13.7 Big-Theta

Not to be confused with Big-O.

[Asymptotics1, Video 8] Big Theta

Formalizing Order of Growth

Given some function $Q(N)$, we can apply our last two simplifications to get the order of growth of $Q(N)$.

For example, if $Q(N) = 3N^3 + N^2$, the order of growth is N^3.

From now onward, we will refer to order of growth as Θ (pronounced "big theta").

Order of Growth Examples

The following functions have these corresponding order of growths:

Function	Order of Growth
$N^3 + 3N^4$	N^4
$1/N + N^3$	N^3
$1/N + 5$	1
$Ne^N + N$	Ne^N
$40sin(N) + 4N^2$	N^2

Instead of saying a function has *order of growth* ___, we say that the function *belongs to* $\Theta($___$)$. In other words, it belongs to the family of functions that have that same order of growth.

Formal Definition

For some function $R(N)$ with order of growth $f(N)$, we write that:

$R(N) \in \Theta(f(N))$ and there exists some positive constants k_1, k_2 such that...

$k_1 \cdot f(N) \leq R(N) \leq k_2 \cdot f(N)$ for all values N greater than some N_0 (a very large N).

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