Tecnológico de Monterrey

Fundamentos de computación

Homework 6

Student:
Jacob Rivera

Professor:
Dr. Hugo Terashima

March 17, 2019

1 Problems

Solve the following problems:

1. For the selection algorithm, analyze and discuss the resulting complexity when the initial list is divided into groups of 19 elements (instead of 15). Derive the proper conclusions.
2. Given a set of n numbers, we want to find the i largest in sorted order using a comparison-based algorithm. Analyze and compare the following methods in terms of n and i:
   (a) Sort the numbers, and list the i largest.
   (b) Build a max-priority queue (like a heap) with the numbers and extract the minimum i items.
   (c) Use the k-max (session 06) to find the i-th largest, partition around that number, and sort the i largest.
3. For n distinct elements $x_1, x_2, ..., x_n$ with positive weights $w_1, w_2, ..., w_n$ such that $\sum_{i=1}^{n} w_i = 1$, the weighted (lower) median is the element x_k satisfying $\sum_{x_i<x_k} w_i < \frac{1}{2}$ and $\sum_{x_i>x_k} w_i \leq \frac{1}{2}$

   For example, if the elements are 0.1, 0.35, 0.05, 0.1, 0.15, 0.05, 0.2 and each element equals its weight then the median is 0.1, but the weighted median is 0.2.
   (a) Argue that the median of $x_1, x_2, ..., x_n$ is the weighted median of the x_i with weights $w_i = 1/n$ for $i = 1, 2, ..., n$
   (b) Show how to compute the weighted median ofnelements inO(nlogn) worst-case using sorting.
   (c) Show how to compute the weighted median ofnelements inO(n) worst-case.
4. Investigate on how the adversary argument concept can be used to determine the lower bound of merging two ordered lists.