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Kapitel: 5. Hardware Modification Machines

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Proof sketch: It suffices to show that SATISFIABILITY is in the second class given it is in the first class. Reasoning as above, the Turing machine M can check whether a candidate aggregate β_n' correctly tells whether a propositional formula F is satisfiable by making β_n' produce a satisfying assignment bit by bit, by plugging in partial truth assignments to F and asking β_n' about the result. The trouble is M cannot remember the partial assignments in small space. However, the problem of whether "the i-th bit is 1 in the lexocographically first assignment which β_n' says satisfies F" is in P. Thus by theorem 4.2 this bit can be determined in space O ($\log n$. $\log\log n$), and M can determine whether this assignment satisfies F in small space.

5. Hardware Modification Machines

As mentioned in the introduction, there is a need to define a parallel model which is more powerful than an aggregate, in that it can modify its circuits, but less powerful than existing parallel RAM models, in that each unit of hardware can only perform a bounded amount of work in one step. We shall call the new machine a *hardware modification machine* (HMM), since it is intended to be the parallel analog of the storage modification machine. An HMM consists of a finite collection of finite state machines connected together as in a conglomerate. At each step, each machine may, in addition to assuming a new state and transmitting output signals, modify its input connections. Specifically, it may detach any of its inputs and re-attach it to a new machine which it brings into the HMM, or it may re-attach it to an output of any machine which can be reached by a path of length at most two traced backwards from the input.

One advantage of an HMM over circuits, aggregates, and conglomerates is that there is no question of uniformity. The machine is uniform because it constructs itself.

An HMM can execute an algorithm like the one described in [FW] to simulate a deterministic S space bounded machine in time O (S), and HMM time S can be simulated in deterministic space O (S^2). Thus the inclusions (1.2) apply.

The theory of HMM's is developed in [D1].