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...