



# Contents

|   |           |
|---|-----------|
| PREFACE                                   | vi        |
| <b>Chapter 1      SETS</b>                | <b>1</b>  |
| 1.1 Introduction                          | 1         |
| 1.2 Working with Sets                     | 5         |
| 1.3 Cartesian Products                    | 18        |
| 1.4 Real Numbers                          | 19        |
| 1.5 Summary                               | 24        |
| <b>Chapter 2      LOGIC</b>               | <b>29</b> |
| 2.1 Introduction                          | 29        |
| 2.2 Statements and Logical Possibilities  | 30        |
| 2.3 Connectives and Negations             | 32        |
| 2.4 Conditional Statements                | 39        |
| 2.5 Biconditional Statements              | 46        |
| 2.6 Symbols to Sentences and Vice Versa   | 52        |
| 2.7 Logical Reasoning with Tables         | 56        |
| 2.8 Reasoning with Diagrams               | 63        |
| 2.9 Summary                               | 68        |
| <b>Chapter 3      ANALYTICAL GEOMETRY</b> | <b>73</b> |
| 3.1 Introduction                          | 73        |
| 3.2 Coordinate Lines                      | 73        |

|            |  |     |
|------------|--|-----|
| <b>3.3</b> | Coordinate Planes                            | 79  |
| <b>3.4</b> | Relations and Functions                      | 87  |
| <b>3.5</b> | Linear Equations                             | 96  |
| <b>3.6</b> | Linear Systems—Graphical Solutions           | 107 |
| <b>3.7</b> | Linear Systems—Algebraic Solutions           | 111 |
| <b>3.8</b> | Equations of the Form $ax + by + cz + d = 0$ | 117 |
| <b>3.9</b> | Summary                                      | 123 |

## **Chapter 4 MATRICES** 127

|            |                     |     |
|------------|---------------------|-----|
| <b>4.1</b> | Introduction        | 127 |
| <b>4.2</b> | Addition            | 127 |
| <b>4.3</b> | Multiplication      | 132 |
| <b>4.4</b> | Inverse of a Matrix | 147 |
| <b>4.5</b> | Summary             | 164 |

## **Chapter 5 LINEAR PROGRAMMING** 171

|            |                      |     |
|------------|----------------------|-----|
| <b>5.1</b> | Introduction         | 171 |
| <b>5.2</b> | Inequalities         | 172 |
| <b>5.3</b> | Graphic Method       | 183 |
| <b>5.4</b> | Matrices and Duality | 191 |
| <b>5.5</b> | Simplex Method       | 198 |
| <b>5.6</b> | Summary              | 213 |

## **Chapter 6 COUNTING FINITE SETS** 217

|             |  |     |
|-------------|--|-----|
| <b>6.1</b>  | Introduction   | 217 |
| <b>6.2</b>  | Partitions and Cross Partitions                          | 218 |
| <b>6.3</b>  | Cardinality  | 223 |
| <b>6.4</b>  | Product Sets   | 232 |
| <b>6.5</b>  | Permutations of $n$ Different Objects                    | 242 |
| <b>6.6</b>  | Permutations of $n$ Objects Not All Different            | 249 |
| <b>6.7</b>  | Circular Permutations                                    | 251 |
| <b>6.8</b>  | Combinations of $n$ Different Things Taken $r$ at a Time | 254 |
| <b>6.9</b>  | Ordered Partitions                                       | 258 |
| <b>6.10</b> | Binomial Coefficients                                    | 263 |
| <b>6.11</b> | Summary  | 270 |

|   |            |
|---|------------|
| <b>Chapter 7      PROBABILITY</b>                       | <b>275</b> |
| <b>7.1</b> Introduction                                 | 275        |
| <b>7.2</b> Relative Frequency                           | 276        |
| <b>7.3</b> Fundamentals of Probability                  | 286        |
| <b>7.4</b> Compound Events                              | 295        |
| <b>7.5</b> Conditional Probability                      | 308        |
| <b>7.6</b> Independence and Bayes' Formula              | 317        |
| <b>7.7</b> Stochastic Processes                         | 328        |
| <b>7.8</b> Expected Value                               | 335        |
| <b>7.9</b> Summary                                      | 338        |
| <br>  |            |
| <b>Chapter 8      STATISTICS</b>                        | <b>343</b> |
| <b>8.1</b> Introduction                                 | 343        |
| <b>8.2</b> Data   | 345        |
| <b>8.3</b> Measures of Central Tendency and Dispersion  | 358        |
| <b>8.4</b> Binomial and Normal Distributions            | 374        |
| <b>8.5</b> Statistical Decision—Testing Hypotheses      | 392        |
| <b>8.6</b> Summary                                      | 400        |
| <br>  |            |
| <b>Appendix A      SUMMATION</b>                        | <b>407</b> |
| <b>Appendix B      SQUARES AND SQUARE ROOTS</b>         | <b>408</b> |
| <b>Appendix C      MEDIAN</b>                           | <b>417</b> |
| <b>Appendix D      THE STANDARD NORMAL DISTRIBUTION</b> | <b>419</b> |
| <br>  |            |
| <b>ANSWERS TO SELECTED PROBLEMS</b>                     | <b>420</b> |
| <br>  |            |
| <b>INDEX</b>  | <b>439</b> |