

# Homework Assignment 01

Name: **Asrar Syed**

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Course Section: **CSC 4520-006**

1. Give the best possible Big-O characterization for each of the following running time estimates, where  $n$  is the size of the input:

a.  $2\log n + 100,000 \rightarrow O(\log n)$

We drop the constants because  $\log n$  dominates.

b.  $n^2 + 2n \rightarrow O(n^2)$

$2n$  is a lower order growth so it's negligible and can be dropped.

c.  $(2n + 1) + (2n - 1) + \dots + 5 + 3 + 1 \rightarrow O(n^2)$

This is the sum of the first  $n + 1$  odd numbers, i.e.  $(n + 1)^2 = n^2 + 2n + 1$

Same reason as b as to why it can be dropped.

d.  $2^{20} + 3^{10} \rightarrow O(1)$

Pure constant (independent of  $n$ ).

e.  $1 + n^2 + 2n + n! \rightarrow O(n!)$

Factorial  $n!$  grows far faster than any polynomial, so it dominates.

2. Which of the following functions

$3n$	Linear in $n$
$2n + 3$	Linear in $n$
$n^2 + n$	Quadratic dominates
$\log n^2$	Grows slower than $n$
$\sqrt[3]{n}$	Grows slower than linear
$\log 2n$	Sublinear

belong to

- $O(n)$ :  $3n, 2n + 3, \log n^2, \sqrt[3]{n}, \log 2n$
- $\Theta(n)$ :  $3n, 2n + 3$
- $\Omega(n)$ :  $3n, 2n + 3, n^2 + n$