ON PROJECT SCHEDULING PROBLEM WITH CHANGING CONSUMPTION AND SUPPLY RATES OF RENEWABLE RESOURCES[1]

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We consider NP-hard project scheduling problem under resource constraints. Let the project consists of a set of interrelated tasks $I = \{1, \ldots, m\}$. The interrelation between tasks is defined by the sequence relation of a kind $i \to j$, where task j can not start before completion of task i. Preemptions of tasks are not allowed. There are n kinds of renewable resources that may be used to perform a task. Each task $i \in I$ is characterized by its execution time $p_i \in \mathbf{Z}^+$ and rates of resource consumptions, that may change in execution time of the task and are defined in the following way. The execution time of task $i \in I$ is divided into a_i^q periods of integer duration for each $q = 1, \ldots, n$. The consumption rate of resource of kind q by the task is constant in each period. At different time of planning horizon the resource availability of each kind may be different. There are $b_{\max}^q$ periods of integer duration, in each of that the availability of resource of kind q is constant, $q = 1, \ldots, n$.

It is required to find a schedule, which satisfies the partial order of processing of tasks and restrictions on resource consumptions, minimizing the total completion time $C_{\max}$.

The problem with single renewable resource has been considered in [1, 2]. Integer linear programming models have been formulated, dynamic programming algorithms have been developed and some polynomially and pseudo-polynomially solvable cases have also been identified.

In this work we generalize dynamic programming algorithms [1, 2] on the case, when there are several kinds of resources. The basic idea of proposed algorithms consists in enumeration of every possible state of processing of tasks, and for each state the minimal time moment, when it is reached, is calculated. The problem is proved to be NP-hard, but pseudo-polynomially solvable if the width of the partial order is bounded by a constant. New polynomially solvable cases of the problem are found.

REFERENCES

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