CONTENTS

Preface *page* vii

1 Introduction 1
1.1 The model of parallel computation 2
1.2 Some general algorithmic techniques 6
1.3 Reducing the number of processors 11
1.4 Examples of fast parallel computations on vectors and lists 13
Bibliography 19

2 Graph algorithms 20
2.1 Parallel computations on trees 21
2.2 Paths, spanning trees, connected components and blocks 24
2.3 Eulerian circuits and maximal matchings 40
2.4 Colouring of graphs 56
Bibliographic notes 85
Bibliography 85

3 Expression evaluation 88
3.1 Constructing the expression tree 88
3.2 A parallel pebble game with applications to expression evaluation 95
3.3 An optimal parallel algorithm for expression evaluation 103
3.4 The optimal parallel transformation of regular expressions to non-deterministic finite automata 112
3.5 Evaluation of generalised expressions: straight-line programs 122
3.6 More efficient algorithms for dynamic programming 133

3.7 A more algebraic point of view: a method of simultaneous substitutions 138
Bibliographic notes 139
Bibliography 140

4 Parallel recognition and parsing of context-free languages 142
4.1 Parallel recognition of general context-free languages 143
4.2 Parallel recognition of unambiguous context-free languages 154
4.3 Parallel parsing of general context-free languages 158
4.4 Optimal parallel recognition and parsing of bracket languges 165
4.5 Optimal parallel recognition of input-driven languages 175
Bibliographic notes 178
Bibliography 179

5 Fast parallel sorting 180
5.1 Batcher's sorting networks 181
5.2 Cole's optimal parallel merge sort 188
5.3 A theoretical optimal sorting network: Paterson's version of the algorithm of Ajtai, Komlos and Szemeredi 198
Bibliographic notes 215
Bibliography 215

6 Parallel string matching 217
6.1 Analysis of the text 219
6.2 Preprocessing the pattern 225
6.3 Complexity of the whole pattern-matching algorithm 233
Bibliographic notes 234
Bibliography 234

7 *P*-completeness: hardly parallelisable problems 235
7.1 A first *P*-complete problem 236
7.2 A selection of *P*-complete problems 240
Bibliographic notes 254
Bibliography 255

Index of definitions, techniques and algorithms 257