

ROTHMAN WRITES AGAIN

Allyn Rothman writes from New York:

"I don't have much progress to report on the hardware side, but my logic design has undergone several revisions. My basic philosophy still remains that of implementing the machine instructions by means of a microprogram stored in some type of read-only-memory or alterable ROM. This neatly divides my work effort into two convenient sections. I can design and test the logic of my microprogram on another computer using simulation techniques, thus saving the expense and time of building complex logical functions with hardware. The hardware I require, then, becomes just the ROM plus relatively simple data busses and gates. I have redesigned the micro-logic several times, since as various ICs become cheaper on the market, it pays to take advantage of them in the overall design. Prices are dropping rapidly, so I tend to spend more time developing my "firmware," and less on the hardware. ROMs are still expensive, and with my computer depending heavily on them, the longer I wait to buy, the cheaper my machine becomes. For me, looking at the output from a successful micro-logic simulation run is just as satisfying as seeing the lights blinking on the finished machine.

"I have been lucky in one respect. My memory, which is a 10K x 12-bit unit taken from an IBM 1620, is working satisfactorily in a bread-board setup. It runs with a 10-microsecond cycle time and appears to be 100% reliable as far as errors are concerned. I see that Bob Carpenter is also making use of an IBM 1620 memory [Mar. 1972,

p 3], which he obtained from the same source that I did, Herbach & Rademan. I regret not having bought additional modules, because the slow cycle time plus the core matrix switches used for drive-line selection make the unit relatively easy to operate. The 10- $\mu$ sec cycle time also gives me plenty of room for micro-programming to control all the necessary functions between cycles. A 500-nsec cycle time may be right with the state of the art, but I'd sooner avoid the problems and aggravation from such high frequencies, and settle for a slower memory that works reliably. I think Bob is at a decided disadvantage using his 12-plane unit for a 12-bit word. Having a spare plane (which I would advise his somehow adding) provides a parity bit, and this is crucial to reliable operation. Not just by indicating obvious catastrophic failures, but for "tuning" the memory to operate in the middle of its error-free operation area. I check the parity error count and I vary the select drive currents and the matrix switch bias current to develop a plot which neatly defines for me in what region my memory is most reliable.

"Steve Wiebking quotes an excellent text [Nov. 1971, p 5] on micro-programming concepts, but I submit that it is possible to implement the micro-logic to support the IBM 360 instruction set in a far more simple manner than the approach taken by IBM. IBM's micro-logic was not designed to minimize the number of separate functions needed to support its instruction set. It was designed, rather, for complete flexibility so that emulators for their older computers and a very complex I/O channel system could be included in the machine capabilities. The 360 micro-



x 12-bit extended core memory; ASR 33 Teletype; video display (16 lines of 64 characters, 1K refresh memory, 5x7 dot-matrix characters); X-Y D/A converter and storage scope.

"All of the PDP-8 software works on my system. This has saved considerable time, as you can well imagine. I have used the following DEC software: compilers (Focal - 8K, Basic - Poly, Fortran - 8K); assemblers (Macro 8, Pal III, Saber); maintenance programs, disk monitor systems (my 32K core memory looks like a DF32 Disk System).

"My entire system logics are mounted in a 19-inch rack and all of the packages are wire-wrapped together using 30-gage wire. I use wire-wrap boards on which you can mount 200 TTL packages. They are mounted upside down and soldered to pins that go through the board and are wire-wrapped on the other side. This allowed me to put my whole computer logic (registers plus control and timing) on one card. I have a module that holds 10 such cards, including: one for video display logic, one 32K interface logic, two core memory, one Teletype and high-speed reader/punch logic, one computer card.

"I have devoted most of my spare time for the last four years in accumulating the parts and developing my software."

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#### THE TRADING POST & HELP WANTED

##### 1101 RAMs

Dave Vednor (P.O. Box 1317, Tustin, Calif. 92680) writes: "I've had a mfr offer me 2700 pieces of a CMI 1101 256-bit RAM. These are new, but have been scrapped due to a product change." With at least 16, at \$1.50 each, you've got a 4K x 1 memory, at \$24. With at least 256,

at \$1.25 each, a 4K x 16 memory for \$320. And with at least 512 of these, at \$1.17 each, an 8K x 16 memory, for \$600. "I need a total order of 500 minimum to get these prices. If I can move all 2700, prices would be about 10-15% lower. Again, these devices are new and are being offered to me by a computer mfr. However, I can offer no guarantee."

##### Time-Sharing Club

Frank Eperjesi (P.O. Box 221, Burbank, Calif. 91503) writes: "I would like to start a local club in either LA or Orange County. I live in Orange County but am in LA so much that I don't care which area — it depends on where I could drum up the other members. The purpose of the club would be to buy a small time-sharing system. I figure that if 20 people were to kick in \$250 each to join, and possibly \$250 a year thereafter, this would allow me and the other members to have a fairly powerful system at minimum expense, and expandable as extra members join. The other possibility would be for ten people to get together to purchase an Intel computer development system (about \$1K) and a TI printer/dual mag-tape unit with keyboard (\$2400) and misc. hardware at about \$1K. This would be a fairly powerful mini-computer system at minimum expense."

##### 727 Tape Drives

Alvin Marshall (412 Oakwood, Angola, Ind. 46703) says: "I have some 727 tape drives — with the books — \$100; you haul 'em. These are tube, but worked when removed. They are stored at Pocomoke, Md., not at my place, but they can be picked up at almost any time."

##### 727 Circuit Info?

Al Sinclair (941 Hedge Dr., Mississauga, Ont., Canada): "I acquired an IBM 727 tape drive in perfect



and 28 combined micro-commands programmed in a diode matrix that is in the form of a read-only memory. This matrix can be altered by the user who wishes to try out his own instructions. The entire System One is \$695. The plans, with all schematics and parts layout, is \$25. The first ad will appear in the May Radio-Electronics.

You will need a good scope (at least 10 MHz), preferably dual-trace, for setting the core levels. System One has a data-bus terminator connector, and there are instructions for setting up I/O to anything that operates on an 8-bit binary code. Only 15 machines will be offered at this time, because EPD has only 15 IBM 1401 core memories, bought surplus, and no more are available. When the core is gone, they will switch to solid-state memory, either Intel 1106 or Signetics 2601 1024-bit types. This will add about \$200 to the price; this machine will be System Two; another change will be from 8-bit with link to 16-bit with link.

System One is patterned after the PDP-8, but comes only with a list of commands. There is no user group yet -- only 11 of the original System One machines were made (plus 2 prototypes).

Also available is an 80-page Memory Core Booklet, MPB-1, for \$5, on setting up a core memory, with values for the 1401 memory as used in System One, but with all the equations for adapting to any core memory.

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IN PRINT

### Cryptology and Computers

By coincidence, two articles on a subject quite rare in trade magazines appeared in January: "Computers and Cryptology" by Chesson in

Datamation (Jan. 1973, pp 62-64, 77-81) and "How to protect data with ciphers that are really hard to break" by Geffe in Electronics (Jan. 4, 1973, pp 99-101). The first is about programs for cryptanalysis and includes a Fortran program for simple work; the second describes enciphering methods.

### ROMs in Digital Systems

"ROMs are versatile in digital systems" by Percival of National Semiconductor (Electronic Design, June 8, 1972, pp 66-71) goes into lookup tables, programming the ROM, arithmetic with ROMs, converting codes, and microprogramming.

### LSI and Central Processors

In the Nov. 1972 IEEE Spectrum, "MOS/LSI launches the low-cost processor" (pp 33-40) is well worth reading (reprint is \$1.50 from IEEE, 345 E. 47 St., NY, NY 10017; ask for article X72-112 within a year).

The devices outlined are the American Microsystems 7200, Fairchild PPS-25, Intel MCS-4 and MCS-8, National MAPS and GPC/P. The MCS-4 is noted as having an extensive software library compared with other processor families.

The article points out the slower execution times of MOS processors, the minimum applications support from the makers, and the need to buy large quantities of an IC to offset customized masking charges.

### TV Set for Data Display

"TV set is display for data terminal," by Bratt of Motorola (Electronic Design, Sept. 14, 1972, pp 134-141), has an all-digital character-generation circuit; 1024 characters, each in a 5x7 dot matrix, with 16 rows of 64 columns; full set of 64 ASCII alphanumeric characters available. Six 1024-bit

