

Parallel and Distributed Algorithms

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Assignment 11

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11.1. Problem (4)

Nick's Class

The complexity class \mathcal{NC} consists of all languages $L \subseteq \{0, 1\}^*$ such that L can be recognized by a CRCW-PRAM algorithm in poly-logarithmic time with a polynomial number of processors.

\mathcal{P} is the class of all languages which are recognizable by Turing machines within polynomial time.

Show that $\mathcal{NC} \subseteq \mathcal{P}$.

11.2. Problem (12)

Broadcasting on CREW and EREW PRAMs

We would like to solve the one-to-all broadcasting problem, assuming that one processor sends a message to n other processors.

(a) Show how to solve the one-to-all broadcasting problem in time $O(1)$ on a CREW PRAM with n processors.

(b) Show that time $\Theta(\log_2 n)$ is sufficient and necessary, if we work with an EREW PRAM with n processors.

11.3. Problem (8)

Path sums

A tree T is given by parent pointers. Moreover we assign a real number x_v to each node v . Show how to determine, in parallel for all nodes v , the sum of all values which are assigned to nodes on the path from v to the root. You may work with CREW-PRAM in time $O(\log_2 n)$ with n processors, provided T has n nodes.