CS 61B Spring 2017

Sorting Algorithms

Discussion 13: April 19, 2017

1 Warm-up

Algorithm	Best-case	Worst-case	Stable
Selection Sort			
Insertion Sort			
Merge Sort			
Quicksort			
Heapsort			

1.1 Give a best and worst case input for insertion sort.

1.2 Do you expect selection or insertion sort to run more quickly on a reverse list?

1.3 Give a worst case input for quicksort. Assume that we're always picking the left-most item as our pivot.

1.4 Why does Java's built-in `Array.sort` method use quicksort for `int`, `long`, `char`, or other primitive arrays, but merge sort for all `Object` arrays?

2 Inversions & Decisions

We have a list of N elements that should be sorted, but to our surprise we recently discovered that there are at most k pairs out of order, or k **inversions**, in the list. As a small example, the list `{ 0, 1, 2, 6, 4, 5, 3 }` contains 5 inversions: $(6,4)$, $(6,5)$, $(6,3)$, $(4,3)$, $(5,3)$.

2.1 Given a list of objects that is totally sorted except for $K < \log N$ randomly chosen elements that are out of place, choose the best sorting algorithm to solve the problem and give a tight asymptotic runtime bound.

2.2 What's the best sorting algorithm to apply on an array of N randomly distributed objects? Give a tight asymptotic runtime bound as well.

3 What's that sort?

3.1 Each of the following sequences represent an array being sorted at some intermediate step. Match each sample with one of the following sorting algorithms: **insertion sort, selection sort, heap sort, merge sort, quicksort**. The original array is below.

`5103 9914 0608 3715 6035 2261 9797 7188 1163 4411`

(a)	`5103 9914 0608 3715 2261 6035 7188 9797 1163 4411` `0608 2261 3715 5103 6035 7188 9797 9914 1163 4411`	Merge sort
(b)	`0608 1163 5103 3715 6035 2261 9797 7188 9914 4411` `0608 1163 2261 3715 6035 5103 9797 7188 9914 4411`	Selection sort
(c)	`9797 7188 5103 4411 6035 2261 0608 3715 1163 9914` `4411 3715 2261 0608 1163 5103 6035 7188 9797 9914`	Heap sort
(d)	`5103 0608 3715 2261 1163 4411 6035 9914 9797 7188` `0608 2261 1163 3715 5103 4411 6035 9914 9797 7188`	Quicksort
(e)	`0608 5103 9914 3715 6035 2261 9797 7188 1163 4411` `0608 2261 3715 5103 6035 9914 9797 7188 1163 4411`	Insertion sort