1002226596 Hands-On 3

sxa6596

1. function $x = f(n)$

    $x = 1$

    for $i = 1:n$

        for $j = 1:n$

            $x = x + 1$

$$T(n) = \sum_{i=1}^{n} \sum_{j=1}^{n} 1$$

$$= \sum_{i=1}^{n} (1 \cdot n) = n \cdot n$$

$$= n^2 \Rightarrow \Theta(n^2)$$

2. is on github.

3.

T(n) that we got from 2. is

$$T(n) = (2.79 \times 10^{-3})n^2 - (5.93 \times 10^{-5})n + (6.95 \times 10^{-7})$$

By definition

$$0 \le c_1 g(n) \le T(n) \le c_2 g(n)$$

Assume $c_1 = 10^{-4}$ $c_2 = 100$

$g(n) = n^2$

$$0 \le 10^{-4} n^2 \le (2.79 \times 10^{-3})n^2 - (5.93 \times 10^{-5})n + (6.95 \times 10^{-7}) \le 100 n^2$$

Lower bound

Upperbound

Dividing by n^2

$$0 \le \frac{10^{-4} n^2}{n^2} \le \frac{(2.79\times10^{-3})n^2}{n^2} - \frac{(5.93\times10^{-5})n}{n^2} + \frac{6.95\times10^{-7}n}{n^2} \le \frac{100n^2}{n^2}$$

Applying Limit $\lim_{n\to\infty}$

$$0 \le 10^{-4} \le (2.79\times10^{-3}) - 0 + 0 \le 100$$

$$0 \le 10^{-4} \le 2.79\times10^{-3} \le 100$$

which will always hold true when $n \ge 1$ which is our n_0.

$\Theta(T(n)) = n^2$

$O(T(n)) = 100n^2 = O(n^2)$

$\Omega(T(n)) = 10^{-4}n^2 = \Omega(n^2)$

4. In the given curve (from Part 2), we can see that.

(let the fitted curve be $T(n)$)

$T(n) > f(n) \ \forall n \ge 20000$

Hence, $n_0 \ge 20000$

i.e no value of $f(n)$ exceeds $T(n)$ on & after 20k.

5. On github

6. Will it effect your results from #1?

$$T(n) = \sum_{i=1}^{n} \left(1 + \sum_{j=1}^{n} 1\right)$$

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

$$\sum_{i=1}^{n} \sum_{j=1}^{n} 1 = n^2 \text{ (from Part1)}$$

$$= n + n^2 \Rightarrow \Theta(n^2)$$

So, it doesn't affect the time complexity.

7. On github