# LAB - 3

→ **Problem 1:**

1) We can write these terms as: $10^{10} n^2$ vs $n^3$
- $c \cdot \theta(n^2)$ vs $\theta(n^3)$
- Since $\theta(n^3) > \theta(n^2)$, we can say asymptotically, $\boxed{n^3}$ is asymt. greater.

2) $n^2 \log(n)$ vs $n(\log(n))^{10}$
- $n^2 \log(n)$ vs $10 n \log(n)$
- Since: $\theta(n^2 \log(n)) > \theta(n \log(n)) \to \boxed{n^2 \log(n)}$ is asymt. greater

3) $n^{\log(n)}$ vs $2^{\sqrt{n}}$

$\log(n^{\log(n)})$ vs $\log(2^{\sqrt{n}})$

$\log(n) + \log(n)$ vs $\log(\sqrt{n}) + \log(2)$

$2(\log(n))$ vs Constant $\cdot \log(\sqrt{n})$

Since $\to \theta(\log(n)) > \theta(\log(\sqrt{n})) \to \boxed{n^{\log(n)}}$ is asymt. greater.

4) $2^n$ vs $2^{2n}$
- Since we are interested in functions being asymt. greater, we will take the closest upper bound of both function

→ Since $O(2^n) < O(2^{2n})$ → we can say $2^{2n}$ asymt. greater.

→ **Problem 2:**

① Best case: $n = 2$ → for loop will run only once.

→ lower bound $= \Omega(1)$

② Worst case: n is not a prime number. assuming n is very big

| Iterations | $i^2$ |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 9 |
| R | $R^2$ |

→ Let $i^2 > n$

→ then $R^2 > n$

→ $\sqrt{n} < R$

→ UPPER BOUND follows $O(\sqrt{n})$

③ Avg. anything between $\Omega(1) \longleftrightarrow O(\sqrt{n})$ is avg case