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2) Xác định mqh phức tạp thuật toán theo kí pháp tiệm cận.

B_1:

a) worst_case

$f(x) = 50x + 7 \leq 51x \Leftrightarrow x \geq 7$

vs $x \geq 7$, $c = 51$, $f(x) \leq 51x$.

$\Rightarrow O(n)$.

b) Best_case.

$f(x) = 50x + 7 \geq 7 \quad \forall x \geq 0$.

$\Rightarrow \forall x \geq 0, \forall c, f(x) \geq 7 \Rightarrow \Omega(7)$.

c) Average case.

$50x \cancel{+7} \leq f(x) \leq 51(x)$

$\Longrightarrow$ kí pháp θ.

Bài 2:

a) $2n(n-1)/2 \in O(n^3)$ True

Thật vậy:

$$f(n) = \frac{2n(n-1)}{2} = n^2 - n \leq n^2 \leq n^3.$$

$\forall n \geq 0$

Vậy vs $n \geq 0$, $c = 1$, $f(n) \leq n^3$

$\Rightarrow O(n^3)$.

b) $2n(n-1)/2 \in O(n^2)$ True.

Do $f(n) = n^2 - n \leq n^2 \; \forall n \geq 0$

Vậy $\forall n \geq 0$, $c = 1$, $f(n) \leq n^2$.

$\Rightarrow f(n) \in O(n^2)$

c) $2n(n-1)/2 \in \Theta(n^3)$ False.

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$f(n) = n^2 - n \le n^2 \quad \forall n \ge 0$

$f(n) = n^2 - n \ge n^2 - n \cdot \frac{n}{2} = n^2 - \frac{n^2}{2} = \frac{1}{2} n^2$

$\forall n \ge 0$

$\frac{1}{2} n^2 \le f(n) \le n^2$

$\Rightarrow f(n) \in \Theta(n^2)$

d) $2n(n-1)/2 \in \Omega(n)$ True.

$f(n) = 2n(n-1)/2 = n^2 - n \ge \frac{n^2}{2}$

$\forall n \ge 0$

$f(n) \in \Omega\left(\frac{n^2}{2}\right)$.

$\Leftrightarrow f(n) \in \Omega(n)$.

Bài 5:

Sắp xếp theo t.t tăng dần:

$\sqrt{n}, \ \ln^3 n, \ 2\lg(n+50)^5, \ 0{,}05n^{10} + 3^{n^3} + 1,$

$3^{2n}, \ 3^{3n}, \ (n^2+3)!$

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Bài 7:

a) If ($f(n) \in O(g(n)$ then $g(n) \in \Omega(f(n))$.

True.

Thật vậy:

Nếu $f(n) \in O[g(n)]$

$\Leftrightarrow \exists\ n \geq n_0,\ c = c_0$ sao cho

$f_n \leq c_0 . g(n)$.

$\Leftrightarrow g(n) \geq \frac{1}{c_0} f(n)$

$(g(n), f(n) > 0)$

b) $\Theta(\alpha g(n)) = \theta(g(n))$ where $\alpha > 0$

False, điều này xảy ra khi $\alpha = 0$

c) $\Theta(g(n)) = O(g(n)) \cap \Omega(g(n))$.

True, Bởi.

⊕ $g(n) \in O(g(n))$ tức

$\exists\ n \geq n_0,\ c = c_0$ sao cho

$g(n) \leq c_0 . g(n)$.

⊕ $g(n) \in \Omega(g(n)$

$\Leftrightarrow \exists\ n \geq n_0,\ c = c_1$ sao cho

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$g(n) \geq c_1 . g(n)$.

Hay

$$\Theta(g(n)) = O(g(n)) \cap \Omega(g(n)).$$

d). For any two nonnegative function $f(n)$ and $g(n)$ defined of the set of nonnegative integer, either

$$f(n) \in O(g(n)), \text{ or } f(n) \in \Omega(g(n)), \text{ or both}$$

CM.

(+) TH_1: gds. $f(n) \geq g(n)$,

$\Leftrightarrow \exists\, k \in N$, sao cho.

$fn \geq k . g(n)$

$\Leftrightarrow fn \in \Omega(g(n))$.

VD:
$f(n) = n^4$
$g(n) = 2n^3$.
$\cancel{f(n) = 4}$
$n^4 \geq 2n^3$
$\Rightarrow n^4 \in \Omega(2n^3)$.

(+) TH_2: $f(n) \leq g(n)$ khi đó:

$\exists\, k \in N$, sao cho.

$f(n) \leq k\, g(n)$

$\Leftrightarrow fn \in O(g(n))$.

VD:
$f(n) = n+1$
$g(n) = n^2$
$n+1 \leq n^2$
$\Leftrightarrow n+1 \in O(n^2)$.

(+) TH_3: $f(n) = g(n)$ khi đó

$\exists\, k, q \in N^*$, sao cho

$q\, g(n) \leq f(n) \leq k\, g(n)$

$fn \in O(g(n)), f(n) \in \Omega(g(n))$

$\Rightarrow$ đpcm.

VD: $f(n) = g(n) = n^3$.

$\Leftrightarrow 0{,}5n^3 \leq n^3 \leq 5n^3$.