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A BIT OF NYBBLING AT BYTES IN A WORD

Dear Sir:

I was very delighted to receive the first issue of BYTE. I found all the articles, and even the letters interesting, absorbing, and amusing. There are, though, three points about which I would appreciate some information and clarification.

First of all, I seem to be a bit confused about your use of the words "word", "byte" and "bit". As I understand their usage, "word" refers to the grouping of "bytes" which are considered to be one memory location, and "byte" is a grouping of bits, three or four depending on whether octal or hexadecimal is used. The article "Which Microprocessor for You?" seems to use the terms "word" and "byte" interchangeably, which confuses me about the processor's location referencing ability. Who is right, me or you?

Secondly, I have seen information about 8-bit and 16-bit microprocessors, but no ads about 12-bit microprocessors. Having gotten my programming training on a 12-bit system (PDP-8/L) may have made me unduly partial to 12-bit words, but an 8-bit system would not allow me to cheat and store two ASCII characters in a location, while 16 bits seems too big for my desires. Does anybody put out a 12-bit microprocessor with 4k memory?

Finally, I see a large number of keyboards out on the market; I do not see any printers, line or teletype type. Where are they hiding?

Thank you for your attention.

Stephen Holland
Glenview IL

Thank you for your letter, Stephen. Precision in description of concepts is one of the most powerful techniques in the human race's evolutionary bag of tricks. The only hitch is communicating what the definitions are when there are many different people involved and each has a unique past experience. Hopefully in written communications we can keep the ambiguities (other than occasional fun) to a minimum. To clarify your very valid complaint about memory terms, the following are some fairly fundamental definitions. When you read certain articles, such as Hal Chamberlin's, it turns out that two of these definitions are equivalent. For other situations they may not be:

**A bit is the fundamental — it is the unit of storage. All other terms are described in terms of bits. One memory cell can hold one bit's value of logical zero or one.*

**A byte is a grouping of bits in the organization of memory, usually defined ala IBM as 8 bits. (Nybbles are half-bytes.)*

**A word is the generic and very general term for "n" bits at once in a computer's memory. The term word is the same as byte when referencing an 8-bit byte-oriented machine, but will certainly differ for a 12-bit PDP-8 or a 16-bit PDP-11 or some old 36-bit Univac clunker or a 60-bit CDC machine.*

If that's not enough to confuse the issue, some of the early literature on machines such as IBM's old STRETCH computer referenced variable sized bytes extending the definition to "any group of n bits".

In general, though, a given machine will have a "memory address space" for direct reference to a particular size of "word". For the byte-bangers (8080, 6800, 8008, 6501, F8, etc.) each memory address gets you one byte. For a PDP-8 each address in memory gets you one 12-bit word. And so on.

As far as 12-bit micros go, there are none which are generally available to amateurs yet. There is the CMOS PDP-8 replacement which Intersil makes, but it is very expensive as yet. There is the FABRI-TEK processor which is an MSI copy of a PDP-8 at about $1000 for the CPU, but again a working system is not inexpensive. The FABRI-TEK machine does come with 4k built in at the price.

Concerning printers, you are again getting up in price. A simple receive only Teletype is about $200-300 if you get to the right place at the right time in the surplus market. There is something called a Creed Teletype which I have seen some literature on — an old 5-bit Baudot machine which you could probably hook up fairly easily to Bill Godbout's PACE processor with its ASCII-Baudot software. Where are the printers hiding? In surplus houses which don't advertise 'em because their stock changes too frequently.

. . . Carl

Dear Carl,

I just finished reading the first issue of BYTE, received today. I found the articles interesting but now realize how little I know about programming terms and functions.

I've been in ham radio and radio and television broadcast engineering for well over 15 years. I understand the basics of digital electronics and have designed control circuits and enjoy using digital techniques in other types of electronic circuitry.

I can follow the articles until the author starts hitting me with programming terms, then I'm lost. Perhaps you might try to educate such as I with some very basic articles on programming and those hardware functions mostly limited to computers. You might also recommend some up-to-date books on these subjects.

I would very much like to learn more about this field. Perhaps I'm not the typical reader you are publishing BYTE for, but I suspect there are other readers out there with the same problems.

I'd also like to see you insert a bingo card to make it easier to get further information and catalogs from your advertisers.

Kenneth Knecht
Chicago IL

Thank you for your input, Ken. I am indeed worried about the problem of acquainting the novice readers of BYTE with the terminology and concepts of home brew computing. I'm working on getting various authors to submit tutorials on the concepts of programming for people such as yourself with a strong hardware background. Then there is the analogous problem from the other side — explaining the mysteries of hardware to software people. For instance, a software-oriented friend of mine

pointed out that he got lost on the diode matrix concept in the keyboard article of BYTE #1, a concept which is probably familiar to a number of readers with a hardware background. As long as I am enumerating possible approaches to the art of home brew computing, I shouldn't forget the person who has neither hardware or software background — the complete novice.

The way I can find out about what "the typical reader" is thinking is for "the typical reader" to send in comments, as you have. One of the biggest unknowns I had when I first came up with the problem of editing this magazine was figuring out in my mind just what the readership is: Is it a bunch of hackers from the MIT or SRI artificial intelligence labs? Hardly — although I know a few who subscribe. Is it the group of ambitious people who started 8008 projects when they first came out? Yes — but not exclusively, by a long shot. Is it the engineer who always wanted his own hardware — but never heard of software engineering? Yes — some readers fall in that realm. Is it the applications programmer who gets kicks out of programming and always wanted a processor of his own? Of course — there is more than one COBOL programmer in the audience to say nothing of FORTRAN people and PL/1 people.

Is it the BASIC fundamentalist who is lost in his applications games and suddenly discovers there is more to computing than GOSUB and LET? Sure — and he has a whole realm of hardware and software to learn about. The problem is a tough one — but constructive input from readers in the form of articles and opinion is an important key to shaping the content of the magazine. Introductory materials and articles to get people acquainted with terminology will be in future issues — as you'll find to be true in this issue as well.

... Carl

WHO IS STEPHEN B. GRAY?

Dear Sir,

Your description of the Amateur Computer Society (ACS) in the Clubs column of the first issue of BYTE is strangely constructed. Please allow me to supply your readers with further info about the ACS along with some history of the home computer "hobby."

Stephen Gray organized the ACS in 1966 to serve everyone who is involved in designing and building his own home computer. The ACS is an informal organization, with no such thing as officers or meetings, since its members are widely separated across the U.S. The main function of ACS has been to initiate the exchange of ideas and equipment among its members. This is done by the *ACS Newsletter*, which describes the plans and accomplishments and acquisitions of the various members. It also lists the sources of surplus computer parts available for the hobbyist. Back in the late 60's and early 70's there were no kits available to buy, and not too much surplus computer equipment. This meant that most home computer builders had to design their CPUs and I/O interfaces from scratch. The ACS in those years was made up mostly of digital circuit and systems design engineers. It was like the early decades of amateur radio, when not much commercial equipment was available for hams to buy.

Today there are several hundred ACS members representing all kinds of careers in the electronics and computer industries. Lots of them have had operating home computers for five to eight years! These people have a really wide variety of home computers, from old vacuum tube ones and all discrete germanium transistor ones to microprogrammable LSI minis and microprocessor based ones. Some of them have reconditioned obsolete models that you can't even buy parts for anymore, with such weird peripherals as drum memories and flexowriters. Others have lots of the latest stuff, like CRT graphics terminals, digital cassettes, and floppy disks. And of course lots of them have designed their own CPU architecture and instruction sets to provide special purpose capabilities that are unmatched by anything in the industry.

"The ACS is an informal organization, with no such thing as officers or meetings ... the main function has been to initiate the exchange of ideas and equipment ..."

With such a wide variety of approaches, design philosophies and languages existing in the home computer field, each ACS member's computer "lives" in its own special world, having little in common with the next member's computer (which may be several dozen miles away). Compare that with tomorrow's home computer scene, where there will be thousands of people with systems built around audio cassette mass storage, VDTs and 6800s and 8080s. Then any article published for one of these systems will be quite useful to thousands of people.

But as it is now, there is little in the line of construction articles and detailed program descriptions (with source code listings) that could be directly used by more than a handful of ACS members. Therefore, Stephen Gray does not publish such articles in the ACS newsletter. Instead he has used this disparity as an opportunity to make it a more personal newsletter, reporting in each issue what various individuals have accomplished, what difficulties or experiences we have written about, who of us have information or equipment to sell, or trade, who needs information about certain equipment, what new items are available commercially, to the home computer market and so on. All in all it's a very helpful and informative newsletter.

I feel that Mr. Gray has done an excellent job of bringing us home computer builders together, and I believe that the ACS and its members have quite a lot to offer to the new generation of home computer enthusiasts that have been spawned by the age of the microprocessor. I think that the recent developments in our field are just great and the near future promises to be absolutely fantastic! It all can't come soon enough for

me! Even though science fiction writers predicted it long ago, who knows what the future of computing will bring? I certainly welcome BYTE into our field and wish you the best in this new computer age.

Dick Snyder
Chelmsford MA

Strangely constructed? Indeed! The goal of obtaining more information was accomplished, Dick, although Mr. Gray is too modest to send it to BYTE himself. All I had to go on was one cryptic letter Stephen B. Gray had written to Wayne Green and a file reference supplied to me by Richard Gardner who makes it his business to know what's going on where and by whom.

I am firmly of the belief that anyone who has made verifiable contributions to the technological progress of this extremely interesting hobby should be recognized — as you point out in your letter Mr. Gray has made such a contribution by serving as a focal point for a group of the pioneer home computer hackers. To the best of my knowledge he is the earliest person to put together a vehicle for communications amongst home brew computer people, a notable contribution.

. . . Carl

The comparison of simple subroutines for different microcomputers does not show the relative merits of the machines.

WHICH MICROPROCESSOR EVALUATOR FOR YOU?

Dear Editor,

I am pleased to see a high quality magazine for the computer hobbyist. In the large and fast changing field BYTE will be invaluable as an educational and informational forum.

I have spent the last three years programming microcomputers, most recently writing ALTAIR BASIC with Paul Allen and Monte Davidoff, and hope to share some of what I've learned with your readers.

I do have some disagreement with statements made in Hal Chamberlin's article "Which Microprocessor for You?" Of the three micros, the IMP-16, the Intel 8080 and the Intel 8008, the 8080 has the best memory efficiency due to the number of things that can be done in a single 8-bit instruction. The IMP-16 is second best, requiring 30% more memory bits; and the 8008 is a distant third, requiring about twice as much memory as the 8080.

The IMP-16 is the fastest machine with the 8080 a close second. The 8008 is at least 12 times as slow as the 8080. This is because the 8008 not only has a much slower cycle time, but it requires many more operations to perform an equivalent function.

Software from MITS costs about six times as much if hardware is not purchased from MITS. As long as hardware is purchased from MITS, MITS is willing to just break even on the software.

The comparison of simple subroutines for different microcomputers does not show the relative merits of the machines. The best way someone who doesn't know a lot about software can judge the different microcomputers is by seeing how large and how fast a large program like a BASIC interpreter or FORTRAN compiler written by a professional programmer will run on the machine.

William H. Gates
President, Micro-Soft
Albuquerque NM

PS: The program on page 54 of BYTE #1 doesn't work since the dispatch table entries are three bytes long instead of two.

The substance of Bill Gates' letter is that the problem of evaluating a computer's performance is a complicated issue. Every machine has its little idiot-syncrasies which enable it to outperform its competitor in a specific context. The tests one uses to evaluate the machine in many ways affect one's results: Bill (like myself) would tend to evaluate a machine based upon a complicated "benchmark" application or systems program. This sort of evaluation typically will exercise the full range of the CPU's instruction set in a real-world large program context. Other people would tend to evaluate not upon that benchmark, but on the ease of generation of machine code which is fully optimized by a modern compiler. The compiler writer's benchmark is different from the systems hacker's benchmark. Then there is the small computer world — which is the best computer from the home brew hacker's standpoint? Probably in the current state of the art it is the machine which has the easiest instruction set to deal with given a modicum of support in the form of assemblers from the kit supplier.

People have been evaluating computer instruction sets since the first time some disgruntled programmer cursed at an IBM 650 (or earlier) product. And people will continue to do so. I'd like to see some of BYTE's readers giving personal evaluations of their own experiences programming some of the machines which are now available. This will produce still another form of benchmark.

Oh yes, regarding the mistake on page 54 — see the "Diagnostics" heading in the Nucleus of the Queue, in this issue.

. . . Carl

IT'S GREEK TO ME . . .

Carl,

With all due respect, your dump of computer organizations in the last issue of BYTE was incomplete! (Obviously a hardware bug.) You omitted perhaps the biggest one of them all (at least in potential) — Beta Iota Tau (BIT). Yes fans — that's right — it's here now — the first computer science college fraternity. Us knurds got our (expletive deleted) together this time. You say you never heard of us? That's understandable, we're new (and not fully established yet). As of the present only two chapters are emerging from the mass of red tape (7, 9 and Cassette): the founding chapter here at Rose-Hulman Institute of Technology (and software disproving grounds), and the Beta chapter at Michigan State. As the probability of this publication finding its way to college campuses this fall approaches one as a limit, we would like to take this time to rip off some advertising space.

Are you interested in starting a chapter of BIT at your college or university? If you are, then ASCII some of your friends. Show them this crazy letter we're writing at this crazy hour. Drop us a

line (RS-232 compatible) at the address below. We'll send you more information as we get it ready. If nothing else we'll help synchronize you with the rest of the knurds at your school (provided they write in also). Write to:

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001 * c/o Richard A. Petke
002 * R.H.I.T. Box 520
003 * Terre Haute IN 47803

For BIT,

R. Petke
High Order Bit
B. Copus
Chairman of the Vice
L. Passo
I/O Processor

I suppose it just had to happen some time. I'm glad to hear about BIT, Richard. The very idea of BIT leads to all manner of intricate and exciting possibilities. Why, to start off with, you'll need to recruit a bunch of novices known as "Least Significant Bits" into which they have been indoctrinated with their Initialization Writes, they can work their way up through the ranks. But you will have to be selective about it — you'll have to watch out for shifty characters. AND in the fall you can schedule (at high priority) some major social events in the BIT house culminating in the Masked Ball around Halloween. OR in the spring you can have another big social affair at which you'll crown the Queen of the PROM (hopefully she'll not get burned). Speaking of such matters, to be fair you had better organize the logical complement of your organization. Find some ladies to form a sorority, or change your parameters and get some grand scale integration into your organization. Keep me posted on progress of BIT.

. . . Carl

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