

CONTENTS

CURRICULUM VITAE	i
ABSTRACT	iv
ZUSAMMENFASSUNG	vi
RESUMÉ	viii
	PAGE
1 INTRODUCTION	4
1.1 Background	4
1.1.1 Dyanmic Evaluation in BI Systems	5
1.1.2 Dynamic Evaluation in IFP Systems	6
1.2 Problem Definition and Research Questions	7
1.3 Proposed Solution: The Dynamic Constant-Delay Linear Representations (DCLRs)	8
1.4 Summary of Contributions	10
1.4.1 Contribution for NCQ	10
1.4.2 Contributions for GCQs	12
1.4.3 Contributions for Computing GJTs	13
1.5 Statement	14
1.6 Thesis Structure	14
2 RELATED WORK	15
2.1 Dynamic Query Evaluation	15
2.1.1 BI systems	15
2.1.2 IFP systems	17
2.2 Constant Delay Enumeration	19
2.2.1 Practical and Static CDE	20
2.2.2 Theoretical and Dynamic CDE	22
2.3 Join Algorithms	23
2.3.1 Equi-Join Algorithms	23
2.3.2 Inequality-Join Algorithms	24
2.4 Join Tree Computation	25

3 THE DYNAMIC YANNAKAKIS ALGORITHM (DYN)	27
3.1 Preliminaries	27
3.1.1 Computational Model	29
3.1.2 Acyclicity	30
3.2 Dynamic Yannakakis	32
3.2.1 Constant delay enumeration	32
3.2.2 Constant Delay Yannakakis	33
3.2.3 Dynamic Yannakakis	35
3.2.4 Complexity of Dynamic Yannakakis	40
3.2.5 Enumeration	46
3.2.6 Optimality	51
3.3 Experimental Evaluation	55
3.3.1 Practical Implementation	55
3.3.2 Experimental Setup	56
3.3.3 Experimental results	57
3.4 Conclusion	60
4 GENERALIZED DYN (GDYN)	62
4.1 Preliminaries	62
4.2 Generalized Acyclicity	63
4.3 Dynamic Joins with Equalities and Inequalities: An Example	70
4.4 Dynamic Yannakakis over GCQs	73
4.5 Experimental Evaluation	81
4.5.1 Experimental Setup	81
4.5.2 Experimental Evaluation	85
4.6 Conclusion	90
5 JOIN TREE COMPUTATION	92
5.1 Classical GYO	92
5.2 GYO-reduction for GCQs	93
5.3 Correctness of GYO for GCQs	98
5.3.1 Soundness and Completeness	98
5.4 Proof of Confluence of GYO for GCQs	105
5.5 Conclusion	110
6 DISCUSSION AND FUTURE DIRECTIONS	111
6.1 Summary	111
6.2 Strength, Limitations and Future Directions	112
6.2.1 Strengths	112

6.2.2 Limitations and Future Directions	112
BIBLIOGRAPHY	114
LIST OF FIGURES	120
LIST OF TABLES	121
LIST OF ACRONYMS	122
A BENCHMARK QUERIES	124
A.1 Queries for evaluation of DYN	124
A.1.1 Full Join Queries	124
A.1.2 TPC-H Queries	125
A.1.3 TPC-DS Queries	127
A.2 Queries for Evaluation of IEDYN	128
A.2.1 Queries in SQL Syntax for IEDYN and DBToaster	128
A.2.2 Queries in Esper EPL	130
A.2.3 Queries in Tesla/TRex Rule Language Syntax	131
A.2.4 SASE rule language	133