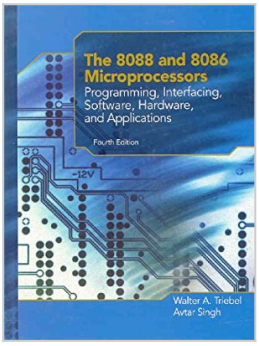

The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications (4th Edition)

By Walter A. Triebel, Avtar Singh

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Designers of microprocessor-based electronic equipment need a *systems-level* understanding of the 80x86 microcomputer. This volume offers thorough, balanced, and practical coverage of both software and hardware topics. Develops basic concepts using the 8088 and 8086 microprocessors, but the 32-bit version of the 80x86 family is also discussed. Examines how to assemble, run, and debug programs, and how to build, test, and troubleshoot interface circuits. Provides detailed coverage of floating-point processing and the single instruction multiple data (DIMD) processing capability of the advanced Pentium processor. Includes added material on number systems, logic functions and operations, conversion between number systems, and addition/subtraction of binary numbers. Includes new advanced material such as floating Point Architecture and Instructions, Multimedia (MMX) Architecture and Instructions, and the hardware and hardware architecture of the Pentium 3 and Pentium 4 processors. Covers the Intel architecture microprocessor families: 8088, 8086, 80286, 80386, 80486, and the latest Pentium® processors. Illustrates commands of the DEBUG program and how to assemble, disassemble, load, save, execute, and debug programs on the IBM PC. Introduces the contents of the 8088's instruction set. Explores practical implementation techniques, covering the use of latches, transceivers, buffers, and programmable logic devices in the memory and I/O interfaces of the microcomputer system. A valuable handbook for self-study in learning microprocessors, for electrical engineers, electronic technicians, and all computer programmers.

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- Sales Rank: #1262491 in Books
- Published on: 2002-09-08
- Ingredients: Example Ingredients
- Original language: English
- Number of items: 1
- Dimensions: 9.10" h x 2.00" w x 6.90" l, 3.48 pounds
- Binding: Paperback
- 1019 pages

Editorial Review

From the Publisher
This text provides a systems-level understanding of the 80X86 microcomputer and its hardware and software. Equal emphasis is given to both assembly language software and microcomputer circuit design.

From the Back Cover

Intel's 80x86 family of microprocessors is the most widely used architecture in modern microcomputer systems. This widely acclaimed edition provides comprehensive coverage of both the software and hardware of the 8088 and 8086 microprocessors. New material has been added on number system conversions, binary arithmetic, and combinational logic operations.

- Part I explores the software architecture and how to write, execute, and debug assembly language programs. It includes many practical concepts and software applications. In addition, the various steps of the assembly language program development cycle are explored.
- Part II examines the hardware architecture of microcomputers built with the 8088 and 8086 microprocessors. It presents the function and operation of each of the microprocessors' hardware interfaces: memory, input/output, and interrupt. The role of each of these subsystems is explored in relation to overall microcomputer system operation.
- Part III provides detailed coverage of the other microprocessors in the 80x86 family: the 80286, 80386, 80486, and Pentium' processors. The newest Pentium® family—Pentium® III and Pentium® IV#&151;are also examined.

Intel's 80X86 family of microprocessors is the most widely used architecture in modern microcomputer systems. The family includes both 16-bit microprocessors, such as the 8088, 8086, 80C 186, 80C 188, and 80286 processors, and 32-bit microprocessors, such as those of the 80386, 80486, and Pentium processor families. The 8088, which is the 8-bit bus version of the 8086, was the microprocessor used in the original IBM personal computer (PC). Many other manufacturers used the 8088 and 8086 microprocessors to make personal computers compatible with IBM's original PC. IBM's original personal computer advanced technology (PC/AT) was designed with the 80286 microprocessor. Like the PC, many other manufacturers made PC/AT compatible personal computers, and today they are built with Pentium processor family microprocessors. Intel's 80X86 family of microprocessors is also used in a wide variety of other electronic equipment.

The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications, Fourth Edition, is a thorough study of the 8088 and 8086 microprocessors, their microcomputer system architectures, and the circuitry used in the design of the microcomputer of the original IBM PC. Written as a textbook for microprocessor courses at community colleges, four-year colleges, and universities, this book may be used in a one- or two-semester course that emphasizes both assembly language software and microcomputer circuit design.

Individuals involved in the design of microprocessor-based electronic equipment need a systems-level understanding of the 80X86 microcomputer-that is, a thorough understanding of both their software and their

hardware. The first part of this book explores the software architecture of the 8088 and 8086 microprocessors and teaches the reader how to write, execute, and debug assembly language programs.

In this new edition, our coverage of software architecture and assembly language programming has been further reorganized to make the chapters shorter. Also, new material has been added on number system conversions, binary arithmetic, and combinational logic operations such as AND, OR, NOT, exclusive-OR, half- and full-adders, and half- and full-subtractors.

To successfully write assembly language programs for the 8088/8086 microprocessors, one must learn the following:

1. Software architecture: The internal registers, flags, memory organization and stack, and their uses from a software point of view.
2. Software development tools: Using the commands of the program debugger (such as DEBUG) to assemble, execute, and debug instructions and programs.
3. Instruction set: The function of each of the instructions in the instruction sect, the permissible operand variations, and writing statements using the instructions.
4. Programming techniques: Basic techniques of programming, such as flowcharting, jumps, loops, strings, subroutines, and parameter passing.
5. Applications: The step-by-step process of writing programs for several practical applications, such as a block move routine.

All of this material is developed in detail in Chapters 2 through 7.

The software section includes many practical concepts and practical software applications. Examples are used to demonstrate practical applications such as 32-bit addition and subtraction, "masking of bits, and the use of branch and loop operations to implement IF-THEN-ELSE, REPEAT UNTIL, and WHILE-DO program structures. In addition, the various steps of the assembly language program development cycle are explored.

The study of software architecture, instruction set, and assembly language programming is closely coupled with use of the DEBUG program on the PC. That is, the line-byline assembler in DEBUG is used to assemble instructions and programs into the memory of the PC, while other DEBUG commands are used to execute and debug the programs. The use of a practical 80X86 assembler program, the Microsoft MASM Assembler, is also covered. Using MASM and other PC-based software development tools, the student learns to create a source program; assemble the program; form a run module; and load, run, and debug a program.

The second part of the book examines the hardware architecture of microcomputers built with the 8088 and 8086 microprocessors. To understand the hardware design of an 8088- or 8086-based microcomputer system, the reader must begin by first understanding the function and operation of each of the microprocessor's hardware interfaces: memory, input/output, and interrupt. Next, the role of each of these subsystems is explored relative to overall microcomputer system operation. This material is presented in Chapters 8 through 13.

Chapter 8 examines the architecture of the 8088 and 8086 microprocessor from a hardware point of view. Included is information on pin layout, minimum and maximum mode signal interfaces, signal functions, and clock requirements. The latter part of the chapter covers the memory and input/output interfaces of the 8088/8086. This material includes extensive coverage of memory and input/output bus cycles, address maps, memory and input/output interface circuits (address latches and buffers, data bus transceivers, and address decoders), the use of programmable logic devices in implementing bus-control logic, types of input/output, and input/output instructions and programs.

This hardware introduction is followed by separate studies of the architecture, operation, devices, and typical circuit designs for the memory (Chapter 9), input/output (Chapter 10), and interrupts interfaces of the 8088/8086-based microcomputer (Chapter 11). Chapter 9 covers devices and circuits for the program storage memory (ROM, PROM, EPROM, and FLASH), data storage memory (SRAM and DRAM), and cache memory subsystems. Practical bus interface circuit and memory subsystem design techniques are also examined, including paritychecker/generator circuitry and wait-state generator circuitry.

Chapter 10 covers input/output interface circuits and LSI peripheral devices. The material on core I/O interfaces includes detailed studies of discrete parallel input/output circuits, 82CSSA, 8X54, and 82C37A peripheral ICs. The chapter also explores a number of special-purpose peripheral IC devices and interfaces. For instance, serial communication and the 8250/16450 UART controllers are examined and keyboard scanning and display driving are demonstrated with the 8279 keyboard/display controller.

Chapter 11 introduces the interrupt context switching mechanism and related topics such as priority, interrupt vectors, the interrupt vector table, interrupt acknowledge bus cycle, and interrupt service routine. External hardware interrupt interface circuits are demonstrated using both discrete circuitry and the 82C59 programmable interrupt controller peripheral IC. The chapter also covers special interrupt functions such as software interrupts, the nonmaskable interrupt, reset operation, and internal interrupt processing.

The hardware design section continues in Chapter 12 with a study of the 8088based microcomputer design used in the IBM PC. We present the circuitry used in the design of the memory subsystem, input/output interfaces, and interrupt interface on the system processor board of the PC. This chapter demonstrates a practical implementation of the material presented in the prior chapters on microcomputer interfacing techniques.

The material on hardware includes interface circuit operation, design, and troubleshooting. For example, the chapter on input/output devices explains circuits and programs for polling switches, lighting LEDs, scanning displays and keyboards, and printing characters at a parallel printer port. Moreover, Chapter 13 explores PC bus interfacing and techniques for circuit construction, testing, and troubleshooting.

The third part of the textbook provides detailed coverage of the other microprocessors of the 80X86 family: the 80286, 80386, 80486, and Pentium processors. Throughout these chapters, the focus is on how the processors' software and hardware architectures differ from those of the earlier family members. Advanced topics introduced include DISC, CRISP, and superscaler processor architectures, real-mode and protected-mode operation, burst, pipelined, and cached bus cycles, virtual memory, instruction set extensions, system control instructions, descriptors, paging, protection, multitasking, virtual 8086 mode, big and little endian data organization, clock scaling, dynamic bus sizing, address and data parity, and code and data cache memory.

Coverage of the 80486 and Pentium processor families has been further expanded in this edition. For example, new sections are included in Chapter 15 on floating-point architecture and multimedia architecture. Floating-point numbers, floating-point registers, and the floating-point instruction set are introduced relative to the 80486DX microprocessor. Material on the MMX technology, SIMI) data, MMX registers, and the operation of MMX instructions is introduced relative to the Pentium Processor with MMX technology. Finally, Chapter 16 examines the newest Pentium family processors-the Pentium III processor and Pentium IV processor.

SUPPLEMENTS

An extensive package of supplementary materials is available to complement the 80X86 microprocessor

program offered by this textbook. It includes materials for the student and instructor for easy implementation of a practical PC-hosted laboratory program. These materials are:

1. *Instructor's Solution Manual to accompany The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications,* 4th Ed. ISBN 0-13-093082-2, Prentice Hall, Upper Saddle River, NJ 07458

   Provides the answers to all of the student exercises in the textbook as well as transparency masters for over 300 of the illustrations in the textbook. A CD-ROM is included, which contains all of the programs and executable files that are created by the student in the process of performing the 25 exercises in the laboratory manual. Based on the method identified in the exercise, the programs have been created with either the assembler in DEBUG or the Microsoft Macro Assembler.

2. *The 8088 and 8086 Microprocessors Laboratory Manual,* 4th Ed. ISBN 0-13045231-9, Prentice Hall, Upper Saddle River, NJ 07458

   Contains 25 skill-building laboratory exercises that explore the software architecture of the 80X86 microcomputer in the PC, assembly language program development, the internal hardware of the PC, and interface circuit operation, design, testing, and troubleshooting. Also included is a CD containing all of the programs needed by the student to perform the exercises in the laboratory manual. Included are files that contain the source program, source listing, object code, and run module. These files have been produced by assembling the source program with the Microsoft Macro Assembler.

3. *PCuLAB,* Microcomputer Directions, Inc. P.O. Box 15127, Fremont, CA 94539 www.mcdlab.com (Not available through Prentice Hall)

   An easy-to-use and versatile, external hardware expansion environment for any personal computer for experimenting with microcomputer interface circuits. It extends the ISA bus external to the PC, thereby forming a bench-top laboratory text unit for building, testing, and troubleshooting interface circuits. It includes a large solderless breadboard area for working with student-constructed circuitry; a single PC/AT compatible ISA bus slot for installation of commercially available or custom-build add-on cards; and built-in I/O devices, LEDs, switches, and a speaker. The PCuLAB also has a continuity tester and logic probe for testing circuit operation.

Walter A.Triebel
Avtar Singh

Users Review

From reader reviews:

Becky Pope:

The publication with title The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications (4th Edition) has lot of information that you can understand it. You can get a lot of help after read this book. This particular book exist new understanding the information that exist in this e-book represented the condition of the world at this point. That is important to yo7u to know how the improvement of the world. This particular book will bring you with new era of the glowbal growth. You can read the e-book on the smart phone, so you can read this anywhere you want.

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Jessie Adams:

With this era which is the greater individual or who has ability in doing something more are more important than other. Do you want to become one of it? It is just simple method to have that. What you should do is just spending your time almost no but quite enough to experience a look at some books. One of several books in the top list in your reading list is The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications (4th Edition). This book that is qualified as The Hungry Mountains can get you closer in getting precious person. By looking way up and review this e-book you can get many advantages.

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