



Preface	*	v

Part 1	Overview	1
Chapter 1	Introduction	3
	1.1 FAQs about software engineering	5
	1.2 Professional and ethical responsibility	14
:	Key Points Further Reading Exercises	17 18 18
Chapter 2	Socio-technical systems	20
	2.1 Emergent system properties	23
	2.2 Systems engineering	25
	2.3 Organisations, people and computer systems	34
	2.4 Legacy systems	38
	Key Points Further Reading Exercises	40 41 41

xiv	Contents
XIV	Contents

Chapter 3	Critical systems	43
	3.1 A simple safety-critical system	46
	3.2 System dependability	47
	3.3 Availability and reliability	51
	3.4 Safety	55
	3.5 Security	58
	Key Points Further Reading Exercises	60 61 61
Chapter 4	Software processes	63
	4.1 Software process models	65
	4.2 Process iteration	71
	4.3 Process activities	74
	4.4 The Rational Unified Process	82
	4.5 Computer-Aided Software Engineering	85
	Key Points Further Reading Exercises	89 90 91
Chapter 5	Project management	92
	5.1 Management activities	94
	5.2 Project planning	96
	5.3 Project scheduling	99
	5.4 Risk management	104
	Key Points	111
. •	Further Reading Exercises	112 112

Col	nter	ıtc
CUI	IILEI	ILƏ

XV

Part 2	Requirements	115
Chapter 6	Software requirements	117
	6.1 Functional and non-functional requirements	119
	6.2 User requirements	127
	6.3 System requirements	129
	6.4 Interface specification	135
	6.5 The software requirements document	136
	Key Points Further Reading Exercises	140 140 141
Chapter 7	Requirements engineering processes	142
	7.1 Feasibility studies	144
	7.2 Requirements elicitation and analysis	146
	7.3 Requirements validation	158
	7.4 Requirements management	161
	Key Points Further Reading Exercises	166 167 167
Chapter 8	System models	169
	8.1 Context models	171
	8.2 Behavioural models	173
	8.3 Data models	177
	8.4 Object models	181
	8.5 Structured methods	187
	Key Points Further Reading Exercises	190 191 191

Contents		
Chapter 9	Critical systems specification	193
	9.1 Risk-driven specification	195
	9.2 Safety specification	202
	9.3 Security specification	204
	9.4 Software reliability specification	207
	Key Points	213
	Further Reading	214 214
	Exercises	217
Chapter 10	Formal specification	217
	10.1 Formal specification in the software process	219
	10.2 Sub-system interface specification	222
	10.3 Behavioural specification	229
•	Key Points	236
	Further Reading Exercises	236 237
Part 3	Design	239
Chapter 11	Architectural Design	241
	11.1 Architectural design decisions	245
	11.2 System organisation	247
	11.3 Modular decomposition styles	252
	11.4 Control styles	256
	11.5 Reference architectures	260
	Key Points	263
. •	Further Reading Exercises	264 264
	EXELCISES	
Chapter 12	Distributed Systems Architectures	266
	12.1 Multiprocessor architectures	269

		Contents	iivx
	12.2 Client–server architectures	:	270
	12.3 Distributed object architectures		275
	12.4 Inter-organisational distributed computing		282
	Key Points		289
	Further Reading Exercises		290 290
Chapter 13	Application Architectures		292
	13.1 Data processing systems		295
	13.2 Transaction processing systems		298
	13.3 Event processing systems		304
	13.4 Language processing systems		307
	Key Points		310
	Further Reading Exercises		310 311
•			
Chapter 14	Object-oriented Design		313
	14.1 Objects and object classes		316
	14.2 An object-oriented design process		320
	14.3 Design evolution		335
	Key Points		336
	Further Reading Exercises		337 337
		•	
Chapter 15	Real-Time Software Design		339
	15.1 System design		342
	15.2 Real-time operating systems		346
. •	15.3 Monitoring and control systems		349
	15.4 Data acquisition systems		355
	Key Points		357
	Further Reading Exercises		359 359

Chapter 16	User Interface Design	362
	16.1 Design issues	366
	16.2 The UI design process	376
	16.3 User analysis	378
	16.4 User interface prototyping	381
	16.5 Interface evaluation	383
	Key Points Further Reading Exercises	385 386 386
Part 4	Critical Systems	389
Chapter 17	Rapid Software Development	391
	17.1 Agile methods	396
•	17.2 Extreme programming	398
	17.3 Rapid application development	405
	17.4 Software prototyping	409
	Key Points Further Reading Exercises	412 413 414
Chapter 18	Software Reuse	415
	18.1 The reuse landscape	418
	18.2 Design patterns	421
	18.3 Generator-based reuse	423
	18.4 Application frameworks	426
	18.5 Application system reuse	428
	Key Points Further Reading Exercises	437 437 438

		Contents xix
Chapter 19	Component-based Software Engineering	439
	19.1 Components and component models	442
	19.2 The CBSE process	450
	19.3 Component composition	452
	Key Points	460
	Further Reading	460
	Exercises	461
Chapter 20	Critical Systems Development	462
	20.1 Dependable processes	466
	20.2 Dependable programming	467
	20.3 Fault tolerance	475
	20.4 Fault-tolerant architectures	482
	Key Points	486
·	Further Reading Exercises	486
		487
Chapter 21	Software Evolution	488
	21.1 Program evolution dynamics	490
	21.2 Software maintenance	492
	21.3 Evolution processes	498
•	21.4 Legacy system evolution	504
	Key Points	509
	Further Reading Exercises	510
		510
Part 5	Verification and Validation	513
Chapter 22	Verification and Validation	515
	22.1 Planning verification and validation	519
	22.2 Software inspections	521

	22.3 Automated static analysis	527
·	22.4 Verification and formal methods	530
	Key Points Further Reading Exercises	535 535 536
Chapter 23	Software Testing	537
	23.1 System testing	540
	23.2 Component testing	547
	23.3 Test case design	551
	23.4 Test automation	561
	Key Points Further Reading Exercises	563 564 565
Chapter 24	Critical Systems Validation	566
	24.1 Reliability validation	568
	24.2 Safety assurance	574
	24.3 Security assessment	581
•	24.4 Safety and dependability cases	583
	Key Points Further Reading Exercises	586 587 587
Part 6	Managing People	589
Chapter 25	Managing People	591
	25.1 Selecting staff	593
	25.2 Motivating people	596
	25.3 Managing Groups	599
	25.4 The People Capability Maturity Model	607

		Contents xxi
	Key Points Further Reading	610 610
	Exercises	611
Chapter 26	Software Cost Estimation	612
	26.1 Software productivity	614
	26.2 Estimation techniques	620
	26.3 Algorithmic cost modelling	623
	26.4 Project duration and staffing	637
	Key Points	638
	Further Reading Exercises	639 639
		553
Chapter 27	Quality Management	641
	27.1 Process and product quality	644
	27.2 Quality assurance and standards	645
	27.3 Quality planning	652
	27.4 Quality control	653
	27.5 Software measurement and metrics	655
	Key Points	663
	Further Reading Exercises	663 664
		33.
Chapter 28	Process Improvement	665
	28.1 Process and product quality	667
	28.2 Process classification	669
	28.3 Process measurement	672
	28.4 Process analysis and modelling	673
	28.5 Process change	678
	28.6 The CMMI process improvement framework	680
	Key Points	687,

nfiguration Management 1 Configuration management planning	689
1 Configuration management planning	
	693
2 Change management	69
3 Version and release management	69
4 System building	70
5 CASE tools for configuration management	70
Points	71
•	71 71
 Y	.3 Version and release management .4 System building .5 CASE tools for configuration management y Points rhter Reading ercises