

CSE373 Week 3 Section Worksheet

- Find values for c and n_0 (according to the definition of $O(\cdot)$) for $f(n)$ is $O(g(n))$, where
 - $f(n)=7n$, $g(n)=n/10$
 - $f(n)=1000$, $g(n)=3n^3$
 - $f(n)=7n^2+3n$, $g(n)=n^4$
 - $f(n)=n+2n\log n$, $g(n)=n\log n$
- True or false?
 - $f(n)$ is $\Theta(g(n))$ implies $f(n)$ is $O(g(n))$
 - $f(n)$ is $\Theta(g(n))$ implies $g(n)$ is $\Theta(f(n))$
 - $f(n)$ is $\Omega(g(n))$ implies $f(n)$ is $O(g(n))$
- Find functions $f(n)$ and $g(n)$ such that $f(n)$ is $O(g(n))$ and the constant c for the definition of $O(\cdot)$ must be >1 . That is, find f & g such that c must be greater than 1, as there is no sufficient n_0 when $c=1$.
- Write the $O(\cdot)$ run-time of the functions with the following recurrence relations
 - $T(n)=3+T(n-1)$, where $T(0)=1$
 - $T(n)=3+T(n/2)$, where $T(1)=1$
 - $T(n)=3+T(n-1)+T(n-1)$, where $T(0)=1$

5. Prove by induction that $\sum_{i=0}^n i^2 = \frac{n(n+1)(2n+1)}{6}$

6. What's the $O(\cdot)$ run-time of this code fragment in terms of n :

- ```
int x=0;
for(int i=n;i>=0;i--)
 if((i%3)==0) break;
 else x+=n;
```
- ```
int x=0;
for(int i=0;i<n;i++)
    for(int j=0; j<(n*n/3); j++)
        x+=j;
```
- ```
int x=0;
for(int i=0;i<=n;i++)
 for(int j=0; j<(i*i); j++)
 x+=j;
```