

Contents

List of Figures	v
Abstract	vii
Zusammenfassung	ix
1 Introduction	1
1.1 Motivation	1
1.2 Overview	1
1.3 Thesis Organization	3
1.4 Acknowledgements	4
2 Basics	7
2.1 Structure	7
2.1.1 Basic structure - set	7
2.1.2 Basic structure - sequence	8
2.1.3 Equivalence between a set and a set of sequences	8
2.1.4 Combination of sets and sequences	8
2.2 Group	9
2.2.1 Basic definitions	9
2.2.2 Permutation	12
2.2.3 Permutation group	14
2.2.4 General structure	15
2.3 Homomorphism, isomorphism and automorphism	17
2.3.1 Basic definitions	17
2.4 t-Design	20
2.4.1 Basic definitions	20
2.4.2 Example	21
2.4.3 Hussain graph	24

3	Isomorphism problem and canonical form	25
3.1	Graph isomorphism problem	25
3.1.1	Example to start	25
3.1.2	Another example for graph	26
3.1.3	Graph isomorphism problem	27
3.1.4	Canonical form for graphs	28
3.2	General canonical form	31
3.2.1	Extended language - CANO	31
3.2.2	Type graph and object graph	32
3.2.3	General canonical form	38
4	Iterated classification, Fixstep, Backtracking	47
4.1	Introduction	47
4.1.1	Outline of CANO	47
4.1.2	An example to control flow of CANO	48
4.2	Initiation	51
4.3	Iterated classification	51
4.3.1	Upstep	52
4.3.2	Downstep	55
4.3.3	Iterated Classification	59
4.4	Fixstep	59
4.5	Backtracking	61
4.6	Complete algorithms	64
5	Algorithm analysis and improving	67
5.1	Overview of existing algorithms	67
5.1.1	Mckay's algorithm - Nauty	67
5.1.2	Schimmel's algorithm - Auto	67
5.1.3	Krec's algorithm - Stabnuaty	68
5.2	Time and space complexity of CANO	68
5.2.1	Definitions	68
5.2.2	Primary input size in CANO	70
5.2.3	Space complexity of CANO	70
5.2.4	Time complexity of CANO	71
5.3	Algorithm improving	76
5.3.1	Data structure	76
5.3.2	Compilation optimization	76
5.4	Runtime test for some examples	77

6	W3C XML Schema and Database management	81
6.1	XML	81
6.1.1	Why XML?	81
6.1.2	W3C XML Schema	82
6.1.3	A valid XML document for CANO	86
6.2	Database design	93
6.3	Interface program	94
6.3.1	Complete processing flow	94
6.3.2	PHP script	97
7	A complete example	101
8	Concluding remark	113
8.1	Conclusion	113
8.2	Open problems	114
	Bibliography	115