

# CONTENTS

INTRODUCTION .....	vii
<b>I. MATHEMATICAL PRELIMINARIES</b> .....	<b>1</b>
1. Linear Algebra .....	2
2. Polyhedral Theory .....	6
3. Linear Programming and Duality Theory .....	9
4. Graph Theory .....	12
5. Independence Systems and Matroids .....	17
6. Computational Complexity Theory .....	20
<b>II. POLYHEDRAL COMBINATORICS</b> .....	<b>26</b>
1. Integer Programming .....	27
2. Combinatorial Optimization and Integer Programming .....	29
3. Separation and Optimization .....	38
4. Integrality and Total Dual Integrality .....	43
5. Faces and Facets of Combinatorial Polytopes and their Identification .....	46
<b>III. THE ACYCLIC SUBDIGRAPH PROBLEM</b> .....	<b>52</b>
1. Definition of the Acyclic Subdigraph Problem (ASP) .....	53
2. Computational Complexity of the ASP .....	54
3. Equivalent Combinatorial Optimization Problems .....	57
<b>IV. THE ACYCLIC SUBDIGRAPH POLYTOPE</b> .....	<b>62</b>
1. Definition of $P_{AC}(D)$ and Trivial Properties .....	63
2. Subdivision and Contraction .....	68
3. Facets of $P_{AC}(D)$ .....	72
4. Node Splitting .....	97
<b>V. WEAKLY ACYCLIC DIGRAPHS</b> .....	<b>101</b>
1. A Polynomial Time Separation Algorithm for $P_C(D)$ .....	102
2. The Polytope $P_C(D)$ and Weakly Acyclic Digraphs .....	108
<b>VI. DISCUSSION AND RESEARCH PROBLEMS</b> .....	<b>119</b>
REFERENCES .....	122
INDEX OF DEFINITIONS .....	126