Types of Time Complexities

1. **Omega (Ω) – Best Case**
    a. What it means: Omega (Ω) describes the best-case scenario for an algorithm.
    b. In simple terms: It tells you the fastest an algorithm can run in the best circumstances.
2. **Theta (Θ) – Average Case**
    a. In simple terms: It tells you what to generally expect in terms of time complexity.
3. **Big O (O) - Worst Case**
    a. What it means: Big O (O) describes the worst-case scenario for an algorithm.
    b. In simple terms: It tells you the slowest an algorithm can run in the worst circumstances.

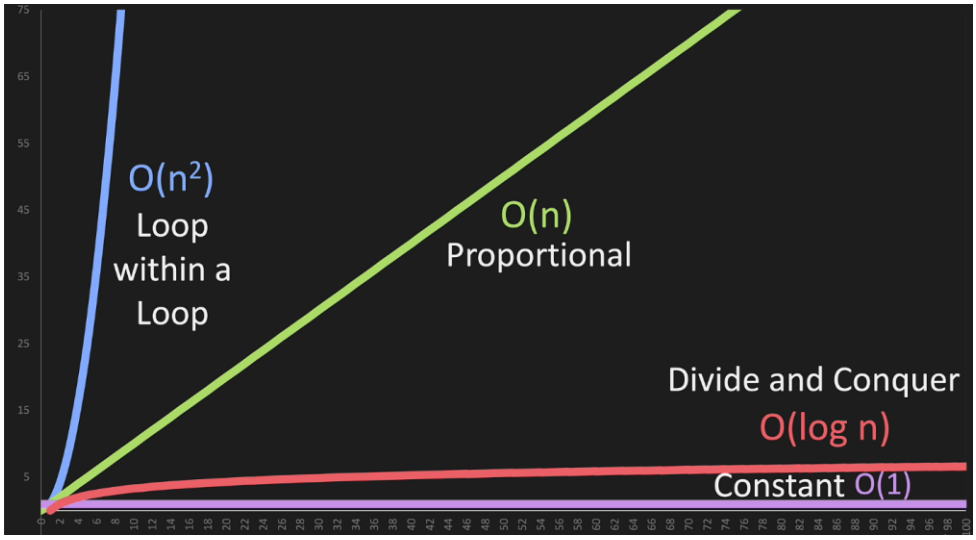
Big O Basic Concepts:

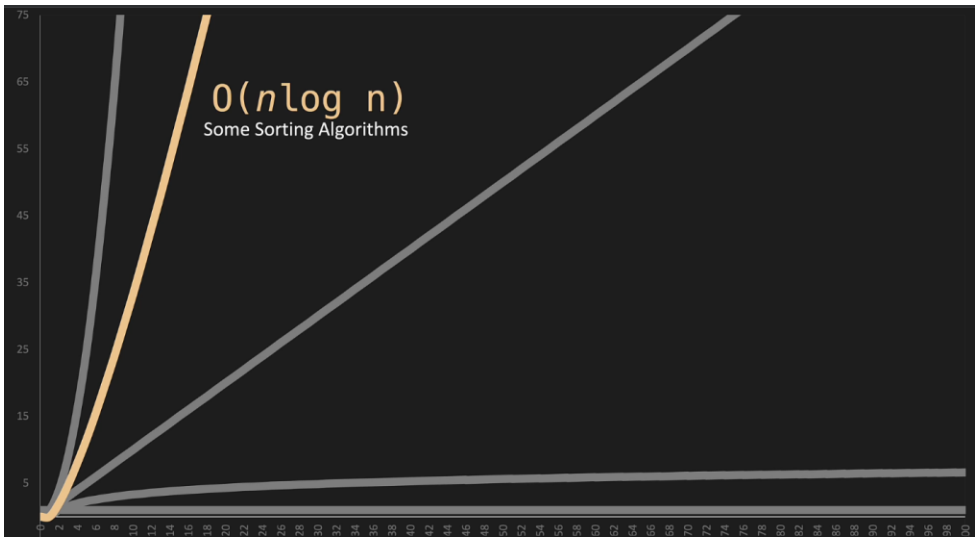
1. **O(1): Constant Time**
    a. Doesn't depend on the size of the data set.
    b. Example: Accessing an array element by its index.
2. **O(log n): Logarithmic Time**
    a. Splits the data in each step (divide and conquer).
    b. Example: Binary search.
3. **O(n): Linear Time**
    a. Directly proportional to the data set size.
    b. Example: Looping through an array.
4. **O(n log n): Linearithmic Time**
    a. Splits and sorts or searches data.
    b. Example: Merge sort, quick sort.
5. **O(n2): Polynomial Time**
    a. Nested loops for each power of n.
    b. Example: Bubble sort (O(n^2)).

Other Concepts:

1. **Drop Non-Dominant Terms:** In O(n^2 + n), focus on O(n^2) as it will dominate for large n.
2. **Drop Constants:** O(2n) simplifies to O(n)
3. **Different Terms for inputs:** If there is are 2 separate loops with different parameters -> O(n+m)

Good reference: https://www.bigocheatsheet.com/





Code for O(n)

```
def print_items(n):
    # print_items accepts one argument 'n'. It will print
    # a sequence of numbers from 0 up to, but not including, 'n'.

    for i in range(n):
        # A for loop is initiated with 'i' iterating over
        # the sequence of numbers produced by range(n).
        # For each iteration, 'i' takes the current number in
```

```
9.      # the sequence from 0 up to but not including 'n'.
10.
11.     print(i)
12.     # Inside the loop, print(i) is called. This prints
13.     # the current value of 'i' to the console. This
14.     # action is performed 'n' times due to the for loop,
15.     # resulting in printing of numbers from 0 to 'n - 1'.
```

Other possible solutions:

There are a few different ways the for loop in your **print_items** function could be rewritten. Here are a few examples:

1. **Using a while loop instead of a for loop:**

```
1. def print_items(n):
2.     i = 0
3.     while i < n:
4.         print(i)
5.         i += 1
```

2. **Using a for loop with an explicitly defined list:**

```
1. def print_items(n):
2.     for i in list(range(n)):
3.         print(i)
```

3. **Using a for loop with iterator:**

```
1. def print_items(n):
2.     for i in iter(range(n)):
3.         print(i)
```

4. **Using list comprehension**

   (though this isn't recommended if the goal is just to print the items, as it unnecessarily creates a list of **None** values):

```
1. def print_items(n):
2.     _ = [print(i) for i in range(n)]
```

5. **Using the map function.**

This method is also not recommended for printing purposes, as it's less readable and efficient than a simple loop, and it also unnecessarily creates a list of **None** values:

```
1. def print_items(n):
2.     _ = list(map(print, range(n)))
```

Each of these alternative solutions achieves the same result as the original function, but the simplest and most straightforward solution is the original for loop.

If there are 2 separate for loops

O(n) + O(n)

O(n + n)

O(2n)

O(n)

Lesson Learnt – Drop constants

Code for $O(n^2)$:

```
def print_items(n):
    for i in range(n):
        for j in range(n):
            print(i,j)
```

Code for O(1)

```
n = 1
n + n (Single Operation, no matter how n grows)
```

Code for O(log(n))