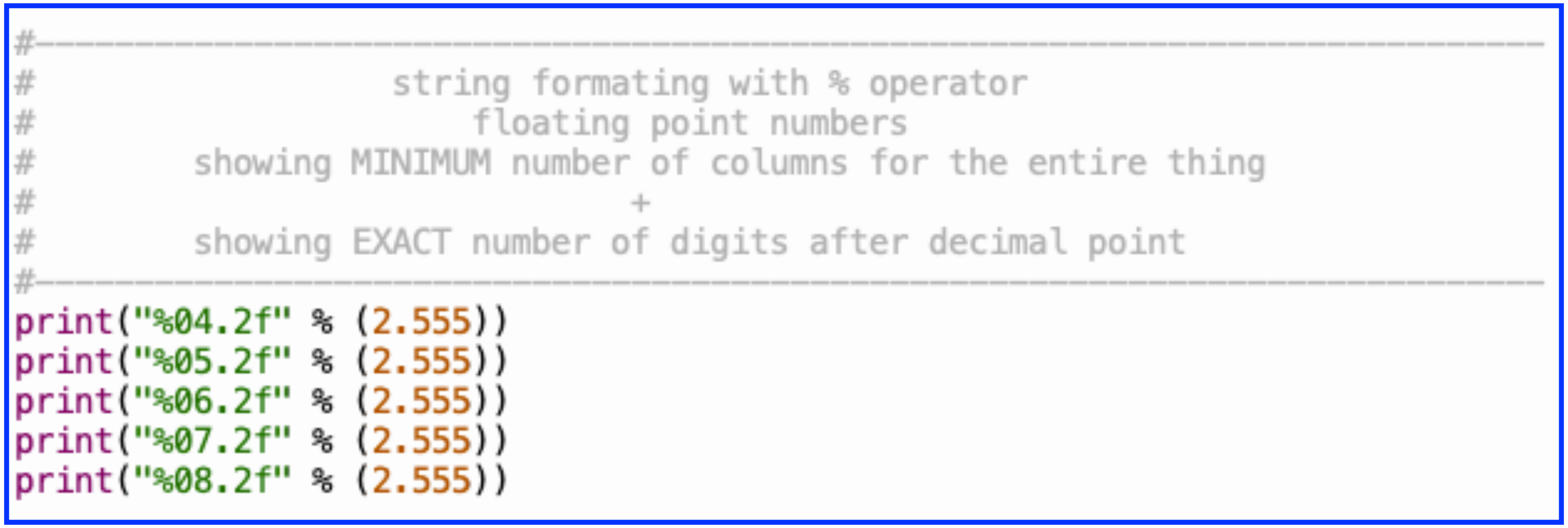
```
#-----------------------------------------------------------------------
#                 string formating with % operator
#         showing MINIMUM number of columns for the entire thing
#             filling in (the leading empty spaces) with ZEROS
#-----------------------------------------------------------------------
print("%03d" % (1))
print("%04d" % (2))
print("%05d" % (3))
```

col_1	col_2	col_3	col_4	col_5
0	0	1		
0	0	0	2	
0	0	0	0	3



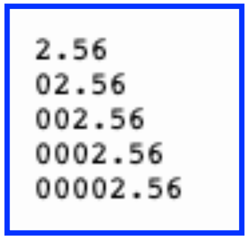
```
001
0002
00003
```

String formating: % operator



```
#-----------------------------------------------------------------------------
#                    string formating with % operator
#                        floating point numbers
#          showing MINIMUM number of columns for the entire thing
#                                  +
#          showing EXACT number of digits after decimal point
#-----------------------------------------------------------------------------
print("%04.2f" % (2.555))
print("%05.2f" % (2.555))
print("%06.2f" % (2.555))
print("%07.2f" % (2.555))
print("%08.2f" % (2.555))
```

col$_1$	col$_2$	col$_3$	col$_4$	col$_5$	col$_6$	col$_7$	col$_8$
2	.	5	6				
0	2	.	5	6			
0	0	2	.	5	6		
0	0	0	2	.	5	6	
0	0	0	0	2	.	5	6



```
2.56
02.56
002.56
0002.56
00002.56
```

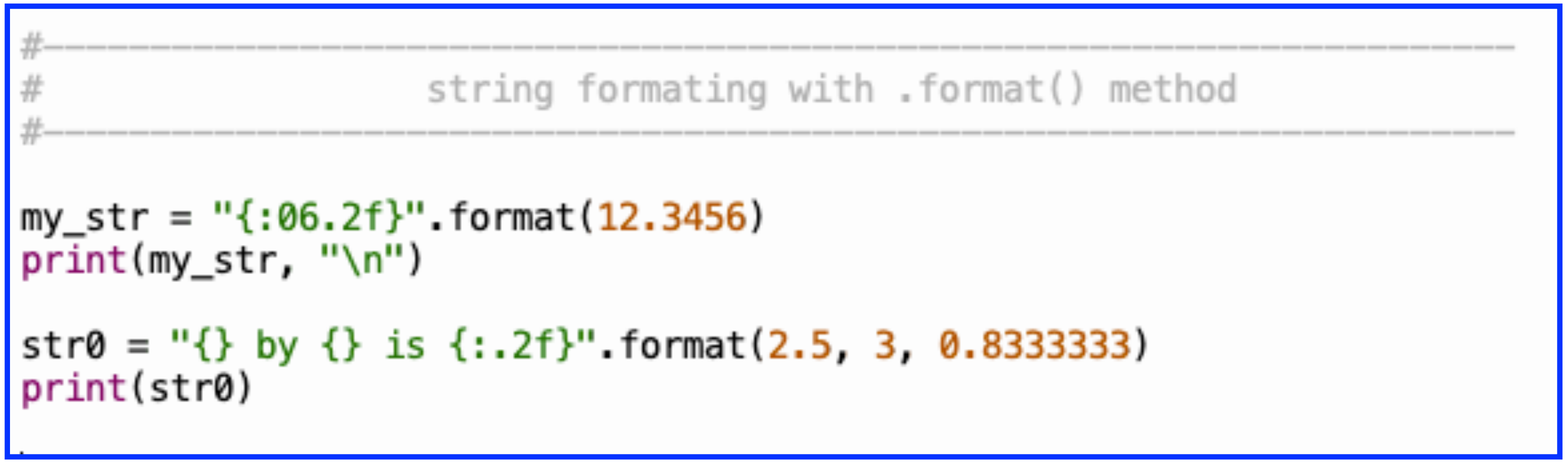
String Formating

- Two popular approaches:
  - Percent operator %
  - **format()** method

String formating with .format() method

- **.format()** method
  - include {}'s as placeholders in string, put style rules inside
  - provide the substitutions as arguments to .format() method
  - {} divide by {} is {} **%.format(** args_1 , args_2 , args_n)

String formating with .format() method

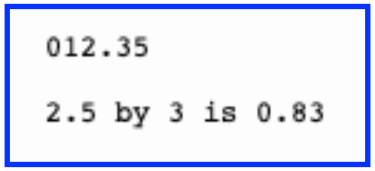


```
#-----------------------------------------------------------------------------
#                    string formating with .format() method
#-----------------------------------------------------------------------------

my_str = "{:06.2f}".format(12.3456)
print(my_str, "\n")

str0 = "{} by {} is {:.2f}".format(2.5, 3, 0.8333333)
print(str0)
```

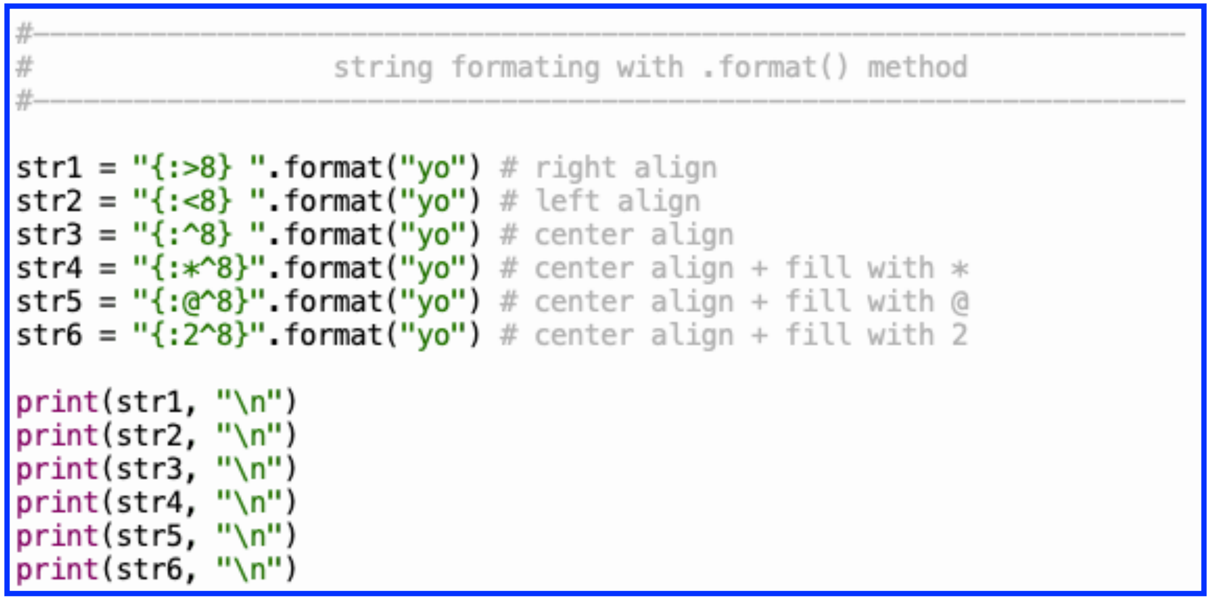
col_1	col_2	col_3	col_4	col_5	col_6
0	1	2	.	3	5



```
012.35

2.5 by 3 is 0.83
```

String formating with .format() method

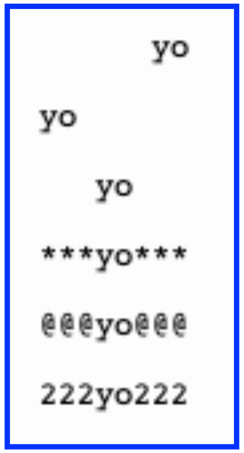


```
#---------------------------------------------------------------------
#                  string formating with .format() method
#---------------------------------------------------------------------

str1 = "{:>8} ".format("yo") # right align
str2 = "{:<8} ".format("yo") # left align
str3 = "{:^8} ".format("yo") # center align
str4 = "{:*^8}".format("yo") # center align + fill with *
str5 = "{:@^8}".format("yo") # center align + fill with @
str6 = "{:2^8}".format("yo") # center align + fill with 2

print(str1, "\n")
print(str2, "\n")
print(str3, "\n")
print(str4, "\n")
print(str5, "\n")
print(str6, "\n")
```

col$_1$	col$_2$	col$_3$	col$_4$	col$_5$	col$_6$	col$_7$	col$_8$
						y	o
y	o						
			y	o			
*	*	*	y	o	*	*	*
@	@	@	y	o	@	@	@
2	2	2	y	o	2	2	2



```
      yo

yo

   yo

***yo***

@@@yo@@@

222yo222
```