1720694

Theme: Assignment 2.

Date: 24 / 11 /2020

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1. $3n^2 + 10n \log_2 n = O(n \log_2 n)$

$= 3n^2 + 10n \log_2 n \leq c \cdot (n \log_2 n)$.

$= \frac{3n^2}{n \log_2 n} + \frac{10 n \log_2 n}{n \log_2 n} \leq c$

Disapproved, since n^2 is asymptotically faster growing than $n \log n$ and hence not upperbounded by it.

2. $3n^2 + 10n \log_2 n = \Omega(n^2)$

$\frac{3\cancel{n^2}}{\cancel{n^2}} + \frac{10\cancel{n} \log_2 n}{n^{\cancel{2}}} \geq c$

$3 + \frac{10 \log_2 n}{n} \geq c$

$n = 2 \quad c = 7$.

$3 + \frac{10 \log_2 (2)}{(2)} \geq 7$

$8 \geq 7$

Rough:

$n = 3 \quad c = 13$

$3 + \frac{10 \log_2 (3)}{3} \geq 13$

$8.2 \geq 13$.

Approved, since n^2 asymptotically grows like n^2 and hence ~~$\Omega(n^2)$~~ it is $\Omega(n^2)$

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3. $3n^2 + 10n \log_2 n = \theta(n^2)$

$c_1 n_2 \leq 3n^2 + 10n \log_2 n \leq c_2 n_2$

For C_1;

$C_1 n_2 \leq 3n^2 + 10n \log_2 n$

$C_1 \leq \frac{3n^2}{n^2} + \frac{10n \log_2 n}{n^2}$

$C_1 \leq 3 + \frac{10 \log_2 n}{n}$

For $n = 3$, $C = 13$;

$13 \leq 3 + \frac{10 \log_2 (3)}{3}$

$7 \leq 8.2$.

For C_2;

$\frac{3n^2}{n^2} + \frac{10n \log_2 n}{n^2} \leq C_2$

$3 + \frac{10n \log_2 (3)}{(3)} \leq 9$

$8.2 \leq 9$.

Rough:

$n = 3 \quad C = 13$

$13 \leq 3 + \frac{10 (\log_2 (2))}{(2)}$ // maximum

$13 \leq 8.2$

Approved, since $\theta(n^2)$ faster grower than nlogn and hence not upperbounded by it.

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4. $n \log_2 n + \frac{n}{2} = O(n)$

$= n \log_2 n + \frac{n}{2} \leq c \cdot n$

$= \frac{\cancel{n} \log_2 n}{\cancel{n}} + \frac{n^2}{2} \leq c.$

$= \log_2 n + \frac{n^2}{2} \leq c$

Disapproved, since nlogn is not asymptotically upperbounded by c.
n^2 grows exponentially.

5. $10\sqrt{n} + \log_2 n = O(n)$

$= 10\sqrt{n} + \log_2 n \leq c \cdot n$

$= \frac{10\sqrt{n}}{n} + \frac{\log_2 n}{n} \leq c.$

$10 n^{\frac{1}{2}-1} + \frac{\log_2 (n)}{(n)} \leq c$

for $n = 2$ $c = 5$

$10 (2)^{\frac{1}{2}-1} + \frac{\log(2)}{(2)} \leq 5$

$3.53 \leq 5$

for $n = 3$ $c = 5$

$10 (3)^{\frac{1}{2}-1} + \frac{\log(3)}{(3)} \leq 5$

$1 \leq 5$

Approved, since $10\sqrt{n}$ is asymptotically upperbounded by n.

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6. $\sqrt{n} + \log_2 n = O(\log_2 n)$

$\sqrt{n} + \log_2 n \leq c \cdot \log_2 n$ $n = 3 \quad c = 5$

$\frac{\sqrt{n}}{\log_2 n} + \frac{\log_2 n}{\log_2 n} \leq c$ $\frac{3^{1/2}}{\log 3} + 1 \leq 5$

$2.09 \leq 5$

$\frac{n^{1/2}}{\log n} + 1 \leq c$

Disapproved, since $\sqrt{n}$ is not asymptotically upperbounded by c.

7. $\sqrt{n} + \log_2 n = \Theta(\log_2 n)$

= $c_1 \log_2 n \leq \sqrt{n} + \log_2(n) \leq c_2 \cdot \log_2 n$

= For c_1;

$c_1 \leq \cancel{\frac{\sqrt{n} + \log_2(n)}{\log_2 n}}$ $\frac{\sqrt{n}}{\log_2 n} + \frac{\log_2 n}{\log_2 n}$.

$c_1 \leq \frac{\sqrt{n}}{\log_2 n} + 1$

For $n = 2 \quad c_1 = 2$

$c_1 \leq \frac{\sqrt{2}}{\log(2)} + 1$

$1 \leq 2.41$

For c_2;

$\frac{\sqrt{n}}{\log_2 n} + 1 \leq c_2$.

Disapproved, can't be bounded.

$\sqrt{n}$ is asymptotically fast growing.

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8. $\sqrt{n} + \log_2 n = \theta(n)$

$C_1 \cdot n \leq \sqrt{n} + \log_2 n \leq C_2 \cdot n$

$C_1 \cdot n \leq \sqrt{n} + \log_2 n$

$C_1 \leq \frac{\sqrt{n}}{n} + \frac{\log_2 n}{n}$

$\frac{\sqrt{n}}{n} + \frac{\log_2 n}{n} \leq C_2$.

$n = 5$

When $n = 1$ $\quad C_1 \leq 1$.

$n = 2$ $\quad C_1 \leq 1.2$

$n = \cancel{5}3$ $\quad C_1 \leq 1.1$

~~n= 5 C1 ≤~~

Disapproved, $\sqrt{n}$ is asymptotically ~~faster~~ slower growing than n.

9. $2n + \log_2 n = \theta(\sqrt{n})$

$C_1 \cdot \sqrt{n} \leq 2n + \log_2 n \leq C_2 \cdot \sqrt{n}$

$C_1 \cdot \sqrt{n} \leq 2n + \log_2 n$

$C_1 \leq \frac{2n}{\sqrt{n}} + \frac{\log_2 n}{\sqrt{n}}$

$n = 1$ $\quad C_1 \leq 2$

$n = 2$ $\quad C_1 \leq 2.1$

$n = 3$ $\quad C_1 \leq 2.06$

$n = 4$ $\quad C_1 \leq 2$

$n = 6$ $\quad C_1 \leq 1.6$

$n = 7$ $\quad C_1 \leq 1.81$

$n = 10$ $\quad C_1 \leq 1.6$

$n = 100$ $\quad C_1 \leq 0.8$.

~~can't be lowerb.~~

for C_2;

$\frac{2n}{\sqrt{n}} + \frac{\log_2 n}{\sqrt{n}} \leq C_2$.

$n = 3$ $\quad C = 3$

$2.06 \leq 3$

Disapproved, this can't be lower bounded.

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10. $\frac{1}{2}n^2 - 3n = \theta(n^2)$

$c_1 . n_2 \leq \frac{1}{2}n^2 - 3n \leq c_2 . n_2$

$c_1 . n_2 \leq \frac{1}{2}n^2 - 3n$

$c_1 \leq \frac{\frac{1}{2}(n)^2}{n_2} - \frac{3n}{n^2}$

$n = 1 \quad c_1 \leq -2.5 \qquad -2.5 \leq 1$ // true

$n = 2 \quad c_1 \leq -1/2$

$n = 3 \quad c_1 \leq 0.5$

$n = 10 \quad c_1 \leq 4.7.$

For c_2; $\frac{\frac{1}{2}(n^2)}{n^2} - \frac{3}{n} \leq c_2$

$n = 100$

$49.9.$

Disapproved, ~~since~~ for arbitary large n, since c is constant.

11. $6n^3 = \theta(n^2)$

$c_1 . n_2 \leq 6n^3 \leq c_2 . n^2$

$c_1 \leq \frac{6n3}{n^2}$

$c_1 \leq 6n$

$n = 2 \quad c = 2$

$2 \leq 2$

for c_2;

$6n \leq c_2$.

Disapproved, n^3 can't be upperbounded.

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12. $\sqrt{n} + \log_2 n = \Omega(1)$

$\sqrt{n} + \log_2 n \geq c_1 \cdot 1$.

$n=2$; 2.41 ———————— $2.41 \geq 1$.

$n = 1 \quad c = 1$.

$\sqrt{1} + \log_2(1) \geq 1$

$1 \geq 1$

Approved, since $\sqrt{n}$ is asymptotically faster growing than 1.

13. $\sqrt{n} + \log_2(n) = \Omega(\log_2 n)$

$\sqrt{n} + \log_2 n \geq c \cdot \log_2 n$

$\frac{\sqrt{n}}{\log_2 n} + \frac{\log_2 n}{\log_2 n} \geq c$.

$\frac{\sqrt{n}}{\log_2 n} + 1 \geq c$

$n=2$	2.41
$n=3$	2.09
$n=7$	1.94
$n=9$	1.94
$n=12$	1.96
$n=16$	2
$n=100$	2.50

$c = 1 \quad n = 2$.

$\frac{\sqrt{2}}{\log(2)} + 1 \geq 1$

$2.41 \geq 1$

Approved, $\sqrt{n}$ is asympotically faster growing than $\log n$.

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14. $\sqrt{n} + \log_2 n = \Omega(n)$

$\sqrt{n} + \log_2 n \geq c \cdot (n)$

$\frac{\sqrt{n}}{n} + \frac{\log_2 n}{n} \geq c$

$n = 1 - 1$

$n = 2 - 1.20$

$n = 4 - 1$

$n = 5 - 0.9$

$n = 10 - 0.6$

Disapproved, this can't be bounded by C.
$\sqrt{n}$ asymptotically slower growing than n.