equipment reports

Scelbi Computer 8008/8080 Programming Manuals

CIRCLE 37 ON FREE INFORMATION CARD

MICROCOMPUTER FANS HAVE AN INSATIABLE appetite for program listings and programming manuals. There is not enough good instructive material around. Engineering computer texts are usually away over the head of most hobbyists. Microcomputer data sheets and manuals familiarize you with a specific device and cannot be expected to give much in the way of programming technique.

The four Scelbi books that are the subject of this review contain a rare mixture of useful programs and substantial illustration of technique. If you use them as texts and study them without skipping, you will be much more confident when you approach your next programming task. Minimizing memory was a secondary concern of the writers; the first was the ease of following the logic.

While the four books are written for 8008- and 8080-based microcomputers, I highly recommend them for owners of any type computer. If you want to run the programs on your machine they can be converted, which although a fairly tedious job, is much easier than starting from scratch. It is an unbeatable educational experience to boot.

And I practice what I preach since I have taken the floating point arithmetic package from *Machine Language Programming for the 8008 and Similar Microcomputers* and converted it to run on the JOLT microcomputer that uses the MOS Technology 6502 μP. The manageable game programs presented in *Scelbi's First Book of Computer Games for the 8008/8080* is an ideal place to start such a try at translating from one instruction set to another because of their uncomplicated fundamental structure.

Now to the books themselves. *Machine Language Programming for the 8008 and Similar Microcomputers* starts out at the most basic level of any of the texts and proceeds through a sophisticated program development. The manual begins with a description of the instruction set of the 8008 and talks about flow charts and hand assembly techniques. It covers 2's complement number representation and methods of converting between octal and decimal base number systems. Moving on, the manual demonstrates common programming problems by listing and explaining fully table search and sorting routines. Mathematical operations follow and more importantly the floating point package I mentioned earlier. The floating-point package uses four memory bytes (8-bit words) to store each number. Three words are used for the 23-bit mantissa plus 1-bit sign, and one word for the exponent and its sign. The data input, output, multiplication, addition, subtraction and division routines are explained in detail but in down to earth language.

Listed below is the terminal printout of my converted floating-point package. The first line beginning with the asterisk is the JOLT monitor printout following the initial carriage return. Next the program counter is set to 0100 using the colon alter command.

```
* 7052 30 2A FF 01 FF
.: 0100
.G 12 × 12 = +0.1440000E+03
144 / 12 = +0.1200000E+02
123456E10 + 876543E10 =
+0.1000001E+17
99999.9 – 11111.1 = +0.8888883E+05
1E6 × 22.2 = +0.2220001E+08
1E7 / 10 = +0.1000000E+07
1E9 / 1E–4 = +0.1000000E+14
10 – = +0.1000000E+02
10 – 1 = +0.9000000E+01
12E30 × 20E–2 = +0.2400009E+31
```

Following the command prompting dot on the third line is the **G** or go command that starts program execution. The input data routine accepts numbers in integer, fixed point, and scientific notation. **E** stands for exponent and signifies that the succeeding digits are powers of ten. **1E–4** is 1×10^{-4} or 0.0001. Output is always in the normalized form **±0.-------E±--**. Seventh place inaccuracies are caused by accumulated conversion errors and can be eliminated by a little more work.

As with all four books a complete assembled listing for the 8008 is given. The other three have dual listings for both the 8008 and 8080. Published in a large 8½ × 11-inch format, the 200-page edition is priced at $19.95.

Scelbi's First Book of Computer Games for the 8008/8080 includes complete descriptions and program listings for Space Capture, Hexpawn and Hangman.

Space Capture uses an eight by eight space checkerboard in which you must capture an alien ship by surrounding it with PHASOR hits. The initial program message describes the game perfectly:

> "SPACESHIP CAPTURE. YOU HAVE 15 PHASOR SHOTS WITH WHICH TO DESTROY MY TRAVEL SECTORS. IF ALL MY ADJACENT SECTORS ARE DESTROYED I AM CAPTURED. IF YOU HIT ME OR RUN OUT OF PHASOR ENERGY, THEN YOU LOSE!."

Messages are stored one character per word in a contiguous block of memory. Messages are separated by blank characters. You can shorten the statements to conserve memory or alter them to your own taste.

Hexpawn is a simplified chess game that uses a 9-square board with three pawns on each side. The game is won by getting one of your pawns to the opposite side of the board or destroying all the computer's men.

Hexpawn is very instructive in technique because the computer learns as it plays. At the start of the first game the computer is literally empty-headed and loses easily. But every time the machine makes a mistake and loses it remembers the error by blanking out the move in a memory table. The next time the same situation is encountered the computer will not repeat the mistake. It reaches the point where you can no longer win—the best chance you have is forcing a draw.

Moves are printed out with three octal digits representing either side's board positions. Memory storage requirements are five 256-word pages and can be reduced to under four pages by shortening text messages.

Hangman is the familiar word game of the same name. One of a series of words stored in memory is randomly selected by the computer. The game offers tremendous language learning possibilities. By starting with the simpler words of a language you are studying and then gradually increasing the difficulty of the vocabulary you learn while enjoying yourself.

An 8-bit word-buffer holds the word selected from the list. The guess-buffer is initially filled with hyphens which are replaced with letters from the word buffer as matches occur between the word buffer and the guessed letter. A program loop sequentially tests the characters in the word buffer for a match.

The printout below shows how Hangman looks on the terminal. Scelbi's computer game book sells for $14.95.

```
WANT A NEW WORD?  Y
GUESS A LETTER:   A
NOPE! H———
GUESS A LETTER:   E
GOOD. YOU HAVE:       ———E–
GUESS A LETTER:   O
GOOD. YOU HAVE:       –O——E–
GUESS A LETTER:   N
NOPE! HA———
GUESS A LETTER:   P
GOOD. YOU HAVE:       –O——ER
GUESS A LETTER:   L
NOPE! HAN——
GUESS A LETTER:   T
GOOD. YOU HAVE:       –O——TER
GUESS A LETTER:   C
GOOD. YOU HAVE:       CO——TER
GUESS A LETTER:   M
GOOD. YOU HAVE:       COM—TER
GUESS A LETTER:   P
GOOD. YOU HAVE:       COMP–TER
GUESS A LETTER:   U
GOOD. YOU HAVE:       COMPUTER
CONGRATULATIONS!
WANT A NEW WORD?  N
GOODBYE!
```

The next book is entirely devoted to a single fascinating game. *Scelbi's Galaxy Game for the 8008/8080* works with 64 sectors in space each having a matrix of 64 quadrants. You can give commands that give short and long term scans, fire torpedos and phasors, and navigate your ship. Every move you make consumes energy and energy conservation is crucial. Then there is the additional consideration of protecting yourself with energy shields. Firing at enemy ships and missing causes immediate retaliation. Space refueling stations are scattered through space, but don't collide with one or hit one with a weapon or you are apt to run out of fuel.

Each time the game is started the space objects are distributed randomly in the sectors. Random numbers are generated by executing a sequence of arithmetic operations at high speed while waiting for the operator's response to the initial message. Even conscious effort of a knowing player has no influence on the random number.

Fourth and most complicated is the text titled *SCELBAL—A Higher Level Language for 8008/8080 Systems.* SCELBAL (*SC*ientific *EL*ementary *BA*sic *L*anguage) is a form of the popular Basic computative language useful for scientific and general problem solving. The 400 8½ × 11-inch pages of SCELBAL will reveal many of the mysteries of computer art to the devoted reader. The text simplifies the program by looking at the overall plan with the help of flow charts and then expands each of the main chart blocks.

SCELBAL requires 8K of memory and includes a close facsimile of the floating-point package in the first book as an essential component. Although SCELBAL does not include extended features such as trigonometric and logarithmic functions, after a study of the book and some research in

representing functions as truncated series, the reader should be able to add his own functions (with additional memory). No doubt periodic updates or reader submissions in this vein will be published later on.

SCELBAL has three basic modes of operation. Most significant is stored program operation where line numbers are typed at the beginning of each line. These are stored for later execution using the RUN command. The second mode is direct execution. If line numbers do not precede the statements they will be executed immediately after the carriage return. In this mode the program operates something like a calculator.

Third is the command mode. SCELBAL detects four commands. Entering LIST triggers a printout of your program. SAVE and LOAD store and reload programs stored on paper tape, magnetic tape cassettes, or any external storage device. SCR clears the program buffer and variable storage memory areas in preparation for a new program.

User programs can contain 26 variables but more can be handled with the extended array capability. 8K of memory leaves about 1250 words for higher level program storage. The SCELBAL manual is priced at $49.95.

All four publications are available from Scelbi Computer Consulting, Inc., 1322 Rear—Boston Post Road, Milford, CT 06460. **R-E**

Heathkit AA-1640 Power Amplifier

CIRCLE 50 ON FREE INFORMATION CARD

IF YOU ARE DIGITALLY DEXTEROUS, DETERmined, dauntless, patient, possessed of intellectual curiosity and like to accept challenges, here is THE project for you—the Heathkit model AA-1640, a 200-watts per channel stereo power-amplifier.

If you like the feeling that there's a worthy reward at the end of a demanding project, the AA-1640 will more than satisfy it. In fact, you're likely to feel that you actually did little to earn such a large reward for your efforts and time.

My "journey" with the AA-1640 was not a smooth one. While I worked with great care and patience, it was still possible to commit "boo-boos." While I found the instruction manual complete in terms of installation details, I found it confusing in a number of spots. While Heath comes on strong with a pledge that it will be a "silent partner" in your project, its implementation of that partnership leaves a bit to be desired.

Construction

My total investment of time was 70 hours—a lot to spend on a single project. But it was done pleasurably, over a period of two months, in working sessions of one to two and a half hours. The latter is the maximum I would recommend; going beyond that can put a strain on your concentration capabilities and could easily result in mistakes. In fact, the company advises you to "proceed at a leisurely pace . . . to avoid getting tired from working too long at one time." Actually, I found myself wanting to go beyond a two and a half hour maximum; this, I hear, is called "kit fever"—a driving impulse that keeps you going beyond reasonable limits.

Were I to build another AA-1640, I could lower the time figure by about 15 hours. I'm certain an experienced kit builder could put the unit together in 50 to 60 hours at the outset. I found myself spending a lot of time rechecking parts numbers and hardware sizes because of an overly cautious nature. To show you the amount of parts/hardware involved, it required over three hours to initially check them against the packing lists.

One of the first things that impressed me about the AA-1640 amplifier was the way it was packed. It came in three boxes. One contained the meters and related circuit boards. Another contained a single item—the power transformer, a 25-pound "monster." The third contained the rest of the kit. Splitting the kit enabled Heath to ship via United Parcel, a company noted for handling electronic products with care. Packing the kit in three boxes also substantially reduced the chances of internal damage, as for example, the power transformer loosening from its moorings and slamming into a lighter, more vulnerable part of the kit.

The second thing that impressed me was the sense of security I had after reading a note from Bob Ellerton, Technical Consultant, "your personal consultant during the assembly and checkout of your kit . . . we're partners in the project." While I'd built two other electronic kits several years ago—an integrated amplifier and a stereo tape recorder—I still had a certain amount of stage fright. The note dispelled it. (My personal consultants actually were members of the Heathkit Electronic Center staff in Manhattan.)

Being a cautious type, I decided to "ground" myself before starting by perusing the construction manual. Again I was impressed, this time by the manual's thoroughness. Much of it is well thought out.

My first sense of reward came at the end of less than two hours of working time, which consisted of checking out one of several parts lists and wiring the test meter—a device indispensable for putting this kit together. The meter did what it was supposed to during its checkout.

My second came an hour and a half later, on completion of the input amplifier circuit board. I was relieved to find that rewiring (and reheating) a miswired transistor had not affected its capabilities.

My third came two and a half hours later on completion of the power-supply circuit board, the largest so far. At this point I felt that I would have few problems completing the set, with no real complications as long as I steadfastly observed each nitty-gritty detail as outlined.

My first apparent trouble occurred some eight working hours later at the end of wiring the first of two output-amplifier circuit boards. The meter did not respond as it should have at one check point (page 50 of the manual)—it barely moved. Following instructions, I rechecked the entire board for solder connections, shorts, etc. Finding none, I then continued following instructions and replaced a capacitor. I got the same miniscule meter reading, nowhere near as broad as indicated in the manual. I was stumped and decided to wire the second board and see what happened when I checked it out, for comparison and as a kind of double check. I also figured that if I had trouble with it, I would take both boards to my Heathkit consultant for help.

On completing the second amplifier circuit board, and comparing it part for part, placement for placement with the first, I ran the same checks. As with the first board I got correct meter readings at all but one check point—the same one. This suggested there might be an error in the manual, the instructions, or what have you. I headed for midtown Manhattan with the manual for help from the Heathkit center.

There I was told that while the manual reading showed a span of one-fifth of the meter scale, that the miniscule reading I had obtained was, indeed, desirable and that I had no problem. Relief! However, I left feeling a bit miffed that the manual did not spell out the fact that a virtual no-reading reading was OK.

A major disappointment occurred some 26 working hours later when I conducted the input amplifier tests (page 110 of the manual). Nothing. Zero. . . . Thinking the tuner/preamp combination was at fault, I checked it out. It worked. On rehooking the units and starting a recheck, I blew a fuse. I attributed this to having accidentally shorted the tips of a pair of bare blue wires that extended from the innards of the kit. That stopped me cold. At this point I decided to stop by the kit center for advice. There I was told that I had probably blown two diodes as a result of my inadvertent short and was given free replacements plus a new fuse.

Wiring them in and turning on the set, I heard a momentary buzz and saw a puff of smoke. It was one of the replacement diodes. This suggested I take the amplifier in to Heath for a look-see and additional assistance.

After explaining the matter at the Heathkit center, I was told that I had probably shorted a relay that caused the diode to blow. In the process of asking for further explanation and what I might do next to correct the problem, I was informed that others were waiting for their questions to be answered and that there were phone calls lined up for the technician to answer. Rather than risk trying to comprehend a hurried, impatient explanation of what then seemed to be a complicated matter in such a hectic, pushy atmosphere, I opted to leave the unit for repair. I was told it would be ready in two weeks.

It was ready in exactly one month. I was informed that the delay was caused by a total remodelling of the Heathkit center and employee vacations. My invoice read "Fuse blown by defective D101,102 (diodes), defect caused by left-channel circuit-breaker wires not being connected. Protection board now works. Initial tests all OK, now ready

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