
Contents

Introduction	ix
Chapter 1. Programming with Graphs	1
1.1. Creating a graph	2
1.2. Feature structures	5
1.3. Information searches	6
1.3.1. Access to nodes	7
1.3.2. Extracting edges	7
1.4. Recreating an order	9
1.5. Using patterns with the GREW library	11
1.5.1. Pattern syntax	13
1.5.2. Common pitfalls	16
1.6. Graph rewriting	20
1.6.1. Commands	22
1.6.2. From rules to strategies	24
1.6.3. Using lexicons	29
1.6.4. Packages	31
1.6.5. Common pitfalls	32
Chapter 2. Dependency Syntax: Surface Structure and Deep Structure	35
2.1. Dependencies versus constituents	36
2.2. Surface syntax: different types of syntactic dependency	42
2.2.1. Lexical word arguments	44
2.2.2. Modifiers	49

2.2.3. Multiword expressions	51
2.2.4. Coordination	53
2.2.5. Direction of dependencies between functional and lexical words	55
2.3. Deep syntax	58
2.3.1. Example	59
2.3.2. Subjects of infinitives, participles, coordinated verbs and adjectives	61
2.3.3. Neutralization of diatheses	61
2.3.4. Abstraction of focus and topicalization procedures	64
2.3.5. Deletion of functional words	66
2.3.6. Coordination in deep syntax	68
Chapter 3. Graph Rewriting and Transformation of Syntactic Annotations in a Corpus	71
3.1. Pattern matching in syntactically annotated corpora	72
3.1.1. Corpus correction	72
3.1.2. Searching for linguistic examples in a corpus	77
3.2. From surface syntax to deep syntax	79
3.2.1. Main steps in the <i>SSQ</i> to <i>DSQ</i> transformation	80
3.2.2. Lessons in good practice	83
3.2.3. The <i>UD</i> to <i>AUD</i> transformation system	90
3.2.4. Evaluation of the <i>SSQ</i> to <i>DSQ</i> and <i>UD</i> to <i>AUD</i> systems	91
3.3. Conversion between surface syntax formats	92
3.3.1. Differences between the <i>SSQ</i> and <i>UD</i> annotation schemes	92
3.3.2. The <i>SSQ</i> to <i>UD</i> format conversion system	98
3.3.3. The <i>UD</i> to <i>SSQ</i> format conversion system	100
Chapter 4. From Logic to Graphs for Semantic Representation	103
4.1. First order logic	104
4.1.1. Propositional logic	104
4.1.2. Formula syntax in <i>FOL</i>	106
4.1.3. Formula semantics in <i>FOL</i>	107
4.2. Abstract meaning representation (AMR)	108
4.2.1. General overview of <i>AMR</i>	109

4.2.2. Examples of phenomena modeled using <i>AMR</i>	113
4.3. Minimal recursion semantics, <i>MRS</i>	118
4.3.1. Relations between quantifier scopes	118
4.3.2. Why use an underspecified semantic representation?	120
4.3.3. The <i>RMRS</i> formalism	122
4.3.4. Examples of phenomenon modeling in <i>MRS</i>	133
4.3.5. From <i>RMRS</i> to <i>DMRS</i>	137
Chapter 5. Application of Graph Rewriting to Semantic Annotation in a Corpus	143
5.1. Main stages in the transformation process	144
5.1.1. Uniformization of deep syntax	144
5.1.2. Determination of nodes in the semantic graph	145
5.1.3. Central arguments of predicates	147
5.1.4. Non-core arguments of predicates	147
5.1.5. Final cleaning	148
5.2. Limitations of the current system	149
5.3. Lessons in good practice	150
5.3.1. Decomposing packages	150
5.3.2. Ordering packages	151
5.4. The <i>DSQ_to_DMRS</i> conversion system	154
5.4.1. Modifiers	154
5.4.2. Determiners	156
Chapter 6. Parsing Using Graph Rewriting	159
6.1. The Cocke–Kasami–Younger parsing strategy	160
6.1.1. Introductory example	160
6.1.2. The parsing algorithm	163
6.1.3. Start with non-ambiguous compositions	164
6.1.4. Revising provisional choices once all information is available	165
6.2. Reducing syntactic ambiguity	169
6.2.1. Determining the subject of a verb	170
6.2.2. Attaching complements found on the right of their governors	172
6.2.3. Attaching other complements	176
6.2.4. Realizing interrogatives and conjunctive and relative subordinates	179

6.3. Description of the POS_to_SSQ rule system	180
6.4. Evaluation of the parser	185
Chapter 7. Graphs, Patterns and Rewriting	187
7.1. Graphs	189
7.2. Graph morphism	192
7.3. Patterns	195
7.3.1. Pattern decomposition in a graph	198
7.4. Graph transformations	198
7.4.1. Operations on graphs	199
7.4.2. Command language	200
7.5. Graph rewriting system	202
7.5.1. Semantics of rewriting	205
7.5.2. Rule uniformity	206
7.6. Strategies	206
Chapter 8. Analysis of Graph Rewriting	209
8.1. Variations in rewriting	212
8.1.1. Label changes	213
8.1.2. Addition and deletion of edges	214
8.1.3. Node deletion	215
8.1.4. Global edge shifts	215
8.2. What can and cannot be computed	217
8.3. The problem of termination	220
8.3.1. Node and edge weights	221
8.3.2. Proof of the termination theorem	224
8.4. Confluence and verification of confluence	229
Appendix	237
Bibliography	241
Index	247