Technische Universität München
Institut für Informatik
Theoretical Computer Science

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Fundamental Algorithms 8

Exercise 1 (Parallel Scalar)

Write a parallel program that computes the scalar product of two vectors (stored in two arrays). Discuss the runtime complexity on the EREW PRAM model. How many processors can be used?

Exercise 2 (Parallel Vector)

Extend the program of exercise 1 to compute a matrix-vector product. Again, discuss the runtime complexity on the EREW PRAM and state the number of processors that are used.

Exercise 3 (Parallel Optimization)

Given the following parallel algorithm PrefixPRAM for prefix multiplication (with EREW-PRAM). First, argue why the algorithm is correct. Then, assume that the j-loop is changed to a sequential loop. State why the resulting algorithm now no longer is correct and suggest how to change the j-loop to obtain a correct sequential implementation.

Algorithm 1: PrefixPRAM

```
Input: A: Array[1..2^k]
tmp ← Array[1..2^k];
for l = 0 to k − 1 do
    for j = 2^l + 1 to n in parallel do
        tmp[j] ← A[j − 2^l];
        A[j] ← tmp[j] · A[j];
    end
end
```