

Contents

1	Introduction	1
1.1	Historical Review on Methods for Rearranging Railcars .	2
1.2	Classification of Rearrangement Problems	5
2	Preliminaries	15
2.1	Problems, Algorithms, and their Complexity	15
2.2	Combinatorial Optimization	18
2.2.1	Problems	18
2.2.2	Solution Methods	20
2.3	Integer Sequences and Intervals	23
2.4	Relevant Graph Classes	24
2.4.1	Polygon-Circle Graphs	27
3	Mathematical Formulations and Relations	33
3.1	Equivalent Formulations	35
3.2	Relations between Versions	36
3.3	Related Problems	42
4	Computational Complexity	45
4.1	Permutation and Pattern Versions	45
4.1.1	Unbounded Case	45
4.1.2	Bounded Case	46
4.2	Chain-Split Versions	47
4.2.1	Unbounded Case	47
4.2.2	Bounded Case	50
4.3	Versions with no Shunting	51
4.3.1	Unbounded Case	55
4.3.2	Bounded Case	64

4.4	Versions applied at Hump Yards	68
4.4.1	Unbounded Case	77
4.4.2	Bounded Case	81
5	Coloring Polygon-Circle Graphs	83
5.1	Approximation	83
5.2	Preprocessing	85
5.3	Heuristics	85
5.4	Exact Solution Methods	87
5.4.1	Assignment Formulation	88
5.4.2	Network Flow Formulation	92
6	Computational Results	103
6.1	Versions with no Shunting	103
6.2	Versions with real Application at a Hump Yard	113
7	Online Versions	123
7.1	Definitions	123
7.2	Results	126
8	Conclusion	133
	Bibliography	135
	Name Index	146
	Subject Index	150
	Nomenclature	153
	List of Figures	158
	List of Algorithms	159
	List of Tables	161