

## CONTENTS

	Preface to	o the Second Edition	x)ii
	Preface to	o the First Edition	XV
0	Introduct	ion	1
0-1		and Problem Solving nic Notation	5
0-2	Algorithm	mat Conventions	6
	0-2.1.1.	Name of Algorithm	6
	0-2.1.2	Introductory Comment	6
	0-2.1.3	Steps	6
	0-21.4	Comments	7
	0-2.2 Stat	ements and Control Structures	7
	0-2.2.1	Assignment Statement	7
	0-2.2.2	If-statement	8
	0-2.2.3	Case Statement	9
	0-2.2.4	Repeat statement	10
	0-2.2.5	Go To and Exit Loop Statements	

		2.2.6 Exit Statement		1
	0-2	2.2.7 Variable Names		1
	0-2.3	Data Structures		1
	0-2	2.3.1 Arrays		Î
	0-2	2.3.2 Dynamic Storage		1
	0-2.4	Arithmetic Operations and Ex		ī
	0-2.5	Strings and String Operations		1
	0-2.6	Relations and Relational Ope		1
	0-2.7	Logical Operations and Expre	essions	1
	0-2.8	Input and Output		1
	0-2.9	Subalgorithms		1
		.9.1 Functions		1:
	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	.9.2 Procedures		15
		.9.3 Parameters		. 10
0-3	TOTAL TO ANY TOTAL CO.		for Time and Space Requirements	10
	0-3.1	Rate of Growth		10
	0-3.2	Basic Time Analysis of an Al	gorithm	10
	0-3.3	Order Notation		19
	0-3.4	More Timing Analysis		20
	0-3.5	Space Analysis of an Algorith	m	22
	Bibli	iography		22
1		mation and Its Storage Repres	sentation	23
1-1		Nature of Information		24
, ,		cises for Sec. 1-1		26
1-2		Transmission of Information		27 30
1-3		Storage of Information		32
1-4		Operations on Data Structure		32
	1-4.1	Operations on Data Structure	3	33
	1-4.2	Number Systems Exercises for Sec. 1-4.2		35
	1 1 2			35
	1-4.3	Integers Exercises for Sec. 1-4.3		43
	111	Real Numbers		43
	1-4.4	Exercises for Sec. 1-4.4		48
	1 15	Character Information		49
	1-4.5	Exercises for Sec. 1-4.5		56
	116	Logical Information		56
	1-4.6	Pointer Information		58
		iography		64
	DIOII	lography		
2	The	Representation and Manipulati	ion of Strings	65
				66
2-1	Defi	nitions and Concepts		67
2-2	Strin	ng Manipulation and Pattern M	atching	67
3.00	2-2:1	Markov Algorithms		73
		Exercises for Sec. 2-2.1		75
	2-2.2	Primitive Functions		77
	2-2.3	Composite Functions		
	2-2.4	String Manipulation in Pascal		3
		Exercises for Sec. 2-2.4		

	CONTENTS	vii
2	2-2.5 String Manipulation in SNOPOL	
	2-2.5 String Manipulation in SNOBOL Exercises for Sec. 2-2	93
2-3	Grammars	100
	Exercises for Sec. 2-3	101
2-4	Storage Representation of Strings	115
	Exercises for Sec. 2-4	116
2-5	String Manipulation Applications	123
	2-5.1 Text Handling	124
	Exercises for Sec. 2-5.1	134
	2-5.2 Lexical Analysis	135
	Exercises for Sec. 2-5.2	138
	2-5.3 KWIC Indexing	139
	Exercises for Sec. 2-5.3	143
	Bibliography	144
3	Linear Data Structures and Their Sequential Storage Representation	145
3-1	Concepts and Terminology for Nonprimitive Data Structures	146
3-2	Storage Structures for Arrays	147
	Exercises for Sec. 3-2	152
3-3		153
	Exercises for Sec. 3-3	161
3-4	Stacks	167
	3-4.1 Definitions and Concepts	168
	3-4.2 Operations on Stacks	168
3-5	Applications of Stacks	176
	3-5.1 Recursion	176 186
	Exercises for Sec. 3-5.1	197
	3-5.2 Polish Expressions and Their Compilation 3-5.2.1 Polish Notation	197
	3-5.2.1 Polish Notation 3-5.2.2 Conversion of Infix Expressions to Polish Notation	202
	3-5.2.3 Conversion of Polish Expressions to Code	209
	Exercises for Sec. 3-5.2	213
	3-5.3 Stack Machines	215
3-6	, _	217
5 0	Exercises for Sec. 3-6	222
3-7		223
	Exercises for Sec. 3-7	241
3-8		242
	Exercises for Sec. 3-8	242
	Bibliography	
	Demonstration	245
4	Linear Data Structures and Their Linked Storage Representation	
11	Pointers and Linked Allocation	246
4-1	- · · · · · · · · · · · · · · · · · · ·	254
4-2	Linked Linear Lists 4-2.1 Operations on Linear Lists Using Singly Linked Storage Structures	255 275
	Exercises for Sec. 4-2.1	283
	4-2.2 Circularly Linked Linear Lists	284
	Exercises for Sec. 4-2.2	

Exercises for Sec. 5-4.5

456

			CONTENTS	ix
5-4.	6 Sı	panning Trees		
	E	exercise for Sec. 5-4.6		456
5-4	.7 A	An Example of a Time Commission of the Commissio		458
	F	An Example of a Time-Consumming Problem Exercises for Sec. 5-4.7		458
5-5		cations of Graphs		462
5-5	1 P	PERT and Palated Task		462
3-3	F	PERT and Related Techniques Exercise for Sec. 5-5.1		462
5-5				469
3-3	F	Computer Graphics Applications Exercises for sec. 5-5.2		470
5-5				488
3-3		Topological Sorting  Exercises for Sec. 5-5.3		488
5-6		mic Storage Management		498
5-0				498
		Fixed Block Storage Allocation		498
		First-fit Storage Allocation		501
		Storage Release		505
		Buddy System Garbage Collection		509
				525
3-0				530
D:hi:				534
Biblio	ograph	ıy		334
6	Sortin	ng and Searching		537
6-1	Sortin			538
		Notation and Concepts		538
		Selection Sort		540
		Bubble Sort		541
		Merge Sorting		543
		Tree Sorts		549
		Partition-Exchange Sort		555
		Radix Sort		560
		Address-Calculation Sort		562
	1.9	Summary of Sorting Methods		568
0-		Exercises for Sec. 6-1		568
				569
6-2	Search	Sequential Searching		569
	2.1	Binary Searching		570
		Search Trees		574
0-	-2.3 6-2.3	· · · · · · · · · · · · · · · · · ·		574
	0-2.2	Exercises for Sec. 6-2.3.1		585 585
	6-2.3	3.2 2-3 Trees		594
	0-2.2	Exercises for Sec. 6-2.3.2		594
	6-2.3	3 3 Weight-Balanced Trees		600
	0 2	Exercises for Sec. 6-2.3.3		601
	6-2.3	3.4 Trie Structures		605
		Exercises for Sec. 6-2.3.4		606
6	-2.4	Hash-Table Methods		607
0.	6-2.4	41 Introduction		607
	6-2.	12 Hashing Functions		611
	6-2.4	4.3 Collision-Resolution Techniques		621
	0 2.	Exercises for Sec. 6-2.4		623
	Biblio	ography		

7 Fi	ile Structures	
7-1 Ex	xternal Storage Devices	
7-1.1		
7-1.2		
7-1.3	0	
7-1.4		
7-1.5	Intermediate Storage Devices	THE PARTY NAMED IN A PARTY
	vercises for Sec. 7-1	
7-2 De	efinitions and Concepts	
7-3 Re	ecord Organization	
Exc	tercises for Sec. 7-3	(
	quential Files	(
7-4.1	The Structure of Committee	
	of Seduential Files	6
7-4.3	Sequential Files in Dr. (*	6
34	Sequential Files in PL/I Exercises for Sec. 7-4	6
7-5 A S	Small Billing C.	6
7-5.1	Small Billing System System Analysis	6
	J THE T SALES VILLA	6
7-5.3	System Design	6
7-6 Evt	Implementation	6
	ternal Sorting	6
7-6.1	- Lists	67
7-0.2	Tape Sorting	67
7-0	6.2.1 Polyphase Sorting	67
/-0	0.2.2 Oscillating Sorting	67
7-6.3	Sorting on Disks	68
7-6.4	Generating Extended Initial Runs	69
7-6.5	Recent Developments	69
	Exercises for Sec. 7-6	69
7-7 Inde	exed Sequential Files	69
7-7.1	The Structure of Indexed Sequential Ex-	69
7-7.2	Processing Indexed Sequential Files	69
7-7.3	Indexed Sequential Files in PL/I	70:
	Exercises for Sec. 7-7	711
7-8 Class	ss-Record Retrieval System	717
7-8.1	System Analysis	718
	System Design	718
7-8.3	Implementation	719
	ct Files	723
21100		732
	The Structure of Direct Files	732
	Processing Direct Files	737
7-9.3	Direct Files in PL/I	740
10 1 0	Exercises for Sec. 7-9	750
	on-Line Banking System	751
	System Analysis	751
	System Design	753
7-10.3	Implementation	755
	rnal Searching	764
	Distribution-Dependent Hashing Function	764
	Dynamic Hashing Techniques	770
7/11/11	,	

	CONTENTS X
7-11.2.1 Organizing Direct Files with Hashing	
7-11.2.2 Linear Hashing	77
7-11.2.3 Virtual Hashing	775
7-11.2.4 Experimental Results with Dynamic Hashing Techni	782
7-11.2.5 Other Dynamic Hashing Techniques	
Exercises for Sec. 7-11	790
7-12 Other Methods of File Organization	796 797
7-12.1 Virtual Memory	797
7-12.2 VSAM Files	805
Exercises for Sec. 7-12	810
7-13 Multiple-Key Access	811
7-13.1 Multilist Organization	813
7-13.2 Inverted-List Organization	815
7-13.3 The Controlled List Length Multilist Organization	817
7-13.4 Celiular Partitioned Structures	818
7-13.5 Maintenance of a Multilist	820
7-13.6 Maintenance of an Inverted List	822
7-13.7 Maintenance of Constrained Multilist and Cellular Suuctu	res 823
7-13.8 Summary of Secondary Access Methods	823
Exercises for Sec. 7-13	825
7-14 An Introduction to Data-Base Systems	826
7-14.1 General Concepts in Data-Base Systems	826
7-14.2 Hierarchical Approach	829
7-14.3 Network Approach	832
7-14.4 Relational Approach	835
7-14.5 Summary	839
Bibliography	840
Index	.843

TENERS OF THE PERSON AND THE PERSON OF THE P