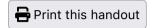
CSC110 Lecture 3: Comprehensions and Introduction to Functions



Exercise 1: Practice with comprehension expressions

Here is a summary of the three types of comprehensions, for your reference:

Comprehension type	Syntax	
set comprehension	{ <expression> for <variable> in <collection> }</collection></variable></expression>	
list comprehension	<pre>[<expression> for <variable> in <collection>]</collection></variable></expression></pre>	
dict comprehension	<pre>{ <key_expr>: <value_expr> for <variable> in <collection> }</collection></variable></value_expr></key_expr></pre>	

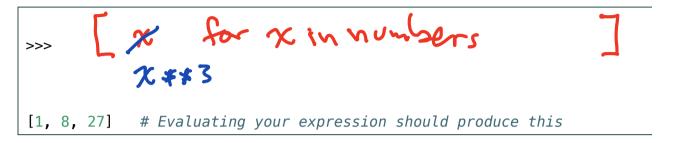
- 1. Suppose we assign the variable numbers = [1, 2, 3].
 - a. Fill in the table below.

Expression	Value
numbers[0]	1
numbers[1]	2
numbers[2]	3
numbers[0] ** 3	1
numbers[1] ** 3	8

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Expression	Value
numbers[2] ** 3	27

b. Write a comprehension that evaluates to the *list* of every integer in numbers cubed (i.e., raised to the power of 3).



c. Write a comprehension that evaluates to a *dictionary* mapping every integer in numbers to three times that integer.

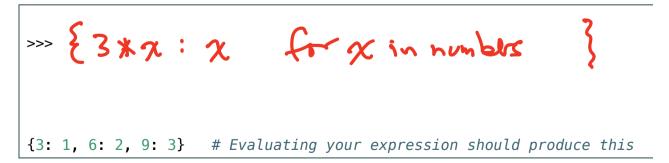
>>> { And for
$$\chi$$
 in number }

X: 3 * χ
{1: 3, 2: 6, 3: 9} # Evaluating your expression should produce this

Hint: the *identity dictionary comprehension* has the following form:

>>> {x : x for x in numbers}

d. Write a comprehension that evaluates to the given output dictionary shown.



e. Write a comprehension that is a translation of the set builder expression $\{\frac{x}{x+1} \mid x \in \mathtt{numbers}\}$

{ x/(x+i)

Exercise 2: Comprehensions and range

- 1. Write down the integers that are contained in each of the following Python range expressions.
 - a. range(0, 5)

- 2. For each of the following descriptions, write a comprehension that evaluates to the described collection.
 - a. The set of integers between 30 and 50, inclusive.

b. The list of integers between -30 and 30, inclusive (in ascending order).

c. The set of the squares of the natural numbers less than 2000.

d. A mapping from a number to its square, for the natural numbers less than 2000.

3. You are given a variable s that refers to a (very very long) string:

```
>>> s = 'nonsensenonsensenonsensenonsensenonsensenonsense'
```

Write a list comprehension expression that evaluates to a list containing the first 20 characters in th string, in the order they appear.

Hint: s [19] is the last character in s that should be included in the list.

Suppose we have assigned the following variables in the Python console:

```
>>> n = -5
>>> numbers_list = [1, 10, n]
>>> numbers_set = {100, n, 200}
```

1. Complete the following table showing the value of each variable.

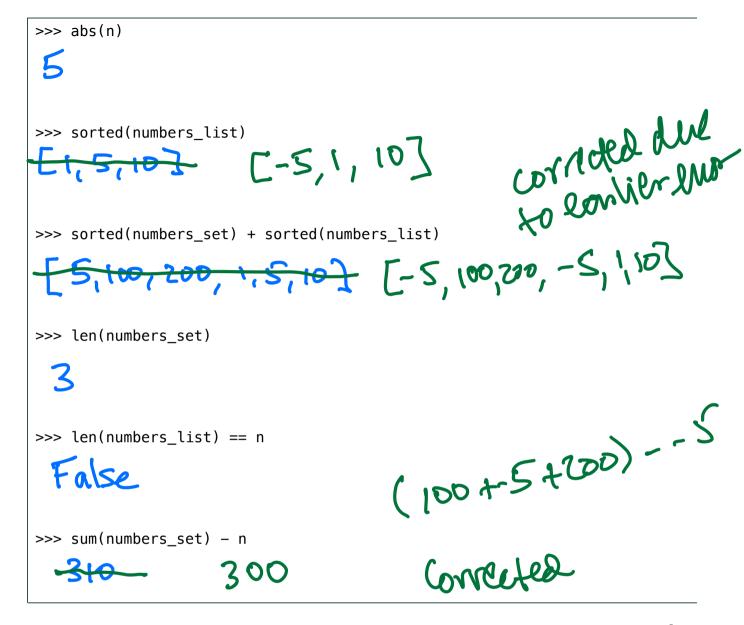
Variable	Value		
n	-5		
numbers_list	[1,10,-5]	corrected	: had
numbers_set	€ 100,-5,200}	Corrected Avopped	one 5

2. Write down what each of the following expressions evaluate to. *Do this by hand first! (Then check your work in the Python console.)*

You may find it helpful to consult <u>Appendix A.1 Python Built-In Function Reference</u>

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(https://www.teach.cs.toronto.edu/~csc110y/fall/notes/A-python-builtins/01-builtins.html).



3. The variable numbers refers to a list that contains a mix of positive and negative integers (e.g., [-1, 2, 3]). Write a comprehension that evaluates to the set of the absolute values of every integer in numbers.

(Hint: the structure is the same as earlier problems on this worksheet. Use the abs function.)

¿ abs (x) for x in numbers Note that the len of this set may be Additional exercises smaller than len (numbas).

When both - y and y eve in

numbers for some value y.

- 1. Comprehension practice. For each of the following mappings, write a Python dictionary expression that evaluates to the mapping.
 - a. A mapping from a number to its square, for the first 50 natural numbers.
 - b. A mapping from input to output of the function $f(x) = \frac{x}{x-1}$, for integer inputs greater than 1 and less than 2000. { x: x/(x-1) for x in range (2, 2000) }
 - c. A mapping from a number to a list that contains the same number of items, where every item is the string 'Hello', for the first 50 natural numbers. (e.g., 3 maps to the list ['Hello', {x: ['Hello'] *x for x in range (50)} 'Hello', 'Hello'].)
 - d. A mapping from an integer to the set of integers between o and that integer inclusive, for
- integers 1 to 20, inclusive.

 2. Comprehensions with multiple variables. Suppose you have the lists: nums1 = [1, 2, 3] and nums2 = [4, 5, 6].
 - a. Using both nums1 and nums2, write a comprehension that evaluates to: [[1, 4], [1, 5], [1, 6], [2, 4], [2, 5], [2, 6], [3, 4], [3, 5], [3, 6]]. [[a,b] for ain nums for b in nums 2]
 - b. Using both nums1 and nums2, write a comprehension that evaluates to: [[4, 1], [5, 1], [6, 1], [4, 2], [5, 2], [6, 2], [4, 3], [5, 3], [6, 3]].[[b,a] for a in hums | for b in hums 2]
 - c. Using both nums1 and nums2, write a comprehension that evaluates to: {5, 6, 7, 8, 9}.
- 3. Function practice. Using the same variables defined in Exercise 3, determine the value of each of the following Python expressions. corrected

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```
>>> type(n)
>>> type(abs(n))
       INT
>>> type(numbers_list == n)
       bool
>>> type(numbers_list) == type(n)
>>> max(numbers_list + [5])
>>> max(numbers_list) + 5
>>> max(sorted(numbers_list)) == max(numbers_list)
         Trul
```

4. *Interpreting errors*. Your friend is practicing in the Python console again, and is trying to add two numbers. They type in the following, and get an error:

```
>>> sum(3, 4)
Traceback (most recent call last):
    ... [some output omitted] ...
File "<stdin>", line 1, in <module>
TypeError: 'int' object is not iterable
```

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Once again, explain this error to your friend, and how they can correctly add two numbers in Pythor (*Hint*: treat "iterable" as another word for "collection".)

The sum builtin function expects to be given a collection data type and in mis function call it was given 2 miss. To defermine the degree routh, put the literal values 3.4 misto a collection and give it to the sum succition.

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