

# GRADED ASSIGNMENT ALGORITHM

## MASTER THEOREM SOLUTION

a)  $T(n) = 3T(n/2) + n$

b)  $T(n) = 64T(n/8) - n^2(\log n)$

c)  $T(n) = 2nT(n/2) + n^n$

d)  $T(n) = 3T(n/3) + n/2$

e)  $T(n) = 7T(n/3) + n^2$

A)  $T(n) = 3T(n/2) + n$

Solution:  $\Theta(n^a \log_a b)$   $a = 3$   $b = 2$   $f(n) = \Theta(n) \Rightarrow d = 1$   $b^d = 2 = 2 \Rightarrow a > b^d$

So, Case 3. Thus,  $T(n) = \Theta(n^a \log_a b)$

b)  $T(n) = 64T(n/8) - n^2(\log n)$

Solution: NA  $f(n) = n^2(\log n)$

Here  $f(n)$  is not in the form of  $\Theta(n^d)$ .

So we cannot apply Master Theorem.

c)  $T(n) = 2nT(n/2) + n^n$

*Solution: NA  $f(n) = n^n$  is not in the form of  $\Theta(n^d)$ .*

*So we cannot apply Master Theorem.*

d)  $T(n) = 3T(n/3) + n/2$

Solution:  $\Theta(n^3 \log n)$   $a = 3$   $b = 3$   $f(n) = \Theta(n) \Rightarrow d = 1$   $b^d = 3 = a \Rightarrow a = b^d$

So, Case 2. Thus,  $T(n) = \Theta(n^d \log n) = \Theta(n^3 \log n)$

e)  $T(n) = 7T(n/3) + n^2$

Solution:  $\Theta(n^2)$   $a = 7$   $b = 3$   $f(n) = \Theta(n^2) \Rightarrow d = 2$   $b^d = 3^2 = 9 > a \Rightarrow a < b^d$

So, Case 1. Thus,  $T(n) = \Theta(n^d) = \Theta(n^2)$