

On the Potentially Optimal Solutions of Classical Shop Scheduling Problems

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Abstract—In this paper, we consider an important class of *NP*-hard shop scheduling problems, where one of the major tasks is to minimize the makespan objective over the set of all sequences. We study the existence of minimal potentially optimal solution in classical shop scheduling problems. The concept of potentially optimal solution has proven one of the most important and fertile research topics as this solution set contains at least one optimal sequence for arbitrary processing times. Here, the potentially optimal solution of all irreducible sequences is surveyed and a new decomposition approach is presented in this class. The contribution of this paper is a brief survey of the existing results together with few new results. The research results obtained in past several years are presented along with open problems and possible extensions. Varieties of results and examples we analyzed provide useful structural insights and enough motivations for the developments of exact or heuristic algorithms.

Keywords—Shop scheduling problems, Computational complexity, Counting problem, Potential optimality, Irreducibility, Sequence decomposition

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