The Status of Stable Quicksort

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3rd STL Workshop
DIKU, Denmark, 17 December 2001
Introduction

A sorting method is said to be stable if it preserves the relative order of items with duplicate keys.

Stability can always be forced by appending an index to each key before sorting.

Mergesort is stable with straightforward implementation of the merging using an extra array.

Heapsort is not stable, but in-place.

Quicksort is — normally — not stable, but (as good as) in-place.

Jyrki Katajainen & Tomi Pasanen
_Stable Minimum Space Partitioning in Linear Time_
BIT 32 (1992) 580–585

Jyrki Katajainen & Jesper Larsson Träff
_On Stable Quicksort_
Unfinished draft...
Stable Quicksort Using an Extra Array

Partition into 3 parts:

- $<$ at beginning of original array
- $=$ at beginning of extra array
- $>$ at end of extra array — in reverse order

Copy of $=$

Quicksort and Retro-Quicksort of $<$ and $>$ respectively

Just one Partition

Also Retro-Copy — and extra Copy or just Reversing...
Stable Quicksort With $O(\sqrt{n})$ Extra Space

Use 3 buckets of size $\sqrt{n}$:

- $<$ items
- $=$ items
- $>$ items

When a bucket gets full, move the items back to original array

Use a stable variant of Selectionsort afterward on the blocks

Selectionsort makes the fewest moves possible for a sorting — $O(n)$ — but is $O(n^2)$, which is ok!

Finally also in-place versions...