MA512 Data Structures and Algorithms Lab

Jan - May 2021

Assignment 3

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1. Implement in C/C++ the *Quicksort* algorithm. Experiment with the performance of different ways of choosing the pivot element.

   One approach is to keep track of the number of comparisons between input array elements made by *QuickSort*. For several different input arrays, determine the number of comparisons made with the following implementations of the *ChoosePivot* subroutine:

   (a) Always use the first element as the pivot.

   (b) Always use the last element as the pivot.

   (c) Use the median-of-three as the pivot element: That is, Consider the first, middle, and final elements of the given array. (For an array with even length $2k$, use the kth element for the middle one.) and identify the *median* of these three elements and use this as the pivot. **While counting the number of comparisons in this case don't count the comparisons involved in finding the median.**

   (d) Use the median-of-three as the pivot element but the program switches to *insertion sort* when the array size become 5.

   Test case #1: This file contains 10 integers, representing a 10-element array. Your program should count 25 comparisons if you always use the first element as the pivot, 31 comparisons if you always use the last element as the pivot, and 21 comparisons if you always use the median-of-3 as the pivot (not counting the comparisons used to compute the pivot). **Test case #2:** This file contains 100 integers, representing a 100-element array. Your program should count 620 comparisons if you always use the first element as the pivot, 573 comparisons if you always use the last element as the pivot, and 502 comparisons if you always use the median-of-3 as the pivot (not counting the comparisons used to compute the pivot). **Challenge data set:** This file contains all of the integers between 1 and 10,000 (inclusive) in some order, with no integer repeated. The ith row of the file indicates the ith entry of an array. How many comparisons does QuickSort make on this input when the first element is always chosen as the pivot? If the last element is always chosen as the pivot? If the median-of-3 is always chosen as the pivot? If the median-of-3 is always chosen as the pivot and switch to insertion sort when the array size become 5?