Contents

Preface xi

Glossary xvii

Chapter 1. Fundamentals of Testing 1

1.1. What is testing? 1
1.1.1. Software and systems context 1
1.1.2. Causes of software defects 3
1.1.3. Role of testing in software development, maintenance and operations 5
1.1.4. Tests and quality 5
1.1.5. Terminology 7
1.2. What is testing? 8
1.2.1. Origin of defects 8
1.2.2. Common goals of testing 9
1.2.3. Examples of objectives for testing 9
1.2.4. Test and debugging 10
1.3. Paradoxes and main principles 11
1.3.1. Testing identifies the presence of defects 11
1.3.2. Exhaustive testing is impossible 11
1.3.3. Early testing 12
1.3.4. Defect clustering 12
1.3.5. Pesticide paradox 13
1.3.6. Testing is context dependent 13
1.3.7. Absence-of-errors fallacy 14
1.4. Test activities, testware and test roles 14
1.4.1. Planning 15
1.4.2. Monitoring and control 16
1.4.3. Test analysis and design 17

1.4.4. Test implementation 20
1.4.5. Test execution 21
1.4.6. Reporting 23
1.4.7. Test completion activities 24
1.4.8. The value of traceability 25
1.4.9. Impact of context on the test process 25
1.5. Roles in testing 26
1.6. Essential skills and "good practices" in testing 26
1.6.1. Generic skills 26
1.6.2. Specific skills 27
1.6.3. Whole team approach 27
1.6.4. Independence of testing 28
1.6.5. Levels of independence 29
1.6.6. Adapt to objectives 30
1.6.7. Destructive or constructive? 32
1.6.8. People skills 32
1.6.9. Change of perspective 33
1.7. Testers and code of ethics (FL 1.6) 33
1.7.1. Public 34
1.7.2. Client and employer 35
1.7.3. Product 35
1.7.4. Judgment 37
1.7.5. Management 37
1.7.6. Profession 38
1.7.7. Colleagues 39
1.7.8. Self 40
1.8. Sample exam questions 41

Chapter 2. Testing Throughout the Software Life Cycle 47

2.1. Testing through the software development life cycle 47
2.1.1. Sequential models 48
2.1.2. Iterative models 50
2.1.3. Incremental model 52
2.1.4. RAD 54
2.1.5. Agile models 55
2.1.6. Selection of a development model 61
2.1.7. Positioning tests 62
2.1.8. Test-first and shift-left approaches 63
2.2. Test levels and test types 64
2.2.1. Component-level testing or component tests 65
2.2.2. Integration-level testing or integration tests 66
2.2.3. System tests 68

2.2.4. Acceptance tests. 70
2.2.5. Other levels 72
2.3. Types of tests. 72
2.3.1. Functional tests 73
2.3.2. Nonfunctional tests 74
2.3.3. Tests based on the structure or architecture of the software. 76
2.3.4. Tests associated with changes 77
2.3.5. Comparisons and examples 79
2.4. Test and maintenance 80
2.4.1. Maintenance context 81
2.4.2. Evolutive maintenance 81
2.4.3. Corrective maintenance 82
2.4.4. Retirement and replacement 83
2.4.5. Regression test policies. 83
2.4.6. SLA validation and acceptance 86
2.5. Oracles 86
2.5.1. Problems with oracles 87
2.5.2. Sources of oracles. 87
2.5.3. Oracle usage. 88
2.6. Process improvements. 89
2.6.1. Objectives 89
2.6.2. Measurements. 89
2.6.3. Retrospectives and improvements. 89
2.7. Specific cases 90
2.7.1. Performance tests 90
2.7.2. Maintainability tests 91
2.8. Sample exam questions 91

Chapter 3. Static Testing 97

3.1. Static techniques and the test process 97
3.2. Review process 100
3.2.1. Types of reviews 101
3.2.2. Roles and responsibilities during reviews. 106
3.2.3. Phases of reviews 109
3.2.4. Success factors for reviews 122
3.2.5. Comparison of the types of reviews. 123
3.3. Static analysis by tools 125
3.3.1. Types of static analysis. 125
3.3.2. Types of defects that can be identified 130
3.3.3. Data flow analysis 131
3.4. Added value of static activities. 136
3.5. Sample exam questions 137

Chapter 4. Test Design Techniques 141

4.1. The test development process. 143
4.1.1. Terminology. 143
4.1.2. Traceability 144
4.2. Categories of test design techniques 146
4.2.1. Black box, white box or gray box 147
4.2.2. Experience-based techniques 148
4.2.3. Test characteristics 149
4.2.4. Limitations and assumptions. 149
4.3. Black-box techniques 151
4.3.1. Equivalence partitioning 152
4.3.2. Boundary value analysis 158
4.3.3. Decision tables 161
4.3.4. Other combinational techniques 166
4.3.5. State transition testing 166
4.3.6. Use case testing 173
4.3.7. Limitations and assumptions. 175
4.4. Structure-based techniques 175
4.4.1. Statement testing and coverage 178
4.4.2. Decision testing and coverage 183
4.4.3. Other structure-based techniques 186
4.4.4. MC/DC coverage 188
4.4.5. Limitations and assumptions of structure-based testing 189
4.4.6. Coverage level and exit criteria 190
4.5. Experience-based technique 190
4.5.1. Attacks. 191
4.5.2. Defect taxonomies 192
4.5.3. Error guessing and ad hoc testing 193
4.5.4. Exploratory testing 194
4.5.5. Limitations and assumptions. 195
4.6. Collaboration-based test approaches 196
4.6.1. Collaborative user stories 196
4.6.2. Acceptance criteria 197
4.6.3. Acceptance test-driven development 197
4.7. Choosing test techniques 198
4.8. Sample exam questions 200

Chapter 5. Test Management 209

5.1. Test organization. 209
5.1.1. Independence levels 209
5.1.2. Roles and responsibilities 212
5.1.3. Human and contractual aspects 214

5.2. Test planning and estimation . . . 215
5.2.1. Planning and evaluation activities . . . 218
5.2.2. Test planning activities . . . 229
5.2.3. Test documentation . . . 231
5.2.4. Entry and exit criteria for test activities . . . 236
5.3. Test progress monitoring and control (FL 5.3) . . . 240
5.4. Reporting . . . 243
5.4.1. What to report, to whom and how? . . . 243
5.4.2. Statistics and graphs . . . 245
5.5. Transverse processes and activities . . . 248
5.5.1. Test data definition . . . 248
5.5.2. Configuration management (FL 5.4) . . . 249
5.5.3. Change management . . . 250
5.6. Risk management (FL 5.2) . . . 250
5.6.1. Principles of risk management . . . 251
5.6.2. Project risks and product risks . . . 255
5.6.3. Introduction to risk management . . . 256
5.7. Defect management (FL 5.5) . . . 259
5.7.1. Introduction to defect management . . . 260
5.7.2. Defect identification . . . 261
5.7.3. Actions applied to defects . . . 266
5.7.4. Defect disposition . . . 266
5.8. Sample exam questions . . . 267

Chapter 6. Tools Support for Testing . . . 277

6.1. Types of test tools . . . 277
6.1.1. Test tool classification . . . 278
6.1.2. Tools supporting test management . . . 278
6.1.3. Tools supporting requirement management . . . 279
6.1.4. Tools supporting static tests . . . 279
6.1.5. Modeling tools . . . 280
6.1.6. Tools supporting test design and test data creation . . . 280
6.1.7. Tools supporting test execution . . . 281
6.1.8. Tools supporting test environment management . . . 281
6.1.9. Tools supporting test data comparison . . . 282
6.1.10. Tools supporting test coverage measurement . . . 282
6.1.11. Other test supporting tools . . . 282
6.2. Assumptions and limitations of test tools . . . 283
6.2.1. Advantages and risks of the tools . . . 283
6.2.2. Specific considerations for some tools . . . 285
6.3. Selecting and introducing tools in an organization . . . 289
6.3.1. Main principles . . . 289

6.3.2. Tool selection process 290
6.3.3. Test tool implementation 293
6.3.4. To build or to buy test tools? 294
6.4. Sample exam questions 295

Chapter 7. Mock Exam 299

Chapter 8. Templates and Models 313

8.1. Master test plan 313
8.2. Test plan 315
8.2.1. Test plan as per IEEE 829-1998 315
8.2.2. Test plan as per IEEE 829-2008 315
8.3. Test design document 317
8.3.1. Test design specifications as per IEEE 829-1998 317
8.3.2. Test design document as per IEEE 829-2008 317
8.4. Test case 318
8.4.1. Test case document as per IEEE 829-1998 318
8.4.2. Test case document as per IEEE 829-2008 318
8.5. Test procedure 319
8.5.1. Test procedure document as per IEEE 829-1998 319
8.5.2. Test procedure document as per IEEE 829-2008 319
8.6. Test log 320
8.6.1. Test log as per IEEE 829-1998 320
8.6.2. Test log as per IEEE 829-2008 320
8.7. Defect report 320
8.7.1. Defect report as per IEEE 829-1998 320
8.7.2. Defect report as per IEEE 829-2008 321
8.8. Test report 322
8.8.1. Test report as per IEEE 829-1998 322
8.8.2. Interim test report as per IEEE 829-2008 322
8.8.3. Level test report as per IEEE 829-2008 323
8.8.4. Master test report as per IEEE 829-2008 323

Chapter 9. Answers to the Questions 325

9.1. Answers to the end-of-chapter questions 325
9.2. Correct answers to the sample paper questions 327

References 329

Index 333