ECE 9343 hw1 - DSA Answers

Data Structure and Algorithm (New York University) nlt id : ps4792

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YOUVA

1.(a) $n = \omega(\sqrt{n})$, Here, $T(n) = n$ & $f(n) = \sqrt{n}$

Applying L'Hospital Rule,

$$\lim_{n \to \infty} \frac{T(n)}{f(n)} = \lim_{n \to \infty} \frac{T'(n)}{f'(n)}$$

$$= \lim_{n \to \infty} \frac{1}{\frac{1}{2\sqrt{n}}}$$

$$= \lim_{n \to \infty} 2\sqrt{n}$$

$$= \infty$$

So, Here, we can see that as n tends to ∞, the expression tends to ∞.

$\therefore$, $\boxed{n > \sqrt{n}}$ Hence Proved.

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1.(b) $f(n) = \Omega(g(n))$ && $h(n) = \theta(g(n))$

$f(n) = \Omega(g(n))$

$f(n) \geq \frac{1}{c} \cdot g(n)$ (using Big Omega defination)

$c \cdot f(n) \geq g(n)$ —— (1)

$h(n) = \theta(g(n))$

$h(n) = \frac{1}{c} \cdot g(n)$ (using Theta defination)

$c \cdot h(n) = g(n)$ —— (2)

using (2) in (1) :-

$\cancel{c} \cdot f(n) \geq \cancel{c} \cdot h(n)$

$f(n) \geq h(n)$

$\therefore$ $f(n) = \Omega(h(n))$ $\boxed{\text{Hence Proved}}$

Hence proved

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1.(c) $f(n) = O(g(n))$ if and only if $g(n) = \Omega(f(n))$

(Transpose Symmetry Property)

$g(n) = \Omega(f(n))$

$g(n) >= \frac{1}{c} \cdot f(n)$ (using Big Omega definition)

$c \cdot g(n) >= f(n)$

$O(g(n)) = f(n)$

$\therefore$, $\underline{f(n) = O(g(n))}$ $\boxed{\text{Hence Proved}}$

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2. Use "Yes" or "NO"

Case Index	A	B	O	o	Ω	ω	Θ
a	$\lg^k n$	n^ε	Yes	Yes	NO	NO	NO
b	n^k	c^n	Yes	Yes	NO	NO	NO
c	$\sqrt{n}$	$n^{\sin n}$	NO	NO	NO	NO	NO
d	2^n	$2^{n/2}$	NO	NO	Yes	Yes	NO
e	$n^{\lg c}$	$c^{\lg n}$	Yes	NO	Yes	NO	Yes
f	$\lg(n!)$	$\lg(n^n)$	Yes	NO	Yes	NO	Yes

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3. $A_1 \rightarrow O(n)$ $\quad <=$

$A_2 \rightarrow \theta(n \log n)$ $\quad ==$

$A_3 \rightarrow \Omega(n^2)$ $\quad >=$

$A_4 \rightarrow o(n^3)$ $\quad <$

$A_5 \rightarrow \omega(n^{3/2})$ $\quad >$

(a) $4(5^{3\log_5 n}) + 12n + 9527 \rightarrow A_3, A_5$

(b) $\sqrt[5]{3n!} \rightarrow A_3$

(c) $\left(\frac{5^{\log_5 n}}{6}\right)^2 + 4n + 17 \rightarrow A_1$

(d) $3n\log_3 n + (\log_2 n)^3 \rightarrow A_2$

(e) $\log_4 \log_2 n + 61 \rightarrow A_1, A_4$

(f) $2^{5\log_4 n} \rightarrow A_3$

(g) $(\log_2 n)^2 + \log_3 \log_3 n \rightarrow A_1$

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4. $A = [7, 3, 8, 5, 9]$

9

MAXIMUM (A, 1, 5)

(9,8)

lmax = MAXIMUM(A, 1, 3) 8

rmax = MAXIMUM (A, 4,5) 9

lmax = MAXIMUM (A,1,2) 7

(8,7)

rmax = MAXIMUM (A, 3, 3)

A[3] = 8

lmax = MAXIMUM (A, 4, 4)

A[4] = 5

(9,5)

rmax = MAXIMUM (A, 5, 5)

A[5] = 9

lmax = MAXIMUM (A,1,1)

A[1] = 7

(3,7)

rmax = MAXIMUM (A, 2, 2)

A[2] = 3

1. (3, 7)
2. (8, 7)
3. (9, 5)
4. (9, 8)