

DevOps Engineering

DevOps Engineering: Reference-1

	Engineering DevOps: From Chaos to Continuous Improvement and Beyond
	Part-01: What is Engineering DevOps, and Why is It Important?
	What is Engineering DevOps?
01	Introduction
02	DevOps Engineering Blueprint
03	DevOps Engineering Tenets and CALMS
04	Origins of DevOps form an Engineering Point of View
05	The Dilemma of Defining Engineering DevOps
06	DevOps Engineering Terms
	Nine Pillars of Engineering DevOps
07	Introduction
08	Leadership Pillar
09	Collaborative Culture Pillar
10	Design for DevOps Pillar
11	Continuous Integration (CI) Pillar
12	Continuous Testing (CT) Pillar
13	Elastic Infrastructure (EI) Pillar
14	Continuous Monitoring (CM) Pillar
15	Continuous Security Pillar
16	Continuous Delivery (CD) Pillar
	Why is Engineering DevOps Important?>
17	Introduction
18	Engineering DevOps Myths and Realities
19	How Will I Know When I Have Engineered DevOps?
20	Benefits of Well-Engineered DevOps – ½
21	Benefits of Well-Engineered DevOps – ½
22	Cost of Not Engineering DevOps Properly
	Part-02: Engineering People, Process, and Technology for DevOps
	How Should People, Process, and Technology be Engineered for DevOps?
23	Does DevOps Engineering Require People to be Engineers?
24	DevOps People, Process, and Technology Engineering Maturity Levels
25	Three Dimensions of Engineering DevOps – People, Process, and Technology – People
26	Three Dimensions of Engineering DevOps – People, Process, and Technology – Process
27	Three Dimensions of Engineering DevOps – People, Process, and Technology – Technology
28	Twenty-Seven DevOps Engineering Critical Success Factors
29	Learn DevOps Value-Stream Pipeline Engineering – 1/3
30	Learn DevOps Value-Stream Pipeline Engineering – 1/ 3
31	Learn DevOps Value-Stream Pipeline Engineering – 1/3
	Value-Stream Management (VSM)
32	Why Is Value-Stream Management Important to DevOps?
33	How Does Value-Stream Management Work with DevOps? – ½
34	How Does Value-Stream Management Work with DevOps? – ½
35	What is Needed to Engineer a Value-Stream Management Solution for DevOps?
	Application Release Automation (ARA)
36	Why is Application Release Automation Important?
37	How Does Application Release Automation Work?

38	What is Needed to Implement Well-Engineered ARA?
39	Version Management – 1/3
40	Version Management – 1/3
41	Version Management – 1/3
	Continuous Decurity (a.k.a. DevSecOps)
42	Why Is Continuous Security Important to Engineering DevOps?
43	How Does Continuous Security Work with DevOps Engineering? – 1/3
44	How Does Continuous Security Work with DevOps Engineering? – 1/3
45	How Does Continuous Security Work with DevOps Engineering? – 1/3
46	Implementing Continuous Security
	Service Catalogs Facilitate DevOps Engineering
47	Why Is the Service Catalog Important to DevOps Engineering?
48	How are DevOps Service Catalogs Engineered for DevOps?
49	What is Needed to Engineer a DevOps Service Catalog?
	DevOps Governance Engineering
50	Why Is Governance Engineering Important for DevOps Engineering?
51	How Is Governance Engineered for DevOps?
52	What is Needed to Engineer Governance for DevOps?
	Site Reliability Engineering (SRE)
53	Why is SRE Important to DevOps Engineering?
54	How Does SRE Work with DevOps?
55	What is Needed to Engineer SRE with DevOps?
	DevOps Disaster Mitigation and Recovery
	Part-03: Engineering Applications, Pipelines, and Infrastructures for DevOps
	DevOps Application Engineering
56	Application Design for DevOps
57	Applications for Which DevOps Does Not Apply
58	DevOps Applied to Enterprise Apps
59	DevOps Applied to COST Systems
60	DevOps Applied to Manufactured Software Embedded Products
61	DevOps Applied to Software Services
62	Five Levels of Application Maturity
	CI/CD Pipeline Engineering Indicated in the Last Chapter...
63	CI/CD Tools
64	CI/CD Toolchains to Realize Continuous Flow...
65	CI/CD with Multitier Applications...
66	CI/CD for Databases
67	CI/CD for Micro-services Pipelines Micro-Services Architectures...
68	The Complexity of Many Parallel Micro-services DevOps Pipelines
69	CI/CD Pipelines in the Clouds Considering the Global Movement of IT Infrastructures...
70	Five Levels of CI/CD Pipeline Maturity...
	DevOps Elastic Infrastructures
71	Ephemeral Elastic Infrastructures DevOps Works Best...
72	Idempotency and Immutable Infrastructure...
73	Bare Metal, Virtual Machines, Containers, and Server-less The Workhorse of IT...
74	Infrastructure as Code (IAC)...
75	Infrastructure-as-Code Tools...
76	Net DevOps
77	Ad-Hoc Infrastructures
78	Private Data Centers...
79	Cloud Cost Management Recommended Engineering Practices

80	Cloud System Performance Recommended Engineering Practices
81	High-Availability Cloud Services Recommended Engineering Practices
82	Cloud Change Management Recommended Engineering Practices
83	Cloud Security and Compliance Recommended Engineering Practices
84	DevOps Hybrid Cloud
85	DevOps Hybrid Cloud Orchestration Tools
86	DevOps Multi-Cloud
87	DevOps Multi-Cloud Services...
88	Five Levels of Infrastructure Maturity...
	Continuous Test Engineering
89	Why Is Continuous Test Engineering Important to DevOps
90	How Is Continuous Testing Engineered for DevOps
91	Dev Stage Continuous Test Assessment Examples
92	Integration Stage Continuous Test Assessment Examples
93	Pre-Prod Stage Continuous Test Assessment Examples
94	Post-Prod Stage Continuous Testing Assessment Examples
95	Advanced Continuous Test Engineering
	Continuous Monitoring Engineering
96	Why Is Continuous Monitoring Engineering Important to DevOps?
97	How Continuous Monitoring Is Engineered for DevOps?
98	Engineering Continuous Monitoring for Applications
99	Engineering Continuous Monitoring for Pipelines
100	Engineering Continuous Monitoring for Infrastructures
	Continuous Delivery and Deployment Engineering
101	Why Is Continuous Delivery and Deployment Important to Engineering DevOps?
102	How Is Continuous Delivery and Deployment Engineered?
103	Blue-Green Deployments...
104	Dark Launching Release Strategy...
105	Feature Toggles and A/B Test Strategy...
106	Feature Flag Roll-Out Deployments...
107	Canary Deployments
108	Deployment Database Changes...
109	Micro-services Deployments Best Practice...
110	Deploying Containers with Kubernetes...
	Part-4: DevOps Seven-Step Transformation Engineering Blueprint
	DevOps Seven-Step Transformation Engineering Blueprint
	Step One: Visioning
111	Why is the Visioning Step Important to DevOps Engineering?
112	How is the Visioning Step Accomplished?
113	Overcoming Challenges with the Visioning Step...
	Step Two: Alignment
114	Why is the Alignment Step Important to Engineering DevOps?
115	How is the Alignment Step Accomplished?
116	Overcoming Challenges with the Alignment Step
	Step Three: Assessment
117	Why Is the Assessment Step Important to Engineering DevOps
118	How is the Assessment Step Accomplished?
119	Discover Current State
120	Assess the Maturity of DevOps Practices
121	Create a Current State Value-Stream Map
122	Align Priorities for Solution Requirements

123	Overcoming Challenges with the Assessment Step
	Step Four: Solution
124	Why is the Solution Step Important to Engineering DevOps?
125	How Is the Solution Step Accomplished?
126	Create a Future State Value-Stream Map...
127	Road-Mapping DevOps Transformation...
128	Estimate ROI Business Managers will Not Likely Approve a Solution Unless It Will Yield a ROI.
129	Solution Recommendation Alignment...
130	Overcoming Challenges with the Solution Step Estimates Required for Completing...
	Step Five: Realize
131	Why is the Realize Step Important to Engineering DeOps?
132	How is the Realize Step Accomplished?
133	Task Level Planning
134	Proof of Concept (POC) Trials
135	Implementation
136	Release to Production
137	Training
138	Governance
139	Overcoming Challenges with the Realize Step
	Step Six: Operationalize
140	Why is the Operationalize Step Important to Engineering DevOps?
141	How is the Operationalize Step Accomplished?
142	Controlled Access
143	Monitoring
144	Governance
145	Support
146	Evolution
147	Overcoming Challenges with the Operationalize Step
	Step Seven: Expansion
148	Why is the Expansion Step Important to Engineering DevOps?
149	How is the Expansion Step Accomplished?
150	DevOps Continuous Flow Model Evolutions...
151	Mastering DevOps Maturity Level 4 – Second Way (Continuous Feedback)...
152	Mastering DevOps Maturity Level 5 – Third Way (Continuous Improvement)...
153	Beyond DevOps Maturity Level 5 – Continuous Autonomous Improvement...
154	Future of Engineering DevOps – Beyond Continuous Improvement...
	Continuous Learning
155	Learning Continuous Flow...
156	Why is Learning Continuous Flow Important to Engineering DevOps?
157	How is Learning Continuous Flow Accomplished?
158	What is Needed to Implement Learning for Continuous Flow?
159	Learning Continuous Feedback...
160	Why is Learning Continuous Feedback Important to Engineering DevOps?
161	How is Learning Continuous Feedback Accomplished?
162	What is Needed to Implement Learning for Continuous Feedback?
163	Learning Continuous Improvement...
164	Why is Learning Continuous Feedback Important to Engineering DevOps?
165	How is Learning Continuous Feedback Accomplished?

DevOps Engineering: Reference-2

	Learning DevOps: Complete Guide to Accelerate Collaboration with Jenkins, Kubernetes, Terraform, Azure
	Section-01: DevOps and Infrastructure as Code
	DevOps Culture and Practice
01	Getting Started with DevOps
05	Implementing CI/CD and Continuous Deployment – Topics 4
15	Understanding IaC Practices – Topics 10
16	Summary
17	Questions
18	Further Reading
	Provisioning Cloud Infrastructure with Terraform
19	Technical Requirements
25	Installing Terraform – Topics 6
28	Configuring Terraform for Azure – Topics 3
32	Writing a Terraform Script to Deploy Azure Infrastructure – Topics 4
35	Deploying the Infrastructure with Terraform – Topics 3
40	Terraform Command Lines and Life Cycle – Topics 5
41	Protecting tfstate in a Remote Backend
42	Summary
43	Questions
44	Further Reading
	Using Ansible for Configuring IaaS Infrastructure
45	Technical Requirements
49	Installing Ansible – Topics 4
52	Creating an Inventory for Targeting Ansible Host – Topics 3
55	Writing the First Playbook – Topics 3
58	Executing Ansible – Topics 3
60	Protecting Data with Ansible Vault – Topics 2
61	Using a Dynamic Inventory for Azure Infrastructure
62	Summary
63	Questions
64	Further Reading
	Optimizing Infrastructure Deployment with Packer
65	Technical Requirements
73	An Overview of Packer – Topics 8
78	Creating Packer Templates for Azure VMs with Scripts – Topics 5
80	Using Ansible in a Packer Template – Topics 2
83	Executing Packer – Topics 3
84	Using a Packer Image with Terraform
85	Summary
86	Questions
87	Further Reading
	Section-02: DevOps CI/CD Pipeline
	Managing Your Source Code with Git
88	Technical Requirements
92	Overviewing Git and Its Command Lines – Topics 4
96	Overviewing Git and Its Command Lines – Topics 4
100	Overviewing Git and Its Command Lines – Topics 4
104	Understanding the Git Process and GitFlow Pattern – Topics 4

108	Understanding the Git Process and GitFlow Pattern – Topics 4
109	Summary
110	Questions
111	Further Reading
	Continuous Integration and Continuous Delivery
112	Technical Requirements
114	The CI/CD Principles – Topics 2
117	Using a Package Manager – Topics 3
121	Using Jenkins – Topics 4
124	Using Azure Pipelines – Topics 3
128	Using GitLab CI – Topics 4
129	Summary
130	Questions
131	Further Reading
	Section-03: Containerized Applications with Docker and Kubernetes
	Containerizing Your Application with Docker
132	Technical Requirements
135	Installing Docker – Topics 3
137	Creating a Dockerfile – Topics 2
140	Building and Running a Container on a Local Machine – Topics 3
141	Pushing an Image to Docker Hub
143	Deploying a Container to ACI with a CI/CD Pipeline – Topics 2
144	Summary
145	Questions
146	Further Reading
	Managing Containers Effectively with Kubernetes
147	Technical Requirements
150	Installing Kubernetes – Topics 3
151	First Example of Kubernetes Application Deployment
152	Using HELM as a Package Manager
155	Using AKS – Topics 3
157	Creating a CI/CD Pipeline for Kubernetes with Azure Pipelines – Topics 2
158	Summary
159	Questions
160	Further Reading
	Section-04: Testing Your Application
	Testing APIs with Postman
161	Technical Requirements
164	Creating a Postman Collection with Request – Topics 3
165	Using Environments and Variable to Dynamize Requests
166	Writing Postman Tests
167	Executing Postman Request Tests Locally
168	Understanding the Newman Concept
170	Preparing Postman Collections for Newman – Topics 2
171	Running the Newman Command Line
176	Integration of Newman in the CI/CD Pipeline Process – 5
177	Summary
178	Questions
179	Further Reading
	Static Code Analysis with SonarQube
180	Technical Requirements

181	Exploring SonarQube
186	Installing SonarQube – Topics 5
187	Real-time Analysis with SonarLint
189	Executing SonarQube in Continuous Integration – Topics 2
190	Summary
191	Questions
192	Further Reading
	Security and Performance Tests
193	Technical Requirements
195	Applying Web Security and Penetration Testing with ZAP – Topic 2
196	Running Performance Tests with Postman
197	Summary
198	Questions
199	Further Reading
	Section-05: Taking DevOps Further
	Security in the DevOps Process with DevSecOps
200	Technical Requirements
201	Testing Azure Infrastructure Compliance with Chef InSpec – 7
202	Using the Secure DevOps Kit for Azure – Topics 3
203	Preserving Data with HashiCorp’s Vault – Topics 6
204	Summary
205	Questions
206	Further Reading
	Reducing Deployment Downtime
207	Technical Requirements
208	Reducing Deployment Downtime with Terraform
209	Understanding Blue-green Deployment Concepts and Patterns – Topics 3
210	Applying Blue-Green Deployments on Azure – Topics 2
211	Introducing Feature Flags
212	Using an Open Source Framework for Feature Flags
213	Using the LaunchDarkly Solution
214	Summary
215	Questions
216	Further Reading
	DevOps for Open Source Projects
217	Technical Requirements
219	Storing the Source Code in GitHub – Topics 2
220	Contributing Using Pull Requests
221	Managing the Changelog and Release Notes
222	Sharing Binaries in GitHub Releases
223	Using Travis CI for Continuous Integration
224	Getting Started with GitHub Actions
225	Analyzing Code with SonarCloud
226	Detecting Security Vulnerabilities with WhiteSource Bold
227	Summary
228	Questions
229	Further Reading
	DevOps Best Practices
230	Automating Everything
231	Choosing the Right Tool
232	Writing All Your Configuration in Code

233	Designing the System Architecture
234	Building a Good CI/CD Pipeline
235	Integrating Tests
236	Applying Security with DevSecOps
237	Monitoring Your System
238	Evolving Project Management
239	Summary
240	Questions
241	Further Reading

DevOps Engineering: Reference-3

	DevOps for Developers: Integrate Development and Operations, The Agile Way
	Part-01: Fundamentals
	Beginning DevOps for Developers
04	The Definition for DevOps – Topics 4
06	What DevOps is Not – Topics 2
07	Structure of This Book
08	Conclusion
	Introducing DevOps
09	Traditional Project Settings
10	Agile Project Settings
13	Blame Game: Dev vs. Ops – Topics 3
15	Operations as Bottleneck – Topics 2
16	DevOps to the Rescue
19	The Essence of DevOps – Topics 3
20	Conclusion
	Building Blocks of DevOps
22	Measurement and Metrics – Topics 2
24	Improving Flow of Features – Topics 2
26	Improve and Accelerate Delivery – Topics 2
27	Conclusion
	Part-02: Metrics and Measurement View
	Quality and Testing
28	What is Quality? – Topics 1
33	Patterns for Improving Quality – Topics 5
34	Conclusion
	Introduce Shared Incentives
35	War Study: Magic Kingdoms
37	What is a Team? – Topics 2
39	Becoming a Team – Topics 2
41	Success Stories – Topics 2
42	Conclusion
	Part-03: Process View
	Gain Fast Feedback
43	The DevOps Area Matrix
44	Extend Development to Operations
45	Extend Operations to Development
46	Embed Development into Operations
47	Embed Operations into Development
50	Starting with Kanban – Topics 3
52	Example Use Case – Topics 2
53	Conclusion
	Unified and Holistic Approach
54	Getting Started with Concepts – Topics 1
58	Origins of Conceptual Deficits – Topics 4
61	Attributes of a Unified Approach – Topics 3
62	Conclusion
	Part-04: Technical View
	Automatic Releasing

63	Prerequisites for Automatic Releasing
70	Patterns with Appropriate Tools – Topics 7
71	Conclusion
	Infrastructure as Code
73	Starting with Infrastructure as Code – Topics 2
77	Test Environments with Vagrant – Topics 4
79	Provisioning with Puppet – Topics 2
81	Use Case: Open Source Infrastructure with Puppet – Topics 2
82	Where to Look Next? – Topics 1
83	Conclusion
84	Specification by Example
85	Getting Started with Acceptance Tests – Topics 1
93	Defining Your Acceptance Criteria – Topics 8
94	Reporting on the Test Outcomes – Topics 1
95	Conclusion
96	Moving On

Probability and Statistics for Engineers

Probability and Statistics: Reference-1

	Introduction to Probability and Statistics for Engineers and Scientist
	Introduction to Statistics
01	Introduction
02	Data Collection and Descriptive Statistics
03	Inferential Statistics and Probability Models
04	Populations and Samples
05	A Brief History of Statistics
	Problems
	Descriptive Statistics
06	Introduction
09	Describing Data Sets – Topics 3
12	Summarizing Data Sets – Topics 3
13	Chebyshev's Inequality
14	Normal Data Sets
15	Paired Data Sets and the Sample Correlation Coefficient
16	The Lorenz Curve and Gini Index
17	Using R
	Problems
	Elements of Probability
18	Introduction
19	Sample Space and Events
20	Venn Diagrams and the Algebra of Events
21	Axioms of Probability
22	Sample Spaces Having Equally Likely Outcomes
23	Basic Principle of Counting
24	Notation and Terminology
25	Conditional Probability
26	Bayes' Formula
27	Independent Events
	Problems
	Random Variables and Expectation
28	Random Variables
29	Types of Random Variables
31	Jointly Distributed Random Variables – Topics 2
32	Expectation
33	Properties of the Expected Value – Topics 1
34	Variance
35	Covariance and Variance of Sums of Random Variables
36	Moment Generating Functions
37	Chebyshev's Inequality and the Weak Law of Large Numbers
	Problems
	Special Random Variables
38	The Bernoulli and Binomial Random Variables – Topics 1
39	The Poisson Random Variable – Topics 1
40	The Hypergeometric Random Variable
41	The Uniform Random Variable
42	Normal Random Variables

44	Exponential Random Variables – Topics 2
45	The Gamma Distribution
48	Distributions Arising from the Normal – Topics 3
49	The Logistics Distribution
	Problems
	Distributions of Sampling Statistics
50	Introduction
51	The Sample Mean
53	The Central Limit Theorem – Topics 2
54	The Sample Variance
56	Sampling Distributions from a Normal Population – Topics 2
57	Sampling from a Finite Population
	Problems
	Parameter Estimation
58	Introduction
59	Maximum Likelihood Estimators – Topics 1
62	Interval Estimates – Topics 3
63	Estimating the Difference in Means of Two Normal Populations
64	Approximate Confidence Interval for the Mean of a Bernoulli Random Variable
65	Confidence Interval of the Mean of the Exponential Distribution
66	Evaluating a Point Estimator
67	The Bayes Estimator
	Problems
	Hypothesis testing
68	Introduction
70	Significance Levels – Topics 2
74	Tests Concerning the Mean of a Normal Population – Topics 4
75	Hypothesis Tests concerning the Variance of a Normal Population – Topics 1
76	Hypothesis Tests in Bernoulli Populations – Topics 1
77	Tests Concerning the Mean of a Poisson Distribution – Topics 1
	Problems
	Regression
78	Introduction
79	Least Squares Estimators of the Regression Parameters
80	Distribution of the Estimators
85	Statistical Inferences About the Regression Parameters – Topics 5
86	The Coefficient of Determination and the Sample Correlation Coefficient
87	Analysis of Residuals: Assessing the Model
88	Transforming to Linearity
89	Weighted Least Squares
90	Polynomial Regression
92	Multiple Linear Regression – Topics 2
93	Logistic Regression Models for Binary Output Data
	Problems
	Analysis of Variance
94	Introduction
95	An Overview
98	One-Way Analysis of Variance – Topics 3
99	Two-Factor Analysis of Variance: Introduction and Parameter Estimation
100	Two-Factor Analysis of Variance: Testing Hypotheses
101	Two-Way Analysis of Variance with Interaction

	Problem
	Goodness of Fit Tests and Categorical Data Analysis
102	Introduction
103	Goodness of Fit Tests When All Parameters are Specified – Topics 1
104	Goodness of Fit Tests When Some Parameters are Unspecified
105	Tests of Independence in Contingency Table
106	Tests of Independence in Contingency Tables Having Fixed Marginal Totals
107	The Kolmogorov-Smirnov Goodness of Fit Test for Continuous Data
	Problems
	Non-parametric Hypothesis Tests
108	Introduction
109	The Sign Test
110	The Signed Rank Test
111	The Two-Sample Problem – Topics 1
112	The Runs Test for Randomness
	Problems
	Quality Control
113	Introduction
114	Control Charts for Average Values: The X Control Chart – Topics 1
115	S-Control Charts
116	Control Charts for the Fraction Defective
117	Control Charts for Number of Defects
120	Other Control Charts for Detecting Changes in the Population Mean – Topics 3
	Problems
	Life Testing
121	Introduction
122	Hazard Rate Functions
126	The Exponential Distribution in Life Testing – Topics 4
127	A Two-Sample Problem
128	The Weibull Distribution in Life Testing – Topics 1
	Problem
	Simulation, Bootstrap Statistical Methods, and Permutation Tests
129	Introduction
130	Random Numbers – Topics 1
131	The Bootstrap Method
133	Permutation Tests – Topics 2
134	Generating Discrete Random Variables
135	Generating Continuous Random Variables – Topics 1
136	Determining the Number of Simulation Runs in a Monte Carlo Study
	Problems
	Machine Learning and Big Data
137	Introduction
138	Late Flight Probabilities
140	The Naïve Bayes Approach – Topics 1
142	Distance-Based Estimators. The k-Nearest Neighbors Rule – Topics 2
143	Assessing the Approaches
145	When Characterizing Vectors are Quantitative – Topics 2
146	Choosing the Best Probability; A Bandit Problem
	Problems

Probability and Statistics: Reference-2

	Applied Statistics and Probability for Engineers
	The Role of Statistics in Engineering
02	The Engineering Method and Statistical Thinking – Topics 2
07	Collecting Engineering Data – Topics 5
08	Mechanistic and Empirical Models
09	Probability and Probability Models
	Probability
12	Sample Spaces and Events – Topics 3
13	Counting Techniques
14	Interpretations and Axioms of Probability
15	Unions of Events and Addition Rules
16	Conditional Probability
17	Intersections of Events Multiplication and Total Probability Rules
18	Independence
19	Bayes Theorem
20	Random Variables
	Discrete Random Variables and Probability Distributions
21	Probability Distributions and Probability Mass Functions
22	Cumulative Distribution Functions
23	Mean and Variance of a Discrete Random Variable
24	Discrete Uniform Distribution
25	Binomial Distribution
26	Geometric and Negative Binomial Distributions
27	Hypergeometric Distribution
28	Poisson Distribution
	Continuous Random Variables and Probability Distributions
29	Probability Distributions and Probability Density Functions
30	Cumulative Distribution Functions
31	Mean and Variance of a Continuous Random Variable
32	Continuous Uniform Distribution
33	Normal Distribution
34	Normal Approximation to the Binomial and Poisson Distributions
35	Exponential Distribution
36	Erlang and Gamma Distribution
37	Weibull Distribution
38	Lognormal Distribution
39	Beta Distribution
	Joint Probability Distributions
40	Joint Probability Distributions for Two Random Variables
41	Conditional Probability Distributions and Independence
42	Joint Probability Distributions for More Than Two Random Variables
43	Covariance and Correlation
45	Common Joint Distributions – Topics 2
46	Linear Functions of Random Variables
47	General Functions of Random Variables
48	Moment-Generating Functions
	Descriptive Statistic
49	Numerical Summaries of Data

50	Stem-and-Leaf Diagrams
51	Frequency Distributions and Histograms
52	Box Plots
53	Time Sequence Plots
54	Scatter Diagrams
55	Probability Plots
	Point Estimation of Parameters and Sampling Distributions
56	Point Estimation
57	Sampling Distributions and the Central Limit Theorem
62	General Concepts of Point Estimation – Topics 5
65	Methods of Point Estimation – Topics 3
	Statistical Intervals for a Single Sample
70	Confidence Interval on the Mean of a Normal Distribution, Variance Known – Topics 5
72	Confidence Interval on the Mean of a Normal Distribution, Variance Unknown – Topics 2
73	Confidence Interval on the Variance and Standard Deviation of a Normal Distribution
74	Large-Sample Confidence Interval for a Population Proportion
75	Guidelines for Constructing Confidence Intervals
76	Bootstrap Confidence Interval
77	Tolerance and Prediction Intervals – Topics 2
	Tests of Hypotheses for a Single Sample
83	Hypothesis Testing – Topics 6
86	Tests on the Mean of a Normal Distribution, Variance Known – Topics 3
88	Tests on the Mean of a Normal Distribution, Variance Unknown – Topics 2
90	Tests on the Variance and Standard Deviation of a Normal Distribution – Topics 2
92	Tests on a Population Proportion – Topics 2
93	Summary Table of Inference Procedures for a Single Sample
94	Testing for Goodness of Fit
95	Contingency Table Tests
98	Nonparametric Procedures – Topics 3
99	Equivalence Testing
100	Combining P-Values
	Statistical Inference for Two Samples
103	Inference on the Difference in Means of Two Normal Distributions, Variances Known – Topics 3
106	Inference on the Difference in Means of Two Normal Distributions, Variances Unknown – Topics 3
109	A Nonparametric Test for the Difference in Two Means – Topics 3
110	Paired t-Test
114	Inference on the Variances of Two Normal Distributions – Topics 4
117	Inference on Two Population Proportions – Topics 3
118	Summary Table and Road Map for Inference Procedures for Two Samples
	Simple Linear Regression and Correlation
119	Empirical Models
120	Simple Linear Regression
121	Properties of the Least Squares Estimators
123	Hypothesis Tests in Simple Linear Regression – Topics 2
125	Confidence Intervals – Topics 2
126	Prediction of New Observations
128	Adequacy of the Regression Model – Topics 2
129	Correlation
130	Regression on Transformed Variables
131	Logistic Regression
	Multiple Linear Regression

135	Multiple Linear Regression Model – Topics 4
137	Hypothesis Tests in Multiple Linear Regression – Topics 2
139	Confidence Intervals in Multiple Linear Regression – Topics 2
140	Prediction of New Observations
142	Model Adequacy Checking – Topics 2
146	Aspects of Multiple Regression Modeling – Topics 4
	Design and Analysis of Single-Factor Experiments: The Analysis of Variance
147	Designing Engineering Experiments
152	The Completely Randomized Single-Factor Experiment – Topics 5
154	The Random Effects Model – Topics 2
157	Randomized Complete Block Design – Topics 3
	Design of Experiments with Several Factors
158	Introduction
159	Factorial Experiments
162	Two-Factor Factorial Experiments – Topics 3
163	General Factorial Experiments
165	2k Factorial Designs – Topics 2
166	Single Replicate of the 2K Design
167	Addition of Center Points to a 2k Design
168	Blocking and Confounding in the 2k Design
169	One-Half Fraction of the 2k Design
170	Smaller Fractions: The 2k-p Fractional Factorial
171	Response Surface Methods and Designs
	Statistical Quality Control
173	Quality Improvement and Statistics – Topics 2
177	Introduction to Control Charts – Topics 4
178	X and R or S Control Chart
179	Control Charts for Individual Measurements
180	Process Capability
182	Attribute Control Charts – Topics 2
183	Control Chart Performance
185	Time-Weighted Charts – Topics 2
186	Other SPC Problem-Solving Tools
188	Decision Theory – Topics 2
189	Implementing SPC
	Appendix: Statistical Tables and Charts
	Schaum's Outlines Probability and Statistics

Software Testing

Software Testing: Reference-1

	Software Testing: Principles and Practices
	Testing Methodology
	Introduction to Software Testing
01	Introduction
02	Evolution of Software Testing
03	Software Testing – Myths and Facts
04	Goals of Software Testing
05	Psychology for Software Testing
06	Software Testing Definitions
07	Model for Software Testing
08	Effective Software Testing vs. Exhaustive Software Testing
09	Effective Testing is Hard
10	Software Testing as a Process
11	Schools of Software Testing
12	Software Failure Case Studies
	Software Testing Terminology and Methodology
13	Software Testing Terminology
14	Software Testing Life Cycle (STLC)
15	Software Testing Methodology
	Verification and Validation
16	Verification and Validation Activities
17	Verification
18	Verification of Requirements
19	Verification of High-Level Design
20	Verification of Low-Level Design
21	How to Verify Code
22	Validation
	Testing Techniques
	Dynamic Testing: Black-Box Testing Techniques
23	Boundary Value Analysis (BVA)
24	Equivalence Class Testing
25	State table-Based Testing
26	Decision Table-Based Testing
27	Cause-Effect Graphing Based Testing
28	Error Guessing
	Dynamic Testing: White-Box Testing Techniques
29	Need of White-Box Testing
30	Logic Coverage Criteria
31	Basis Path Testing
32	Graph Matrices
33	Loop Testing
34	Data Flow Testing
35	Mutation Testing
	Static Testing
36	Inspections
37	Structured Walkthroughs
38	Technical Reviews

	Validation Activities
39	Unit Validation Testing
40	Integration Testing
41	Function Testing
42	System Testing
43	Acceptance Testing
	Regression Testing
44	Progressive vs. Regressive Testing
45	Regression Testing Produces Quality Software
46	Regression testability
47	Objectives of Regression Testing
48	When is Regression Testing Done?
49	Regression Testing Types
50	Defining Regression Test Problem
51	Regression Testing Techniques
	Managing the Testing Process
	Test Management
52	Test Organization
53	Structure of Testing Group
54	Test Planning
55	Detailed Test Design and Test Specifications
	Software Metrics
56	Need of Software Measurement
57	Definition of Software Metrics
58	Classification of Software Metrics
59	Entities to be Measured
60	Size Metrics
	Testing Metrics for Monitoring and Controlling the Testing Process
61	Measurement Objectives for Testing
62	Attributes and Corresponding Metrics in Software Testing
63	Attributes
64	Estimation Models for Estimating Testing Efforts
65	Architectural Design Metric Used for Testing
66	Information Flow Metrics Used for Testing
67	Cyclomatic Complexity Measures for Testing
68	Function Point Metrics for Testing
69	Test Point Analysis (TPA)
70	Some Testing Metrics
	Efficient Test Suit Management
71	Why Does a Test Suite Grow?
72	Minimizing the Test Suite and its Benefits
73	Defining Test Suite Minimization Problem
74	Test Suite Prioritization
75	Types of Test Case Prioritization
76	Prioritization Techniques
77	Measuring the Effectiveness of a Prioritized Test Suite
	Quality Management
	Software Quality Management
78	Software Quality
79	Broadening the Concept of Quality
80	Quality Cost

81	Benefits of Investment on Quality
82	Quality Control and Quality Assurance
83	Quality Management (QM)
84	QM and Project Management
85	Quality Factors
86	Methods of Quality Management
87	Software Quality Metrics
88	SQA Models
	Testing Process Maturity Models
89	Need for Test Process Maturity
90	Measurement and Improvement of a Test Process
91	Test Process Maturity Models
	Test Automation
	Automation and Testing Tools
92	Need for Automation
93	Categorization of Testing Tools
94	Selection of Testing Tools
95	Costs Incurred in Testing Tools
96	Guidelines for Automated Testing
97	Overview of Some Commercial Testing Tools
	Testing for Specialized Environment
	Testing Object-Oriented Software
98	OOT Basics
99	Object-Oriented Testing
	Testing Web-based Systems
100	Web-based System
101	Web Technology Evolution
102	Traditional Software and Web-based Software
103	Challenges in Testing for Web-based Software
104	Quality Aspects
105	Web Engineering (Webe)
106	Testing of Web-based Systems
	Tracking the Bug
	Debugging
107	Debugging: An Art or Technique?
108	Debugging Process
109	Debugging is Difficult
110	Debugging Techniques
111	Correcting the Bugs
112	Debuggers
	Income Tax Calculator: A Case Study
	Step-1: Introduction to Case Study
	Step-2: Income Tax Calculator SRS ver 1.0
	Step-3: Verification on Income Tax Calculator SRS ver 1.0
	Step-4: Income Tax Calculator SRS ver 2.0
	Step-5: Verification on Income Tax Calculator SRS ver 2.0
	Step-6: Income Tax Calculator SRS ver 3.0
	Step-7: Black-Box Testing on Units/Modules of Income Text Calculator SRS ver 3.0
	Step-8: White-Box Testing on Units/Modules of Income Tax Calculator
	Appendices

Software Testing: Reference-2

	Agile Testing: A Practical Guide for testers and Agile Teams
	Introduction
	What is Agile Testing, Anyway?
01	Agile Values
02	What do We Mean by 'Agile Testing'?
05	A Little Context for Roles and Activities on an Agile Team – Topics 3
08	How is Agile Testing Different? – Topics 3
09	Whole-Team Approach
	Summary
	Ten Principles for Agile Testers
10	What's an Agile Tester?
11	The Agile Testing Mind-Set
21	Applying Agile Principles and Values – Topics 10
22	Adding Value
	Summary
	Organizational Challenges
	Cultural Challenges
27	Organizational Culture – Topics 5
33	Barriers to Successful Agile Adoption by Test/QA Teams – Topics 6
36	Introducing Change – Topics 3
38	Management Expectations – Topics 2
44	Change Doesn't Come Easy – Topics 6
	Summary
	Team Logistics
47	Team Structure – Topics 3
48	Physical Logistics
50	Resources – Topics 2
55	Building a Team – Topics 5
	Summary
	Transitioning Typical Processes
56	Seeking Lightweight Processes
61	Metrics – Topics 5
65	Defect Tracking – Topics 4
67	Test Planning – Topics 2
69	Existing Processes and Models – Topics 2
	Summary
	The Agile Testing Quadrants
	The Purpose of Testing
71	The Agile Testing Quadrants – Topics 2
72	Knowing When a Story is Done – Topics 1
73	Managing Technical Debt
74	Testing in Context
	Summary
	Technology-Facing Tests that Support the Team
76	An Agile Testing Foundation – Topics 2
80	Why Write and Execute These Tests? – Topics 4
81	Where Do Technology-Facing Tests Stop?
84	What if the Team Doesn't Do These Tests? – Topics 3

89	Toolkit – Topics 5
	Summary
	Business-Facing Tests that Support the Team
90	Driving Development with Business-Facing Tests
95	The Requirements Quandary – Topics 5
96	Thin Slices, Small Chunks
97	How Do We Know We’re Done?
98	Tests Mitigate Risk
99	Testability and Automation
	Summary
	Toolkit for Business-Facing Tests that Support the Team
100	Business-Facing test Tool Strategy
106	Tools to Elicit Examples and Requirements – Topics 6
108	Tools for Automating Test Based on Examples – Topics 2
112	Strategies for Writing Tests – Topics 4
114	Testability – Topics 2
115	Test Management
	Summary
	Business-Facing Tests that Critique the Product
116	Introduction to Quadrant 3
117	Demonstrations
118	Scenario Testing
121	Exploratory Testing – Topics 3
124	Usability Testing – Topics 3
126	Behind the GUI – Topics 2
128	Testing Documents and Documentation – Topics 2
133	Tools to Assist with Exploratory Testing – Topics 5
	Summary
	Critiquing the Product Using Technology-Facing Tests
134	Introduction to Quadrant 4
135	Who Does It?
136	When DO You Do It?
143	ility Testing – Topics 7
149	Performance, Load, Stress, and Scalability Testing – Topics 6
	Summary
	Summary of Testing Quadrants
150	Review of the Testing Quadrants
152	A System Test Example – Topics 2
154	Tests Driving Development – Topics 2
157	Automation – Topics 3
162	Critiquing the Product with Business-Facing Tests – Topics 5
	Summary
	Automation
	Why We Want to Automate Tests and What Holds Us Back
170	Why Automate? – Topics 8
179	Barriers to Automation – Things that Get in the Way – Topics 9
180	Can We Overcome These Barriers?
	Summary
	An Agile Test Automation Strategy
182	An Agile Approach to Test Automation – Topics 2
191	What Can We Automate? – Topics 9

195	What Shouldn't We Automate? – Topics 4
196	What Might Be Hard to Automate?
200	Developing an Automation Strategy – Where Do We Start? – Topics 4
206	Applying Agile Principles to Test Automation – Topics 6
210	Supplying Data for Tests – Topics 4
214	Evaluating Automation Tools – Topics 4
215	Implementing Automation
217	Managing Automated Tests – Topics 2
218	Go Get Started
	Summary
	An Iteration in the Life of a Tester
	Tester Activities in Release or Theme Planning
219	The Purpose of Release Planning
222	Sizing – Topics 3
224	Prioritizing – Topics 2
228	What's in Scope? – Topics 4
235	Test Planning – Topics 7
240	Test Plan Alternatives –Topics 5
243	Preparing for Visibility – Topics 3
	Summary
	Hit the Ground Running
246	Be Proactive – Topics 3
249	Advance Clarity – Topics 3
250	Examples
251	Test Strategies
252	Prioritize Defects
253	Resources
	Summary
	Iteration Kickoff
257	Iteration Planning – Topics 4
258	Testable Stories
259	Collaborate with Customers
262	High-Level Tests and Examples – Topics 3
	Summary
	Coding and Testing
269	Driving Development – Topics 7
270	Tests that Critique the Product
272	Collaborate with Programmers – Topics 2
274	Talk to Customers – Topics 2
275	Completing Testing Tasks
278	Dealing with Bugs – Topics 3
283	It's All About Choices – Topics 5
285	Facilitate Communication – Topics 2
289	Regression Tests – Topics 4
290	Resources
292	Iteration Metrics – Topics 2
	Summary
	Wrap Up the Iteration
293	Iteration Demo
295	Retrospectives – Topics 2
296	Celebrate Successes

	Summary
	Successful Delivery
267	What Makes a Product?
268	Planning Enough Time for Testing
276	The End Game – Topics 8
278	Customer Testing – Topics 2
279	Post-Development Testing Cycles
280	Deliverables
283	Releasing the Product – Topics 3
285	Customer Expectations – Topics 2
	Summary
	Summary
	Key Success Factors
	Use the Whole-Team Approach
	Adopt an Agile Testing Mind-Set
	Automate Regression Testing
	Provide and Obtain Feedback
	Build a Foundation of Core Practices – Topics 6
	Collaborate with Customers
	Look at the Big Picture

Software Metrics

Software Metrics: Reference-1

	Software Metrics: A Rigorous and Practical Approach
	Fundamentals of Measurement and Experimentation
	Measurement: What is it and Why Do It?
02	Measurement in Everyday Life – Topics 2
05	Measurement in Software Engineering – Topics 3
15	The Scope of Software Metrics – Topics 10
	Summary
	Exercises
	The Basics of Measurement
18	The Representational Theory of Measurement – Topics 3
21	Measurement and Models – Topics 3
26	Measurement Scales and Scale Types – Topics 5
30	Meaningfulness in Measurement – Topics 4
	Summary
	Exercises and Further Reading
	A Goal-Based Framework for Software Measurement
38	Classifying Software Measures – Topics 8
44	Determining What to Measure – Topics 6
55	Applying the Framework – Topics 11
57	Software Measurement Validation – Topics 2
61	Software Measurement Validation in Practice – Topics 4
	Summary
	Exercises and Further Reading
	Empirical Investigation
69	Four Principles of Investigation – Topics 8
89	Planning Formal Experiments – Topics 20
92	Planning Case Studies – Topics 3
	Summary
	Exercise and Further Reading
	Software-Metrics Data Collection
93	What is Good Data
99	How to Define the Data – Topic 6
103	How to Collect Data – Topics 4
104	When to Collect Data
106	How to Store and Extract Data – Topics 2
	Summary
	Exercises and Further Reading
	Analyzing Software-Measurement Data
207	Introduction
216	Analyzing the results of Experiments – Topics 9
224	Examples of Simple Analysis Techniques – Topics 8
233	More Advanced Methods – Topics 9
240	Overview of Statistical Tests – Topics 7
	Summary
	Exercises and Further Reading
	Software-Engineering Measurement
	Measuring Internal Product Attributes: Size

241	Aspects of Software Size
250	Length – Topics 9
251	Reuse
256	Functionality – Topics 5
260	Complexity
	Summary
	Exercises and Further Reading
	Measuring Internal Product Attributes: Structure
261	Types of Structural Measures
275	Control-Flow Structure – Topics 14
285	Modularity and Information Flow Attributes – Topics 10
286	Object-Oriented Metrics
287	Data Structure
288	Difficulties with General ‘Complexity’ Measures
	Summary
	Exercises and Further Reading
	Measuring External Production Attributes
289	Modeling Software Quality
300	Measuring Aspects of Quality – Topics 11
	Summary
	Exercises and Further Reading
	Software Reliability: Measurement and Prediction
304	Basics of Reliability Theory – Topics 4
302	The Software Reliability Problem – Topics 2
308	Parametric Reliability Growth Models – Topics 6
314	Predictive Accuracy – Topics 6
316	The Recalibration of Software-reliability Growth Predictions – Topics 2
317	The Importance of the Operational Environment
318	Wider Aspects of Software Reliability
	Summary
	Exercises and Further Reading
	Resource Measurement: Productivity, Teams, and Tools
319	The Meaning of Productivity
320	Productivity of What?
322	Measuring Productivity – Topics 2
326	Teams, Tools, and Methods – Topics 4
	Summary
	Exercises and Further Reading
	Making Process Predictions
329	Good Estimates – Topics 3
332	Cost Estimation: Problems and Approaches – Topics 3
340	Models of Effort and Cost – Topics 8
343	Problems with Existing Modeling Methods – Topics 3
348	Dealing with Problems of Current Estimation Methods – 5
349	Implications for Process Prediction
	Summary
	Exercises and Further Reading
	Measurement and Management
	Planning a Measurement Program
355	What is a Metrics Plan? – Topics 6
356	Why and What: Developing Goals, Questions, and Metrics

357	Where and When: Mapping Measures to Activities
358	How: Measurement Tools
360	Who: Measurers, Analysis, and Audience – Topics 2
361	Revising the Plan
	Summary
	Exercises and Further Reading
	Measurement in Practice
364	Success Criteria – Topics 3
366	Measurement in the Small – Topics 2
372	Measurement in the Large – Topics 6
374	Lessons Learned – Topics 2
	Summary
	Exercises and Further Reading
	Empirical Research in Software Engineering
378	Problems with Empirical Research – Topics 4
382	Investigating Products – Topics 4
385	Investigation resources – Topics 3
388	Investigating Processes – Topics 3
390	Measurement Today and Tomorrow – Topics 2
	Summary
	Exercises and Further Reading
	Appendix
	Solutions to Selected Exercises
	Metrics Tools

Software Metrics: Reference-2

Software Measurement and Estimation: A Practical Approach	
	Introduction
01	Objective
02	Approach
03	Motivation
	Summary
	References
	What to Measure
04	Method 1: The Goal Question Metrics Approach
05	Method 2: Decision Maker Model
06	Method 3: Standards Driven Metrics
07	Extension to GQM: Metrics Mechanism
08	What to Measure is a Function of Time
	Summary
	Problems, Project
	References
	Measurement Fundamentals
09	Initial Measurement Exercise
10	The Challenge of Measurement
15	Measurement Models – Topics 5
16	Meta-Model for Metrics
17	The Power of Measurement
24	Measurement Theory – Topics 7
25	Accuracy Versus Precision and the Limits of Software Metrics
	Summary
	Problems and Projects
	References
	Measuring Size
30	Physical Measurements of Software – Topics 5
38	Measuring Functionality – Topics 8
	Summary
	Problems and Project
	References
	Measuring Complexity
49	Structural Complexity – Topics 11
50	Conceptual Complexity
51	Computational Complexity
	Summary
	Problems and Project
	References
	Estimating Effort
52	Effort Estimation: Where Are We?
72	Software Estimation Methodologies and Models – Topics 20
73	Combining Estimates
76	Estimating Issues – Topics 3
77	Estimating Early and Often
	Summary
	Problems and Project

	References
	In Praise of Defects: Defects and Defect Metrics
78	Why Study and Measure Defects?
79	Faults Versus Failures
85	Defect Dynamics and Behaviors – Topics 6
93	Defect Projection techniques and Models – Topics 8
98	Additional Defect Benchmark Data – Topics 5
99	Cost Effectiveness of Defect Removal by Phase
100	Defining and Using Simple Defect Metrics: An Example
101	Some Paradoxical Patterns for Customer Reported Defects
	Answer to the Initial Questions
	Summary
	Problems and Project
	References
	Software Reliability Measurement and Prediction
102	Why Study and Measure Software reliability?
103	What is reliability?
104	Faults and Failures
105	Failure Severity Classes
106	Failure Intensity
107	The Cost of Reliability
112	Software Reliability Theory – Topics 5
114	Reliability Models – Topics 2
119	Failure Arrival Rates – Topics 5
120	But When Do I Ship??
121	System Configurations: Probability and Reliability
	Answers to Initial Question
	Summary
	Problems and Project
	References
	Response Time and Availability
122	Response Time Measurements
130	Availability – Topics 8
	Summary
	Problems and Project
	References
	Measuring Progress
131	Project Milestones
132	Code Integration
133	Testing Progress
135	Defects Discovery and Closure – Topics 2
136	Process Effectiveness
	Summary
	Problems and Project
	References
	Outsourcing
137	The ‘O’ Word
138	Defining Outsourcing
139	Risk Management and Outsourcing
140	Metrics and the Contract
	Summary

	Problems and Project
	References
	Financial Measures for the Software Engineer
141	It's All About the Green
142	Financial Concepts
155	Building the Business Case – Topics 13
156	Living the Business Case
	Summary
	Problems and Project
	References
	Benchmarking
157	What is Benchmarking?
158	Why Benchmark?
159	What to Benchmark
160	Identifying and Obtaining a Benchmark
161	Collecting Actual Data
162	Taking Action
163	Current Benchmarks
	Summary
	Problems and Project
	References
	Presenting Metrics Effectively to Management
164	Decide on the Metrics
165	Draw the Picture
166	Create a Dashboard
167	Drilling for Information
168	Example for the Big Cheese
169	Evolving Metrics
	Summary
	Problems and Project
	References

Software Requirements

	Requirements Engineering for Software and Systems
	Introduction to Requirements Engineering
01	Motivation
02	What is Requirements Engineering?
03	You Probably Don't Do Enough Requirement Engineering
04	What are Requirements?
05	Requirements Engineering Activities
06	Bodies of Knowledge
07	The Requirements Engineer
08	Requirements Engineer Roles
09	Role of the Customer
10	Problems with Traditional Requirements Engineering
11	Difficulties in Enveloping System Behavior
12	Exercises
	References
	Preparing for Requirements Elicitation
13	Production Mission Statement
14	Encounter with a Customer
15	Identifying the System Boundaries
16	Stakeholders
17	Customer Wants and Needs
18	Why Do Customers Change Their Minds?
19	Stakeholder Prioritization
20	Communicating with Customers and Other Stakeholders
21	Stakeholder Negotiations
22	Uncovering Stakeholder Goals
23	Exercises
	References
	Requirements Elicitation
24	Introduction
25	Preparing for Requirements Elicitation
31	Elicitation Techniques Survey – Topics 6
37	Elicitation Techniques Survey – Topics 6
43	Elicitation Techniques Survey – Topics 6
47	Elicitation Techniques Survey – Topics 4
48	Eliciting Nonfunctional Requirements
49	Elicitation Summary
50	Eliciting Hazards
51	Exercise
	References
	Writing the Requirements Document
52	Requirements Agreement and Analysis
53	Requirements Representation
54	ISO/IEC/IEEE Standard 29148
55	UML/SysML
56	The Requirement Document – Topics ½
57	The Requirement Document – Topics ½
58	Behavioral Specifications

59	Best Practices and Recommendations
60	Exercises
	Reference
	Requirements Risk Management
61	What is Requirements Risk Management?
62	Requirements Validation and Verification – Topics ½
63	Requirements Validation and Verification – Topics ½
64	Standards for V&V – Topics ½
65	Standards for V&V – Topics ½
66	NASA Requirements Testing – Topics ½
67	NASA Requirements Testing – Topics ½
68	Exercises
	Reference
	Formal Methods
69	Motivation
70	What Are Formal Methods?
71	Examples – Topics 1/3
72	Examples – Topics 1/3
73	Examples – Topics 1/3
74	Objections, Myths, and Limitations
75	Bowen and Hinchey’s Advice
76	Exercises
	Reference
	Requirements Specification and Agile Methodologies
77	Introduction to Agile Methodologies
78	Extreme Programming
79	Scrum
80	Requirements Engineering for Agile Methodologies – Topics ½
81	Requirements Engineering for Agile Methodologies – Topics ½
82	Writing User Stories
83	Agile Requirements Engineering
84	Challenges for Requirements Engineering in Agile Methodologies
85	Exercises
	Reference
	Tool Support for Requirements Engineering
86	Introduction
87	Traceability Support
88	Requirements Management Tools
89	Open-Source Requirements Engineering Tools
90	Requirements Engineering Tool Best Practices
91	Elicitation Support Technologies
92	Requirements Metrics
93	Exercises
	References
	Requirements Management
94	Introduction
95	Configuration Management and Control
96	Reconciling Differences
97	Expectation Revisited: Pascal’s Wager
98	Global Requirements Management
99	Anti-patterns in Requirements Management – Topics ½

100	Anti-patterns in Requirements Management – Topics ½
111	Other Paradigms for Requirements Management
112	Standards for Requirements Management
113	Exercises
	References
	Value Engineering of Requirements
114	What, Why, When, and How of Value Engineering
115	Estimating Using COCOMO and Its Derivatives
116	Estimating Using Function Points
117	Requirements Feature Cost Justification – Topics ½
118	Requirements Feature Cost Justification – Topics ½
119	Putting It All Together
120	Exercises
	References
	Appendix
121	Software Requirements Specification for a Smart Home
122	Software Requirements for a Wastewater Pumping Station Web Well Control System
123	Unified Modeling Language (UML)
124	User Stories
125	Use Case
126	IBM DOORS Requirements Management Tool

Software Maintenance

	Effective Software Maintenance and Evolution: A Reuse-Based Approach
	Introduction
	Chapter Summary
01	Background
02	The Problem of Software Change
03	Software Evolution and Its Challengers
04	About This Book
	References
	Conventional Methods of Software Maintenance and Evolution
	Static Program Analysis Methods
	Chapter Summary
05	Introduction to Static Program Analysis
06	Approaches to Static Program Analysis
07	How Does an SPA Work?
08	Source Language: SIMPLE
14	Program Design Abstractions for SIMPLE – Topics 6
20	Querying Programs with PQL – Topics 6
21	Design of PQL and SPA
22	Optimizing the Performance of Query Evaluation
23	PQL for COBOL
24	Conclusions
	References
	Reverse Engineering Methods
	Chapter Summary
25	Review of Approaches to Reverse Engineering
26	Incremental and Interactive reverse Engineering Process
27	Recovering Object Models from Code
28	Object recovery Heuristics
29	Semiautomatic Recovery of Abstract Objects as Candidates for Classes
30	A Plan for Semiautomatic Recovery of Abstract Data Types as Candidates for Classes
31	Specifying Reverse Engineering Heuristics in PQL
32	Specifying Object Recovery Heuristics for C Programs
33	Generation of Recovered Design Views in Extended PQL
34	Conclusions
	References
	Model-Based Design for Ease of Maintenance
	Chapter Summary
35	The Role of Models in the Design of Software Tools
36	The concept of Model-Based Design
37	Model-Based PQL Query Validator in SPA and REA
38	Model-Based Design of the PQL Query Evaluator in SPA and REA
45	Model-Based Design of a Software Project-Support Environment – Topics 7
46	Conclusions
	References
	Evolution of Versions and Configuration Management
	Chapter Summary
47	A Working Example: FRS Evolution
48	FRS Component Architecture

49	Evolution of FRS with CVS
50	Reuse of Features Implemented in Past releases When Building New System Releases
51	Adding New Features to a System Release
52	Selective Propagation of New Features to Past Releases
53	The Visibility of Changes During Evolution
54	Explosion of Variant Features and Feature Dependencies
55	Lessons Learned
56	Related Work
57	Conclusions
	References
	Limits of Conventional Techniques
	Chapter Summary
58	Software Complexity Factor
59	Tackling Software Evolution Challenges
60	Conclusions
	References
	Reuse-Based Software Maintenance and Evolution
	The Mixed-Strategy Approach: An Overview
	Chapter Summary
61	Concepts of Reuse-Based Evolution
62	Change-Design versus Design for Change
63	Concepts of the Mixed-Strategy Approach
65	A Preview of the Mixed-Strategy Approach: An Example – Topics 2
66	The Role of Genericity in the Mixed-Strategy Approach
67	Conclusions
	References
	Step-by-Step Introduction to XVCL
	Chapter Summary
68	Salient Features of XVCL
69	Flexible Composition of X-Frames
71	Defining Compositions with XVCL – Topics 2
72	Specifying Small-Granularity Changes
73	Changes at Various Abstraction Levels
74	Defining Generic Structures and Generators
75	Capturing Change Traces and Similarity Patterns in Evolutionary Changes
76	Handling Implementation Dependencies Among Features
84	Summary of XVCL Rules – Topics 8
85	Conclusions
	References
	Software Similarities: Symptoms and Causes
	Chapter Summary
86	The Problem of Software Similarities and Cloning
87	Software Similarities and Reuse
88	Software Similarities and Generic Design
89	Software Similarities, Genericity, and Software Complexity
97	Similarity Patterns in the Buffer Library: An Example – Topics 8
98	Similarity Patterns and Clones in STL
103	Similarity Patterns in Application Programs – Topics 5
104	General Implications
105	Identifying Similarity Patterns and Automated Detection of Clones
106	Conclusions

	References
	The Mixed-Strategy Approach to Generic Design
	Chapter Summary
110	Buffer Library in Java/XVCL Mixed-Strategy Representation – Topics 4
113	Evaluation of the Mixed-Strategy Buffer Library Solution – Topics 3
114	Conclusions
	References
	Evolution with the Mixed-Strategy Approach
	Chapter Summary
115	Introduction
116	Stages of FRS Evolution
117	An Overview of the FRS X-Framework
118	Development of a New System Release
119	Specifying Changes for FRS-DATE
120	Specifying Changes for FRS-USER and FRS-DATE,USER
121	Specifying Changes for FRS-DATE,USER,PREF
122	Specifying Changes for FRS-DATE,USER,PAY
123	Specifying Changes for FRS-DATE,USER,PREF,PAY
124	Specifying Changes for FRS-DATE,USER,PAY,BR
125	Specifying Changes for FRS-DATE,USER,PAY,BR,BRD
126	Specifying Changes for FRS-USER,BR
127	Specifying Changes for FRS-USER-PD,BR
128	Conclusion
	Scaling Up the Mixed-Strategy Approach
	Chapter Summary
129	Introduction
132	Modeling Features Arising During Evolution – Topics 3
133	A Mixed-Strategy Evolution Support Environment (MESE)
134	An FRS Architecture with Connectors
135	Generic Connectors in the FRS X-Framework
136	Comments on X-Framework Organization Principles
137	An Overview of the X-Framework Customization Process
138	Customization and Assembly Passes Over an X-Framework
139	Using the Customization Decision Tree (CDT)
141	Using MESE to Customize and Evolve the FRS X-Framework: An Example – Topics 2
142	Assembly Pass
143	Related Work on Product Line Research
144	Conclusions
	References
	The Mixed-Strategy Approach in Other Projects
	Chapter Summary
145	STL in C++/XVCL
146	DEMS in C#/XVCL
147	Web Portal Product Line in ASP/XVCL
148	CAP-WP in J2EE/XVCL
149	Role-Playing Games (RPG) for Mobile Phones
150	Conclusions
	References
	Other Techniques Related to XVCL
	Chapter Summary
151	Frame Technology

152	Conventional Techniques
153	Generation Techniques
154	Separation of Concerns and Its Relation to Generic Design
155	Conclusions
	References
	Evaluation of the Mixed-Strategy Approach
	Chapter Summary
156	Summary of the Mixed-Strategy Approach
158	The Mixed-Strategy Process – Topics 2
159	Trade-Offs Involved in Applying the Mixed-Strategy Approach
160	XVCL Workbench
	References
	Conclusions
	Appendix

Cloud Computing and Virtualization

	Cloud Computing: Concepts, Technology and Architecture
	Introduction
01	Objectives of This Book
02	What This Book Does Not Cover
03	Who This Book is for
04	How This Book is Organized
05	Part-1: Fundamental Cloud Computing
06	Understanding Cloud Computing
07	Fundamental Concepts and Models
08	Cloud-Enabling Technology
09	Fundamental Cloud Security
10	Part-2: Cloud Computing Mechanisms
11	Cloud Infrastructure Mechanisms
12	Specialized Cloud Mechanisms
13	Cloud Management Mechanisms
14	Cloud Security Mechanisms
15	Part-3: Cloud Computing Architecture
16	Fundamental Cloud Architectures
17	Advanced Cloud Architectures
18	Specialized Cloud Architectures
19	Part-4: Working with Clouds
20	Cloud Delivery Model Considerations
21	Cost Metrics and Pricing Models
22	Service Quality Metrics and SLAs
23	Part-5: Appendices
24	Case Study Conclusions
25	Mapping Mechanisms to Characteristics
26	Data Center Facilities (TIA-942)
27	Emerging Technologies
28	Cloud Provisioning Contracts
29	Cloud Business Case Template
	Case Study Background
30	Case Study 1: ATN
31	Technical Infrastructure and Environment
32	Business Goals and New Strategy
33	Roadmap and Implementation Strategy
34	Case Study 2: DTGOV
35	Technical Infrastructure and Environment
36	Business Goals and New Strategy
37	Roadmap and Implementation Strategy
38	Case Study 3: Innovartus Technologies Inc.
39	Technical Infrastructure and Environment
40	Business Goals and Strategy
41	Roadmap and Implementation Strategy
	Part-01: Fundamental Cloud Computing
	Understanding Cloud Computing
42	Origins and Influences
43	A Brief History

44	Definition
45	Business Drivers – Topics 3
46	Technology Innovations – Topics 4
47	Basic Concepts and Terminology
48	Cloud
49	IT Resource
50	On-Premise
51	Cloud Consumers and Cloud Providers
52	Scaling – Topics 2
53	Cloud Service
54	Cloud Service Consumer
55	Goals and Benefits
56	Reduced Investments and Proportional Cost
57	Increased Scalability
58	Increased Availability and Reliability
59	Risks and Challenges
60	Increased Security Vulnerabilities
61	Reduced Operational Governance Control
62	Limited Portability Between Cloud Providers
63	Multi-Regional Compliance and Legal Issues
	Fundamental Concepts and Models
64	Roles and Boundaries
65	Cloud Provider
66	Cloud Consumer
67	Cloud Service Owner
68	Cloud Resource Administrator
69	Additional Roles
70	Organizational Boundary
71	Trust Boundary
72	Cloud Characteristics
73	On-Demand Usage
74	Ubiquitous Access
75	Multitenancy (and Resource Pooling)
76	Elasticity
77	Measured Usage
78	Resiliency
79	Cloud Delivery Models
80	Infrastructure-as-a-Service (IaaS)
81	Platform-as-a-Service (PaaS)
82	Software-as-a-Service (SaaS)
83	Comparing Cloud Delivery Models
84	Combining Cloud Delivery Models – Topics 2
85	Cloud Deployment Models
86	Public Clouds
87	Community Clouds
88	Private Clouds
89	Hybrid Clouds
90	Other Cloud Deployment Models
	Cloud-Enabling Technology
91	Broadband Networks and Internet Architecture
92	Internet Service Providers (ISPs)

93	Connectionless Packet Switching (Datagram Networks)
94	Router-Based Interconnectivity – Topics 3
95	Technical and Business Considerations – Topics 3
96	Data Center Technology
97	Virtualization
98	Standardization and Modularity
99	Automation
100	Remote Operation and Management
101	High Availability
102	Security-Aware Design, Operation, and Management
103	Facilities
104	Computing Hardware
105	Storage Hardware
106	Network Hardware – Topics 5
107	Other Considerations
108	Virtualization Technology
109	Hardware Independence
110	Server Consolidation
111	Resource Replication
112	Operating System-Based Virtualization
113	Hardware-Based Virtualization
114	Virtualization Management
115	Other Considerations
116	Web Technology
117	Basic Web Technology
118	Web Application
119	Multitenant Technology
120	Service Technology
121	Web Services
122	REST Services
123	Service Agents
124	Service Middleware Case Study Example
	Fundamental Cloud Security
125	Basic Terms and Concepts
126	Confidentiality
127	Integrity
128	Authenticity
129	Availability
130	Threat
131	Vulnerability
132	Risk
133	Security Controls
134	Security Mechanisms
135	Security Policies
136	Threat Agents
137	Anonymous Attacker
138	Malicious Service Agent
139	Trusted Attacker
140	Malicious Insider
141	Cloud Security Threats
142	Traffic Eavesdropping

143	Malicious Intermediary
144	Denial of Service
145	Insufficient Authorization
146	Virtualization Attack
147	Overlapping Trust Boundaries
148	Additional Considerations
149	Flawed Implementations
150	Security Policy Disparity
151	Contracts
152	Risk Management Case Study Example
	Part-02: Cloud Computing Mechanisms
	Cloud Infrastructure Mechanisms
153	Logical Network Perimeter Case Study Example
154	Virtual Server Case Study Example
155	Cloud Storage Device
156	Cloud Storage Levels
157	Network Storage Interfaces
158	Object Storage Interfaces
159	Database Storage Interfaces – Topics 2
160	Case Study Example
161	Cloud Usage Monitor
162	Monitoring Agent
163	Resource Agent
164	Polling Agent Case Study Example
165	Resource Replication Case Study Example
166	Ready-Made Environment Case Study Example
	Specialized Cloud Mechanisms
167	Automated Scaling Listener Case Study Example
168	Load Balancer Case Study Example
169	SLA Monitor Case Study Example – Topics 2
170	Pay-Per-Use Monitor Case Study Example
171	Audit Monitor Case Study Example
172	Failover System
173	Active-Active Case Study Example
174	Hypervisor Case Study Example
175	Resource Cluster Case Study Example
176	Multi-Device Broker Case Study Example
177	State Management Database Case Study Example
	Cloud Management Mechanisms
178	Remote Administration System Case Study Example
179	Resource Management System Case Study Example
180	SLA Management System Case Study Example
181	Billing Management System Case Study Example
	Cloud Security Mechanisms
182	Encryption
183	Symmetric Encryption
184	Asymmetric Encryption Case Study Example
185	Hashing Case Study Example
186	Digital Signature Case Study Example
187	Public Key Infrastructure (PKI) Case Study Example
188	Identity and Access Management (IAM) Case Study Example

189	Single Sign-On (SSO) Case Study Example
190	Cloud-Based Security Groups Case Study Example
191	Hardened Virtual Server Images Case Study Example
	Part-03: Cloud Computing Architecture
	Fundamental Cloud Architectures
192	Workload Distribution Architecture
193	Resource Pooling Architecture
194	Dynamic Scalability Architecture
195	Elastic Resource Capacity Architecture
196	Service Load Balancing Architecture
197	Cloud Bursting Architecture
198	Elastic Disk Provisioning Architecture
199	Redundant Storage Architecture Fundamental Cloud Architectures
	Advanced Cloud Architectures
200	Hypervisor Clustering Architecture
201	Load Balanced Virtual Server Instances Architecture
202	Non-Disruptive Service Relocation Architecture
203	Zero-Disruptive Service Relocation Architecture
204	Cloud Balancing Architecture
205	Resource Reservation Architecture
206	Dynamic Failure Detection and Recovery Architecture
207	Bare-Metal Provisioning Architecture
208	Repaid Provisioning Architecture
209	Storage Workload Management Architecture
210	Case Study Example
211	Specialized Cloud Architectures
212	Direct I/O Access Architecture
213	Direct LUN Access Architecture
214	Dynamic Data Normalization Architecture
215	Elastic Network Capacity Architecture
216	Cross-Storage Device Vertical Tiering Architecture
217	Intra-Storage Device Vertical Tiering Architecture
218	Load Balanced Virtual Switches Architecture
219	Multipath Resource Access Architecture
220	Persistent Virtual Network Configuration Architecture
221	Redundant Physical Connection for Virtual Servers Architecture
	Part-04: Working with Clouds
	Cloud Delivery Model Considerations
222	Cloud Delivery Models: The Cloud Provider Perspective
223	Building IaaS Environments – Topics 4
224	Equipping PaaS Environments – Topics 3
225	Optimizing SaaS Environments Security
	Cloud Delivery Models: The Cloud Consumer Perspective
226	Working with IaaS Environments
227	IT Resource Provisioning Considerations
228	Working with PaaS Environments
229	IT Resource Provisioning Considerations
230	Working with SaaS Services
231	Case Study Example
	Cost Metrics and Pricing Models
232	Business Cost Metrics

233	Up-Front and On-Going Costs
234	Additional Costs Case Study Example
235	Product Catalog Browser – Topics 4
236	Client Database – Topics 4
237	Cloud Usage Cost Metrics
238	Network Usage – Topics 3
239	Server Usage – Topics 2
240	Cloud Storage Device Usage – Topics 2
241	Cloud Service Usage – Topics 3
242	Cost Management Considerations
243	Pricing Models
244	Additional Considerations Case Study Example
245	Virtual Server On-Demand Instance Allocation
246	Virtual Server Reserved Instance Allocation
247	Cloud Storage Device
248	WAN Traffic
	Service Quality Metrics and SLAs
249	Service Quality Metrics
250	Service Availability Metrics – Topics 2
251	Service Reliability Metrics – Topics 2
252	Service Performance Metrics – Topics 7
253	Service Scalability Metrics – Topics 3
254	Service Resiliency Metrics – Topics 2
255	Case Study Example
256	SLA Guidelines
257	Case Study Example – Topics 5
	Virtualization Essential