CSI2110 09/11/2017

Algorithm

- Series of steps
- transforms inputs
- has outputs

Efficiency

- Running time
- Memory
- Quality
- Simplicity

Run time

- depends on input
- also depends on data
  (sorted vs. unsorted)
  (structured vs unstructured)
- Best / Worst / Average cases

Theoretical Analysis:

- We need to develop a general methodology
- Running time as a function of input size
- independant of environment

Primitive Operations:

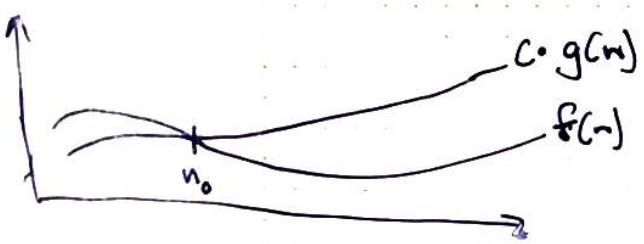
Low-level comparisons from the programming language can be identified in pseudocode

By inspecting pseudocode we can count the number of primitive operations executed by an algorithm

Big-Oh (upper bound)

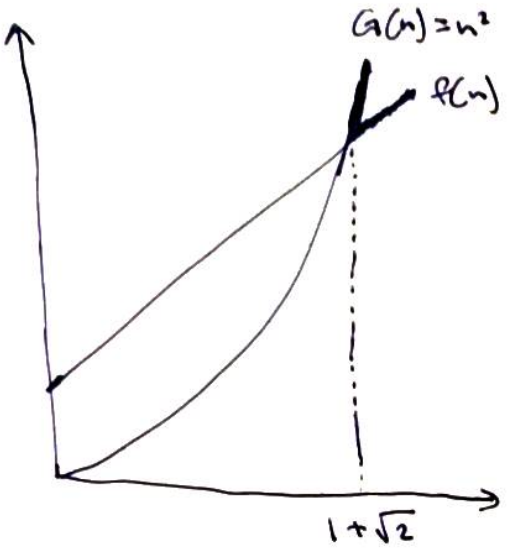
given $f(n)$ and $g(n)$, $f(n)$ is $O(g(n))$ iff there are positive constants c and n_0 such that

$$\{f(n) \leq c \cdot (g(n)) \text{ for } n \geq n_0 \mid c > 0\}$$



after some point n_0, $c \cdot g(n)$ is always greater than $f(n)$.

Graphical Example of



$f(n)$ is $O(n^2)$

$f(n) \leq c \cdot g(n)$ for $n \geq n_0$

$f(n) \leq g(n)$ for $n \geq 1+\sqrt{2}$

Prove $60n^2+5n+1$ is $O(n^2)$

we must find c and n_0 s.t.

$60n^2+5n+1 \leq c \cdot n^2 \quad \forall n \geq n_0$

$5n \leq 5n^2 \quad \forall n \geq 1$

$1 \leq n^2 \quad \forall n \geq 1$

$\Rightarrow f(n) \leq 60n^2+5n^2+n^2 \quad \forall n \geq 1$

$f(n) \leq 66n^2 \quad \forall n \geq 1 \quad \therefore n_0 = 1 \quad c = 66 \quad \therefore O(n^2)$