Theory Homework 4

3137 - Data Structures and Algorithms in JAVA
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Out: Oct 30, 2013
Due: Nov 14, midnight.

1) Columbia Airlines wants to give first-class upgrades to their top log n frequent fliers, based on the number of miles accumulated, where n is the total number of the airlines' frequent flier miles. The algorithm they currently use which runs in O(n log n) time sorts the flyers by number of miles, and then scans the sorted list to pick out the top log n flyers. Describe an algorithm that pulls out the top log n fliers in O(n) time.

2) If you implement a priority queue based on a sorted array. What are the runtimes of insert and findmin. Show support for your runtime..

3) Suppose we are given a sequence S of n elements, each of which is colored red or blue. Assuming S is represented as an array, give an in-place method for ordering S so that all the blue elements are listed before all the red elements. Can you extend your approach to three colors?

4) Let A be a collection of objects. Describe an efficient method for converting A into a unique set. That is, please describe an **efficient** algorithm for removing all duplicates from A. what is the running time of this method?

5) Starting with a list containing the integers between 0 and 16 [0..16], show the result of the following sequence of instructions:
union(14,15), union(12,13), union(9,15),
union(10,13), union(7,8), union(8,15), union(6,13),
union(5,13), union(3,13), union(2,1), union(16,0),
union(0,2), union(13,15), union(2,15)

a. performed so that union(x,y) makes y a child of x,
b. performed by height
c. performed by size

6) Hubble sort is an adoption of bubble sort. It alternates the direction in which the array elements are scanned during each pass. The first pass starts its scan with the first element, moving the larger element in each pair down the array. The second pass starts its scan with the next to last element, moving the smaller element in each pair up the array, and so on. Indicate what are the advantages of using a hubble sort over bubble sort.

7) When implementing quicksort, if the array contains lots of duplicates, is it better to perform a three-way partition (less than, equal to, greater than the pivot), to make smaller recursive calls instead of the standard 2 partitions(less than,greater than) Is this true or false? Justify your answer.

8) Describe 2 pivot choosing algorithms for quick sort and compare the advantage and disadvantage of each of them.

9) Based on the class discussion on search engines, describe how you would design an image based search engine include description of operation, runtimes, and data structures..…

10) What is the effect on the runtimes for changing an AVL to re-balancing the AVL tree every other insert/delete operations ? that is instead of a re-balance when we insert/delete an item, we only rebalance every other operation…