cs141 Workshop: Asymptotic Notation

Asymptotic Notation

Big O:

$$\mathrm{O}\left(g\left(n\right)\right)=\left\{f\left(n\right):\exists c,n_0>0 \text{ st. } 0\le f\left(n\right)\le cg\left(n\right)\ \forall n\ge n_0\right\}$$

Omega:

$$\Omega\left(g\left(n\right)\right)=\left\{f\left(n\right):\exists c,n_0>0 \text{ st. } 0\le cg\left(n\right)\le f\left(n\right)\ \forall n\ge n_0\right\}$$

Theta:

$$\Theta\left(g\left(n\right)\right)=\left\{f\left(n\right):\exists c_1,c_2,n_0>0 \text{ st. } 0\le c_1g\left(n\right)\le f\left(n\right)\le c_2g\left(n\right)\ \forall n\ge n_0\right\}$$

Examples:

1) Show that $20n^3+10n\log n+5$ is $\mathrm{O}\left(n^3\right)$.

choose $c=35$ and $n_0=1$ such that:

$$20n^3+10n\log n+5\le 35n^3,\ for\ n\ge 1$$

2.) Show that 2^{100} is $\mathrm{O}\left(1\right)$.

choose $c=1$ and $n_0=1$ such that:

$$2^{100}\le 2^{100}\bullet 1,\ for\ n\ge 1$$

3) Show that $5n^3+3n+8$ is $\Theta(n^3)$.