Contents

PREFACE: TO THE TEACHER

PREFACE: TO THE STUDENT

1. SETS AND FUNCTIONS

- 1.1 Sets
- 1.2 Ways of Specifying Sets
- 1.3 Universal Sets
- 1.4 Subsets
- 1.5 Finite and Infinite Sets
- 1.6 Venn Diagrams
- 1.7 The Empty Set
- 1.8 New Sets from Old: Operations with Sets
- 1.9 The Intersection of Sets
- 1.10 The Complement of a Set
- 1.11 The Partition of a Set
- 1.12 The Difference between Two Sets
- 1.13 The Algebra of Sets
- 1.14 Postulates and Theorems about Sets
- 1.15 Set Products and Relations

- 1.16 Specifying Relations 1.17 The Importance of I
- .17 The Importance of Mathematical Relations
- 1.18 The Domain and Range of a Relation
- 1.19 Functional Relations
- 1.20 Weight Functions and Measure Functions on Sets
- 1.21 Variables and Functional Notation
- 1.22 Independent and Dependent Variables
- 1.23 Continuous Variables and Functions
- 1.24 Functions with Several Independent Variables
- 1.25 Functions and Precise Prediction
- 1.26 Statistics in the Search for Relations

2. ELEMENTARY PROBABILITY THEORY

- 2.1 Simple Experiments2.2 Events
- 2.3 Events as Sets
- 2.4 Families of Events
- 2.5 Probability Functions
- 2.6 A Special Case: Equally Probable Elementary Events
- 2.7 "In the Long Run"

- 2.8 Bernoulli's Theorem
- 2.9 An Example of Simple Statistical Inference
- 2.10 Other Interpretations of Probability
- 2.11 Probabilities, Betting, Odds, and Lotteries
- 2.12 Random Sampling
- 2.13 Random Number Tables
- xiii

47

ii v

3. FREQUENCY AND PROBABILITY DISTRIBUTIONS

- 3.1 Measurement Scales
- 3.2 Measurement Levels and Statistical Methods
- 3.3 Frequency Distributions
- 3.4 Frequency Distributions with a Small Number of Measurement Classes
- 3.5 Grouped Distributions
- 3.6 Class Interval Size and Class Limits
- 3.7 Interval Size and the Number of Class Intervals
- 3.8 Midpoints of Class Intervals
- 3.9 Another Example of a Grouped Frequency Distribution
- 3.10 Frequency Distributions with Open or Unequal Class Intervals
- 3.11 Graphs of Distributions: Histograms

- 3.12 Frequency Polygons
- 3.13 Cumulative Frequency Distributions
- 3.14 Probability Distributions
- 3.15 Random Variables
- 3.16 Discrete Random Variables
- 3.17 Graphs of Probability Distributions
- 3.18 Function Rules for Discrete Random Variables
- 3.19 Continuous Random Variables
- 3.20 Cumulative Distribution Functions
- 3.21 Graphic Representations of Continuous Distributions
- 3.22 Continuous Random Variables as an Idealization
- 3.23 Frequency and Probability Distributions in Use

4. JOINT EVENTS AND INDEPENDENCE

- 4.1 Joint Events
- 4.2 Combining Probabilities of Joint Events
- 4.3 Conditional Probability
- 4.4 Relations among Conditional Probabilities
- 4.5 Bayes' Theorem
- 4.6 Independence
- 4.7 Representing Joint Events in Tables

- 4.8 Independence of Random Variables
- 4.9 Independence of Functions of Random Variables
- 4.10 Representation of Joint Random Variables
- 4.11 Joint Frequency Distributions and Inferences about Association
- 4.12 Statistical Relations and Association

5. SOME DISCRETE RANDOM VARIABLES: THE BINOMIAL, PASCAL, AND POISSON DISTRIBUTIONS

- 5.1 Computing Probabilities
- 5.2 Sequences of Events
- 5.3 Number of Possible Sequences for N Trials: Counting Rule 1
- 5.4 Counting Rule 2
- 5.5 Counting Rule 3: Permutations
- 5.6 Counting Rule 4: Ordered Combinations
- 5.7 Counting Rule 5: Combinations
- 5.8 Some Examples: Poker Hands
- 5.9 Bernoulli Trials
- 5.10 Sampling from a Bernoulli Process
- 5.11 Number of Successes as a Random Variable: The Binomial Distribution
- 5.12 The Binomial Distribution and the Binomial Expansion
- 5.13 Probabilities of Intervals in the Binomial Distribution

- 5.14 The Binomial Distribution of Proportions
- 5.15 The Form of a Binomial Distribution
- 5.16 The Binomial as a Sampling Distribution
- 5.17 A Preview of a Use of the Binomial Distribution
- 5.18 The Sign and the Median Tests for Two Groups
- 5.19 The Pascal and Geometric Distributions
- 5.20 Some Uses of Pascal Distributions
- 5.21 The Poisson Distribution
- 5.22 Solving Problems through the Use of the Poisson Distribution
- 5.23 The Multinomial Distribution
- 5.24 The Hypergeometric Distribution

140

6. CENTRAL TENDENCY AND VARIABILITY

- 6.1 The Summation Notation6.2 Measures of Central Tendency
- 6.3 The Mode
- 6.4 The Median
- 6.5 The Arithmetic Mean
- 6.6 The Mean as the "Center of Gravity" of a Distribution
- 6.7 "Best Guess" Interpretations of the Mode and Median
- 6.8 Central Tendency in Discrete Probability Distributions
- 6.9 The Mean of a Random Variable as the Expectation
- 6.10 A Theoretical Expectation: The Mean of the Binomial Distribution
- 6.11 The Algebra of Expectations: Appendix B
- 6.12 The Expectation of a Continuous Random Variable
- 6.13 The Mean as a Parameter of a Probability Distribution
- 6.14 The Mode and Median of a Continuous Distribution
- 6.15 Relations between Central Tendency Measures and the "Shapes" of Distributions

- 6.16 Measures of Dispersion in Frequency Distributions
- 6.17 The Standard Deviation
- 6.18 The Computation of the Variance and Standard Deviation
- 6.19 Some Meanings of the Variance and Standard Deviation
- 6.20 The Mean as the "Origin" for the Variance
- 6.21 The Variance of a Discrete Random Variable
- 6.22 An Example of the Variance of a Discrete Random Variable: The Binomial Distribution Once Again
- 6.23 The Variance of a Continuous Ran-Dom Variable
- 6.24 Moments of Distribution
- 6.25 Percentiles and Percentile Ranks
- 6.26 The Relative Location of a Score in a Frequency Distribution: Standardized Scores
- 6.27 Standardized Scores in Probability Distributions
- 6.28 Tchebycheff's Inequality

7. SAMPLING DISTRIBUTIONS AND POINT ESTIMATION

- 7.1 Populations, Parameters, and Statistics
- 7.2 Sampling Distributions
- 7.3 Characteristics of Single-Variate Sampling Distributions
- 7.4 The Mean and Variance of a Sampling Distribution
- 7.5 Sample Statistics as Estimators
- 7.6 The Principle of Maximum Likelihood
- 7.7 Unbiased Estimators
- 7.8 Consistency
- 7.9 Relative Efficiency
- 7.10 Sufficiency
- 7.11 The Sample Mean as an Estimator
- 7.12 The Variance and Standard Error of the Mean
- 7.13 Standardized Scores Corresponding to Sample Means

- 7.14 Sample Size and Estimation
- 7.15 Correcting the Bias in the Sample Variance as an Estimator
- 7.16 Estimating the Standard Deviation of the Population and the Standard Error of the Mean
- 7.17 Parameter Estimates Based on Pooled Samples
- 7.18 Sampling from Finite Populations
- 7.19 The Sample Proportion as an Unbiased Estimator
- 7.20 The Sampling Distribution of the Sample Variance and of Other Statistics
- 7.21 The Uses of Sampling Distributions
- 7.22 Other Kinds of Sampling
- 7.23 To What Populations Do Our Inferences Refer?

8. NORMAL POPULATION AND SAMPLING DISTRIBUTIONS

- 8.1 The Normal Distribution
- 8.2 Cumulative Probabilities and Areas for the Normal Distribution
- 8.3 The Use of Tables of the Normal Distribution
- 8.4 The Importance of the Normal Distribution
- 8.5 The Normal Approximation to the Binomial
- 8.6 The Theory of the Normal Distribution of Error
- 8.7 Statistical Properties of Normal Population Distributions

- 8.8 Independence of Sample Mean and Variance
- 8.9 **Distributions of Linear Combinations** of Scores
- 8.10 Means and Variances of Linear Combinations
- 8.11 The Central Limit Theorem
- 8.12 The Central Limit Theorem and Linear Combinations of Means
- 8.13 Using the Normal Distribution in Inferences about Means
- 8.14 The Gamma and Beta Families of Distributions

9. HYPOTHESIS TESTING AND INTERVAL ESTIMATION

- 9.1 Statistical Tests
- 9.2 Statistical Hypotheses
- 9.3 Assumptions in Hypothesis Testing
- 9.4 Testing a Hypothesis in the Light of Sample Evidence
- 9.5 Choosing a Way to Decide between Two Exact Hypotheses
- 9.6 Errors and Losses
- 9.7 Expected Loss as a Criterion for Choosing a Decision-Rule
- 9.8 Subjective Expected Loss as a Criterion for Choosing among Decision-Rules
- 9.9 The Failure of the Decision-Theory Approach in Psychological Research
- 9.10 The Option of Suspending Judgment
- 9.11 Deciding between Two Hypotheses about a Mean
- 9.12 Conventional Decision-Rules
- 9.13 The Power of a Statistical Test
- 9.14 Power of Tests against Various True Alternatives
 - **10. INFERENCES ABOUT POPULATION MEANS**
- 10.1 Large Sample Problems with Unknown Population σ^2
- 10.2 Confidence Intervals for Large Samples with Unknown σ^2
- 10.3 The Problem of Unknown σ^2 When Sample Size Is Small
- 10.4 The Distribution of t
- 10.5 The t and the Standardized Normal Distribution
- 10.6 The Application of the t Distribution When the Population Is Not Normal
- Tables of the t Distribution 10.7

332

- Power and the Size of α
- 9.15 9.16 The Effect of Sample Size on Power
- 9.17 Power and "Error Variance"
- 9.18 **Testing Inexact Hypotheses**
- 9.19 Type I and Type II Errors
- 9.20 The Basis for the Conventions about
- Type I Errors
- 9.21 **One-Tailed Rejection Regions**
- 9.22 Two-Tailed Tests of Hypotheses
- 9.23 Relative Merits of One- and Two-Tailed Tests
- 9.24 Some Remarks on the General Theory Underlying Tests of Hypotheses
- 9.25 **Confidence** Intervals
- 9.26 Approximate Confidence Intervals for Proportions
- 9.27 Sample Size and the Accuracy of Estimation of the Mean
- 9.28 Evidence and Change in Personal Probability
- 9.29 Significance Tests and Common Sense

- 10.8 The Concept of Degrees of Freedom
- 10.9 Significance Tests for Single Means Using the t Distribution
- 10.10 Confidence Limits for the Mean Using t Distributions
- 10.11 Questions about Differences between Population Means
- 10.12 The Sampling Distribution of Differences between Means
- 10.13 An Example of a Large-Sample Significance Test for a Difference between Means
- 10.14 Large-Sample Confidence Limits for a Difference
- 10.15 Using the t Distribution to Test Hypotheses about Differences
 - 11. THE CHI-SQUARE AND THE F DISTRIBUTIONS
- 11.1 The Chi-square Distribution
- 11.2 The Function Rule and the Mean and Variance for a Chi-square Distribution
- 11.3 Tables of the Chi-square Distribution
- 11.4 The Addition of Chi-square Variables
- 11.5 The Chi-square and the Gamma Distributions
- 11.6 The Distribution of a Sample Variance from a Normal Population
- 11.7 Testing Exact Hypotheses about a Single Variance
- 11.8 Confidence Intervals for the Variance and Standard Deviation

- 10.16 An Example of Inferences about a Difference for Small Samples
- 10.17 The Importance of the Assumptions in a t Test of a Difference
- 10.18 The Power of t Tests
- 10.19 Testmanship, or How Big Is a Difference?
- 10.20 Estimating the Strength of a Statistical Association from Data
- 10.21 Strength of Association and Sample Size
- 10.22 Can a Sample Size Be Too Large?
- 10.23 Paired Observations
- 10.24 Significance Testing in More Complicated Experiments
- 11.9 The Importance of the Normality Assumption in Inferences about σ^2
 - 11.10 The Normal Approximation to the Chi-square Distribution
- 11.11 The F Distribution
- 11.12 The Use of F Tables
- 11.13 The F and the Beta Families of Distribution
- 11.14 Using the F Distribution to Test Hypotheses about Two Variances
- 11.15 The Assumption of the Normal Distribution in Testing Hypotheses about Two Variances
- 11.16 Relationships among the Theoretical Distributions

12. THE ANALYSIS OF VARIANCE: MODEL I, FIXED EFFECTS 457

- 12.10 Computational Forms for the Simple Analysis of Variance
 - 12.11 A Computational Outline for the One-way Analysis of Variance
 - 12.12 The Analysis of Variance Summary Table
 - 12.13 An Example
 - 12.14 The F Test and the t Test
 - 12.15 Another Example of a Simple, Oneway Analysis of Variance
 - 12.16 The Importance of the Assumptions in the Fixed Effects Model
 - 12.17 The Problem of Testing for Homogeneity of Variance
- 12.4 The Partition of the Sum of Squares for Any Set of J Distinct Samples

fects Situation

Model I: Fixed Effects

The Idea of an Effect

12.1

12.2

12.3

12.5 Assumptions Underlying Inferences about Treatment Effects

The Linear Model in the Fixed Ef-

- 12.6 The Mean Square between Groups
- 12.7 The Mean Square within Groups
- 12.8 The Sampling Distribution of MS within
- 12.9 The F Test in the Analysis of Variance

- 12.18 Estimating the Strength of a Statistical Relation from the One-way Analysis of Variance
- 12.19 Strength of Association and The Power of the F Test
- 12.20 The Two-way Analysis of Variance with Replication
- 12.21 Crossing and Nesting in Experiments
- 12.22 The Fixed Effects Model in the Twoway Analysis
- 12.23 The Importance of Interaction Effects
- 12.24 The Idea of Replication
- 12.25 Orthogonal Designs for Experiments
- 12.26 Sums of Effects in the Fixed Model
- 12.27 The Partition of the Sums of Squares for the Two-way Analysis of Variance
- 12.28 Assumptions in the Two-way Fixed Effects Model
- 12.29 The Mean Squares and Their Expectations

- 12.30 Computing Forms for the Two-way Analysis with Replications
- 12.31 A Computational Outline for the Two-way Analysis under the Fixed Effects Model
- 12.32 The Summary Table for a Two-way Fixed Effects Analysis of Variance with Replications
- 12.33 An Example
- 12.34 Estimating Strength of Association from a Two-way Analysis of Variance
- 12.35 The Importance of the Assumptions in the Two-way (or Higher) Analysis of Variance with Fixed Effects
- 12.36 The Analysis of Variance as a Summarization of Data
- 12.37 Analyzing Experiments with More than Two Experimental Factors
- 13. THE ANALYSIS OF VARIANCE: MODELS II AND III, RANDOM EFFECTS AND MIXED MODELS
- 13.1 Model II: Random Effects
- 13.2 Assumptions Made in the Random Effects Model
- 13.3 The Mean Squares for Model II
- 13.4 The Null Hypothesis for Model II
- 13.5 An Example
- 13.6 Estimation of Variance Components in a One-way Analysis
- 13.7 The Intraclass Correlation Coefficient
- 13.8 Interval Estimation for Proportion of Variance Accounted for
- 13.9 Other Hypotheses Testable Using Model II
- 13.10 The Power of the F Test under Model II
- 13.11 Importance of the Assumptions in Model II
- 13.12 Two-factor Experiments with Sampling of Levels
- 13.13 Model II for Two-factor Experiments
- 13.14 The Mean Squares

- 13.15 Hypothesis Testing in the Two-way Analysis under Model II
- 13.16 Point Estimation of Variance Components
- 13.17 Model III: A Mixed Model
- 13.18 A Mixed Model for a Two-factor Experiment
- 13.19 The Expected Mean Squares in a Mixed Model
- 13.20 An Example Fitting Model III
- 13.21 Variance Estimation in Model III
- 13.22 Some Connections among the Three Models
- 13.23 Randomization in Experiments
- 13.24 Simple Matched-Groups Experiments under the Mixed Model: Randomized Blocks
- 13.25 Repeated Observation of the Same Subjects
- 13.26 The General Problem of Experimental Design

14. INDIVIDUAL COMPARISONS AMONG MEANS 581

- 14.1 Asking Specific Questions of Data
- 14.2 Planned Comparisons
- 14.3 Estimates of Population Comparison Values
- 14.4 The Sampling Variance of Planned Comparisons
- 14.5 Interval Estimates and Tests for Planned Comparisons

- 14.6 Independence of Planned Comparisons
- 14.7 An Illustration of Independent and Nonindependent Planned Comparisons
- 14.8 Multiple t Tests on a Set of Data
- 14.9 The Independence of Sample Comparisons and the Grand Mean
- 14.10 The Number of Possible Independent Comparisons
- 14.11 Planned Comparisons and the Analysis of Variance

- 14.12 Pooling the Sums of Squares for "Other Comparisons"
- 14.13 An Example Using Planned Comparisons
- 14.14 The Choice of the Planned Comparisons
- 14.15 Incidental or Post-hoc Comparisons in Data
- 14.16 An Example of Post-hoc Comparisons Following a One-way Analysis of Variance
- 14.17 Planned versus Post-hoc Comparisons

15. PROBLEMS IN LINEAR REGRESSION AND CORRELATION 616

- 15.1 Regression and Correlation Problems
- 15.2 The Descriptive Statistics of Regression and Correlation
- 15.3 The Regression Equation for Predicting z_Y from z_X
- 15.4 The Standard Error of Estimate for Standard Scores
- 15.5 Interpretations of the Correlation Coefficient in a Sample
- 15.6 The Idea of Regressior toward the Mean
- 15.7 The Proportion of Variance Accounted for by Linear Regression
- **15.8** The Regression of z_X on z_Y
- 15.9 The Regression Equations for Raw Scores
- 15.10 The Errors of Estimate for Raw Scores
- 15.11 Computational Forms for r_{XY} and $b_{Y\cdot X}$
- 15.12 An Example of Regression and Correlation Computations for a Sample
- 15.13 Assumptions Made in Computing Correlation and Regression Coefficients for Sample Data
- 15.14 Population Correlation and Regression
 - 16. OTHER TOPICS IN REGRESSION AND CORRELATION
- 16.1 Curvilinear Regression
- 16.2 The Model for Linear and Curvilinear Regression
- 16.3 Another Look at the Partition of the Sum of Squares for Regression Problems
- 16.4 Testing for Linear and Nonlinear Regression
- 16.5 Estimation of the Strength of Linear and Curvilinear Relationship from Data
- **16.6** The Correlation Ratios $\eta_{Y\cdot X}^2$ and $\eta_{X\cdot Y}^2$

15.15 Estimates of the Parameters of the Population Regression Equation, and Standard Errors

- 15.16 The Model for Simple Linear Regression
- 15.17 The Sums of Squares for Regression Problems
- 15.18 The Expectation of the SS for Linear Regression
- 15.19 The Expectation of the Other Sums of Squares
- 15.20 Assumptions Underlying a Test Using This Regression Model
- 15.21 Tests for Zero Linear Regression
- 15.22 Interval Estimation in Regression Problems
- 15.23 Estimating the Strength of Linear Association in a Regression Problem
- 15.24 An Example of a Regression Problem
- 15.25 The Analysis of Covariance
- 15.26 Problems in Correlation in Bivariate Normal Populations
- 15.27 Tests and Interval Estimates in Correlation Problems
- **15.28** Confidence Intervals for ρ_{XY}
- 15.29 An Example of a Correlation Problem
- 15.30 Retrospect: Regression and Correlation Problems
 - 675

- 16.7 An Example of Tests for Linear and Curvilinear Regression
- 16.8 Planned Comparisons for Trend: **Orthogonal** Polynomials
- 16.9 Computations for Trend Analysis Using Orthogonal Polynomials
- 16.10 An Example of Planned Comparisons for Trend
- 16.11 Estimation of a Curvilinear Prediction Function
- 16.12 Trend Analysis in Post-hoc Comparisons
- 16.13 Other Uses of Regression Theory
- 16.14 Linear versus Curvilinear Regression

- 16.15 Some Rudiments of Multiple Regression Theory
- 16.16 The Coefficient of Multiple Correlation
- 16.17 The Standard Error of Estimate and the Interpretation of R^2
- 16.18 Multiple Regression Equation for Raw Scores
- 16.19 Inferences about Multiple Regression and Correlation
- 16.20 Partial Correlation
- 16.21 Testing Significance for Intercorrelations

The Possibility of Exact Tests for

Goodness of Fit and for Association

17.10 A Test for Correlated Proportions in

17.11 Measures of Association in Contin-

17.12 The Phi-Coefficient and Indices of

17.13 A Measure of Predictive Association

17.14 Information Theory and the Analysis

17.15 Retrospect: The χ^2 Tests and Meas-

18.10 The Friedman Test for J Matched

18.12 The Spearman Rank Correlation

18.14 Kendall's Tau versus the Spearman

18.16 A Measure of Association in Ordered

18.17 Kendall's Coefficient of Concordance

18.11 Rank-Order Correlation Methods

18.13 The Kendall Tau Coefficient

Rank Correlation

18.15 Kendall's Tau with Ties

a Two-by-Two Table

for Categorical Data

of Contingency Tables

ures of Association

Variance" by Ranks

18.9 The Kruskal-Wallis

Groups

Classes

Coefficient

gency Tables

Contingency

17. COMPARING ENTIRE DISTRIBUTIONS: CHI-SQUARE TESTS 717 17.9

- 17.1 Comparing Sample and Population Distributions: Goodness of Fit
- 17.2 The Relation to Large-Sample Tests of a Single Proportion
- 17.3 A Special Problem: A Goodness-of-Fit Test for a Normal Distribution
- 17.4 Pearson χ^2 Tests of Association
- 17.5 An Example of a Test for Independence in a Larger Table
- 17.6 The Special Case of a Fourfold Table
- 17.7 The Assumptions in χ^2 Tests for Association
- 17.8 Likelihood Ratio Tests for Categorical Data

18. SOME ORDER STATISTICS

- 18.1 Order Techniques as Substitutes for the Classical Methods
- 18.2 Comparing Two or More Independent Groups: The Median Tests
- 18.3 The Median Test for Matched Groups
- 18.4 The Sign Test for Matched Pairs
- 18.5 Cochran's Test
- 18.6 The Wald-Wolfowitz "Runs" Test for Two Samples
- 18.7 The Mann-Whitney Test for Two Independent Samples
- 18.8 The Wilcoxen Test for Two Matched Samples
 - 19. SOME ELEMENTARY BAYESIAN METHODS 809
- 19.1 Bayes' Theorem Applied to Random 19.2 Variables
- Parameters Treated as Random Variables

"Analysis of

861

871

878

- 19.3 Continuous Prior and Posterior Distributions
- 19.4 Conjugate Prior Distributions
- 19.5 Bayesian Inference for a Bernoulli Process
- 19.6 Normal Processes with Known Variance
- 19.7 The Variance of a Normal Process, µ Known
- **19.8** Normal Process with Both μ and σ^2 Unknown

- 19.9 Other Natural Conjugate Families
- 19.10 Diffuse Prior Distributions
- 19.11 On the Subjectivity of Bayesian Methods
- 19.12 Credible Intervals
- 19.13 Odds Ratios and Hypothesis Testing
- 19.14 Testing Hypotheses about the Mean
- 19.15 Two-tailed Tests for the Mean
- 19.16 Bayesian Inference and Decisionmaking
- 19.17 Some Final Remarks

APPENDIX A. RULES OF SUMMATION

Subscripts Rules of Summation Summation Rules for Two or More Variables

APPENDIX B. THE ALGEBRA OF EXPECTATIONS

APPENDIX C. TABLES

Table I: Cumulative Normal Probabilities	Table VI: The Transformation of r to Z
Table II: Binomial Probabilities	Table VII: Coefficients of Orthogonal
$\langle N \rangle$	Polynomials
$\binom{N}{r} p^r q^{N-r}$	Table VIII: Factorials of Integers
Table III: Upper Percentage Points of the t Distribution	Table IX: Binomial Coefficients, $\binom{N}{r}$
Table IV: Upper Percentage Points of the	Table X: Selected Values of E^{-m}
χ^2 Distribution	Table XI: Powers and Roots
Table V: Percentage Points of the F Distribution	
+	

REFERENCES	908
REFERENCES	700

GLOSSARY OF SYMBOLS 913

SOLUTIONS TO SELECTED PROBLEMS 922

INDEX