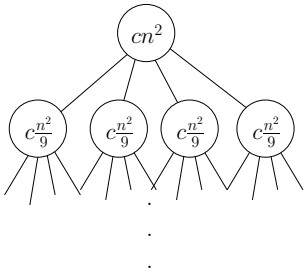
CS583 Spring 2009
Quiz 01 Jan.28.09 Name: _____ .

Show all work clearly and in order. Justify your answers whenever possible; You have 20 minutes to take this 10 point quiz.

1. (*4 points*) Determine if following statements are correct or not and provide a one-sentence explanation to your answer, e.g., correct; because both functions have logarithmic order of growth.

1. $n! \in O(n^n)$?
2. $\sum_{i=1}^{n} i \in \Theta(n \log n)$?
3. $(50n)! \in \Theta(n!)$?
4. $5\sqrt{n+9} + \log n^{3000} + \pi \in \Omega(\log n)$?

2. (*5 points*) Given the recursion tree below, answer the following questions.



1. Write the recursion function of the tree: $T(n) =$
2. Solve the recursion by analyzing the tree (show details)
3. Solve the recursion using the Master theorem (show details)
4. Prove your answer using induction

3. (*1 point*) What is the running time of insertion sort?

Master Theorem

- If we have a problem of size n and our algorithm divides the problems into b instances, with a of them needing to be solved. Then we can set up our running time $T(n)$ as: $T(n) = aT(n/b) + f(n)$, where $f(n)$ is the time spent on dividing and merging.
- If $f(n) \in \Theta(n^d)$, with $d \geq 0$, then

$$T(n) = \begin{cases} \Theta(n^d) & \text{if } a < b^d \\ \Theta(n^d \log n) & \text{if } a = b^d \\ \Theta(n^{\log_b a}) & \text{if } a > b^d \end{cases}$$