

Contents

1	Introduction	1
2	Information Systems Development	7
2.1	The System Development Process	7
2.1.1	Development Phases	8
2.1.2	Quality Criteria	10
2.1.3	Development Principles	12
2.2	Requirements Analysis and Conceptual Modeling	13
2.2.1	Notions and Properties	15
2.2.2	Techniques	17
2.2.3	Object Modeling	19
2.2.4	Knowledge Representation	22
2.3	Requirements and Characteristics of a Logic-based Approach	24
I	Foundations	27
3	Basic Notions of System Specification and Modeling Approaches	29
3.1	Algebraic Specification	29
3.2	Semantic and Object-Oriented Data Modeling	33
3.3	Models of Reactive and Concurrent Systems	40
3.4	Modal and Temporal Logics	47
3.5	Object-Oriented Modeling and Specification	50
3.5.1	Object-Oriented Specification	51
3.5.2	Object Identification and Referencing	52
3.5.3	Object Specification Concepts	54
4	Semantic Concepts	59
4.1	Identifiers and Keys in TROLL	59
4.2	Data Signatures and Specifications	61

4.3	Object Specification Logic	64
4.3.1	Local Specification	64
4.3.2	Template Morphisms	76
4.3.3	Object System Specification	78
4.3.4	Evaluation and Limitations	82
II	Language Definition	85
5	Basic Constructs in TROLL	87
5.1	Base Languages	87
5.1.1	Data Language	88
5.1.2	Temporal Logic Language	89
5.1.3	Pattern Language	98
5.2	High-Level Language Concepts	104
5.2.1	Templates	104
5.2.2	Object and Class Specifications	105
5.2.3	Object Interaction	106
5.2.4	Role Specifications	106
5.2.5	Specialization	106
5.2.6	Composite Objects	106
5.2.7	Relationships and Interfaces	107
6	Template, Object, and Class Specifications	109
6.1	Template Specification	109
6.1.1	Local Signature Declaration	110
6.1.2	Conditions in Specifications	118
6.1.3	Derived Attributes	118
6.1.4	Constraints	120
6.1.5	Effects of Event Occurrences	121
6.1.6	Permissions	124
6.1.7	Obligations	126
6.1.8	Commitments	128
6.1.9	Behavior Patterns	129
6.1.10	Semantics of Simple Templates	132
6.2	Templates versus Classes	135
6.3	Class Specification	135
7	Relating Specifications	141
7.1	Referencing in Collections	141

7.2	Interaction Specification	143
7.3	Specialization	147
7.4	Roles	150
7.5	Composite Objects	157
8	Specification of Systems	169
8.1	Relationships	170
8.2	Interfaces	173
8.2.1	Interface Specification	174
8.2.2	Using Interfaces	177
8.3	Object Systems	179
8.3.1	Object System Specification	179
8.3.2	System Interfaces	181
III	Discussion	183
9	Related Approaches	185
9.1	Formal Languages for Object-Oriented Modeling and Specification .	185
9.2	Graphical Object-Oriented Formalisms	194
10	Discussion and Outlook	201
10.1	Summary	201
10.2	Discussion	203
10.3	Further Work	204
	Bibliography	207
	Index	225