Assignment 10: Boolean Expressions, Normal Forms and Landau Sets

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1 Problem 2

- $n^3 log(n) \in O(n^4)$: We know that $n^4 = n^3 * n$ and $log(n) \leq n$ for all $n \in \mathbb{N}/0$.
- $n + 3n^3 \in \Omega(n + n^2)$: $n^2 \leq n^3$ for all $n \in \mathbb{N}$.
- $2^n \in O(e^{n^2})$: We know that $2^n \in O(e^n)$ and that $n \in O(n^2)$.
- $sin(n) \in O(n)$: $sin(n) \leq 1$ for all $n \in \mathbb{N}$ so there is no $k \in \mathbb{R}$ such that $1 * k \geq n$ for all $n \in \mathbb{N}$.
- $42 \in \Theta(12)$: $42 > 12$ and if we define $k = 100$, $12 * k > 42$.
- $n^4 \in \Omega(\frac{n^2}{log(n)})$: Since $n^2 \in \Omega(n^4)$.
- $log_{10}(n) \in \Omega(ln(n))$: $ln(n)$ allways grows faster than $log_{10}(n)$ so for every k we can allways choose some n large enough such that $ln(n) - k * log_{10}(n) > 0$.
- $n! \in \Omega(5^n)$: Since $5^n = 5 * 5 * 5 * ... * 5$ and $n! = 1 * 2 * 3 * 4...$ so as n so as n grows it get's multiplied by bigger numbers so we can't find a k to make them equivalent.
- $n^{log_n(8^n)} \in O(9^n)$: Taking the log_n of both functions we get $log_n(8^n) * log_n(n) = log_n(8^n)$ and $n * log_n(9) \approx n$ since $log_n(9) \rightarrow 1$ as $n \rightarrow \infty$. Therefore we have $log_n(8^n)$ and n and $log_n(8^n) \in O(n)$.
- $(3(n^3) + 2)^2 \in \Theta(((n^3) + 3)^2)$: Since $9n^6 \in \Theta(n^6)$.