Design and Analysis of Algorithm (CS 412)
Instructor: Dr. Ayesha Enayet
Date: _____
CS 6th

SIS ID:_____ Name:_____

Note: Solve all the questions

A. Choose the correct answer

1. A binary tree of a height 4 can have at most _____ number of leaf nodes. [1]

   a) 8 **b) 16**
   c) 4 d) 24

2. Given a recurrence of the form aT(n/b)+ f(n), which of the following condition must hold to apply Master Theorem: [1]

   a) a>0,b>0 b) a>=0,b>1
   c) a>0,b>1 d) a>2,b>1

B. Given a recurrence, $4T(n/2)+n^2$, where f(n) is n^2, identify whether f(n) is greater, smaller, or equal to the watershed function.
n^2 is equal to $n^{lg_2 4}$ [0.5]

C. Write down any two applications of Divide-and-conquer approach: [0.5]
Merge Sort, Maximum Sum Subarray, Parallel computing.

D. Find out the solution of the recurrence T(n)= 3T(n/3)+n using:

1. The back substitution. [1]
2. The Master theorem. [1]

$T(n)= 3T(n/3)+n$
$T(n/3)=3T(n/3^2)+n/3$
$T(n)= 3[3T(n/3^2)+n/3]+n$
$T(n)= 3[3T(n/3^2)]+n+n$
$T(n)= 3^3T(n/3^3)]+n+n+n$
……
$T(n)= 3^kT(n/3^k)]+k.n$
$K=lg_3 n$
$T(n)= 3^kT(n/3^k)]+n.(lg_3 n)$
$T(n)=O(n.(lg_3 n))$

Case 2:$f(n)= n^{lg_b a}$

- *If y>-1 then* $T(n)=\Theta(n^x lg^{y+1} n)$
- $T(n)= \Theta(nlgn)$