

Contents

PREFACE

WHY THIS BOOK IS FOR YOU.....1

INTRODUCTION3

What You'll Need4

Conventions5

PART I: BASIC MS-DOS PROGRAMMING7

CHAPTER 1: THE PC HARDWARE: AN OVERVIEW.....9

Basic Addressing9

Types of Memory10

Registers11

Addressing Revisited16

Ports17

Hardware Interrupts18

The Timer21

General I/O21

The Keyboard22

Video23

Disks25

CHAPTER 2: THE APPLICATION ENVIRONMENT.....27

Types of DOS Applications28

The DOS Interrupts33

The BIOS Interrupts35

BIOS Variables36

The PSP	36
Memory Allocation in Detail	40
Summary	41
CHAPTER 3: C AND ASSEMBLY FOR DOS.....	43
More About Addressing	43
Accessing the Environment	47
Input and Output	48
Interrupts	49
Servicing Interrupts	55
Assembly Routines for C	56
CHAPTER 4: PROGRAMS AT LAST!	57
ESCAPE	57
SPACE	60
EDISP	61
PRTSCRN	63
SPYS	65
CHAPTER 5: DOS SERVICES	71
The Simple I/O Services	73
File Operations	89
FCB File Services	94
Handle Services	95
Directory Operations	106
Date and Time Operations	109
Process Operations	111
Memory Operations	117
IOCTL Operations	121
Miscellaneous Operations	126
DOS 6 Data Compression (MRCI)	135
DoubleSpace Calls	139
Other DOS Interrupts	140

CHAPTER 6: ROM BIOS SERVICES	149
The Video Services	149
The Equipment Configuration Service	158
Reading the Size of Conventional Memory	159
The Disk Services	159
The Serial Port Services	166
The Keyboard Services	169
Printer Services	171
The Clock Services	173
BIOS Variables	174
CHAPTER 7: DIRECT ACCESS TECHNIQUES	179
Writing Text to Screen Memory	179
Interrupt Rules	184
Managing Hardware Interrupts	186
Direct Keyboard Access	187
Interacting with DOS Memory Allocation	194
DOS 6 Data Compression	197
MRCI, MRCI	210
Timing and Sound Generation	210
The AT's Real-Time Clock	220
Accessing CD-ROM	220
Using Joysticks	225
The Parallel Port	229
The Serial Port	233
CHAPTER 8: THE COPROCESSOR	251
Multiprocessing	252
Data Types and Formats	253
Coprocessor Operation	256
Coprocessor Instructions	259
Coprocessor Emulation	264
A Simple Coprocessor Program	265

A Four-Function Calculator	266
Final Notes	278
PART II: ADVANCED MS-DOS PROGRAMMING.....	279
CHAPTER 9: BUILDING ROBUST APPLICATIONS.....	281
Handling Break Exceptions	283
Handling Critical Errors	289
Which Language is Best?	295
Multitasking Considerations	296
A Simple Program: HEXDUMP	297
A High-Performance Application in C	306
CHAPTER 10: GRAPHICS PROGRAMMING	325
Mode Selection	327
Pixel Representation	330
Setting the Colors	343
Putting it Together	346
Improving Graphics Performance	361
Super VGA Programming	363
CHAPTER 11: OF MICE AND MEN.....	373
Mouse Modes	374
The Mouse Screen	374
The Mouse Cursor	375
Mouse Sensitivity	375
Important Mouse Variables	376
Basic Mouse Commands	376
A Basic Mouse Library in C	386
Polling the Mouse	393
Event-Driven Programming	404
Using the Mouse with Graphics	420

CHAPTER 12: EXPANDING HORIZONS: EMS	423
How EMS Works	424
Detecting EMS	426
Select EMS Commands	427
Maintaining Compatibility	447
The CEMS Library	447
Using CEMS: DUP	452
Executing Code in EMS	465
CHAPTER 13: DEVICE DRIVERS.....	469
Device-Driver Components	469
Loading the Driver	473
Types of Drivers	474
Character-Driver Commands	474
Block-Driver Commands	480
Optional Commands	486
Putting It All Together	487
Sample Drivers	494
A Block Driver	500
Debugging	510
More Fun with Drivers	512
CHAPTER 14: TSR PROGRAMMING.....	513
TSR Architecture	513
Live and Let Live	514
A Simple Interceptor	515
WASTE1: The Next Step	519
WASTE: The Final Version	522
INTASM: A Development Environment for Interceptors	530
Controlling Cursor Size	545
More Fun with Interceptors	548
Pop-Up Fundamentals	549

DOS Access	550
Critical Sections	550
Context Management	551
TSRASM: A Pop-up Development Environment	552
Some Sample Pop-ups	582
If Your TSR Doesn't Work	596

PART III: PROTECTED-MODE TECHNIQUES.....599

CHAPTER 15: 80386 PROTECTED MODE.....601

The Benefits	602
Privileged Segments	604
Multitasking	613
Code Segments Revisited	616
Exceptions	617
Memory Management	620
Living in the Past: Real and V86 Modes	623
Handling Interrupts in V86 Mode	625
Switching to Protected Mode	626
Protected Mode on a PC	629

CHAPTER 16: USING EXTENDED MEMORY.....631

BIOS Calls	631
Allocating Extended Memory	633
The CEXT Library	635
X Marks the XMS	642
Types of XMS Memory	643
Detecting the Driver	644
Calling the Driver	644
Common XMS Calls	646
Virtual Memory XMS-style	648
Summary	654

CHAPTER 17: 80386 DEBUGGING	655
Hardware Debugging	655
The Exact Bits and Other Flags	657
Task-Switch Breakpoints	658
BREAK386	658
Detailed Program Operation	686
Advanced Interrupt Handlers in C	693
CHAPTER 18: ACCESSING 4 GIGABYTES IN REAL MODE	701
The Plan	701
Some Assembly Required	714
Using the SEG4G Library	715
Some Examples	716
CHAPTER 19: DOS EXTENDERS	721
About PROT	721
Using PROT	723
Putting It Together	730
Dynamic Link Mode	732
Debugging	739
What Went Wrong?	741
Multitasking	742
Under the Hood	743
The Seven-Percent Solution	746
Hardware Interrupts	747
Sixteen-Bit Tools in a 32-Bit World	747
Sample Programs	748
The Future	749
Commercial DOS Extenders	881

CHAPTER 20: THE DOS/WINDOWS CONNECTION.....	887
Windows Modes	887
Come In Windows	888
Windows Startup	888
Windows Termination.....	889
Other Windows Calls	889
Running In the DOS Box	890
WINOLDAP Calls	891
Windows and DOS in Review	901
APPENDIX A: GLOSSARY.....	903
APPENDIX B: IBM PC CHARACTER SET	907
APPENDIX C: IBM PC LINE-DRAWING CHARACTERS	911
APPENDIX D: IBM PC SCAN CODES.....	913
APPENDIX E: ANNOTATED BIBLIOGRAPHY.....	917
INDEX	925