recursion practice: https://www.w3resource.com/python-exercises/data-structures-and-algorithms/

python-recursion.php

solving problems:

always check that something exists in the paramaters of what is passed to the function

inter.sort(key = lambda x: x[0])

try to use sort - especially if some type of order is necessary

Python >>>

```
>>> ids = ['id1', 'id2', 'id30', 'id3', 'id22', 'id100']
>>> print(sorted(ids)) # Lexicographic sort
['id1', 'id100', 'id2', 'id22', 'id3', 'id30']
>>> sorted_ids = sorted(ids, key=lambda x: int(x[2:])) # Integer sort
>>> print(sorted_ids)
['id1', 'id2', 'id3', 'id22', 'id30', 'id100']
```

```
In [69]: prime_numbers = [2, 3, 5, 7, 11, 13, 17]

In [70]: removed_element = prime_numbers.pop(2)

In [71]: removed_element
Out[71]: 5

In [72]: prime_numbers
Out[72]: [2, 3, 7, 11, 13, 17]

In [73]: removed_element_2 = prime_numbers.pop(-2)

In [74]: removed_element_2
Out[74]: 13
```

Operation	Linked List	Python's list
Insert at head	O(1)	O(n)
Insert at middle	O(n), O(1) given a reference	O(n)
Remove from head	O(1)	O(n)
Remove from middle	O(n), O(1) given a reference	O(n)
Find k-th element	O(k)	O(1)
Search unsorted	O(n)	O(n)
Search sorted	O(n)	O(log n)

python comparisons are type sensitive

reversed(array)

```
half_n, remainder = divmod(n, 2) # n // 2, n % 2
```

divide + mod, at the same time

update existing

dict: dict.update({new: values})

list: list.append([new, stuff])

set: set.add({new, stuff})

```
1   person = {}
2
3   # Using get() results in None
4   print('Salary: ', person.get('salary'))
5
6   # Using get - define default value
7   print('Salary: ', person.get('salary', 0.0))
8
9   # Using [] results in KeyError
10  print(person['salary']) 56
```

```
PROBLEMS 1   OUTPUT   DEBUG CONSOLE   TERMINAL

ayeletwasserman@Ayelets-MacBook-Pro test_prep % /usr/local/bin/p
Salary:  None
Salary:  0.0
Traceback (most recent call last):
  File "/Users/ayeletwasserman/Documents/CS/intro/test_prep/dict
    print(person['salary'])
KeyError: 'salary'
ayeletwasserman@Ayelets-MacBook-Pro test_prep %
```

```
In [22]: txt = "banana,,,,,ssqqqww....."
    ...: x = txt.rstrip(",.qsw")
    ...: print(x)
banana
```

from **collections** import Counter

list.remove(item_to_remove) - removes only the first occurrence. error if trying to remove value that

does not exist

decorators - without parenthasis

from functools import wraps (@wraps(func) - get the original info of a wrapped func)

@property:

```
class Person:
    def __init__(self, name, age):
        self._name = name
        self._age = age

    # Define a "name" getter
    @property
    def name(self):
        return self._name

    # Define a "name" setter
    @name.setter
    def name(self, value):
        self._name = value

# Create a new Person object
person = Person("Alice", 30)

# Access and set the "name" attribute using the getter and setter
print(person.name)  # "Alice"
person.name = "Bob"
print(person.name)  # "Bob"
```

```python
class Person:
    def __init__(self, name, age):
        self._name = name
        self._age = age

    # define a "name" getter
    @property
    def name(self):
        return self._name

    # define a "name" deleter
    @name.deleter
    def name(self):
        del self._name

# create a new Person object
person = Person("Alice", 30)

# access, set, and delete the "name" attribute
# using the getter, setter, and deleter
print(person.name)  # "Alice"

del person.name
print(person.name)  # AttributeError
```

python arithmetic = leaves floating point stuff

```
>>> 1-1/3 == 2/3
False
```

```
>>> 1-1/3
0.6666666666666667
>>> 2/3
0.6666666666666666
```

```
>>> sys.getsizeof(1/3)
24
>>> sys.getsizeof(2.0**500)
24
```

type(1 + 0.5) == type(float)

int(5.9) == 5, int rounds floats down

float(int) == int.0

String Methods

Python has a set of built-in methods that you can use on strings. For example:

upper()	Converts a string into upper case
split()	Splits the string at the specified separator, and returns a list
replace()	Returns a string where a specified value is replaced with a specified value
count()	Returns the number of times a specified value occurs in a string
encode()	Returns an encoded version of the string
endswith()	Returns true if the string ends with the specified value
index()	Searches the string for a specified value and returns the position of where it was found
find()	Searches the string for a specified value and returns the position of where it was found
format()	Formats specified values in a string
startswith()	Returns true if the string starts with the specified value
strip()	Returns a trimmed version of the string

string.split('what to split with')

'hello'.startswith('o') == False

'hello'.startswith('hel') == True

[4,5,3,5,3].count(3) >>> 2

string.replace(oldvalue, newvalue, count)

range does not include the last value

```
type(range(2))
range
```

```
list1 = list(range(5))
print(list1)
```
[0, 1, 2, 3, 4]

```
list1[0:1] = [1, 2, 3]
print(list1)
```
[1, 2, 3, 1, 2, 3, 4]

```
list1 = list(range(5))
print(list1)
```
[0, 1, 2, 3, 4]

```
list1[0] = [1, 2, 3]
print(list1)
```
[[1, 2, 3], 1, 2, 3, 4]

break - terminates the current loop and continues with the rest of the program

continue - terminates only the curr iteration

```
lst3 = lst[:end] # items from the beginning through end-1
lst4 = lst[start:end:step] # items from start through end-1
                                    by step
lst5 = lst[::step] # from the beginning to the end by step
```

`list.append(x)` – Add **one element** to the end of the list

- equivalent to `a[len(a):] = [x]`

`append()` takes exactly one argument!

list.insert(index, obj) - Inserts object obj into list at offset index

list.extend(seq) - Appends the contents of seq to list

list.sort([func]) - Sorts objects of list, use func to compare, if given

ord('A') = 65, ord('a') = 97. opposite: chr() to convert back to character form

```
x = [[1, 1, 1]] * 3
print(x)
x[0][0] = 0
print(x)
```

```
[[1, 1, 1], [1, 1, 1], [1, 1, 1]]
[[0, 1, 1], [0, 1, 1], [0, 1, 1]]
```

```
x = [1,2,3]
y = copy.copy(x)
z = list(x)

print(y is x)   #False
print(z is x)   #False
```

```
x = "hi"
y = "bye"

z = x + y           # z is a new string!

w = z[2:4]      # slicing creates a copy
                # and doesn't change
                # the original string…

x[0] = 3            #ERROR!
x.append("a")       #ERROR!
```

ranges are immutable

Immutable types are often reused

(and sometimes not)

```
x = "hello"
y = "he" + "llo"

print(x is y) True

x = (0, 1, 2)
y = (0,) + (1, 2)

print(x is y) True
```

```
x = range(10)
y = range(10)

print(x is y) False

print(x == y) True
```

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```
x1 = [[1] * 3] * 3

x2 = [[1] * 3 for i in range(3)]

x3 = [[1 for i in range(3)]  for i in range(3)]

x1[0][0] = 9

x2[0][0] = 9

x3[0][0] = 9

x1
[[9, 1, 1], [9, 1, 1], [9, 1, 1]]

x2
[[9, 1, 1], [1, 1, 1], [1, 1, 1]]

x3
[[9, 1, 1], [1, 1, 1], [1, 1, 1]]
```

== does deep comparison.

Files:

```
with open(file_path, 'w') as our_open_file:
    # we can work here with the open
    # file and be sure it is properly
    # closed in every scenario
```

f = open(filename,'a')

n = f.write(s)

• f.writelines(seq)

• f.close()

•f.read(n)

f.readline()

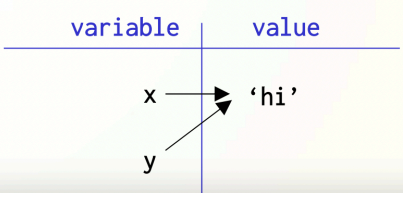
f.readlines()

IF __NAME__ == "__MAIN__": __name__ will have the value "__main__" only if the current module is first to execute.

Quick Summary - Aliasing

- Using the assignment operator (=) always copies just the identity of the variable on the right to the variable on the left (no matter what value the right variable has) – so the value itself is not being copied.
- When we modify the variable's value, we making a new identity for that variable.

```
>>> x = "hi"
>>> y = x
```



Copying with the = sign:

copying a reference

is - tests for identity

== compares the values themselves

```
>>> def init_student_num():
        global num_student
        num_student = 0
```

```
list_of_lists = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]

[y for x in list_of_lists for y in x]
[1, 2, 3, 4, 5, 6, 7, 8, 9]
```

enumerate(seq, **[start_index]**)

Comparison in Python

```
"a" < "b"
```
True

```
"ab" < "ac"
```
True

```
"CAPITAL" < "all lowercase"
```
True

```
(1,2,3) < (1,2,4)
```
True

.sort() returns **None** and **modifies** the values in place, **sorted(list_to_sort)** - The output is a **new**,

sorted list. The original list's initial values are **unchanged**

```
{i+1: i**2 for i in range(3)}
{1: 0, 2: 1, 3: 4}
```

set operations:

.add, .discard, .intersection, .union, .issubset, .issuperset, .symmetric_difference

`len(max(words, key=lambda x: len(x)))`

list.extend([stuff, to, add]) same as [first, arr] + [second, arr]

list.reverse()

x.extend() - does not create a new list

x + [] - creates new list

Type hints

```
from typing import Callable, Any, TypeVar

T = TypeVar("T")


def do_twice(f: Callable[[T], Any], arg: T) -> None:
    f(arg)
    f(arg)
```

[some, list].insert(index, element)

```
def go_flat(lst):
    res = []
    templist = [lst]
    while templist:
        cur = templist.pop()
        if isinstance(cur, list):
            templist.extend(cur)
        else:
            res.insert(0, cur)
    print(res)
```