



VOLUME NINETY FIVE

ADVANCES IN COMPUTERS



Edited by

ATIF MEMON

*University of Maryland
Williams Building
College Park, MD, USA*

REFERENCE BOOK



ELSEVIER

AMSTERDAM • BOSTON • HEIDELBERG • LONDON
NEW YORK • OXFORD • PARIS • SAN DIEGO
SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO

Academic Press is an imprint of Elsevier



CONTENTS

<i>Preface</i>	<i>ix</i>
1. Automated Test Oracles: A Survey	1
Mauro Pezzè and Cheng Zhang	
1. Introduction	2
2. Test Oracles	4
3. Scope of the Survey and Review Protocol	7
4. The Test Oracle Process	9
5. Information Sources and Translations of Test Oracles	12
6. Checkable Forms of Test Oracles	31
7. Summary and Future Directions	41
References	42
2. Automated Extraction of GUI Models for Testing	49
Pekka Aho, Teemu Kanstrén, Tomi Rätty, and Juha Röning	
1. Introduction	50
2. Background	55
3. Automated GUI Testing	61
4. Reverse Engineering and Specification Mining	70
5. Using Extracted Models to Automate GUI Testing	80
6. Conclusion and Discussion	96
References	98
3. Automated Test Oracles: State of the Art, Taxonomies, and Trends	113
Rafael A. P. Oliveira, Upulee Kanewala, and Paulo A. Nardi	
1. Introduction	114
2. Background	116
3. Oracles Taxonomies	128
4. A Quantitative Analysis and a Mapping of Studies	145
5. Discussions	170
6. Final and Concluding Remarks	182
Acknowledgments	184
References	184

4. Anti-Pattern Detection: Methods, Challenges, and Open Issues	201
Fabio Palomba, Andrea De Lucia, Gabriele Bavota, and Rocco Oliveto	
1. Anti-Pattern: Definitions and Motivations	202
2. Methods for the Detection of Anti-Patterns	203
3. A New Frontier of Anti-Patterns: Linguistic Anti-Patterns	220
4. Key Ingredients for Building an Anti-Pattern Detection Tool	225
5. Conclusion and Open Issues	232
References	234
5. Classifying Problems into Complexity Classes	239
William Gasarch	
1. Introduction	240
2. Time and Space Classes	241
3. Relations Between Classes	244
4. $DSPACE(1)$ =Regular Languages	244
5. $L = DSPACE(\log n)$	249
6. $NL = NSPACE(\log n)$	249
7. $P = DTIME(n^{O(1)})$	250
8. Randomized Polynomial Time: R	252
9. $NP = NTIME(n^{O(1)})$	253
10. PH: The Polynomial Hierarchy	268
11. $\#P$	270
12. $PSPACE$	271
13. $EXPTIME$	271
14. $EXPSPACE = NEXPSPACE$	272
15. $DTIME(TOW_i(n))$	273
16. $DSPACE(TOW_i(n^{O(1)}))$	274
17. Elementary	275
18. Primitive Recursive	275
19. Ackermann's Function	278
20. The Goodstein Function	279
21. Decidable, Undecidable and Beyond	280
22. Summary of Relations Between Classes	284
23. Other Complexity Measures	285
24. Summary	286
25. What is Natural?	287
Acknowledgement	288
References	288

<i>Author Index</i>	293
<i>Subject Index</i>	307
<i>Contents of Volumes in this Series</i>	317