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(1) Given two parameters n and m.

Given function = $g(n,m)$

(a) Definition for $\Omega(g(n,m))$

$\Omega(g(n,m)) = \{ f(n,m)$: there exist positive constants c, n_0, and m_0. such that

$0 \le c\,g(n,m) \le f(n,m)$ for all $n \ge n_0$ or $m \ge m_0 \}$

Ex: $f(n,m) = (2n*m)+3$

$(2n*m+3) \ge m*n$ here $g(n,m) = m.n$ $c = 1$

Hence $f(m,n) = \Omega(m*n)$

(b) Definition for $\Theta(g(n,m))$.

$\Theta(g(n,m)) = \{ f(n,m)$: there exist positive constants. c_1, c_2, n_0, and m_0 such that

$0 \le c_1 g(n,m) \le f(n,m) \le c_2\, g(n,m)$ for all $n \ge n_0$

or $m \ge m_0 \}$

Ex: $f(n,m) = (n+2m)+5$

$1 \times (n+m2) \le n+2m+5 \le 12 \times (n+m2)$

Here $c_1 = 1$ $c_2 = 12$ $g(n) = n+m2$

$f(n,m) = \Theta(n+2m)$

(2) Given $T(n) = 3T(n/2) + n \lg n$

According to the master theorem

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

Here we have $a = 3$ $b = 2$ $f(n) = n \lg n$

Here $n^{\log_b a} = n^{\log_2 3} = n^{1.58}$

$f(n)$ is less than the $n^{1.58}$

Since $f(n) = n \lg n = O(n^{\log a - \epsilon})$

$= O(n^{\log 3 - \epsilon})$

for any constant $\epsilon > 0$. based on this

case (1) of the master theorem applies

and $T(n) = \Theta(n^{\log_b a})$

$= \Theta(n^{\log_n 3})$

$= \Theta(n^{\log_2 3})$

$= \Theta(n^{1.58})$