AccessionIndex: TCD-SCSS-V.20150617.002
Accession Date: 17-Jun-2015
Accession By: Dr.Robert Friel
Object name: 6502 Software Design
Vintage: c. 1980
Synopsis: Scanlon, Leo J., ISBN 0-672-21656-6, 1st edition, 4th printing (1981), Howard W.Sams & Co, Inc, 43 West 62nd St, Indianapolis, Indiana 46268, USA, marked 'Robert Friel' on title page.

Description:
Short descriptive text …

For the front and rear covers, title pages, table of contents, selected content, etc, see Figure 1 onwards below.

The homepage for this catalog is at: https://www.scss.tcd.ie/SCSSTreasuresCatalog/
Click *'Accession Index'* (1st column listed) for related folder, or *'About'* for further guidance. Some of the items below may be more properly part of other categories of this catalog, but are listed here for convenience.

Accession Index	Object with Identification
TCD-SCSS-V.20150617.002	Scanlon, Leo J., 6502 Software Design, ISBN 0-672-21656-6, 1st edition, 4th printing (1981), Howard W.Sams & Co, Inc, 43 West 62nd St, Indianapolis, Indiana 46268, USA, marked 'Robert Friel' on title page, 1980.

References:

1. References if required ...

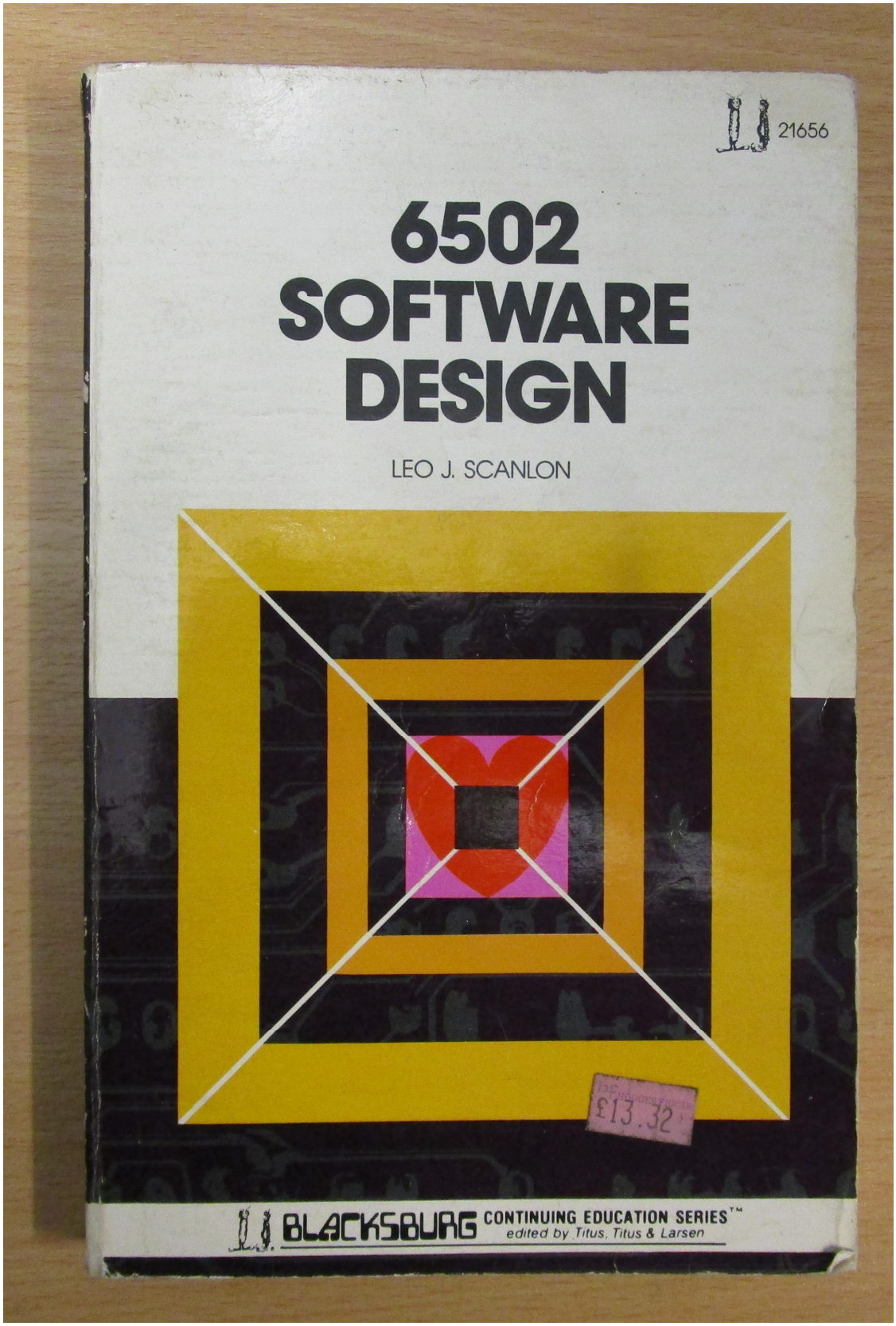
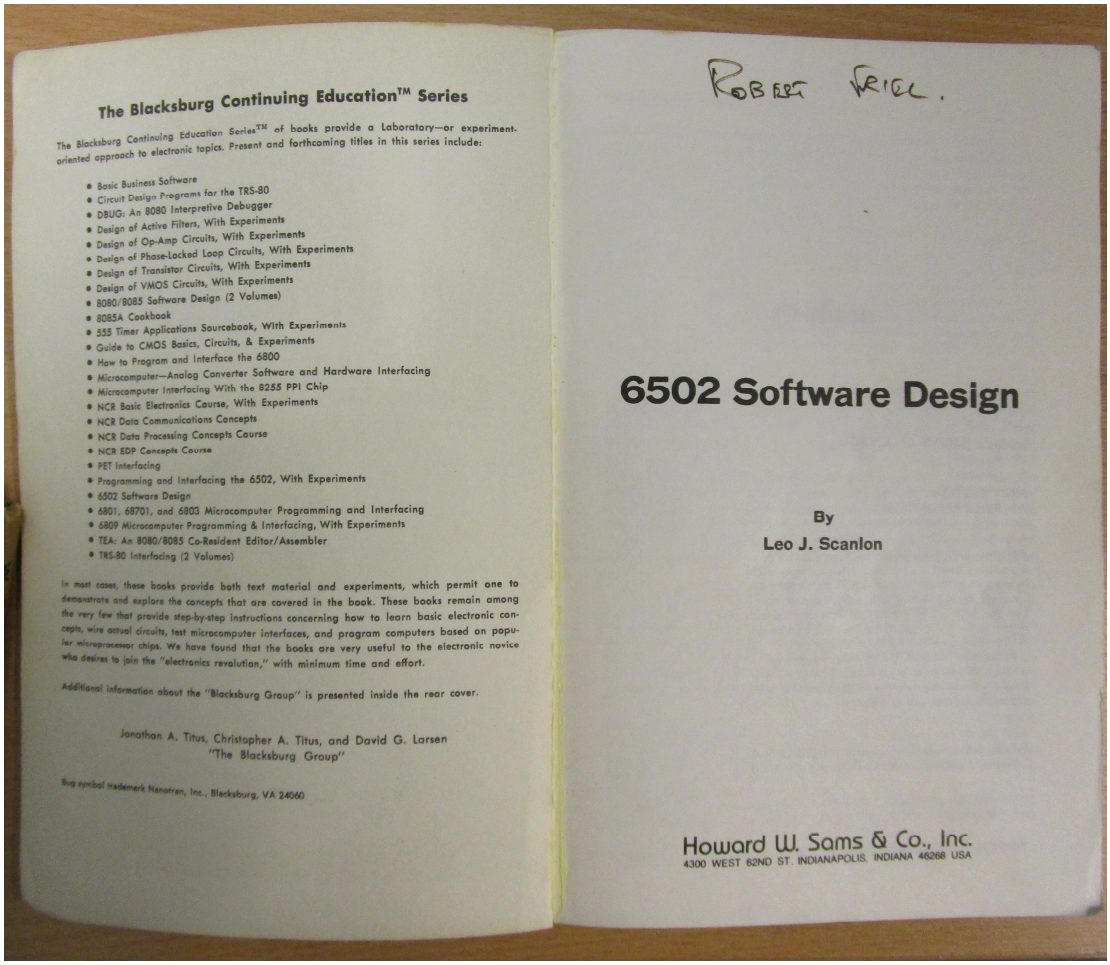


Figure 1: Front Cover



The Blacksburg Continuing Education™ Series

The Blacksburg Continuing Education Series™ of books provide a Laboratory—or experiment-oriented approach to electronic topics. Present and forthcoming titles in this series include:

- Basic Business Software
- Circuit Design Programs for the TRS-80
- DBUG: An 8080 Interpretive Debugger
- Design of Active Filters, With Experiments
- Design of Op-Amp Circuits, With Experiments
- Design of Phase-Locked Loop Circuits, With Experiments
- Design of Transistor Circuits, With Experiments
- Design of VMOS Circuits, With Experiments
- 8080/8085 Software Design (2 Volumes)
- 8085A Cookbook
- 555 Timer Applications Sourcebook, With Experiments
- Guide to CMOS Basics, Circuits, & Experiments
- How to Program and Interface the 6800
- Microcomputer—Analog Converter Software and Hardware Interfacing
- Microcomputer Interfacing With the 8255 PPI Chip
- NCR Basic Electronics Course, With Experiments
- NCR Data Communications Concepts
- NCR Data Processing Concepts Course
- NCR EDP Concepts Course
- PET Interfacing
- Programming and Interfacing the 6502, With Experiments
- 6502 Software Design
- 6801, 68701, and 6803 Microcomputer Programming and Interfacing
- 6809 Microcomputer Programming & Interfacing, With Experiments
- TEA: An 8080/8085 Co-Resident Editor/Assembler
- TRS-80 Interfacing (2 Volumes)

In most cases, these books provide both text material and experiments, which permit one to demonstrate and explore the concepts that are covered in the book. These books remain among the very few that provide step-by-step instructions concerning how to learn basic electronic concepts, wire actual circuits, test microcomputer interfaces, and program computers based on popular microprocessor chips. We have found that the books are very useful to the electronic novice who desires to join the "electronics revolution," with minimum time and effort.

Additional information about the "Blacksburg Group" is presented inside the rear cover.

Jonathan A. Titus, Christopher A. Titus, and David G. Larsen
"The Blacksburg Group"

Bug symbol trademark Nanotran, Inc., Blacksburg, VA 24060

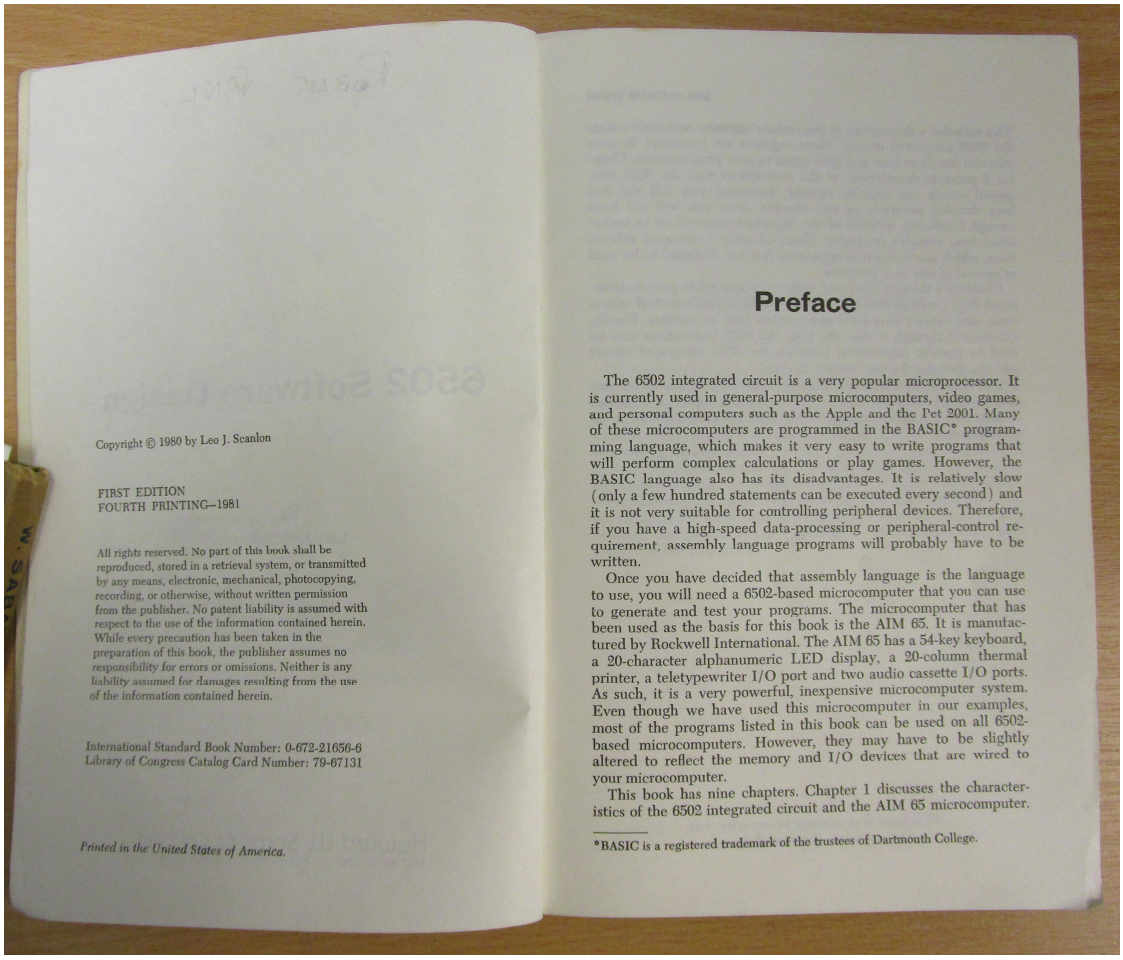
ROBERT FRIEL.

6502 Software Design

By
Leo J. Scanlon

Howard W. Sams & Co., Inc.
4300 WEST 62ND ST. INDIANAPOLIS, INDIANA 46268 USA

Figure 2: Title Pages page 1



FIRST EDITION
FOURTH PRINTING—1981

International Standard Book Number: 0-672-21656-6
Library of Congress Catalog Card Number: 79-67131

Printed in the United States of America.

Preface

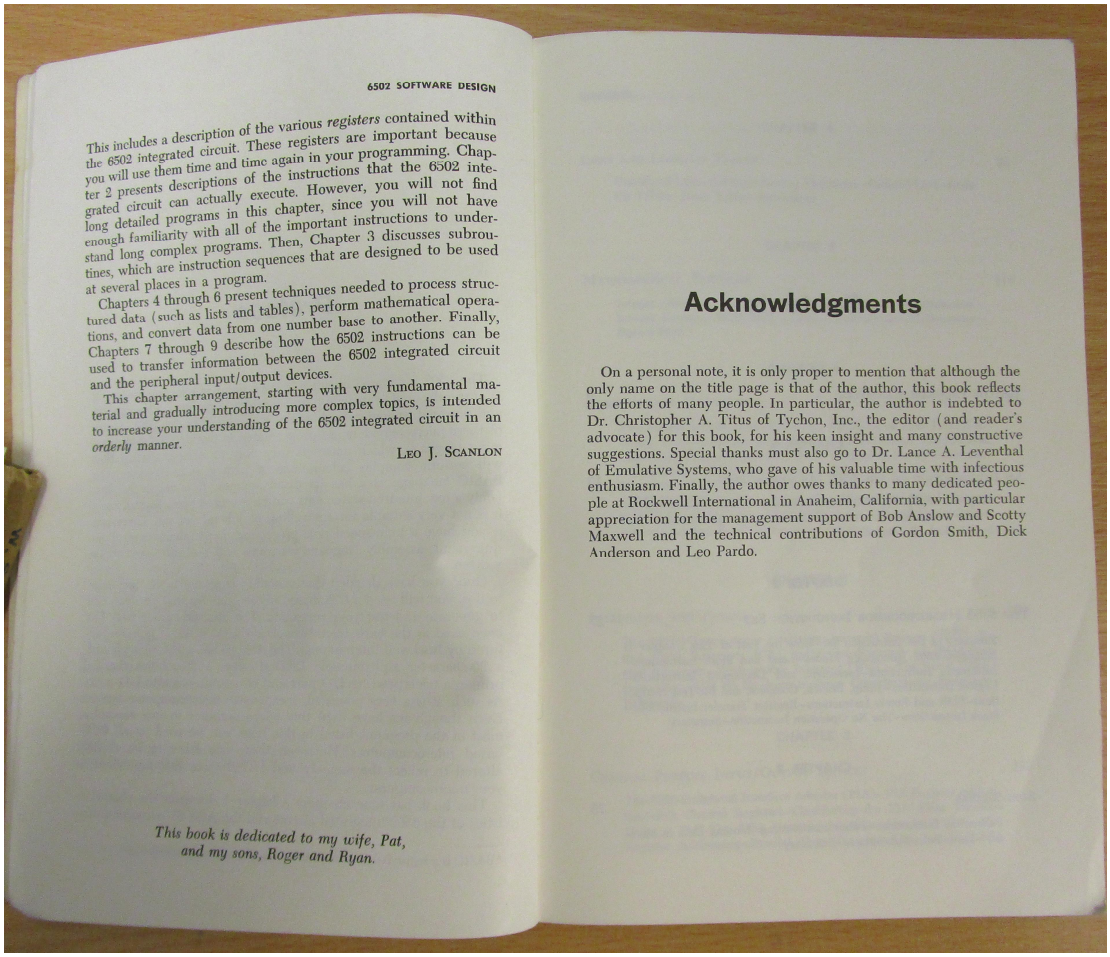
The 6502 integrated circuit is a very popular microprocessor. It is currently used in general-purpose microcomputers, video games, and personal computers such as the Apple and the Pet 2001. Many of these microcomputers are programmed in the BASIC* programming language, which makes it very easy to write programs that will perform complex calculations or play games. However, the BASIC language also has its disadvantages. It is relatively slow (only a few hundred statements can be executed every second) and it is not very suitable for controlling peripheral devices. Therefore, if you have a high-speed data-processing or peripheral-control requirement, assembly language programs will probably have to be written.

Once you have decided that assembly language is the language to use, you will need a 6502-based microcomputer that you can use to generate and test your programs. The microcomputer that has been used as the basis for this book is the AIM 65. It is manufactured by Rockwell International. The AIM 65 has a 54-key keyboard, a 20-character alphanumeric LED display, a 20-column thermal printer, a teletypewriter I/O port and two audio cassette I/O ports. As such, it is a very powerful, inexpensive microcomputer system. Even though we have used this microcomputer in our examples, most of the programs listed in this book can be used on all 6502-based microcomputers. However, they may have to be slightly altered to reflect the memory and I/O devices that are wired to your microcomputer.

This book has nine chapters. Chapter 1 discusses the characteristics of the 6502 integrated circuit and the AIM 65 microcomputer.

*BASIC is a registered trademark of the trustees of Dartmouth College.

Figure 3: Title Pages page 2



This includes a description of the various *registers* contained within the 6502 integrated circuit. These registers are important because you will use them time and time again in your programming. Chapter 2 presents descriptions of the instructions that the 6502 integrated circuit can actually execute. However, you will not find long detailed programs in this chapter, since you will not have enough familiarity with all of the important instructions to understand long complex programs. Then, Chapter 3 discusses subroutines, which are instruction sequences that are designed to be used at several places in a program.

Chapters 4 through 6 present techniques needed to process structured data (such as lists and tables), perform mathematical operations, and convert data from one number base to another. Finally, Chapters 7 through 9 describe how the 6502 instructions can be used to transfer information between the 6502 integrated circuit and the peripheral input/output devices.

This chapter arrangement, starting with very fundamental material and gradually introducing more complex topics, is intended to increase your understanding of the 6502 integrated circuit in an *orderly* manner.

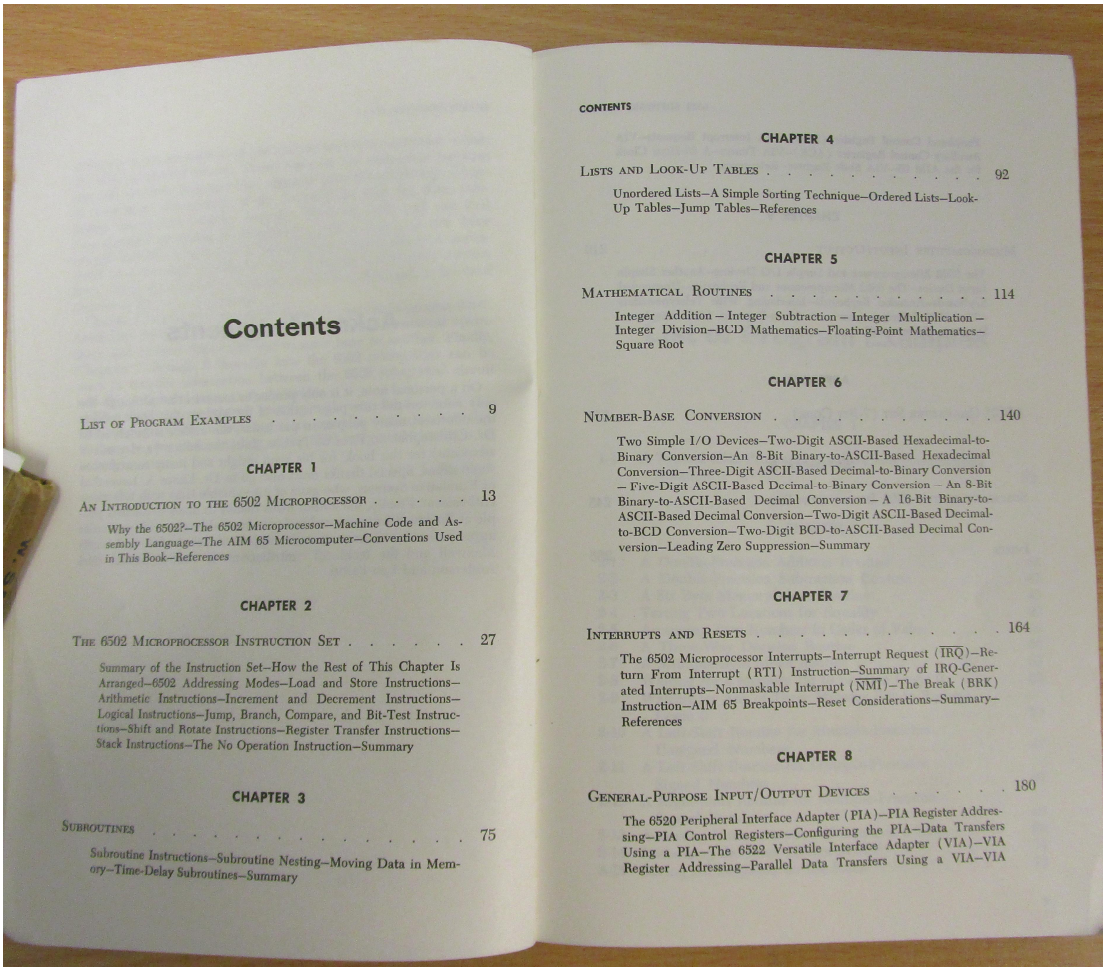
LEO J. SCANLON

This book is dedicated to my wife, Pat,
and my sons, Roger and Ryan.

Acknowledgments

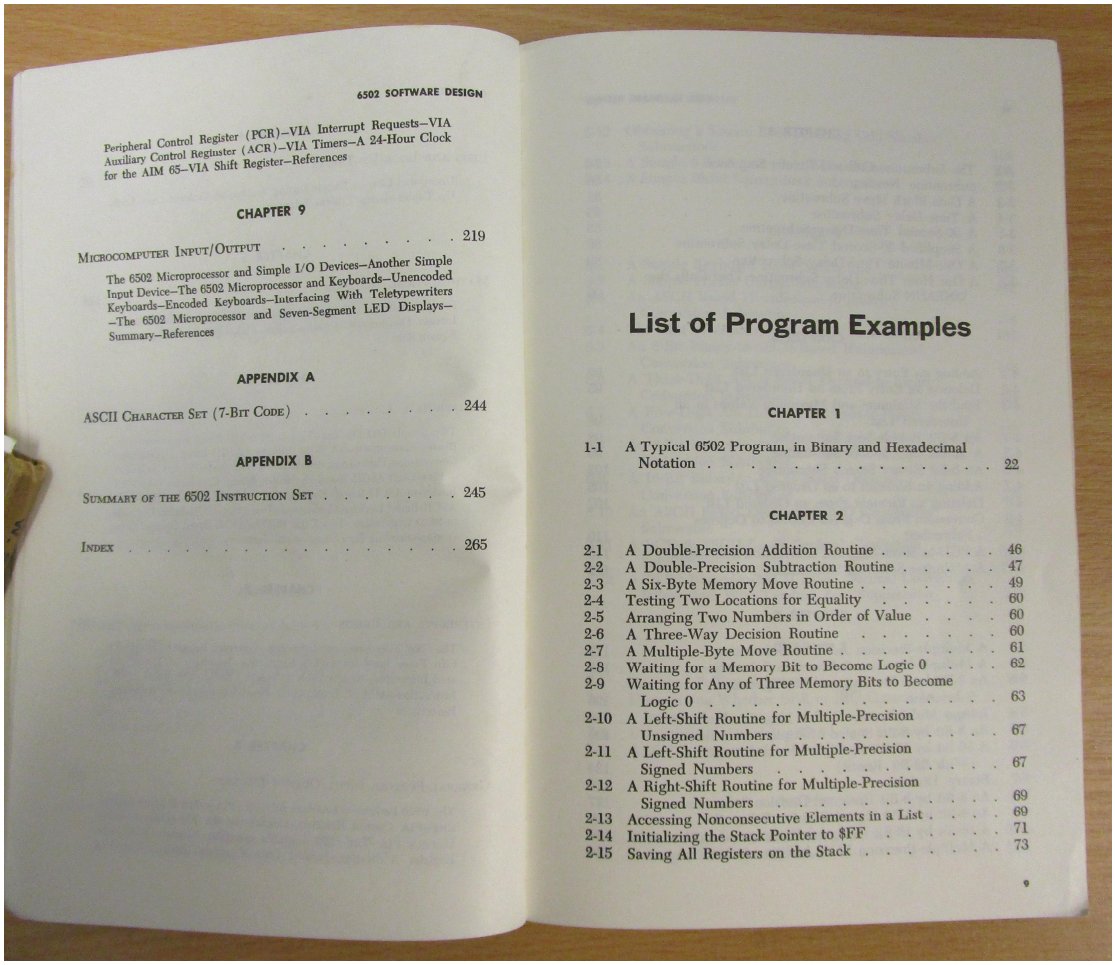
On a personal note, it is only proper to mention that although the only name on the title page is that of the author, this book reflects the efforts of many people. In particular, the author is indebted to Dr. Christopher A. Titus of Tychon, Inc., the editor (and reader's advocate) for this book, for his keen insight and many constructive suggestions. Special thanks must also go to Dr. Lance A. Leventhal of Emulative Systems, who gave of his valuable time with infectious enthusiasm. Finally, the author owes thanks to many dedicated people at Rockwell International in Anaheim, California, with particular appreciation for the management support of Bob Anslow and Scotty Maxwell and the technical contributions of Gordon Smith, Dick Anderson and Leo Pardo.

Figure 4: Title Pages page 3



Contents

Figure 5: Table of Contents page 1

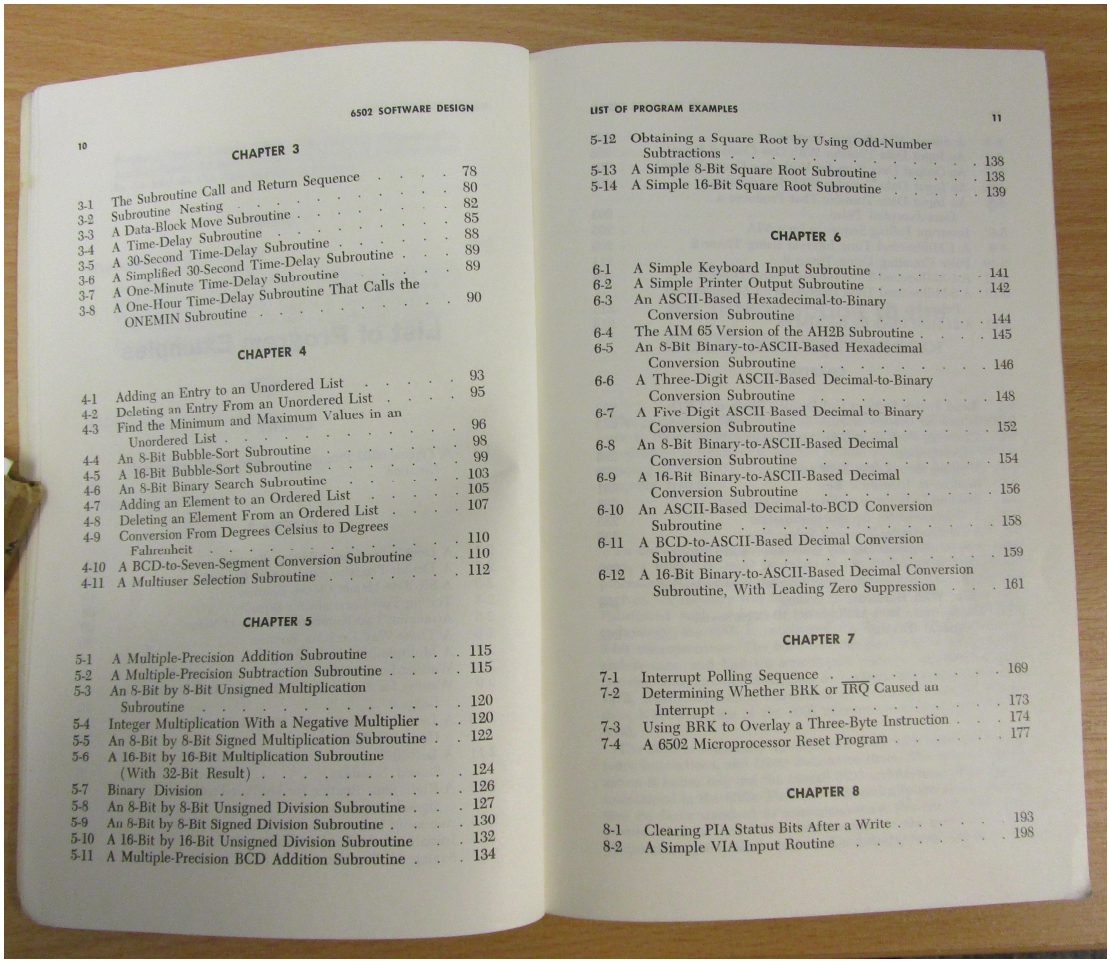


List of Program Examples

CHAPTER 1

CHAPTER 2

Figure 6: Table of Contents page 2



CHAPTER 3

CHAPTER 4

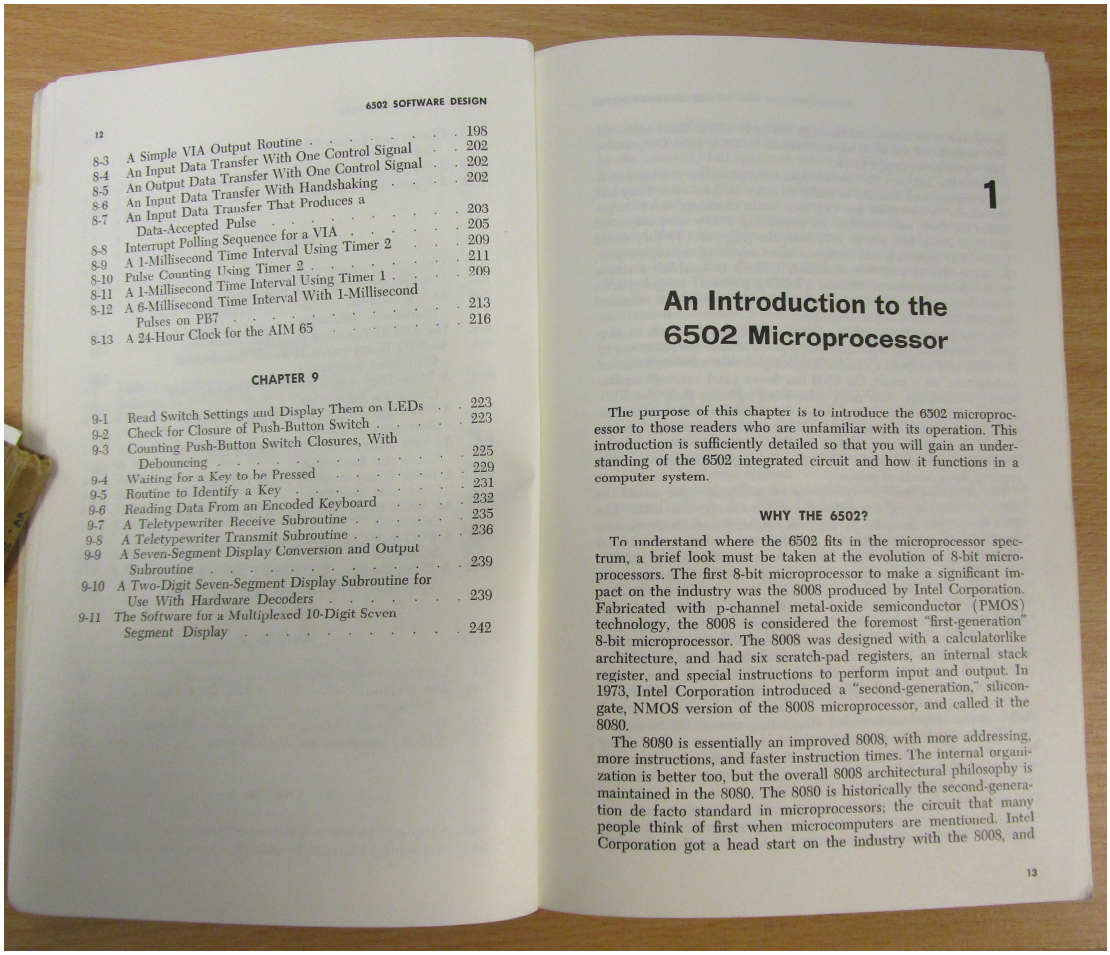
CHAPTER 5

CHAPTER 6

CHAPTER 7

CHAPTER 8

Figure 7: Table of Contents page 3



1

An Introduction to the 6502 Microprocessor

The purpose of this chapter is to introduce the 6502 microprocessor to those readers who are unfamiliar with its operation. This introduction is sufficiently detailed so that you will gain an understanding of the 6502 integrated circuit and how it functions in a computer system.

WHY THE 6502?

To understand where the 6502 fits in the microprocessor spectrum, a brief look must be taken at the evolution of 8-bit microprocessors. The first 8-bit microprocessor to make a significant impact on the industry was the 8008 produced by Intel Corporation. Fabricated with p-channel metal-oxide semiconductor (PMOS) technology, the 8008 is considered the foremost "first-generation" 8-bit microprocessor. The 8008 was designed with a calculatorlike architecture, and had six scratch-pad registers, an internal stack register, and special instructions to perform input and output. In 1973, Intel Corporation introduced a "second-generation," silicon-gate, NMOS version of the 8008 microprocessor, and called it the 8080.

The 8080 is essentially an improved 8008, with more addressing, more instructions, and faster instruction times. The internal organization is better too, but the overall 8008 architectural philosophy is maintained in the 8080. The 8080 is historically the second-generation de facto standard in microprocessors; the circuit that many people think of first when microcomputers are mentioned. Intel Corporation got a head start on the industry with the 8008, and

Figure 8: Table of Contents page 4