Real-time scheduling on bounded number of processors

Przemysław Broniek
Computer Science Department
Jagiellonian University

Abstract

We consider a set of tasks with some relations between them. We want to schedule the tasks before they will be computed. In a real-time situation we get one task at a time and irrevocably assign processor to it. A poset in which points are tasks is a perfect mathematical model for this problem. Tasks calculated by a single processor form a chain. Scheduling therefore can be considered as chain partitioning.

The best known on-line algorithm gives exponential number of chains (Kierstead – $(5^w - 1)/4$). We can also consider restricted problem, when poset is given up-growing. In this case the solution is quadratic with lower and upper bounds (Felsner – $w(w+1)/2$). Restricting ourselves to interval posets given by its representation the general problem is linear and equivalent to the coloring problem of interval graphs (Ślusarek – $3w - 2$).

We prove that on-line chain partitioning of up-growing interval posets given by its representation has an optimal solution (Nearest-Fit algorithm). We show that there is no on-line algorithm constructing the representation of interval orders and graphs, which forces us to design new algorithms. We also prove that the lower bound for the up-growing version of the problem changes.