

1. Answer the following questions.
  - (a) What are the key differences between the analysis of an **iterative algorithm** and the analysis of a **divide and conquer algorithm**?
  - (b) Explain the differences between the  **$\mathbf{o}$ -Notation** and the  **$\mathbf{O}$ -Notation**.
2. There is a recursive algorithm which solves a problem by dividing the problem into **4 sub-problems** each with **half** of the original problem size. It takes  $D(n) = 5n$  time to divide the problem into sub-problems and  $C(n) = 2n^2$  time to combine the solutions from the sub-problems.
  - (a) Write down a **recurrence** (recursive formula) for the running time of this algorithm.
  - (b) Now you are asked to solve the recurrence that you give above using **substitution method**.
    - i. Make a guess for the asymptotic **upper bound** for your solution.
    - ii. **Claim** an **hypothesis** based on your guess.
    - iii. Show that your hypothesis is true.

3. Answer the following questions about **the master method**.

(a) Describe the **applicable conditions** for the master method on a recurrence given as :

$$T(n) = aT(n/b) + f(n)$$

(b) Solve the following recurrences **using the master method**.

i.

$$T(n) = 4T(n/3) + \mathcal{O}(n)$$

ii.

$$T(n) = 4T(n/2) + \Theta(n^2)$$

iii.

$$T(n) = 16T(n/4) + n^{2.5}$$