Non-clairvoyant Scheduling

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Scheduling a sequence of jobs released over time when the processing time of a job is only known at its completion is a classical problem in CPU scheduling in time sharing operating systems. In this seminar we present on-line competitive algorithms for optimizing non-clairvoyantly total flow time on parallel machines. In particular, we present a randomized version of the Multi-level Feedback algorithm proposed in [2, 4] that achieves a poly-logarithmic competitive ratio on parallel identical machines and a tight logarithmic competitive ratio on one single machine. The Multi-level-feedback algorithm is at the basis of the the Windows NT and the Unix operating system scheduling policies.

We later consider the application of the concept of smoothed analysis, a hybrid between worst case and average case analysis, introduced by Spielman and Teng [3] for to explain the practical performance of the Simplex Algorithm, to the analysis of on-line algorithms. In particular we prove [1] tight bounds on the smoothed competitive ratio of the Multi-level Feedback Algorithm when the initial processing times are perturbed by changing the k least significant bits under a quite general class of probability distributions.

A direct consequence of our result is also the first average case analysis of MLF. For instance we show a constant expected ratio of the total flow time of MLF to the optimum under several distributions including the uniform distribution.

References

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