Parallel Scheduling Algorithms

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(Received March 1981; accepted April 1982)

Parallel algorithms are given for scheduling problems such as scheduling to minimize the number of tardy jobs, job sequencing with deadlines, scheduling to minimize earliness and tardiness penalties, channel assignment, and minimizing the mean finish time. The shared memory model of parallel computers is used to obtain fast algorithms.

WITH THE CONTINUING dramatic decline in the cost of hardware, it is becoming feasible to build economical computers with thousands of processors. In fact, Batcher [1979] describes a computer (MPP) with 16,384 processors that is currently being built for NASA. In coming years, one can expect to see computers with a hundred thousand or even a million processing elements. This expectation has motivated the study of parallel algorithms.

Since the complexity of a parallel algorithm depends on the architecture of the parallel computer on which it is run, it is necessary to keep the architecture in mind when designing the algorithm. Several parallel architectures have been proposed and studied. In this paper, we deal directly with only the single instruction stream, multiple data stream (SIMD) model. SIMD computers have the following characteristics.

1. They consist of p processing elements (PEs). The PEs are indexed $0, 1, \cdots, p-1$ and an individual PE may be referenced as in PE(i). Each PE is capable of performing the standard arithmetic and logical operations. In addition, each PE knows its index.
2. Each PE has some local memory.
3. The PEs are synchronized and operate under the control of a single instruction stream.
4. An enable/disable mask can be used to select a subset of the PEs that is to perform an instruction. Only the enabled PEs will perform the instruction. The remaining PEs will be idle. All enabled PEs execute the same instruction (though using possibly different data). The set of enabled PEs can change from instruction to instruction.

Subject classification: 584 parallel scheduling algorithms.

Operations Research
Vol. 31, No. 1, January–February 1983
0030-364X/83/3101-0024 $01.25