The layman's guide:

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A CHART FOR EDP EXPERTS

LAST SPRING Jack Gilmore, the vice president of our embryonic consulting firm, in heated discussion with several top-level representatives of an important client, was asked a very simple question: "What is the access time of the RCA-501?"

In common with all those who have a wide interest in electronic data processing, and particularly with those who have the gall to represent themselves as consultants in the field, Jack had looked over the extensive technical information which RCA had provided. Back at the office on the five-foot shelf there was a manual which gave not only the access time but almost all other pertinent information on the system. It happened, however, that Jack had not worked with the 501, had not anticipated any interest in the system by this particular client, had not yet taken a Dale Carnegie course on memory improvement, and did not have our five-foot shelf in his pocket.

"What we need," he told his unsympathetic associates later, "is a pocket-sized chart listing all of the important characteristics of all of the computers that we should be expected to know about." The work involved in preparing such a chart seemed so prodigious that his friends greeted him with silence. With sudden inspiration he added, "It would be just the thing to print on the back of our new brochure so that the people who receive it won't be quite so likely to throw it away." Thus unburdened, he turned his back on the quietness that often greets a good idea to go on about his business.

A few weeks later Norman Statland, Adams Associates' walking encyclopedia of computer facts, found himself with two free days; so with Allen Rousseau's help he put together a chart of the type Gilmore had suggested. Four months, 87 phone calls, 117 letters, eight visits by Alder Jenkins to Boston's best compositor, and 56 man-days of work later, the results of Norman's two-day effort appeared before the computer world in a privately-published brochure and simultaneously, in condensed form, in an article about it prepared by the editors of BUSINESS WEEK. The complete chart, brought up to date through October 15 and arranged in a format suitable to DATAMATION, is presented here.

which and what

The most immediate problem facing one who sets out to make a chart of computer characteristics is, of course, which computers to include and what data to present about them. Since the basic purpose of our chart was to serve as a convenient, compact reference for technically competent EDP people, a number of items of data were quite obviously needed. Arranging these data into columns served the dual purpose of making the chart more manageable in size and of permitting a rapid scanning of individual columns should one need to know which of the available computers have a fast on-line printer, built-in floating point, or any other feature desirable for a particular job.

Numbers standing unqualified in columns often lead to difficulties for the computer characteristics chartist. Frequently there are two or more devices available, optionally or in combination, so that a single number alone is misleading. Sometimes the speed, size, or even the existence of a particular feature becomes a question of semantics or a problem of averaging. This is no doubt the reason that few charts similar to the one presented here have ever been compiled and that fewer still have received widespread acceptance.

For better or worse, these problems were resolved by us in a combination of three ways: a second row of numbers for each computer was included wherever necessary; values which seemed to need qualification or clarification were referenced to footnotes; and the definitions of some of the column headings were deliberately left loose (**caveat emptor**). Most important of all, since each computer has unique or unusual features which cannot readily be expressed as numbers in columnar form, these features together with footnote information unique to one computer were put together into relatively terse sentences comprising a kind of editorial remark about each individual computer.

speed and price

What is an average monthly rental? What is the effective speed of a computer? For what uses is it primarily intended?

The reader, I am sure, will agree with us that there is no general answer to these questions. We hope he will agree that the data we have presented, while making no pretense of answering these questions, is useful information. No doubt he will feel, and perhaps we will agree, that other data could have been provided in place of or in addition to that which was actually chosen. For example, while detailed rental costs, option by option, seemed out of the question, minimum monthly rental might have been a valuable added column. There is no widely accepted criterion for measuring effective speed, but multiply time might have been useful.

On the other hand, average rental does at least establish the ball park in which each system can compete, and can be used as a criterion to bring systems of like size close to one another in the chart. The optimized add time and the average access time actually given in the chart, taken together with the number of instruction addresses and other information, should give the computer specialist a good multi-parametric feeling for the speed of the machine. And, in the final analysis, one must remember that this chart was never intended to replace completely the reference manuals available for each computer.

In the chart, which follows on the next four pages, characteristics given for all but the first two machines have been confirmed by their respective manufacturers.

Following are the manufacturers and their computers represented in the chart: AUTONETICS, Recomp II; BENDIX, G-20 and G-15; BURROUGHS, 220, 205 and E-103; CONTROL DATA, 1604 and 160; DIGITAL EQUIPMENT, PDP-3 and PDP-1; EL-TRONICS, Alwac III-E; GENERAL ELECTRIC, 210 and 225; IBM, Stretch (7030), 7090, 7080, 709, 705, 704, 7070, 7074, 650, 1401, 305 and 1620; HONEYWELL, H-800 and H-400; MONROE, Monrobot XI; NCR, 304; PACKARD BELL, PB 250; PHILCO, 2000; RCA, 601, 501 and 301; REMINGTON RAND, Larc, 1105, 1103A, U II, U III, File Computer and SS 80/90; ROYAL MC BEE, RPC 9000, RPC 4000 and LGP-30.

COMPUTER CHARACTERISTICS CHART

	GENERAL CHARACTERISTICS					INTERNAL SPEED		MAGNETIC TAPE				PERIPHERAL EQUIPMENT: Input					SPECIAL FEATURES					
	Average Monthly Rental	Solid-State	Storage Capacity and Type	Word Size	Instruction Addresses	Add Time	Average Access Time	Thousands of Characters per Second	Input-Output Channels	Buffering	Maximum Tape Units	Cards per Minute	Paper Tape Characters per Second	Cards per Minute	Paper Tape Characters per Second	Printer Lines per Minute	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Random Access File	Random Inquiry
1 IBM 7030 STRETCH	$200,000	√	16-262K core	64b	1[1]	2μ[1]	1μ[1]	62	32	MRWC	256	1000[2]		250[2]		[2]		√	√	I/O	√	√
Information is preliminary, not confirmed by manufacturer. The computer features an interrupt system, an input-output exchange (which relieves the computer of all input-output control) with a variety of peripheral equipment available. Effective speed will sometimes be faster than shown because of use of look-ahead and look-behind features permitting simultaneous access to several core storage units.																						
2 UNIVAC LARC	$135,000	√	10-97K core	12d	1	4μ	4μ	25 133[1]	10	MRWC	60	1	1	1	1	1	99	√	√	I/O	√	√
Information is preliminary, not confirmed by manufacturer. System includes a versatile processor unit which controls all input-output operations. A second computer unit can be added. The fast add time shown is obtained by means of an instruction look-ahead feature. Many types of peripheral equipment are available, including a high-speed film printer. Numeric information can be read at a rate of 200,000 characters per second.																						
3 IBM 7090	$64,000	√	32K core	36b	1	4.4μ	2.2μ	15-62	8	MRWC	80	250[2]		100[2]		150[2]	3	√	√	I/O	√	
A computer which features multiple read-write-compute by use of a 7606 Multiplexor and up to eight 7607 Data Channels. Each Data Channel acts as a separate input-output unit and as many as ten tape units can be attached. The computer may have equipment for direct transmission of data between it and an external data device.																						
4 IBM 7080	$55,000	√	80-160K core 1K core	1a	1	12μ[1]	2.2μ 1.1μ	15-62	4	MRWC	40	250[2]		100[2]		150 500[2]	0	√		O	√	
A variable-word length computer which has a program interrupt feature. Provision has been made for many combinations of on-line input-output devices, including a 1,000 lpm printer. Add time assumes a five-character field. Simultaneous transmit feature allows internal movement of data in parallel with other computer operations.																						
5 UNIVAC 1105	$43,000		8-12K core 16-32K drum	36b	2	44μ	8μ 17m	25	2	RWC	20	120 300[3]	200	120[3]	60	600[3]	0		√	I/O		
A completely buffered version of the UNIVAC 1103A with increased storage facilities and faster tape drives. A visual display can be attached for on-line output. A program-interrupt feature enables processing of data from other on-line units on a priority basis.																						
6 IBM 709	$40,000		4-32K core	36b	1	24μ	12μ	15	6	MRWC	48	250[4]		100[4]		150[1]	3	√	√	O	√	
The computer can have an auxiliary storage drum of 2,000 to 8,000 words. A maximum of three 766 Data Synchronizers may be attached to a system, each of which has two data channels. Each channel may have up to eight tape units attached. A cathode-ray tube display is also available for output. A 500 lpm and a 1,000 lpm off-line printer are available.																						
7 UNIVAC 1103A	$35,000		4-12K core 16K drum	36b	2	44μ	8μ 17m	13	2	RC, WC[1]	10	120 240[3]	100	120[3]	60	600[3]	0		√	I/O		
The computer utilizes magnetic tapes with forward and reverse read and a lattice arrangement (addresses on drum spaced according to word times) to reduce drum access time. Tape buffering limited to one word. A program interrupt feature permits a switch to another program in microsecond time.																						
8 CONTROL DATA 1604	$34,000	√	8-32K core	48b	1	5μ	4.8μ	30	6	MRWC	96	1300	350	200[4]	60	1000[4]	6	√	√	I/O	√	√
A computer with two instructions per 48-bit word, overlapped core memory banks for increased speed, real-time clock, and program interrupt feature. It is compatible with IBM tape units. MRWC is achieved through the use of multiplex-type device to scan three input and three output buffers.																						
9 RCA 601	$32,000	√	8-32K core	56b	2[1]	6μ	.9- 1.5μ	22-120	16	MRWC	63	600[4]	1000[4]	100[4]	100[4] 300[4]	600[4] 900[4]	8[1]	√	√	I/O		√
The computer uses variable-length instructions on either a character, word, or half-word basis; operations within the computer are in parallel within these categories. Overlapped core memory banks and the processing of different programs simultaneously are features. Eight index registers are available for each program. Double precision arithmetic is available.																						
10 IBM 704	$32,000		4-32K core	36b	1	24μ	12μ	15	1	RC, WC	10	250[4]		100[4]		150[4] 500[3]	3		√	O	√	
The computer can have an auxiliary storage drum of 2,000 to 8,000 words and use of a 774 Tape Data Selector is available to facilitate off-line printing selection. A cathode-ray tube display is also available for output. Part of the arithmetic unit is used as a one word tape buffer. The write instructions permit binary and BCD recording modes.																						
11 PHILCO 2000	$30,000	√	4-32K core	48b	1	15μ[1] 4.5μ[1]	10μ[1] 2μ[1]	90	16	MRWC	256	2000[4]	1000[4]	100[4]	60[4]	900[4]	32		√	I/O	√	√
A parallel asynchronous system with a wide variety of instructions stored two to a word. Up to 32 auxiliary storage drums (32,768 words each) are available. Overlapped core memory banks, multiple memory banks and special instructions increase internal speed. The difference in internal speeds is due to the availability of two different core memories of 10 us and 2 us cycle times.																						

FOOTNOTES

[1] — See remarks immediately beneath the computer data in question.
[2] — The IBM 1401 system (entry #28 in the chart) is available for use as an off-line input-output device.
[3] — This peripheral equipment is available off-line only (i.e., it can be connected to a magnetic tape unit independently of the central computer).
[4] — This peripheral equipment is available with the same characteristics both on-line and off-line.
[5] — The cost of magnetic tape units has not been included.

	GENERAL CHARACTERISTICS					INTERNAL SPEED		MAGNETIC TAPE				PERIPHERAL EQUIPMENT					SPECIAL FEATURES					
												Input		Output								
	Average Monthly Rental	Solid-State	Storage Capacity and Type	Word Size	Instruction Addresses	Add Time	Average Access Time	Thousands of Characters per Second	Input-Output Channels	Buffering	Maximum Tape Units	Cards per Minute	Paper Tape Characters per Second	Cards per Minute	Paper Tape Characters per Second	Printer Lines per Minute	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Random Access File	Random Inquiry
12																						
IBM 705	$30,000		20-80K core	1a	1	86μ[1] 119μ[1]	9μ 17μ	15-62	6 10	RWC	60 100	250[4]		100[4]		150[4] 500[3]	0	✓		O		
A variable-word length computer which can be used as a five-digit word computer. Magnetic tapes are controlled in Models I and II by either a 754 Tape Control, a 777 Tape Record Coordinator, or a 760 Control and Storage unit. In Model III, a 767 Data Synchronizer is used. The use of more than one 767 allows MRWC. Add time assumes a five-character field.																						
13																						
UNIVAC II	$28,000		2K core	12a	1	200μ	40μ	25	2	RWC	16	240[3]		120[3]		600[3]	0			I/O		
Features two instructions per word and magnetic tapes with forward and reverse read. Off-line equipment includes the Unityper II for direct recording of data on magnetic tape, and a paper-tape to magnetic-tape converter which can also be used to produce paper tape from magnetic tape. Duplicate circuits are used to permit checking of all operations.																						
14																						
IBM 7070 7074	$24,000	✓	5-10K core	10d	1	60μ[1] 10μ[1]	6μ 4μ	15-62	4	RWC[1]	40	500[2]		250[2]		150[2]	99	✓[1]	✓	I/O	✓	✓
A computer which features priority processing (making it possible to interrupt one program, switch over to a second program, execute the instructions in the latter, and then return to the first at the point of departure). Add time is variable by the number of digits in the field to be added. Indirect addressing is limited to scatter and gather operations. MRWC is possible when four channels are used. The rental of the 7074 is $5,300 more per month.																						
15																						
HONEYWELL H-800	$22,000	✓	4-32K core	12d	3	24μ	6μ	64[1]	16	MRWC	64	240[4] 650[4]	200[4] 1000[4]	100[4] 250[4]	60	150 900[4]	64	✓	✓	I/O		✓
A computer with facility for running up to eight independent programs concurrently. It uses an automatic error correction feature, called Orthotronic count, when reading magnetic tapes in either direction. The computer can be used as a binary machine with a word size of 48 bits. Numeric information can be read at a rate of 96,000 digits per second.																						
16																						
BENDIX G-20	$20,000	✓	4-32K core	32b	1	15μ	6μ	120[1]	6	MRWC	500	800[4]	500[4]	250[4]	100[4]	1000[4]	63	✓	✓	I/O		✓
All input-output units may operate either on- or off-line under program control. Input-output supervision can be delegated to control buffers. Variable instruction length permits multiple indexing. Numeric information can be read at a rate of 240,000 digits per second. A program interrupt signal can be initiated by a control buffer which can have up to 70 input-output units attached.																						
17																						
UNIVAC III	$20,000	✓	8-32K core	6d	1	9μ	4.5μ	25 133[1]	5	MRWC	32	700[1]		300[1]		700[1]	15	✓		I/O	✓	✓
A computer featuring a flexible storage word which may have four alphabetic, six decimal, or 27 binary characters. An instruction may process up to four data words. Standard off-line input-output units of the UNIVAC line are available. Numeric information can be read at a rate of 200,000 digits per second. Program interrupt and scatter and gather operations are other features.																						
18																						
BURROUGHS 220	$17,000		2-10K core	10d	1	200μ	10μ	25	1	none	10	300	1000	100	60	150 1500[4]	1		✓	I/O	✓	✓
A computer featuring a magnetic tape system which can search and scan independently of the central computer. Five hundred million digits of random access memory are available. Card input-output can be obtained through the use of Burroughs Model 293 and 292. A line printer, Model 289, is also available.																						
19																						
RCA 501	$16,000	✓	16-262K core	1a	2	360μ[1]	15μ	22-66	8	RC, WC or RW	63	400[4]	1000	150[4]	100 300	600[4] 900[3]	8	✓[1]		O	✓	
A variable-word length computer featuring four-character (tetrad) parallel transfer, and magnetic tapes with forward and reverse read and dual recording. Indirect addressing is limited to scatter and gather operations. Add time assumes a five-character field and uses duplicate adder circuits to permit checking of arithmetic operations.																						
20																						
GENERAL ELECTRIC 210	$14,000	✓	4-8K core	6d	1	64μ	32μ	30 50	2	RWC	13	400 1500	200 500		60	1000[4]	1			I/O	✓	
A computer which features on-line and off-line handling of magnetically encoded documents through 1200-document-per minute sorter-readers (of which a two-pocket or a twelve-pocket unit is available). The printer can print magnetically encoded characters. The computer can be used in a double precision (twelve-digit) mode.																						
21																						
NCR 304	$12,500	✓	2-4K core	10a	3	600μ 120μ[1]	60μ	30	8	RW[1]	64	2000[4]	1800[4]	250[3]	60[4]	850[4] 1200[4]	10		✓	I/O		✓
A computer which uses two words per instruction. The internal commands include sort, merge, pack, unpack and a repertoire of microflow, single-address instructions. Pack and unpack can be used to condense numeric data in connection with the magnetic tape system which uses tapes without a space between records. In processing inactive records, RWC is achieved.																						
22																						
UNIVAC File Computer I	$12,000		20 core 1K drum	12a	3	8.6m	.9m 3.1m	10.4	10	RWC	31	150 240[3]	200	150 120[3]	60	600[4]	0			I/O	✓	✓
A computer which can have up to ten general storage drums of 180,000 characters each (average across time is 17.6m). A search command for locating records on the drum is incorporated. The computer can be used in a scan mode to cycle through 32 possible input-output units. An off-line sort-collate unit is available.																						
23																						
UNIVAC SS 80/90	$9,000	✓	4K drum 1K fast	10d	1[1]	85μ	1.7m .425m	25	1	RC, WC	10	600 450		150 120[3]		600[4]	3					✓
The last part of the instruction word indicates the address of the next instruction. In addition to working with binary coded decimal, some operations can be performed in binary. Random access drums (Randex) at six to 24 million characters are available. It can be used as a satellite computer for any of the UNIVAC series.																						

	GENERAL CHARACTERISTICS					INTERNAL SPEED		MAGNETIC TAPE				PERIPHERAL EQUIPMENT: Input		PERIPHERAL EQUIPMENT: Output			SPECIAL FEATURES					
	Average Monthly Rental	Solid-State	Storage Capacity and Type	Word Size	Instruction Addresses	Add Time	Average Access Time	Thousands of Characters per Second	Input-Output Channels	Buffering	Maximum Tape Units	Cards per Minute	Paper Tape Characters per Second	Cards per Minute	Paper Tape Characters per Second	Printer Lines per Minute	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Random Access File	Random Inquiry
24 IBM 650	$9,000		1-4K drum 60 core	10d	1[1]	.7m	2.4m .1m	15	1	RC, WC	6	155- 250	60	100- 250		150[4]	3		✓		✓	✓
The last part of the instruction word indicates the address of the next instruction. Tape records can be written in either BCD mode (six-bit characters) or straight numeric form (four-bit characters). It is possible to use the 774 Tape Data Selector as an off-line tape editor. The Ramac units can store up to twelve million characters per unit, of which there can be a maximum of four units.																						
25 HONEYWELL H-400	$8,700	✓	1-4K core	12d	3	220μ	8μ	64[1]	3	RW	6	650	1000	100 250	60	900	3					
A computer having some of the same features as the H-800. It offers Orthotronic count, magnetic tapes, and the same word flexibility, i.e., eight alphabetic characters, twelve decimal characters, and 48 binary bits. Numeric information can be read at a rate of 96,000 digits per second.																						
26 GENERAL ELECTRIC 225	$8,000	✓	2-16K core 8-32K drum	20b	1	40μ	20μ	15 55	7	MRWC	64	400	100 1000	100	60	600	3	✓	✓	O	✓	✓
Double hyphen precision operations are included as part of the instruction repertoire. Facilities for handling magnetically encoded documents are available through 1200-document-per-minute sorter-readers. The computer can be connected with a transmitter-receiver unit for communication purposes.																						
27 BURROUGHS 205	$8,000		4K drum 80 fast	10d	1	1.7m	8.5m .85m	6	1	none	10	300	540	100	60	150	1		✓	I/O	✓	✓
A computer system with fully buffered and edited card input-output and line printer. Independent search on magnetic tape for up to one million 200-character records, and a full paper-tape system are features of this equipment. The magnetic tape system features addressable blocks.																						
28 IBM 1401	$7,500	✓	1.4-16K core	1a	2[1]	230μ[1]	11.5μ	7.2-62	1	none[1]	10	800		250		600	3					
A variable-word length computer using variable-length instructions. With the 1403 Chain Printer, this system can serve as an off-line input-output device for the 7070, 7080, and 7090 systems. Add time assumes a five-character field. A 500-character per second paper-tape reader and output typewriter are available. Magnetic tape start time may be shared with computing.																						
29 RCA 301	$5,000	✓	10-20K core	1a	2	189μ[1]	7μ	7.5	2	RC, WC or RW	12	600	100	100	100	600	1	✓			✓	
A variable-word length, character-addressable system featuring magnetic tapes with forward and reverse read. Random access is available through disc Record Files (up to five, each with a capacity of 4.6 million characters). A special model featuring faster speeds in arithmetic and data transfer operations plus floating point arithmetic is also available. Add time assumes a five-character field.																						
30 DEC PDP-3	$4,400[5]	✓	4-32K core	36b	1	10μ	5μ	15	4	RC, WC	128		400		60		511	✓		I/O		
A computer which features 511 words of main memory as index registers. The multiplication rate is 40,000 per second (25 microseconds complete), and the memory is expandable to 262,144 words. An optional feature is a cathode-ray tube display unit with light pen.																						
31 IBM 305	$3,600[5]		100 core 2000 drum[1]	1a	2	30m	10m	15	1	RC, WC	4	125	20 60	100 200		30-50[1] 150	0			I/O	✓	✓
The computer has a 200-instruction capacity drum and the ability to call in additional instructions from the disc file, which is available in modules of five to 40 million characters (average access time is 250m). Input editing, logical decisions and character analysis are usually made through the 305 Control Panel. Each output unit has a separate control panel for format control. The "Stick" printer prints one character at a time.																						
32 EL-TRONICS ALWAC III-E	$3,600[5]		4-8K drum	33b	1[1]	1m	4m	21	1	RC, WC	16	100	200	100	60	150	1			I/O		
Two, three or four instructions may be contained within one word. Hexadecimal notation may be used without affecting the operation of the computer. Magnetic tape units can be searched simultaneously with computer operations.																						
33 AUTONETICS RECOMP II	$3,000	✓	4K disc 16 fast	40b	1	9.5m 1.49m	9m .95m						400		20		0		✓	I/O		
A desk-sized computer with magnetic disc memory, control console with decimal readout, and logical echo checking of output. The 49 commands are stored two per word and feature square root and absolute value instructions in both fixed and floating point operations.																						
34 RPC 9000	$2,500	✓	72 delay[1]	12a	1	.23m	.8m	52[1]	15	MRWC	120	400	60 500		30 300	150 1000	0	✓		I/O	✓	✓
A computer using magnetic tape loops for external memory, each loop storing up to one million characters. Internal memory consists of nickel wire magnetrostrictive delay lines and is easily expandable. Separate buffers for input and output units allow mutiple-input-output and search-on-content operations. The 52,000 characters per second is a calculated search rate. Rental includes one magnetic tape unit.																						
35 DEC PDP-1	$2,200[5]	✓	1-4K core	18b	1	10μ	5μ	15	2	RC, WC	64		400		60		0	✓		I/O		
A parallel-circuit computer which features logical instructions, twelve types of shifts, and ten test instructions. The memory is expandable to 28,672 words. Optional devices include a cathode-ray tube display with light pen, magnetic tape and others.																						

	GENERAL CHARACTERISTICS					INTERNAL SPEED		MAGNETIC TAPE			PERIPHERAL EQUIPMENT					SPECIAL FEATURES					
											Input		Output							
	Average Monthly Rental	Solid-State	Storage Capacity and Type	Word Size	Instruction Addresses	Add Time	Average Access Time	Thousands of Characters per Second	Input-Output Channels	Buffering	Maximum Tape Units	Cards per Minute	Paper Tape Characters per Second	Cards per Minute	Paper Tape Characters per Second	Printer Lines per Minute	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Random Access File	Random Inquiry
36 **RPC 4000**	$1,800	✓	8K drum 128 fast	32b	1[1]	 1.0m	8.5m 5.0m						60 500		30 300		1			I/O		
The last half of the instruction word indicates the address of the next instruction. A desk-sized computer featuring a repeat execution command which allows groups of from one to 128 successive words to be operated on within memory by one command at high speed.																						
37 **IBM 1620**	$1,600	✓	20K core	1d	2	560μ[1]	20μ		1			250	150	125	15		0			I/O		
A variable-word length computer with overlapped memory banks for increased speed. Alphabetic characters are represented by two decimal digits. Magnetic tapes may be added. Add time assumes a five-character field.																						
38 **BENDIX G-15**	$1,500[5]		2K drum 16 fast	29b	1[1]	 1.08m	14.5m .54m	.43	1	RC, WC	4	100	400	100	60	100	0			I/O		
One part of instruction word indicates address of next instruction. Magnetic tapes, cards, graph plotters, and a digital differential analyzer are available. Alphanumeric input-output is completely buffered. Special accessories permit on-line use with analog systems.																						
39 **CONTROL DATA 160**	$1,500[5]	✓	4K core	12b	1	12.8μ	6.4μ	15 30	1	none[1]	20	1300	350		60	1000	0	✓		I/O	✓	✓
A desk-sized computer featuring parallel circuitry and versatile input-output capabilities for peripheral equipment. The instruction code allows no address, direct address, indirect address, and relative address modes. Magnetic tape start time may be shared with computing.																						
40 **PACKARD BELL PB 250**	$1,200[5]	✓	1.8-16K delay 16 fast	22b	1	 24μ	1.5m .09m	2	1	none	6		10 300		10 110		1			I/O		
The commands include double-precision arithmetic, variable-length multiply, divide, and square root. Peripheral equipment includes card equipment and analog-to-digital and digital-to-analog converters. Internal storage is magnetostrictive delay lines.																						
41 **RPC LGP-30**	$1,100		4K drum	31b	1	2.26m[1]	8.5m						200		20		0			I/O		
A desk-sized computer featuring an interlaced pattern of word addresses on the drum, which reduces memory access time. An oscilloscope displays contents of control register, instruction register, and accumulator.																						
42 **BURROUGHS E-101**	$900		220 drum	12d	1	50m	10m						20		10	60	2			I/O		
A desk-sized computer using pinboard programming. Multiple paper-tape input and output and card input and output are optional. Simplicity of programming and operator control are major characteristics of this equipment. (Machine now being marketed as the E-103.)																						
43 **MONROBOT XI**	$700	✓	1K drum	32b	1	9m	6m					15	20	15	20					I/O		✓
Limited random access inquiry is available via the drum and one or two paper-tape loops. Input-output facilities, up to any combination of three units, are time-shared.																						

EXPLANATION OF COLUMN HEADINGS

Average Monthly Rental: Rough approximation of what a customer might expect to pay for a complete system with basic peripheral equipment and tapes when available. With so many options available on every system, no precise standard of cost measurement is possible. The figures given should not be used for direct comparison of competitive equipments.

Solid-State: Checkmark indicates that the central system contains few, if any, vacuum tubes. Presumably this, in turn, implies greater reliability, smaller size, lower power requirement, and less heat generation than would be the case were vacuum tubes used.

Storage Capacity and Type: Number of words of addressable internal storage available, K representing "thousand" (e.g., "16-262K core" for the RCA 501 indicates that the internal storage consists of magnetic cores and that from 16,000 to 262,000 words are available at the user's option, a word in this case being a single alphabetic character as shown in the Word Size column). "Fast" indicates a serial-type, fast-access secondary storage, found primarily in drum computers.

Word Size: Number and type of digits comprising one word in storage. (a = alphanumeric, d = decimal, b = binary)

Instruction Addresses: Number of separate storage addresses in a conventional instruction.

Add Time: Time required to acquire and execute one add instruction, in millionths (μ = microseconds) or thousandths (m = milliseconds) of a second. In the case of drum machines, where the add time is lower than the average access time, maximum optimization has been assumed.

Average Access Time: Storage cycle time (including, for example, half of the drum revolution time in the case of drum storage) in millionths (μ) or thousandths (m) of a second.

Thousands of Characters per Second: Transfer rate from computer to tape or vice versa, measured in six-bit characters (one alphabetic, one decimal, or six binary digits) unless otherwise noted.

Input-Output Channels: Number of separate groups of magnetic tapes, usually with a separate buffer for each channel.

Buffering: Combinations of the three operations of reading magnetic tape (R), writing it (W), and computing (C), that can be performed simultaneously. MRWC indicates that multiple reading and writing is possible simultaneously with computing.

Maximum Tape Units: Maximum number of tape units connectable to and addressable by the computer, without regard to simultaneity.

Peripheral Equipment: Speed of each available punched card, punched tape, and printer equipment available. See footnotes for meaning of superscript numbers.

Special Features: Checkmark indicates that some form of the special feature in question is obtainable. In the case of index registers, the maximum available number of such registers is shown, while in the case of console typewriters, O and I/O are used to represent typewriters usable for output or both input and output. Floating point arithmetic can, of course, be programmed in any system in which it is not available as a built-in feature; only built-in features are marked here.