A C S NEWSLETTER

SACK ISSUE

a publication of the
AMATEUR COMPUTER SOCIETY

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MEMBERSHIP

The ACS now has 70 members, in 23 states, Canada, Italy, Japan and Switzerland.

There are ACS members at IBM, GE, RCA, SEL, TRW, Bunker-Ramo, Hughes, Westinghouse, Lockheed, Litton, Hitachi, Bell Labs, Motorola, Goodyear Aerospace, Brookhaven, Western Electric, Teletype, General Radio, Harvard, MIT, Annapolis, Arizona State, Tennessee Tech, Lehigh, and the Universities of Illinois, Michigan and Mississippi.

SACK

This issue was to have told where to look up articles and references about computers. However, the comments received on the proposed Standard Amateur Computer Kit are of a more immediate value, so this issue will be about SACK instead. And there are many miscellaneous items, for which there will be no room in the reference issue.

As expected, comments on the SACK were mixed, both pro and con. Here are excerpts from several letters.

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From Don Fronek:

A standard computer should have:

1. Plug-in cards (can buy ready-made cards, or cards without components).
2. Frame construction with card receptacles (allows the builder to locate his circuits as he wants them).
3. Power supplies to fit within the frame.
4. Universal front panel (pre-punched holes -- when using the kit-builders approach).
5. Input/output (plugs should be available at rear for additional or special outputs).

I find that plug-in cards are the most desirable, because of uniformity and because they do a good job of reducing the overall space. There are plenty of cards available with and without components mounted. If the circuit boards are purchased in quantity (as by a kit-builder company), they should not be expensive. The frame chassis should have the guides (or slots) and the card receptacles mounted. All the card receptacles I've seen are quite expensive, even in quantity, but if the supplying company riveted a utility-grade type to the frame, I don't think the cost would be too much, and would probably work fine (something on the order of riveted tube sockets on those cheap AM radios you buy for $5.99).

I find that two things are the most important: (1) printed-circuit boards and (2) frame chassis mounting hardware. With little exception, the rest of the machine can be expanded in bits and pieces. The frame chassis could come ready-made in rows, so the builder could buy a row at a time. And cards as needed.

It would be desirable to have some sort of "standard" front for input/output that could be prepunched according to the kit one wishes to build. I think this whole system

could be like "tinker toys," with the emphasis on high fidelity. The more you buy, the more things you are able to do and build, but everybody has his own ideas of mixing units, and perhaps the builder would use the kit idea to complement the equipment that he already has.

I would also use solderless connectors in all the wiring between receptacles. I find that I am continuously changing circuits. With close pin spacing, a soldered connection gets very messy even when you are trying to keep things neat. The wires get burned, the solder slops over onto the adjacent pin, and on and on. This means added cost, but I'll have to vote for solderless connectors.

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From Jim Haynes:

Seems to be that the essential problem is trying to decide what you want to do with what you have. I guess memory is the pacing item. Anybody who goes in for core, even small core, is talking about money. Depending on the supply of delay lines, that is probably the way to go for a cheap machine.

I can see how one might build a sort of arithmetic unit demonstrator, perhaps with a couple of registers and the ability to add, subtract, shift, etc.; and this might use the bit-slice idea. From this basis, one could exercise a lot of originality in the instruction set and instruction execution control logic -- so this sort of thing would be hard to standardize, unless one wanted to try to market it for educational purposes and build a course around it or something like that, which probably wouldn't appeal to ACS members.

But without some storage, there's little point in building up the instruction execution logic. And I would really hate to see the thing get mixed up in a formalized educational setup, because then a lot of professional education marketers would get into the act, and the price would go skyhigh.

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From Aubrey Hutchison:

Before embarking on an effort to generate an amateur computer kit, I recommend that serious consideration be given to several items which I feel are a little more basic:

1. With the apparent talent available within the ACS, a set of recommended building blocks (that later could be adapted into a computer kit) possibly should be developed. Examples of building blocks could be shift registers, binary to octal converters, line drivers, sense amplifiers and adder circuits.

2. Consideration also should be given to an amateur standard instruction repertoire that will be versatile enough to allow either wired multiplication and division, or programmed multiplication and division. Also, enough initial consideration should be given to allow the deletion of instructions that an individual feels are not unique to his specific needs.

3. Since the software and hardware are usually related to a great degree, serious consideration should be given to both the hardware and software requirements before determining the word length. In my case, I have chosen a 12-bit word and the instruction repertoire used by Digital Electronics Corp. A word length longer than 12 bits tends to cause the hardware to increase at a rather rapid rate. A

word length less than 12 bits tends to make the programming unnecessarily complex. In my opinion, word lengths ranging between 10 and 14 bits are most suitable for the amateur. One advantage in using the 12-bit word length and the DEC instruction repertoire is the possibility of using programs written for the DEC PDP-8 and PDP-5 series of computers.

4. Most people, so it appears, are concerned with the speed of operation of homemade computers, judging from comments in the Newsletter. It is my opinion that this is an invalid concern; since with the order of speed allowed with Teletype, microsecond equipment seems to be a little on the high side for practical purposes. Milliseconds possibly will be ample in most cases. Therefore, if SACK becomes a reality, it appears that the most practical application would be a four-register serial machine using multi-purpose registers. For example, a buffer-accumulator combination.

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From Bill Pfeiffer:

The idea of the standard amateur computer is excellent. I don't see where it is incompatible with the home-brew idea. As a starter, just the specs would be enough. Those who can scrounge the necessary stuff can go from there. Those who need the works could get what they want. With the right kind of a beginning, all kinds of possibilities could develop for adding new features. Five hundred dollars seems quite high as a starting point.

I favor trying to track somewhat with a machine like the PDP-8/S with minimum features to reduce hardware and complexities.

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From Dave Vednor:

I must say that I am against the idea of SACK. By placing a kit of this type on the market, amateur computer builders would not have any major problems, and very few new ideas would result. Amateur radio is a good case in point. Today most of the gear in use is not home-brew, but manufactured to commercial standards. This is great for the hams who don't know how to build, but what is the purpose of amateur radio? The FCC thinks that the U.S. hams should increase radio technology. This is being done, but not to the extent that it could be. If amateur radio gear was not produced commercially, we would not have as many hams, but those hams would make more contributions than all of the hams make today. I might add that I am also a radio amateur (WB6UHM).

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There they are, five sets of opinions on SACK. They're given here, not to boost the idea of a computer kit, but for the value of their ideas. Further comments welcome.

COMPUTER SCHEMATICS

Build Your Teaching Computer With M.E.L. Sub-Assemblies, 16 pages, free from Amperex Electronic Corp., 230 Duffy Avenue, Hicksville, N.Y. 11802.

This booklet describes a simple computer that can be built in five stages. The first stage performs addition and subtraction on eight-bit words, using one register and an accumulator. Control and data input are manual. Multiplication can be performed by successive addition, and division by succesive subtraction, manually.

The stage two computer can perform

automatic multiplication and division, by use of comparator and auto-restart circuits.

The stage three computer adds extra storage to the stage two computer, by incorporating two 8-bit shift registers, along with circuits for transferring data between these registers and the accumulator or the main register.

Detailed schematics are provided for these three computers. Speeds are 20 Kc, 1 cps, and manual.

For the stage four computer, there is only a block diagram to show how a delay line can be added for extra storage. The stage five block diagram indicates how paper tape might be used for input, and perhaps for output.

The encapsulated logic modules are the Philips Series 2, sold by M.E.L. in England and by Amperex in the U.S.A. The cost of the circuits for stage 1 is about $230; for stage 2, about $310; and for stage 3, about $600. These prices are for building the entire computer at that stage. The price of the M.E.L. delay line is about $155 without U.S. duty.

MORE ON CORES BY ZUCCARO

Sal writes that, in the last newsletter, when he said "the size of the output signal," he should have said, "the size of the signal when integrated." He continues:

Here, a simple RC integrator is used to sum the $\int i\,dt$. Therefore, as a square-loop core has only a certain amount of flux available, it can only charge a capacitor to some pre-determined value, no matter how fast or hard the core is driven.

The integrated signal looks like this:

Here V X RC(t) = flux in webers.

As to the remarks about 80- and 50-mil cores, the ERMA memory in the Bank of America computer uses 80-mil cores. The half-select current is 180 ma. This is much lower than the half-select current of 410 ma for a 30-mil lithium core. Some of the fast 20-mil cores have half-selects of around 500 ma.

For myself (says Sal), I can't imagine anyone in the ACS needing to operate memory to the point where heating becomes a problem. Almost any memory core will operate at 200 Kc, and most high-speed cores need special attention only above 500 Kc.

We have used load-sharing switches in the past, and now they are just novelties we talk about. For driving a stack of any reasonable size (16K, 40-bit) I would use diode decoding and just take care as to how I placed my current paths.

Incidentally, a single 4K plane can be used as the heart of a swell calculator. By operating one axis serially and the other on diode decode, one has 64 words of 16 decimal digits. A little logic hung on and you're in business.

CURRENT PUBLICATIONS

Glow Lamp Manual, Second Edition, General Electric Co., Miniature Lamp Dept., Nela Park, Cleveland, Ohio 44112. If you write for this neon-lamp manual on company letterhead, it's free. Otherwise it will cost you $1.00. Probably available at GE Miniature Lamp sales offices all over the country. Has 117 pages, including 27 on re-

laxation oscillators, and 24 pages on logic and computer applications. Of those 24, 16 are on the binary system, basic logic operations, basic circuits (AND, OR, NOT) and waveforms; the rest is on a pulse generator, bistable and monostable multivibrators, ring counters and memory circuits. The memory circuit consists of only two resistors, a capacitor and a neon lamp; very simple, but to set the memory circuit requires a positive voltage large enough to fire the lamp; to read it requires a positive voltage less than the firing voltage; to reset it requires a negative voltage low enough to extinguish the lamp.

All About Teletype Equipment, 32 pages. Free from Teletype Corp., 5555 Touhy Ave., Skokie, Ill. 60076. For those who know nothing about TTY, this is a very basic beginning: how it works and what it consists of.

Motorola IC Application Notes. For a list of 47 Motorola IC application notes, see page 53 of the Jan. 9 issue of Electronics. Of interest are (1) AN-234, MRTL Family of ICs, (2) AN-251, Decade Counters Using MRTL ICs (3) AN-252, Choosing RTL Integrated Logic Circuits, (4) AN-253, An Analysis of MRTL Integrated Logic Circuits, (5) AN-254, Using MRTL IC Flip-Flops, (6) AN-264, MRTL IC Shift Registers, (7) AN-279, Setup and Release Times in the RTL J-K Flip-Flop, (8) AN-285, Loading Factors and Paralleling Rules for MRTL ICs. May require a business letterhead to get from:

Motorola Semiconductor Products Inc.
Box 955
Phoenix, Arizona 85001

Of the 8 Notes listed above, only AN-285 is directly concerned with the MC700P series, the Unibloc low-cost elements.

Special Issue on Logic and Switching Devices, Control Engineering issue of January 1967. Of interest to ACS members may be: short article by Kintner on digital switching hardware (pages 64-67), such as DTL, RTL, etc.; reed switches for relay logic (84-88); six ways to make logic circuits, from optical switching to cores (116-119); and a round-up on relays for control applications (78-83) and on digital fluidics (100-104). No break-throughs or really new items, but a good issue to browse thru. $1 from Control Engineering, Circulation Dept., 466 Lexington Ave., New York, N.Y. 10017.

Minotaur, A Relay Computer. Not so new, but if you're interested in relay computers, this is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, $3 for hard copy (55 pages), 75¢ for microfiche. The title is misleading, as Minotaur is not a computer, but a fancy relay breadboard, with all relay points and coils brought out to a large 35 X 39 fixed plugboard, to which are also connected 45 lamps, 15 pushbuttons, 35 diodes and five 4PDT lever switches. Of the relays, 14 are 4PDT, and 20 more are 4PDT relays combined with 20 4-pole ratchet relays. The ratchet wheel holds four relay swingers in the make position on every other pulse. This two-relay combination is the basis of counters. The report describes the set-up of logic circuits, binary counter, binary arithmetic, accumulator, and branch functions. Rather simple, but of interest for relay fans.

Large-Scale Integration, special report in Electronics, Feb. 20, pages 123-182. Reprint available at $1.50; 330 West 42 St, New York, N.Y. 10036. Six articles on LSI: system design, memory, customizing by interconnection, computer design of LSI, isolation, MOS versus bi-

The Amateur Computer Society is open to all who are interested in building and operating a digital computer than can at least perform automatic multiplication and division, or is of a comparable complexity.

For membership in the ACS, and a subscription of at least eight issues of the Newsletter, send $3 (or a check made out to me):

Stephen B. Gray
Amateur Computer Society
219 West 81 St
New York, N.Y. 10024

The Newsletter will appear about every two months.

polar ICs. Well worth reading, most of it, even if only for familiarization.

Computers Self-Taught Through Experiments, by Jack Brayton, 192 pages, $4.25, Howard W. Sams & Co. Uses 2N107 throughout, 2N322 for lamp driver, 1N34 diode. There are 28 projects. After building 13 gates, procedes to adders, diode matrix, counters, registers, lamp circuits, ends with a 10-stage adder/subtractor, with pushbutton input and lamp output. Simple circuits, but well presented.

Fairchild Technical Data Manuals are no longer free. The Microcircuit binder, plus updating for a year (12 mailings) costs $5. The updating alone is $2 a year, for data sheets, application notes and technical information.

Fairchild Semiconductor
P.O. Box 1058
Mountain View, Calif. 94040

SURPLUS INTEGRATED CIRCUITS?

The June issue of Electronics World has two ads offering ICs. On page 93, flat-packs for $1-$1.15 each, "guaranteed to work." On page 95, TI "untested flat packs," 6 for $1.89. Has anybody bought these?

ANSWER TO A PREVIOUS PROBLEM

4-3. A member is looking for a supplier for used or rebuilt electric typewriters with electrical inputs for computer I/O use. Any help?

Bob Shostak says 4-3 should forget about electric typewriter I/O. "Thorough investigation reveals that Teletype equipment is much easier to obtain, and much cheaper than typewriters with a non-mechanical triggering system. Teletype equipment is advertised regularly in the ham-ads at the back of QST for as low as $25. Also, it isn't necessary to use the 5-bit system. You can easily invent your own magnet-selector system, or change the character codes."

PROBLEM FOR THIS ISSUE.

5-1. How does one calculate the component values for an RC filter decoupler to keep pulses from circulating through the power-supply wiring and thus showing up where they're not wanted? Does this filter have to be on every circuit board?

TRADING CORNER

A member wishes to acquire either 4K words of 13 bits of core memory, or the equivalent number of core necessary to build his own stacks. He has a TT4A Teletype, 60 and 100 wpm gears; a Hewlett Packard 100D frequency standard that can be used as a computer clock, with outputs of 100 cps, 1 Kc, 10 Kc or 100 Kc; and a General Radio 1304A BFO. He also needs three 7- to 9-track tape heads. Write:

Aubrey B. Hutchinson, Jr.
533 Barksdale Drive
Raleigh, N. Carolina 27604
(K4ANV)

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