On the Pattern Minimisation Problem

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1 Introduction

This talk deals with the pattern minimization problem (PMP), that is, the problem of finding among the optimal solutions of a cutting stock problem (CSP) one that minimizes the number of distinct cutting patterns activated.

2 Bounds obtained by linear relaxation

We here discuss two general formulations of the PMP, both depending on some vector u of parameters:

(1) introduced by Vanderbeck [3];
(2) obtained by adding setup variables to the classical Gilmore-Gomory formulation of the CSP (see [1]).

Let $z_i^{LP}(u)$ be the bound given by the linear relaxation of (i) under a given u. We show that

$$z_2^{LP}(u) \geq z_1^{LP}(u)$$

and provide a case where the inequality holds strict. A preliminary computational experience is discussed.

3 An interesting generalization of quite a particular case

We here focus on a special class of problems, where no more than 2 parts can be cut from any stock item. The feasible cutting patterns form the edge set of an undirected graph G called the *compatibility graph*, which extends the case $G = K_n$ introduced in 1999 by McDiarmid [2].
General properties holding for $G = K_n$ are no longer valid for the general case; however, for special cases of practical relevance, properly including $G = K_n$, quasi-exact solutions of the PMP can be found via a set-packing formulation providing very good lower bounds, essential for the fast convergence of an exact algorithm. A preliminary computational experience is discussed.

4 References

[1] G. Belov and G. Scheithauer, The Number of Setups (Different Patterns) in One-Dimensional Stock Cutting, *Preprint MATH-NM-15-2003*, Department of Mathematics,

Dresden University of Technology.

[2] C. Mc Diarmid, Pattern Minimisation in Cutting Stock Problems, *Discrete Applied Mathematics* 98 (1999) 121-130.

[3] F. Vanderbeck, Exact Algorithm for Minimising the Number of Setups in the One-Dimensional Cutting Stock Problem, *Operations Research* 48 (2000) 915-926.