

Range Reporting

Peter Gabrielsen 20114179
Christoffer Hansen 20114637

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Abstract

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1 Introduction

2 Model of computation

We will argue the results of this thesis in terms of the external memory model of Aggarwal and Vitter [AV88]. The external memory model (or I/O model) measures the efficiency of an algorithm by counting the total number of reads and writes performed. In detail the model consists of two levels of memory; a bounded internal memory of size M and an unbounded external memory. For a total of N records we define an *IO* operation to be the process of transferring B consecutive records between the two levels of memory as depicted in figure 1. We restrict all computations on records to be done in internal memory. Throughout the thesis we will let K denote the total number of records in the output.

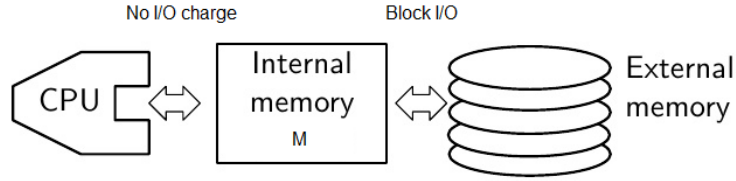


Figure 1: The IO Model. Only reads/writes between internal and external memory is charged.

The fundamental bounds in the external memory model is that scanning can be done in $\mathcal{O}(\text{Scan}) = \mathcal{O}(N/B)$, sorting in $\mathcal{O}(\text{Sort}) = \mathcal{O}(N/B \log_{M/B} N/B)$ and searching in $\mathcal{O}(\log_B N)$. We denote $\mathcal{O}(N/B)$ as being linear in terms of IOs. Note that the B factor is very important as $N/B < \mathcal{O}(N/B \log_{M/B} N/B) \ll N$.

For convenience we will assume $M > B^2$. This assumption is known as the *tall-cache assumption* in the cache-oblivious model and basically states

that the number of blocks M/B is larger than the size of each block B [Pro99].

3 Preliminaries

3.1 Amortization

3.2 Global rebuilding

3.3 Filtering

4 Sublogarithmic Updates

5 External Memory Priority Search Tree

Bibliography

[AV88] Alok Aggarwal and S. Vitter, Jeffrey. The input/output complexity of sorting and related problems. *Commun. ACM*, 31(9):1116–1127, September 1988.

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