Technische Universität München
Fakultät für Informatik
Lehrstuhl für Effiziente Algorithmen
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Winter Semester 2012/13
Problem Set 5
November 20, 2012

Parallel Algorithms

Due Date: November 27, 2012 **before** *class!*

Problem 1 (10 Points)

Prove a lower bound on the number of time steps needed for sorting on a 2-dimensional *rectangular* mesh with r rows and c columns, where $c \leq r^2$.

Problem 2 (10 Points)

Show how to sort into row-major or column-major order on an $n \times n$ mesh in $4n + o(n)$ steps.

Problem 3 (10 Points)

Elaborate an algorithm for sorting n^3 items on a $n \times n \times n$ 3-dimensional mesh. Adapt the $3n$ sorting algorithm seen in the lecture to do so. Use a zyx-order scheme with column-major order within each plane, i.e., at the end, the item in processor (i, j, k) will be at least as large as the item in processor (i', j', k') whenever $k'|j'|i'$ is lexicographically smaller than $k|j|i$.

How many steps does your algorithm take?

Problem 4 (10 Points)

Show that sorting the rows and then the columns of a mesh leaves the rows in sorted order.