

# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Program Analysis Concepts</b>	<b>7</b>
2.1	Basic Definitions . . . . .	8
2.2	Static Analysis . . . . .	9
2.3	Static Analysis versus Program Testing . . . . .	11
2.4	Manual Review Techniques . . . . .	12
2.5	Checklist-Based Code-Reviews . . . . .	16
2.6	Résumé . . . . .	24
<b>3</b>	<b>Checklist-Driven Program Analysis</b>	<b>27</b>
3.1	Principles of Program Understanding . . . . .	27
3.2	Program Post-Documentation . . . . .	30
3.3	Knowledge Representation Scheme . . . . .	34
3.4	Modeling Dependencies between Checks . . . . .	41
3.5	High-Level Knowledge Abstraction . . . . .	47
3.6	Fault Modeling within Meta-Programs . . . . .	51
3.7	Case-Based versus Rule-Based Reasoning . . . . .	59
3.8	Résumé . . . . .	63
<b>4</b>	<b>Checklist Augmentation</b>	<b>65</b>
4.1	Handling Belief Revisions . . . . .	66
4.2	Fact Templates for Fault Modeling . . . . .	74
4.3	Rule-Set Augmentation . . . . .	79
4.4	Factual Augmentation . . . . .	83
4.5	Résumé . . . . .	92

<b>5</b>	<b>Model-Based Classification of Faults According to their Severity</b>	<b>95</b>
5.1	Fault Classification under Uncertainty . . . . .	95
5.2	Fault Severity Estimation during Review Processes . . . . .	98
5.3	Résumé . . . . .	103
<b>6</b>	<b>Review Validation</b>	<b>105</b>
6.1	Metrics to Determine the Efficiency of Reviews . . . . .	107
6.2	Experiments for Performance Evaluation . . . . .	109
6.3	Software Reliability Modeling . . . . .	115
6.4	Rereviews Number Prediction using Software Reliability Models . . . . .	119
6.5	Résumé . . . . .	122
<b>7</b>	<b>The PRORev System</b>	<b>125</b>
7.1	Product Assurance Environment . . . . .	125
7.2	PRORev System Overview . . . . .	127
7.3	The PROGraph menu . . . . .	129
7.4	Program Instrumentor and Analyzer . . . . .	131
7.5	Consistency Checker . . . . .	133
7.6	Report Generator . . . . .	135
7.7	Other Components . . . . .	137
<b>8</b>	<b>Summary</b>	<b>139</b>
	<b>Bibliography</b>	<b>143</b>
<b>A</b>	<b>First-Order Predicate Logic and Prolog</b>	<b>153</b>
A.1	Propositional and First-Order Predicate Logic . . . . .	153
A.2	Logic programming with Prolog . . . . .	156
A.3	Meta-programming with Prolog . . . . .	158
A.4	Outlook on Other Logics . . . . .	159
<b>B</b>	<b>Notation</b>	<b>161</b>