Turing Maschinen mit sublogarithmischen Platzschranken

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The Complexity World below Logarithmic Space

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We investigate space complexity classes defined by Turing machines that use less than logarithmic space. Because of the limited counting ability of such machines most of the standard simulation techniques do not work for sublogarithmic space classes. However, machines with such little space may still be quite powerful. Therefore, it was not obvious how to obtain analogs for inclusion and separation results known for classes above logspace.

We review known facts about the sublogarithmic space world and present several new results, which show that these classes really behave differently. For example, certain closure properties do not hold. The restricted power of these machines makes it possible to prove explicit separations – even for alternating complexity classes – by combinatorial arguments and to obtain a hierarchy of non-relativized complexity classes without any unproven assumption. We will also discuss upward and downward translation issues.

These complexity classes are related to other classes within $\mathcal{P}$, in particular to context-free languages. Finally, we briefly mention extensions to machines that, in addition, can make use of randomness, in other words to interactive proof systems with small space bounds.

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