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CS 161

Homework 1

R-1.3

$10n\ log_2 n = n^2$

$10\ log_2 n = n$

$n \approx 58.77$

Algorithm A and Algorithm B intersect at the point n ≈ 58.7701 and after this point Algorithm A is faster than Algorithm B.

R-1.4

$10n\ log_2 n = n\sqrt{n}$

$10\ log_2 n = \sqrt{n}$

$(10\ log_2 n)^2 = n$

$n \approx 20519.8$

Algorithm A and Algorithm B intersect at the point n ≈ 20519.8 and after this point Algorithm A is faster than Algorithm B.

R-1.7- NOTE: The colored text shows the groups of functions that are big-Theta of one another

1. $1/n$ => $O(1/n)$
2. 2^{100} => $O(1)$
3. $log\ log\ n$ => $O(log\ log\ n)$
4. $\sqrt{log\ n}$ => $O((log\ n)^{1/2})$
5. $log^2 n$ => $O((log\ n)^2)$
6. $n^{0.01}$ => $O(n^{0.01})$

7. $ceiling(\sqrt{n})$ => $O(n^{1/2})$
8. $3n^{0.5}$ => $O(n^{1/2})$
9. $2^{log\,n} = n^{log_2 2}$ => $O(n)$
10. $5n$ => $O(n)$
11. $n\,log_4 n$ => $O(\,n\,log_4 n)$
12. $6n\,log\,n$ => $O(n\,log\,n)$
13. $floor(2n\,log^2 n)$ => $O(n\,(log\,n)^2)$
14. $4n^{3/2}$ => $O(n^{3/2})$
15. $4^{log\,n} = n^{log_2 4}$ => $O(n^2)$
16. $n^2 log\,n$ => $O(n^2\,log\,n)$
17. n^3 => $O(n^3)$
18. 2^n => $O(2^n)$
19. 4^n => $O(4^n)$
20. 2^{2^n} => $O(2^{2^n})$

R-1.10

<u>Base case:</u>

n = 1

So $T(1) = 4$, which means that $4n = 4$ is true when n =1

Therefore $T(n) = 4n$

<u>Induction Step:</u>

Assume that $T(k) = 4k$ where $k \geq 1$

Meaning that $T(k+1) = T(k) + 4$

So $T(k+1) = 4k + 4 = 4(k+1)$

Since $T(n) = 4n$ hold true when $n = k$ and $n = k+1$ it will hold true for all $n \geq 1$