Q:1

$$f(n) = 3n^2 + 21n + 40$$

prove for $\Omega(n^3)$, $O(n^3)$, $\Theta(n^3)$

=> for $\Theta(n^3)$

$$f(n) \leq \Theta(n^3)$$

=> mathematically yess, it is $O(n^3)$ because,

$3n^2 + 21n + 40 \leq c \cdot n^3$

$\because c = +ve$

=> but according to compter it is wrong, becaus in order to compute property it should be $O(n^3)$

=> for $\Omega(n^3)$

as $\Omega(n^3) \leq f(n)$

Ω mean it is tight lower bound who's growth is linear in nature.

$$\Omega(n^3) \leq 3n^2 + 21n + 40$$

So it disatisfies the property because

(left hand side is greater then right hand side it totally disatisfied.)

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$\Rightarrow$ for $\Theta(n^3)$

where $f(n) = 3n^2 + 21n + 40$

$c_1 \cdot g(n) \leq f(n) \leq c_2 \cdot g(n)$

$c_1 \cdot n^3 \leq 3n^2 + 21n + 40 \leq c_2 \cdot n^3$

dividing n^2 both sides

$c_1 \cdot n \leq 3n + 21 + \frac{40}{n} \leq c_2 \cdot n$

So it satisfies the property because $(\leq)$ $c_1(n)$ always less then or eaual to $f(n)$ and for right hand side it is also same that $c_2 \cdot n$ is greater then or eaual to $f(n)$.

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Q:2

let T() for $x = 1$ to n do n
begin
$y = x$
Let L() while $y > 1$ do
$y = y/2$
end

first inner while loop

$$L(y) = \cancel{(x+1)} \sum_{x=0}^{i} 1 = x+1$$

for outerloop

$$\text{for } T() = \sum_{i=1}^{i=1} L(x)$$

$$= \sum_{i=1}^{n=1} x + 1$$

$$= \sum_{i=1}^{n=1} x + \sum_{i=1}^{n} 1$$

$$= \frac{2i(2i+1)}{2} + 2i$$

$$= 2i^2 + 3i$$

=> ignoring lower order term

$$= 2i^2 \quad \text{let } i = n$$

$$= 2n^2$$

$$= O(n^2) \quad \text{-: ignore constant}$$

$$= O(n^2)$$

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