Sample: CS 3329/5549 Midterm Exam 1

Total Time: 40 minutes Total Points: 30

Write your name clearly.

Name:_____ **Date:**_____

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1. **[6]** Describe and analyze Merge Sort algorithm.

2. **[3]** With the help of a diagram and proper explanation prove that a complete binary tree has depth of *logn* and width of *n/2*

3. **[4]** What is heapify procedure? What is the run time of min-heapify? Explain

4. **[5]** By following divide and conquer approach, devise an algorithm to find the minimum value in an array of elements. Then also analyze this algorithm by writing recurrence relation and solving them

5. **[4]** Illustrate the operation of Radix Sort on the following list of numbers: 329,457,657,839,436,720,355

6. **[2]** What is stable sorting ?

7. **[6]**Using the Master Method to give asymptotic bounds for the following recurences:
    a. T(n) = 9T(n/3) + n
    b. T(n) = 3T(n/4) +1

Master Theorem if $T(n) = aT(n/b) + f(n)$ then

$$T(n) = \begin{cases} \Theta\left(n^{\log_b a}\right) & f(n) = O\left(n^{\log_b a - \varepsilon}\right) \\ \Theta\left(n^{\log_b a} \log n\right) & f(n) = \Theta\left(n^{\log_b a}\right) \\ \Theta(f(n)) & f(n) = \Omega\left(n^{\log_b a + \varepsilon}\right) \text{ AND } af(n/b) < cf(n) \text{ for large } n \end{cases} \quad \begin{matrix} \varepsilon > 0 \\ c < 1 \end{matrix}$$