Table of Contents

Chapter One Introduction to Quality 1

Improvement 2

The Meaning of Quality and Quality

	Impr	ovement 2	3.1	Intr	oduction 75		
1.1.1 Dimensions of Quality 3		3.2	Cha	Chance and Assignable Causes of Quality Variation 76			
1.1.2 Quality Terminology 6						of (
.2	A Bri	ef History of Quality Control	3.3	The	e Control Chart 78		
	and	Improvement 8	3.4		e Rest of the Magnificent		
.3	Statistical Methods for Quality Control		Seven 84				
		Improvement 13	3.5	Implementing SPC in a Quality Improvement Program 89			
1.4		ity and Productivity 17	3.6				
1.5		ity Costs 18	3.7	and Instruments with Halling of			
1.6		al Aspects of Quality 24	r tixus	Process Control and Quality			
1.7	Imple	ementing Quality Improvement 26			provement Tools in		
Cha	nter T	wo Management Aspects	Transactional and Service Businesses 97				
	ality						
		200 minute and Day of Pa		Chapter Four Statistical Inference about			
2.1		duction 30	Product and Process Quality 108		d Process Quality 108		
2.2	Historical Development of Quality Philosophy 31		4.1	De	scribing Variation 110		
2.3	Total	Quality Management 39	4	.1.1	Stem and Leaf Plot 110		
2.4	Qual	Quality Systems and Standards 40		.1.2	Histogram 112		
2.5	Six-S	Sigma 45	4	.1.3	Numerical Summary of Data 115		
2.6	Beyo	ond Six-Sigma—DFSS	4	.1.4	The Box Plot 118		
	and	Lean 50	4.2	Pro	bability Distributions 119		
2.7	The	DMAIC Process 55	4.3	The	e Normal Distribution 123		
2.	7.1	The Define Step 59	4	.3.1	The Central Limit		
2.	7.2	The Measure Step 61			Theorem 128		
2.	7.3	The Analyze Step 62	4	.3.2	Normal Probability Plots 130		
2	7.4	The Improve Step 64	4.4	Sta	atistical Inference 131		
2	7.5	The Control Step 64	4.5				
2	.7.6	Examples of DMAIC 65			mple 132		

Chapter Three Tools and Techniques for Quality Control and Improvement 74

4.5.1	Confidence Interval for a Mean When More Than 30 Data Points are Available 133	and	example Applications of \overline{X} , R , S , and Individuals Charts 190		
4.5.2	Confidence Interval for a Mean When Less Than 30 Data Points are Available 134	Cha 5.8 Exp	nulative Sum Control rts 192 onentially Weighted Moving		
4.5.3		5.9 Prod	rage Control Charts 197 cess Capability Analysis Using atrol Charts 201		
4.5.4	Confidence Interval for Variances 136				
	Statistical Inference for Two Samples 137	Chapter Six Control Charts for Attributes 231			
4.6.1	Confidence Interval for Differences in Means When	6.1 Intro	oduction 232		
	More Than 30 Data Points are Available 138		Control Chart for Fraction aconforming 233		
4.6.2	2 Confidence Interval for Differences in Means When Less Than 30 Data Points are Available 139	6.2.1	Subgroup Sample Size 240		
			The <i>np</i> Chart 244		
4.6.3	the Differences of Proportions 140	(Defects) 245			
			The c Chart 246		
4.6.4		6.3.2	The <i>u</i> Chart 251 Variable Sample		
4.6.5	Relationship between		Sizes 253		
	Confidence Intervals and Formal Hypothesis Testing 142	6.4 Choice between Attributes and Variables Control Charts 255			
Chapter	r Five Control Charts for s 162		delines for Implementing Control arts 258 Determining which Characteristics to Control and Where to Put the		
5.1 Introduction 163		6.5.2	Chaosing the Proper Type of		
5.2	R and R Charts 174	0.5.2	Choosing the Proper Type of Control Chart 259		
			Actions Taken to Improve the Process 260 Selection of Data-Collection Systems and Computer Software 261		
5.4 Shewart Control Chart for Individual Measurements 186		34			
5.5 Summary of Procedures for \overline{X} , R , S , and Individuals Charts 189		6.5.4			

Chapter Se	even Lot-by-Lot Acceptance	7.6 MII	STD 414 (ANSI/ASQC Z1.9) 319		
Sampling Pr	ocedures 281	7.6.1 General Description of the Standard 319			
7.1 The Acceptance-Sampling Problem 282		7.6.2 Use of the Tables 321			
7.1.1	Advantages and Disadvantages of Sampling 284	7.6.3 7.7 Ch	Discussion 323 ain Sampling 325		
7.1.2	Types of Sampling Plans 285	7.8 Co	ntinuous-Sampling 326		
7.1.3	Lot Formation 285	7.8.1	CSP-1 327		
7.1.4	Random-Sampling 286	7.8.2	Other Continuous-Sampling Plans 328		
7.1.5	Guidelines for Using Acceptance-Sampling 287	7.9 Ski	p-Lot Sampling Plans 330		
Attrik	e-Sampling Plans for outes 288	Chapter Eight Process Design			
7.2.1	Definition of a Single-Sampling Plan 288	Experimen	vement with Designed nts 336		
7.2.2	The OC Curve 288	8.1 Wh	nat is Experimental Design? 337		
7.2.3	Designing a Single-Sampling Plan with a Specified OC Curve 292	8.2 Exa	amples of Designed periments in Process and		
7.2.4	Rectifying Inspection 294	Product Improvement 339			
	ole-, Multiple-, and Sequential- pling 297		idelines for Designing periments 342		
7.3.1	Double-Sampling Plans 297	8.4 The	e Analysis of Variance 344		
7.3.2	Multiple-Sampling Plans 303	8.5 Fac	ctorial Experiments 353		
7.3.3	XON- Vount	8.5.1	An Example 354		
7.0.0	Sequential-Sampling Plans 303	8.5.2	Statistical Analysis 355		
7.4 Military Standard 105E		8.5.3	Residual Analysis 360		
	ASQC Z1.4, ISO 2859) 306	8.6 Th	e 2 ^k Factorial Design 361		
7.4.1	Description of the Standard 306	8.6.1	The 2 ² Design 361		
7.4.2	Procedure 309	8.6.2	The 2^k Design for $k \ge 3$		
7.4.3	Discussion 310		Factors 367		
	Dodge-Romig Sampling s 315	8.6.3	A Single Replicate of the 2 ^k Design 378		
7.5.1	AOQL Plans 316	8.6.4	Addition of Center Points to		
7.5.2	LTPD Plans 316		the 2 ^k Design 383		

8.6.5 Blocking and Confounding in the 2 ^k Design 388		Appendix 448	
8.7	Fractional Replication of the 2 ^k Design 389	One	Summary of Common Probability Distributions Often Used in Quality Control and Improvement 448
8.	7.1 The One-Half Fraction of the 2 ^k Design 389	Two	Cumulative Standard Normal Distribution 456
8.	7.2 Smaller Fractions: The 2^{k-p} Fractional Factorial Design 395	Three	Percentage Points of the x^2 Distributions 458
8.8	Response Surface Methods 397	Four	Percentage Points of the t Distributions 459
8.9	Robust Product and Process Design 403	Five	Percentage Points of the F Distributions 460
Chapter Nine Reliability 422		Six	Factors for Constructing Variables Control Charts 465
9.1	Basic Concepts of Reliability 423 Life Distributions 424	References 466 Glossary 475	
9.3	Instantaneous Failure Rate 427 Life Cycle Reliability 431		
9.5	Determining System Reliability from Component Reliabilities 431	Answers to Selected Exercises 489	
9.6	Life Testing and Reliability Estimation 438	Chapter Opener Photo Credits 496	
9.7	Availability and Maintainability 441		
9.8	Failure Mode and Effects Analysis 442	Index	497