Scheduling with Limited Storage: computational complexity, exact and approximation algorithms, polynomial-time approximation schemes

Yakov Zinder

Abstract

Limited storage space is a crucial restriction in many practical scheduling problems. For example, memory of the base station limits the data gathering in the star networks where datasets from the worker nodes are to be transferred to the base station for processing. Data transfer can commence only if the available memory of the base station is not less than the size of the corresponding dataset. Only one node can transfer data to the base station at a time, although during this process the base station can process one of the previously transferred datasets. The memory, consumed by a dataset, is released only at the completion of its processing by the base station. Similar situation arises in the systems for auto-assembled multimedia presentations for devices such as cell phones, including query-based presentations from multimedia databases, automatically composed programs based on the user's profile, etc.The above situation can be modelled as the two-machine flow shop with storage. This scheduling model is also adequate to various situations arising in manufacturing and supply chains. The purpose of the lectures is two-fold: to present a survey of the recent results, obtained for the above scheduling model, and to present several aspects of combinatorial optimisation, including design of exact polynomial-time algorithms, analysis of computational complexity, approximation algorithms such as Lagrangian relaxation, and polynomial approximation schemes, using variations of the same mathematical model. Some other practical scheduling problems with limited storage space will be briefly outlined.