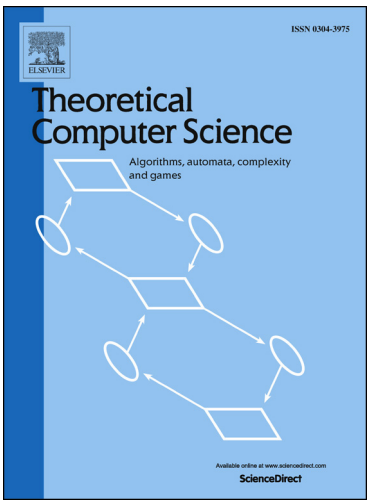
Accepted Manuscript



A study on several combination problems of classic shop scheduling and shortest path

Kameng Nip, Zhenbo Wang, Wenxun Xing

PII: S0304-3975(15)01188-3
DOI: http://dx.doi.org/10.1016/j.tcs.2015.12.027
Reference: TCS 10581

To appear in: *Theoretical Computer Science*

Received date: 22 October 2015
Accepted date: 16 December 2015

Please cite this article in press as: K. Nip et al., A study on several combination problems of classic shop scheduling and shortest path, *Theoret. Comput. Sci.* (2016), http://dx.doi.org/10.1016/j.tcs.2015.12.027

A Study on Several Combination Problems of Classic Shop Scheduling and Shortest Path ☆

Kameng Nip[a], Zhenbo Wang[a,*], Wenxun Xing[a]

[a]*Department of Mathematical Sciences, Tsinghua University, Beijing, China*

Abstract

In this paper we study several combinatorial optimization problems which combine the classic open shop or job shop scheduling problem and the shortest path problem. Our goal is to select a subset of jobs that constitutes a feasible solution of the shortest path problem, and then execute the selected jobs on the shop machines to minimize the makespan, i.e., the last completion time of all the jobs. We prove that these problems are NP-hard even if there are two machines. If the number of machines is an input, we show that it is unlikely to find approximation algorithms with performance ratios better than 2 unless P = NP. We present an intuitive approximation algorithm when the number of machines is an input, and an improve approximation algorithm when the number of machines is fixed. In addition, we propose a polynomial time approximation scheme for the open shop case when the number of machine is fixed.

Keywords: approximation algorithm, combination of optimization problems, shop scheduling, shortest path, open shop, job shop

1. Introduction

Combinatorial optimization has developed into many active subfields, e.g., network flows, scheduling, bin packing. Traditionally, these subfields are motivated by various applications or theoretical interests, and are studied independently. However, the rapid and highly complicated development of the science and society bring a lot of real-world problems integrating different areas, such as manufacturing, service and management. Therefore, the decision-makers always need to deal with problems involving more than one combinatorial optimization problems, for instance, see the network monitoring scenario [18] and the railway manufacturing scenario [13]. The authors in these papers presented some

☆A preliminary version of this paper appeared in the Proceedings of 21th Annual International Computing and Combinatorics Conference (COCOON'15), LNCS, vol. 9198, pp. 97–108.

*Corresponding author. Email: zwang@math.tsinghua.edu.cn