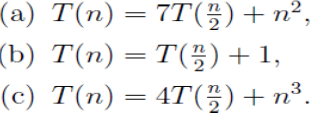
**Midterm Exam** 22nd, Oct

1. (20 pts) For each of the following statements, indicate whether they are TRUE or FALSE. (Brief justification is needed.)  
 (a) If the running time T(n) of an algorithm satisfies T(n) = O(n2) and T(n) = Ω(n2)   
 then it also satisfies T(n) =θ(n2).  
 (b) Radix sorting runs correctly when using any sorting algorithm to sort each digit.  
 (c) In a max-heap, the element with smallest key is always at the rightmost leaf node of the heap.  
 (d) Heapsort requires O(n) extra space.

2. (15 pts) Use the Master Theorem to find the asymptotic solutions for the following recurrences.  


3. (15 pts) Suppose we start with an empty Maxheap, and insert each of the following items, in order: 1 2 3 4 5 6 7.   
(a) Draw the resulting Heap (as a tree).  
(b) Draw the array representation of the above Heap.  
(c) Now, we perform one Heap delete operation on the Heap from the previous parts.  
 Draw the resulting Heap (as a tree)

4.( 30pts)  
 (a) Write Mergesort(A,p,r) and Quicksort(A,p,r) algorithm in pseudocode.  
 (You may assume that you already have Merge and Partition algorithm)  
 (b) Discuss the average case and worst case of each algorithm.  
 (c) What is the running time of Quicksort when all elements of array A have the same value?

5.(20 pts) For each of the following applications, indicate which data structure or algorithm would be most appropriate and give a brief explanation justifying your answer.  
(a) Online telephone directory  
(b) Sorting in embedded system  
(c) Ready list of processes in operating systems by their priorities  
(d) Sorting for small array