

Contents

CHAPTER	PAGE
1. THE BASIC IDEAS	
1.1 Introduction	3
1.2 Small-Scale and Plant-Scale Investigation	6
1.3 Analogy with Biological Natural Selection	8
1.4 Static and Evolutionary Operation	10
1.5 Cutting the Grass	11
1.6 An Example	13
1.7 An Analysis of the Information Board	15
1.8 A Three-Variable Scheme	16
1.9 The EVOP Committee	18
1.10 When Not to Stop	20
2. SIMPLE STATISTICAL PRINCIPLES ON WHICH EVOP IS BASED	
2.1 Industrial Processes, Observations and the Dot Diagram	23
2.2 Frequency Distributions	30
2.3 Distribution Characteristics: Mean and Variance	33
2.4 The Normal Distribution	36
2.5 Estimates of Mean and Standard Deviation from a Sample.	41
2.6 Distribution of the Sample Average (or Sample Mean)	46
2.7 Mean Value and Variance of Important Contrasts	50
2.8 Making Inferences in the Presence of Uncertainty: Significance Tests and Confidence Intervals	55
3. THE 2^2 AND 2^3 FACTORIAL DESIGNS	
3.1 Factorial Designs	63
3.2 The 2^2 Factorial Design	65

CHAPTER	PAGE
3.3 The 2^3 Factorial Design	79
3.4 Dividing the 2^3 Factorial Design into Two Blocks	99
3.5 Summary	104
 4. WORKSHEETS FOR TWO-VARIABLE EVOP PROGRAMS	
4.1 Introduction	105
4.2 Worksheets for a 2^2 Factorial Design with Added Reference Conditions	109
4.3 Worksheets for a 2^2 Factorial without Additional Reference Conditions	117
 5. WORKSHEETS FOR THREE-VARIABLE EVOP PROGRAMS	
5.1 Introduction	119
5.2 Worksheets for a 2^3 Factorial Arranged in Two Blocks with a Reference Run in Each Block	120
5.3 Worksheets for a Blocked 2^3 Factorial without Additional Reference Runs	129
5.4 Simplicity and Sophistication	132
5.5 Block-to-Block Variation and the Standard Error of the Phase Mean	132
 6. SOME ASPECTS OF THE ORGANIZATION OF EVOLUTIONARY OPERATION	
6.1 Training Program	135
6.2 Simulation of Two-Variable EVOP: The EVOP Game	141
6.3 Aids to Successful EVOP	147
 7. EVOP, OPTIMIZATION, AND VARIATIONS OF EVOP	
7.1 Introduction	152
7.2 Optimization Methods and EVOP	160
7.3 Some Optimization Techniques Related to EVOP	164
7.4 Some Optimization Techniques Unrelated to EVOP	175
7.5 Some Suggested Modifications of EVOP	175
 8. COMMENTS AND QUESTIONS ON EVOP	
8.1 A Discussion of Some Objections, Comments, and Queries	180
 APPENDIX 1. THE APPROXIMATE METHOD OF ESTIMATING THE STANDARD DEVIATION IN EVOP (See Section 4.2)	196

CHAPTER	PAGE
APPENDIX 2. GENERATING DATA FOR THE EVOP GAME (See Section 6.2) . . .	198
APPENDIX 3. OPTIMAL EMPIRICAL FEEDBACK (See Section 7.1)	200
3A. Choice of Strategy Using Empirical Feedback to Achieve the Greatest Gain in a Fixed Time	200
3B. Choice of Strategy Using Empirical Feedback to Achieve Maximum Increase in a Response y When the Process Function is a Linear Function of a Variable w	209
APPENDIX 4. HOW MANY CYCLES ARE NECESSARY TO DETECT EFFECTS OF REASONABLE SIZE? (See Section 7.1)	211
 TABLES	
Table I. Normal distribution (single-sided)	218
Table II. Probability points of the normal distribution (single-sided) . . .	220
Table III. Probability points of the normal distribution (double-sided) . . .	220
Table IV. A table of factors w_k which convert the range of a normal sample of size k into an estimate of the standard deviation . . .	222
Table V. A table of values of $f_{k,n}$	222
Table VI. Useful factors for EVOP calculations	223
Table VII. A short table of random normal deviates	224
REFERENCES AND BIBLIOGRAPHY	227
INDEX	233