EL9343 Homework 1
(Due September 29, 2016)

All problem/exercise numbers are for the third edition of CLRS text book

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1. Prove the *Transitivity* property of $\Theta(\cdot)$, i.e. $f(n) = \Theta(g(n))$ and $g(n) = \Theta(h(n)) \Rightarrow f(n) = \Theta(h(n))$.

2. Problem 3-1 in CLRS Text book;

3. Problem 3-2 in CLRS Text book;

4. Problem 3-4 (a) (b) (g), (h) in CLRS Text book;

5. Use the substitution method to show that the solution to $T(n) = T(\alpha n) + T((1-\alpha)n) + 10$, with $0 < \alpha < 1$, is $\Theta(n)$

6. First use the iteration method to solve the recurrence:

$$T(n) = T\left(\frac{n}{4}\right) + T\left(\frac{3n}{4}\right) + n$$

then use the substitution method to verify your solution.

7. First use the iteration method to solve the recurrence

$$T(n) = T\left(\frac{n}{6}\right) + T\left(\frac{n}{3}\right) + n^2$$

then use the substitution method to verify your solution.

8. Solving the recurrence:

$$T(n) = 9T(n^{\frac{1}{3}}) + \log^2(n).$$

(*Hint: Making change of variable*)

9. Give asymptotic upper and lower bounds for $T(n)$ in each of the following recurrences. Make your bounds as tight as possible, and justify your answers.

(a) $T(n) = 2T(n/3) + n^{\frac{1}{2}} \log n$

(b) $T(n) = 25T(n/5) + n^2$

(c) $T(n) = 4T(n/2) + n^2\sqrt{n}$

(d) $T(n) = T(n-2) + 1/n$