

CONTENTS

Preface	v
Procedure for Reading This Set of Books	xii
Notes on the Exercises	xv
Chapter 1—Basic Concepts	1
1.1. Algorithms	1
1.2. Mathematical Preliminaries	10
1.2.1. Mathematical Induction	11
1.2.2. Numbers, Powers, and Logarithms	21
1.2.3. Sums and Products	27
1.2.4. Integer Functions and Elementary Number Theory	39
1.2.5. Permutations and Factorials	45
1.2.6. Binomial Coefficients	52
1.2.7. Harmonic Numbers	75
1.2.8. Fibonacci Numbers	79
1.2.9. Generating Functions	87
1.2.10. Analysis of an Algorithm	96
*1.2.11. Asymptotic Representations	107
*1.2.11.1. The O -notation	107
*1.2.11.2. Euler's summation formula	111
*1.2.11.3. Some asymptotic calculations	116
1.3. MIX	124
1.3.1. Description of MIX	124
1.3.2. The MIX Assembly Language	144
1.3.3. Applications to Permutations	164
1.4. Some Fundamental Programming Techniques	186
1.4.1. Subroutines	186
1.4.2. Coroutines	193
1.4.3. Interpretive Routines	200
1.4.3.1. A MIX simulator	202
*1.4.3.2. Trace routines	212
1.4.4. Input and Output	215
1.4.5. History and Bibliography	229
Chapter 2—Information Structures	232
2.1. Introduction	232

2.2.	Linear Lists	238
2.2.1.	Stacks, Queues, and Deques	238
2.2.2.	Sequential Allocation	244
2.2.3.	Linked Allocation	254
2.2.4.	Circular Lists	273
2.2.5.	Doubly Linked Lists	280
2.2.6.	Arrays and Orthogonal Lists	298
2.3.	Trees	308
2.3.1.	Traversing Binary Trees	318
2.3.2.	Binary Tree Representation of Trees	334
2.3.3.	Other Representations of Trees	348
2.3.4.	Basic Mathematical Properties of Trees	362
2.3.4.1.	Free trees	363
2.3.4.2.	Oriented trees	372
*2.3.4.3.	The “infinity lemma”	382
*2.3.4.4.	Enumeration of trees	386
2.3.4.5.	Path length	399
*2.3.4.6.	History and bibliography	406
2.3.5.	Lists and Garbage Collection	408
2.4.	Multilinked Structures	424
2.5.	Dynamic Storage Allocation	435
2.6.	History and Bibliography	457
Answers to Exercises	466
Appendix A—Tables of Numerical Quantities	619
1.	Fundamental Constants (decimal)	619
2.	Fundamental Constants (octal)	620
3.	Harmonic Numbers, Bernoulli Numbers, Fibonacci Numbers	621
Appendix B—Index to Notations	623
Appendix C—Index to Algorithms and Theorems	628
Index and Glossary	630