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IBM System/3



IBM's first totally cardless System/3 is the new Model 8. It is designed for batch processing and convenient addition of communications, thanks to the first Integrated Communications Adapter available on a System/3. In the foreground, the operator is seated at a directly attached 3741 Data Station, whose interchangeable diskettes substitute for card I/O. A typical system as shown rents for about \$1,849 or sells for \$72,075.

MANAGEMENT SUMMARY

On September 11, 1974, IBM's General Systems Division came of age vigorously and with clear intentions in the field of small business computers. On that day GSD announced the System/3 Model 8—its first new computer system since GSD took over marketing responsibility for IBM's small-scale computers—as well as direct attachment to the System/3 Model 15 of the high-density 3340 disk storage facility.

As a result of these announcements, several things became clear in IBM's business plan. First, GSD is quite obviously autonomous in the IBM fold, because the System/3 announcements by GSD took place on the same day as the IBM Data Processing Division's introduction of its "Advanced Function for Communications." Similarly, the recent discrete and low-key introduction of the 3741's direct attachment to System/3

With well over 20,000 installations to date, IBM's low-cost business data processing system is now offered in four distinct versions: the transaction-oriented Model 6, the new diskette-based Model 8, the batch-oriented Model 10, and the more powerful Model 15.

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

MODELS: System/3 Model 6, Model 8, Model 10, and Model 15.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 1 BCD digit, or 8 binary bits.

FIXED-POINT OPERANDS: Can range from 1 to 16 digits for source fields and from 1 to 31 digits for result fields. Logical operands can range from 1 to 256 bytes.

FLOATING-POINT OPERANDS: No hardware facilities for floating-point arithmetic are provided.

INSTRUCTIONS: 4, 5, or 6 bytes long in 2-address format; 3 or 4 bytes long in 1-address format; 3 bytes long in command format. (Each address can be represented by either a 2-byte direct address or a 1-byte "displacement," and all instructions contain a 1-byte operation code and a 1-byte "Q" code.)

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

STORAGE TYPE: Magnetic core in Models 6 and 10; MOSFET (metal oxide semiconductor field effect transistor) integrated circuits in Models 8 and 15.

CYCLE TIME: 1.52 microseconds per 1-byte access in all models.

CAPACITY: Model 6—8,192, 12,288, or 16,384 bytes; Model 8—16,384, 32,768, 49,152, or 65,536 bytes; Model 10—8,192, 12,288, 16,384, 24,576, 32,768, or 49,152 bytes; Model 15—49,152, 65,536, 93,304, or 131,072 bytes.

CHECKING: Model 6, Model 8, and Model 10—a parity bit with each byte is generated during writing and checked during reading; Model 15—an error detection and correction function permits automatic corrections of single-bit errors and detection of double-bit errors with no loss of processor time.

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▷ becomes understandable. Since the new Model 8 depends primarily on the 3741 Data Station for its sequential, medium-speed input and output, this greatly expands the System/3 beyond an exclusively card-oriented market. Finally, GSD has succeeded in adding a powerful disk facility to the upper-end Model 15. Previously, the 3340 disk had been available only to System/370 users. In all this, IBM has plainly given GSD the tools, products, and stimulus it needs to compete effectively in the small business computer arena.

At first blush, the diskette-oriented Model 8 may not seem to warrant its separate status. Consider, however, that this cardless system offers strong batch processing capabilities combined with conveniently added communications facilities. A user selecting properly can thus have an excellent entry-level system which is operator-oriented and fully checked out. In this way, the Model 8 neatly fills a void in the System/3 line. As a result, it should sell extremely well.

It remains as true today as when announced on July 30, 1969, that the IBM System/3 is oriented primarily toward the needs of small companies that had not previously used computers. For these "entry" users, the System/3 always had—and still has—a lot to offer: compactness, ease of operation, surprisingly high internal speed, and an attractively low price tag.

But when viewed by companies that were already using computers, and by first-time users who had familiarized themselves with competitive equipment, the original System/3 had some serious limitations. It offered little upward compatibility with the larger IBM computers. Its new 96-column card, though compact and easy to handle, was incompatible with all existing punched card equipment. It offered no data communications or magnetic tape capabilities. Its printing and disk access speeds were way below par. Its disk storage capacities were quite limited. And it offered no compiler for the widely used COBOL or FORTRAN language.

During the intervening five years, however, a series of IBM product announcements has eliminated most of ▷

▶ **STORAGE PROTECTION:** Write/Fetch Protection, which guards against unauthorized overwriting and/or reading of data in specified 2048-byte segments of storage, is a standard feature of the Model 15, but is not available for Model 6, Model 8, or Model 10.

CENTRAL PROCESSORS

ADDRESSING: All models have two 16-bit base registers. The contents of either register can be added to a one-byte address (or "displacement") contained in an instruction, permitting base-plus-displacement addressing of any higher storage location within 256 bytes of the base address contained in the register.

In addition, Model 15 has a 32-register Address Translation Table (ATT) that enables it to address up to 131K bytes of main storage. The Supervisor loads the appropriate values into the ATT registers, which are then used to convert the 16-bit addresses in users' programs into the 17-bit addresses required to address 131K bytes.

INSTRUCTION REPERTOIRE: All models have 28 instructions, including addition and subtraction of unpacked (1 digit per byte) decimal operands, but no multiply or divide. Also included are an edit instruction and addition, subtraction, and comparison of logical characters.

In addition to these 28 basic instructions, Model 15 has 3 new instructions—Load CPU, Store CPU, and Command CPU—which are used to implement its multiprogramming capability.

INSTRUCTION TIMINGS: The following times, in microseconds, apply to all four models and assume the use of direct (2-byte) operand addresses.

Decimal add (5 digits):	24.4
Decimal subtract (5 digits):	24.4
Binary (logical) add (5 bytes):	24.4
Binary (logical) subtract (5 bytes):	24.4
Move (5 bytes):	24.4
Compare (5 bytes):	24.4
Edit (5 digits):	24.4
Load or store register (2 bytes):	9.1
Add to register (2 bytes):	9.1
Jump on condition:	4.56

INTERRUPTS: Model 8 and Model 10 have five levels of program interrupts, in descending priority order: (1) Serial I/O Channel, (2) Unassigned, (3) BSCA, (4) Data Entry Keyboard or Printer-Keyboard, and (5) Dual ▶

SUMMARY DATA FOR IBM SYSTEM/3

	Model 6	Model 8	Model 10	Model 15
Announced	October 1970	September 1974	July 1969	July 1973
First shipment	December 1970	June 1975*	January 1970	March 1974
Basic price	\$1,043/mo. (8 KB)	\$1,599/mo. (16 KB)	\$1,583/mo. (12 KB)	\$4,383/mo. (48 KB)
Number installed	Over 5,000	—	Over 15,000	Approx. 50

*Scheduled

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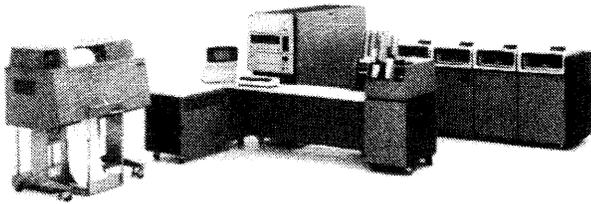
PERIPHERALS/TERMINALS

DEVICE*	DESCRIPTION	SPEED
MAGNETIC TAPE EQUIPMENT		
3410-1 (10, 15)	9-track, 12.5 ips, 1600 bpi	20 KB
3410-2 (10, 15)	9-track, 25 ips, 1600/800 bpi	40/20 KB
3410-3 (10, 15)	9-track, 50 ips, 1600/800 bpi	80/40 KB
3411-1 (10, 15)	9-track, 12.5 ips, 1600 bpi (includes controller)	20 KB
3411-2 (10, 15)	9-track, 25 ips, 1600/800 bpi (includes controller)	40/20 KB
3411-3 (10, 15)	9-track, 50 ips, 1600/800 bpi (includes controller)	80/40 KB
CARD EQUIPMENT		
5496** (6 only)	Data Recorder, 96 col., on-line card reader and punch with print and off-line keypunch capabilities	22 cpm
129** (6 only)	Card Data Recorder, 80 col., on-line card reader and card punch with print and off-line keypunch capabilities	12-50 cpm
5424-A1 (10, 15)	Multi-Function Card Unit, reads, punches, prints, 96 columns	250/60 cpm
5424-A2 (10, 15)	Multi-Function Card Unit, reads, punches, prints, 96 columns	500/120 cpm
1442-6 (15 only)	Card Read Punch, 80 columns	300/60 cpm
1442-7 (15 only)	Card Read Punch, 80 columns	400/120 cpm
2501-A1 (15 only)	Reader, 80-column	600 cpm
2501-A2 (15 only)	Reader, 80-column	1000 cpm
2560-A1 (15 only)	Multi-Function Card Machine, reads, punches, prints, 80-column	500/120 cpm
2560-A2 (15 only)	Multi-Function Card Machine, reads, punches, prints, 80-column	310/90 cpm
N.B. For the Model 8, the 3741 Data Station is fully supported as the input (READER) and output (PUNCH) device.		
PRINTERS		
5213 (6 only)	Serial, 132 columns, 64 characters	85 cps
2222 (6 only)	Serial, 222 columns, 64 characters, ledger-card feed	85 cps
5203-1 (8, 10)	96, 120, or 132 columns, chain, 48 characters	100 lpm
5203-1 (8, 10)	96, 120, or 132 columns, chain, 48 characters	200 lpm
5203-3 (8, 10)	96, 120, or 132 columns, chain, 48 characters	300 lpm
1403-2 (10, 15)	132 columns, chain/train, 48 characters	600 lpm
1403-5 (15 only)	132 columns, chain/train, 48 characters	465 lpm
1403-N1 (10, 15)	132 columns, chain/train, 48 characters	1100 lpm
OPTICAL READERS		
1255-1 (all)	MICR reader, 6 stackers	500 dpm
1255-2 (all)	MICR reader, 6 stackers	750 dpm
1255-3 (all)	MICR reader, 12 stackers	750 dpm
3881-1 (8, 10, 15)	Mark Reader, on-line	4000 to 6000/hour
3881-2 (8, 10, 15)	Mark Reader, off-line	3700 to 5400/hour
CRT		
2265-2 (6 only)	Display Station, 960 char. screen	—
3277-1 (15 only)	Display Station, 480 char. screen	—
OPERATOR KEYBOARD CONSOLE (6 only)	Integrated Keyboard for entering programs and data	—
PRINTER-KEYBOARD		
5471 (8, 10)	44-Key typewriter-style Console	15.5 cps
5475 (10)	Data Recorder, 96-column, console mounted	22 cpm

*Numbers in parentheses indicate the System/3 Model supporting each device.

**The 5496 and 129 cannot be used on-line on the same CPU.

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Model 15 is the biggest, most powerful, and most expensive of the four versions of IBM's System/3. Thus, it's probably not for first-time computer users, but it provides the growth potential that many Model 10 users have sorely needed (and that Model 8 users may someday need). The Model 15 CPU features an operator console with CRT display output. At right are four 3340 disk drives, the large-capacity Winchester models which are now available on the Model 15 as well as on the System/370. The four drives shown provide a data storage capacity of 164 million bytes.

➤ these limitations and greatly broadened the system's sales appeal. As a result, the System/3 is now available in four distinctively different versions—Models 6, 8, 10, and 15—and merits serious consideration from practically every prospective buyer of a small-scale computer. It is equally well suited for use as a stand-alone business data processing system or as a programmable batch terminal in a data communications network.

All System/3 models are byte-oriented and use IBM's integrated "Monolithic Systems Technology" (MST). Internal speed of the System/3 is relatively high. Its main storage cycle time in all four models is 1.52 microseconds per one-byte access. Moreover, its addition speed of 24.4 microseconds for two 5-digit operands is faster than that of the System/360 Model 30. Conversely, the System/3's instruction repertoire is far smaller and less powerful than that of the System/360 or System/370, and there is no program compatibility, at the machine or assembly-language level, between the System/3 and the larger IBM computers.

SYSTEM/3 MODEL 6

The IBM System/3 Model 6, introduced in October 1970, is a small-scale computer that is strikingly different in its peripheral equipment, software, and applications orientation from the original System/3 (now called Model 10) unveiled by IBM in July 1969.

The System/3 Model 6 announcement stressed that this single computer system can be used in two radically different ways. As "the office computer," IBM introduced the Model 6 as a low-cost, stored-program ➤

➤ **Program Control (Interrupt Key).** Any level of interrupt can interrupt the main program or the servicing of any lower-level interrupt. An interrupt causes a transfer of control to a predetermined location; the interrupt servicing program must store and then restore the index registers and program status register for the interrupt program.

Model 15 has a total of eight levels of program interrupts, including an I/O Operation End Interrupt, which facilitates spooling, and a Program Check Interrupt, which improves throughput by preventing errors in one partition from halting the entire system.

OPTIONAL FEATURES: For Model 6, the Command Keys feature provides an additional set of eight keys which can be programmed to perform specific arithmetic operations in the Desk Calculator Mode. (Eight Command Keys are standard equipment.)

For Model 8 and Model 10, the Dual Program feature permits independent loading and processing of two simultaneous programs. The operator can initiate, restart, or terminate either program independently of the other one. Whenever one of the two programs halts to await completion of an I/O operation, the other program is automatically initiated. (The feature is software-supported only for the Model 8 and for Model 10 disk-oriented systems with at least 12K bytes.)

Extra-cost features, called attachments, controls, or channels, must be added to the System/3 Processing Units to accommodate each of the standard peripheral devices.

CONSOLE: The 3277 Model 1 Display Station, equipped with a 78-key Operator Console Keyboard, is a required component of every Model 15 system. The 3277 displays up to 480 characters, in 12 lines of 40 characters each.

INPUT/OUTPUT CONTROL (MODEL 6)

I/O CHANNELS: The 5406 Processing Unit acts as a controller for all System/3 Model 6 I/O operations. All I/O devices are connected, via the appropriate attachment features, to a single I/O attachment interface called the Input/Output Channel. The channel includes logic to establish the "cycle-stealing" and interrupt priorities and to perform code translations between the punched card and internal EBCDIC codes.

SIMULTANEOUS OPERATIONS: Input/output operations are overlapped with computing through a memory "cycle-stealing" technique.

CONFIGURATION RULES: Every System/3 Model 6 requires one 5406 Processing Unit, one 5444 Disk Storage Drive, and one Printer (either Model 5213 or Model 2222). A maximum of two 5444 Disk Storage Drives can be connected. In addition, one directly attached 3741 Data Station, one 5496 Data Recorder (96-column) or 129 Card Data Recorder (80-column), one 1255 Magnetic Character Reader, one 2265 Display Station, and one Binary Synchronous Communications Adapter can be connected. The 2265 Display Station and the 2222 Printer cannot be used in the same system.

INPUT/OUTPUT CONTROL (MODEL 8)

I/O CHANNELS: The 5408 Processing Unit acts as a controller for all System/3 Model 8 I/O operations. All I/O devices are connected through the BSCA, the ➤

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➤ computer, using disk drives for on-line file storage and featuring an Operator Keyboard Console for both data entry and system control. Ledger card processing is also offered as an option. All programming of standard business applications is normally done in the RPG II language.

As "the problem solver," IBM introduced the System/3 Model 6 as a fast arithmetic processor designed to permit engineers, scientists, and other technicians to utilize the system at the keyboard via the conversational BASIC language. An optional CRT display unit is offered for quick display of the results of calculations. The Model 6 also offers features to permit its use as a simple desk calculator.

The original System/3 Model 10 features batch-mode punched card and/or disk processing and has been enthusiastically accepted by thousands of first-time computer users. Yet many other prospective users shied away from the Model 10 because its tab-oriented processing techniques differ so markedly from their present methods of processing data via manual techniques or electronic accounting machines. The System/3 Model 6 was designed as a keyboard-oriented system that these prospective users would be able to understand and use with comparative ease.

The Model 6 offers full operator control of the system via the Operator Keyboard Console. Input data is directly entered at the keyboard, and printing can take place on conventional (non-magnetic) ledger cards. This equipment will seem familiar and comfortable to most small businessmen, as will the design approach used in setting up the applications.

Another reason for the introduction of the Model 6 was IBM's recognition of the fact that many small scientific and engineering firms have been spending their processing dollars with time-sharing firms. By providing the System/3 with a conversational BASIC compiler and an 85-cps serial printer, IBM is attempting to exploit the computational power of its System/3 by luring small companies away from time-sharing and into the IBM fold for the first time.

The basic System/3 Model 6 configuration consists of a processing unit (with 8K, 12K or 16K bytes of core storage), an Operator Keyboard Console, and 85-cps serial printer (available in unique bidirectional-printing models), and a disk storage subsystem of 2.45 to 9.83 million bytes. The processing unit, main memory, and disk storage units are the same as those offered with the original System/3 Model 10. The Operator Console is different, and the wire matrix print mechanism of the serial printers is the same as that used with the System/370's 3215 Console Printer-Keyboard. The basic System/3 Model 6 configuration requires only about 120 square feet of floor space.

➤ Integrated Communications Adapter (ICA), or, via the appropriate attachment features, to a single Serial Input/Output Channel. The channel includes logic to establish the "cycle-stealing" and interrupt priorities for the system.

SIMULTANEOUS OPERATIONS: Input/output operations are overlapped with computing through a memory "cycle-stealing" technique. The I/O devices, thus, effectively "time-share" the processing unit according to priorities predefined for each device.

CONFIGURATION RULES: Every System/3 Model 8 requires one 5408 Processing Unit, one 5203 Model 1 Printer, one 5444 Model A1 Disk Storage Drive, and either one 5471 Printer-Keyboard or one 3741 Model 1 Data Station, attached directly. Any or all of the additional peripheral devices listed under the Model 10 Configuration Rules below can be connected with the exception of the card and tape equipment, the 5475 Data Entry Keyboard, and the 5445 Disk Storage Drive.

INPUT/OUTPUT CONTROL (MODEL 10)

I/O CHANNELS: The 5410 Processing Unit acts as controller for all System/3 Model 10 I/O operations. All I/O devices are connected, via the appropriate attachment features, to a single I/O attachment interface called the Input/Output Channel. The channel includes logic to establish the "cycle-stealing" and interrupt priorities and to perform code translations between the punched card and internal EBCDIC codes.

SIMULTANEOUS OPERATIONS: Input/output operations are overlapped with computing through a memory "cycle-stealing" technique. The I/O devices "time-share" the processing unit according to predefined priorities established for each device.

CONFIGURATION RULES: Every System/3 Model 10 requires one 5410 Processing Unit, one 5203 or 1403 Printer, and either one 5424 Multi-Function Card Unit (96-column) or one 1442 Card Read Punch (80-column); if the 1442 is used, a 5422 Disk Enclosure with at least one 5444 Disk Storage Drive is also required. Any or all of the following additional peripheral devices can be connected: a directly attached 3741 Data Station (for Disk Model 10's only), one or two 5444 Disk Storage Drives, one or two 5445 Disk Storage Drives, one 3410/3411 Magnetic Tape Subsystem with up to four drives, one 1255 Magnetic Character Reader, one 3881 Optical Mark Reader, one or two Binary Synchronous Communications Adapters, and either one 5471 Printer-Keyboard or one 5475 Data Entry Keyboard. To utilize IBM software support, disk-oriented systems must include at least 12K bytes of core storage and one 5444 Disk Storage Drive.

INPUT/OUTPUT CONTROL (MODEL 15)

I/O CHANNELS: The 5415 Processing Unit acts as a controller for all System/3 Model 15 I/O operations. All I/O devices are connected, via the appropriate attachment features, to an I/O attachment interface called the Input/Output Channel. The channel includes logic to establish the "cycle-stealing" and interrupt priorities and to perform code translations between the punched card and internal EBCDIC codes.

SIMULTANEOUS OPERATIONS: Input/output operations are overlapped with computing through a memory "cycle-stealing" technique. The I/O devices "time-share" ➤

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▷ System/3 Model 6 configurations can be expanded by adding a 5496 Data Recorder (for reading, punching, and printing of 96-column cards at 22 cards per minute) or a 129 Card Data Recorder (for reading, punching, and printing of 80-column cards at 12 to 50 cards per minute), a 2265 Display Station, a 1255 Magnetic Character Reader, and, most recently, direct attachment of the 3741 Data Station. Also, a Binary Synchronous Communications Adapter can be added to permit the system to serve as a programmable remote terminal (to another System/3 or to any larger computer in IBM's current product line).

The Model 6 offers disk-based processing at lower entry costs than the original Model 10 system. It appears that the Model 6 has been deliberately restricted in size and I/O device flexibility in order to eventually force users with growing needs to upgrade to punched card processing and the larger configurations possible with the Model 10. However, the direct attachment of the 3741 in any of its models allows significant improvement in speed and flexibility of I/O for the Model 6. This will tend to satisfy the users with such growing needs for some time to come.

The System/3 Model 6 differs from the System/3 Model 10 in the following features and capabilities:

- No line printer.
- No high-speed card processing.
- No expansion of core storage beyond 16K bytes.
- No large-capacity disk drives.
- No magnetic tape I/O.
- No optical mark reader.
- No COBOL compiler.
- No assembler.

But the Model 6 offers these significant features of its own:

- Low-cost serial printers with rated speeds of 85 cps.
- Ledger card processing, with optical reading of the ledger card identification number and last-line mark.
- The 2265 Display Station.
- The conversational BASIC language.
- RPG II, FORTRAN, and BASIC capabilities on the same system. ▷

▶ the processing unit according to predefined priorities established for each device. The 5415 features a 2-byte-wide data path for both 5444 and 5445 disk I/O, which reduces the number of CPU cycles required to service disk I/O requests.

CONFIGURATION RULES: Every System/3 Model 15 built around an A-level 5415 Processing Unit requires one 3277 Model 1 Display Station, one 5444 Model A2 Disk Storage Drive, one 1403 Printer (Model 2, 5, or N1) and 5421 Printer Control Unit, and either a 5424 Multi-Function Card Unit, a 1442 Card Read Punch, or a 2560 Multi-Function Card Machine, together with the necessary prerequisites. If a 1442 or 2560 is selected as the primary card I/O unit, a 5422 Disk Enclosure is also required.

The basic configuration can be expanded by adding any or all of the following peripheral devices: a directly attached 3741 Data Station, a second 5444 Disk Storage Drive (Model A2 or A3), one to four 5445 Disk Storage Drives, one 3410/3411 Magnetic Tape Subsystem with up to four drives, one 1255 Magnetic Character Reader or one 3881 Optical Mark Reader (connected via the optional Serial I/O Channel), one or two Binary Synchronous Communications Adapters, one Multiple Line Terminal Adapter (an RPQ feature), and one Local Communications Adapter (which takes the place of the First BSCA and permits local attachment of a 3741 Model 2 Data Station, a 3271 Control Unit, or a 3275 Display Station).

In Model 15 systems built around the newer B-level 5415 Processing Units, a 3340 Direct Access Storage Facility with two, three, or four disk drives replaces the 5444 and 5445 Disk Storage Drives and precludes their attachment.

MASS STORAGE

3340 DIRECT ACCESS STORAGE FACILITY: Provides fairly rapid random access to large quantities of data stored in interchangeable 3348 Data Modules. Usable only with System/3 Model 15 B-level processors.

The 3340 drives are available in three models with the following configuration rules. Model A2 contains two drives and a control; it can be connected to a System/3 Model 15 via direct attachment. The Model A2 is prerequisite for each 3340 subsystem. The 3340 Models B1 and B2 contain one and two drives, respectively; they can be connected to a 3340 Model A2 to form a string of up to four drives. The maximum number of 3340 drives that can be connected via the integrated attachments is four drives on a Model 15.

Each 3340 drive accommodates one 3348 Data Module, Model 70, at a time. The Data Module is a self-contained unit that includes not only the magnetic disks, but also the associated access arms and read/write heads. Since the same heads always serve the same tracks, head alignment problems should be reduced and data reliability enhanced. Each Data Module is a sealed unit 8 inches high, 16 inches deep, 18 inches long, and 18 pounds in weight. Loading the Data Module is an automatic process; the operator simply places the Data Module on a drive, closes the drive cover, and turns on a switch. Processing can begin in less than 20 seconds.

The 3348 Model 70 Data Module has approximately 506 cylinders and a total storage capacity of 50.8 million bytes. It has 12 tracks per cylinder and can store up to 8,368 bytes in each track. The 3340 exhibits the following performance: average head movement time is 25 milliseconds, average rotational delay is 10.1 milliseconds, and data transfer rate is 885,000 bytes/second. ▶

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- ● A low-cost disk entry system, beginning at \$1,062 per month, including business-oriented software.

And finally, the principal overall limitations of the System/3 Model 6 can be summed up as follows:

- In those business-oriented installations that do not include a card Data Recorder or diskette Data Station, all data files stored on the relatively extensive disk files (up to 9.8 million characters) must be laboriously entered a character at a time via the keyboard. (Even using the optional Data Recorder, data input time is still relatively slow.) Plainly, the direct attachment of the 3741 Data Station is meant to alleviate this labor.
- Line printing speeds are restricted to about 40 to 70 lines per minute, depending on the number of characters printed per line and on the printer model used. Overall system throughput, restricted by the operator's keying action on input and the serial printer on output, will be correspondingly low in most commercial installations.
- Commercial, RPG II-oriented users must learn a fairly involved system control language called OCL (Operation Control Language) for directing the execution of every program. Those users who also utilize the BASIC programming language must learn an entirely different control language to direct the preparation and execution of BASIC programs.
- RPG II and BASIC programs generate and use mutually incompatible disk-based data files. Also, BASIC data files cannot be sorted by the Disk Sort program unless they are first converted to the appropriate format.

With regard to compatibility, the System/3 Model 6 uses basically the same RPG II, FORTRAN, and Disk Sort programs as the System/3 Model 10. The only differences between the two RPG compilers are those based on the unique I/O devices used in each system. Disk cartridge files prepared by the RPG II or Sort programs of one system can be processed with no difficulty by the other. The 5440 Disk Cartridge used in all models of the System/3, however, are incompatible with IBM's larger computer systems and virtually all competitive systems.

Applications such as billing, inventory control, accounts receivable, and sales analysis are the "bread and butter" uses of the Model 6 in the RPG II-based, business-oriented environment. Under BASIC, IBM divides the typical application areas into engineering/scientific, financial (such as bond analysis, lease analysis, rate of return calculations, etc.), and general business (sales forecasting, cash flow analysis, overhead distribution, etc.). For installations using both RPG II and BASIC, ➤



The operator is working at the 5471 Printer-Keyboard, the alternate I/O device to the 3741 diskette Data Station for the new System/3 Model 8. A minimum configuration using the 5471, a 16KB central processor, a 2.46 MB disk drive, and a 100-lpm printer rents for \$1,599 monthly or sells for \$62,525.

- which is much greater than that of previous System/3 disks.

Of the 50.8MB capacity of each Data Module, however, a constant 9.83MB is required for program support. Up to four drives can be used, yielding a total capacity of 164.17MB for on-line data storage. The following combinations of models and resulting capacities are available:

No. of Drives	Models	Data Capacity	Program Support (reserved)
2	A2	82,083,840 bytes	9,830,000 bytes
3	A2 + B1	123,125,760 bytes	9,830,000 bytes
4	A2 + B2	164,167,680 bytes	9,830,000 bytes

It should be noted that the 3348 Data Module used with the System/3 is physically equivalent to the modules used with the System/370. However, the data formatting technique of the System/3 prohibits interchanging 3348 Modules between the System/3 and the System/370 for processing.

In addition to the sealed 3348 Data Modules, the 3340 subsystem includes other features that should contribute to improved reliability. An error correction code permits automatic correction of an error up to 3 bits long and detection of an error up to 11 bits long in each record. A closed-loop air filtration system reduces airborne contaminants that might cause read/write errors. A read-only switch on every 3340 drive is activated by inserting a latch in the Data Module; when the latch is not inserted, the data is protected against erasure or overwriting. ➤

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➤ almost any application is suitable for the System/3 Model 6, provided it does not require large data files and/or high-speed input/output beyond the capacity of the newly announced direct attachment of the 3741.

When the Model 6 was introduced in October 1970, applications software was notably absent from the IBM product offering. Since then, IBM has developed three different approaches to the application programming problem. First, there is a limited but steadily expanding complement of packaged application programs in three categories: IBM Program Products, Field Developed Programs, and Installed User Programs. Second, IBM offers the Application Customizer Service to aid Model 6 users in developing their own programs for Order Writing and Invoicing, Accounts Receivable, Inventory Accounting and Management, and Sales Analysis. Third, in response to criticism that its Application Customizer Service left the hardest parts of the job (the coding and testing) undone, IBM now offers a complete Application Programming Service for the same four applications at fixed prices.

IBM introduced the System/3 Model 6 on October 28, 1970, and demonstrated it in 40 locations across the country on the same day. Customer deliveries of BASIC-oriented systems began in December 1970, and the first RPG-based systems were delivered in March 1971. By mid-1974, more than 5,000 Model 6 systems had been installed, indicating that the Model 6 is gaining widespread acceptance, yet not selling nearly as rapidly as its Model 10 counterpart.

The Model 6, like all current IBM computer systems, is marketed on an "unbundled" basis, meaning that most of the software, educational courses, and technical support are separately priced. When comparing the Model 6 with competitive equipment, prospective users should carefully consider the amounts of these "extras" they will need and the associated costs.

In summary, the System/3 Model 6 is well designed to appeal to first-time computer users—particularly those who are unfamiliar with tab-oriented data processing techniques. The availability of RPG II, BASIC, and FORTRAN helps to make the Model 6 an unusually flexible system that can handle both the business and scientific computational needs of many small companies. The throughput capabilities of the Model 6 in most applications, however, are significantly lower than those of IBM's own System/3 Model 10 and many batch-oriented competitive systems.

SYSTEM/3 MODEL 8

The Model 8, the most recent member of the System/3 line, was announced on September 11, 1974, as the first new system introduction by the General Systems ➤

➤ Customer shipments of the 3340 disk to Model 15 users are set to begin in June 1975.

5444 DISK STORAGE DRIVE, MODELS 1, 2, & 3: Available for System/3 Models 6, 10, and 15. The 5444 Models 1 and 2 each consist of one removable single-disk cartridge and one fixed disk on a single drive, served by a single access mechanism with four vertically-aligned heads. Model 3 accommodates one removable single-disk cartridge only. A System/3 can include one or two disk drives, housed in sliding drawers. The following combinations of models and resulting capacities are available:

No. of Drives	Models	Data Capacity
1	1	2,457,600 bytes
1	2	4,915,200 bytes
2	2 + 3	7,372,800 bytes
2	2 + 2	8,830,400 bytes

Model 1 has 100 data tracks on each recording surface, while Models 2 and 3 have 200 data tracks per surface. Each track consists of 24 sectors, and each sector can hold a 256-byte record.

For all models, average rotational delay is 20 milliseconds and data transfer rate is 199,000 bytes/second. Average head movement time is 153 milliseconds in Model 1 and 269 milliseconds in Models 2 and 3; minimum head movement time for all three models is 39 milliseconds.

The removable 5440 Disk Cartridge weighs 6 pounds and is about 15 inches in diameter and 2.5 inches high. It stores 1.22 million bytes when used with the 5444 Model 1 Drive and 2.45 million bytes when used with the 5444 Model 2 or 3.

5444 DISK STORAGE DRIVE, MODELS A1, A2, & A3: Available for System/3 Models 8, 10, and 15. These drives provide faster access than the original 5444 drives described above. Average head movement time is 86 milliseconds for Model A1 and 126 milliseconds for Models A2 and A3; minimum head movement time for all three models is 28 milliseconds. In other respects, Models A1, A2, and A3 have the same characteristics as Models 1, 2, and 3, respectively. Disk cartridges can be used interchangeably among the Models 6, 8, 10, and 15, and all programs written for the original models will run without change on the faster models. Higher-Performance Disk Attachments (#4501 and #4502) must be added to the 5410 Processing Unit in a Model 10 system to accommodate the faster drives. The following combinations of models and resulting capacities are available:

No. of Drives	Models	Data Capacity
1	A1	2,457,600 bytes
1	A2	4,915,200 bytes
2	A2 + A3	7,372,800 bytes
2	A2 + A2	9,830,400 bytes

5445 DISK STORAGE DRIVE: Provides comparatively large-capacity random-access storage on interchangeable, 11-disk 2316 Disk Packs. Each single-spindle drive holds one pack and stores 20.48 million bytes in 256-byte physical records; when IBM software support is used, all data is recorded in this format. If the System/3 format conventions are followed on a System/360 or System/370, data recorded on 2316 Disk Packs can be interchanged between the systems. Average head movement time is 60 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 312,000 bytes/second. ➤

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▷ Division of IBM. The Model 8 is a batch processing system, without card functions, that supports direct attachment of the 3741 Data Station or 3741 Programmable Work Station. Additionally, the Model 8 supports Binary Synchronous Communications applications and the new Integrated Communications Adapter, an option previously found only on IBM's larger computers.

Virtually all the peripherals available for the System/3 Model 10 are supported by the new Model 8 with the exception of card and magnetic tape equipment. The key input/output device, replacing the 5424 Multi-Function Card Unit, is the 3741 Data Station or 3741 Programmable Work Station. When connected to the Model 8, the 3741 functions as a fairly high-speed sequential input/output device using IBM's flexible diskettes ("floppy disks"). IBM quotes a rated speed of 1500 records per minute for diskette input and 1000 records per minute for output when the 3741 is directly attached to a Model 8.

The minimum Model 8 system comprises a processing unit (with 16K, 32K, 48K, or 64K bytes of semiconductor main storage); either an operator's Printer-Key-board or a 3741 Data Station, directly attached; a 100-lpm printer, and a 2.46-million-byte disk. The processing unit and disk storage are the same as those offered on the Model 10, but the MOSFET memory is the same as that of the Model 15.

System/3 Model 8 configurations can be expanded by adding a 5471 Printer-Key-board (for operator communications, inquiry, program interaction, and secondary output), a 200-lpm or 300-lpm 5203 Printer (a Dual Feed Carriage is optionally available on the 5203), higher-capacity 5444 Model A disk drives (up to four), the 1255 Magnetic Character Reader, or the 3881-1 Optical Mark Reader. A Binary Synchronous Communications Adapter (BSCA), as well as the new Integrated Communications Adapter (ICA), together give the Model 8 versatility as a processor, remote batch terminal, or host processor with its own network of local and/or remote terminals. The optional Serial Input/Output Channel (SIOC) is required for either the 1255 or 3881 readers. When the SIOC is selected on a Model 8, the BSCA cannot also be selected.

The Model 8 offers diskette I/O and disk-based batch processing for slightly higher entry costs than the Model 10, plus the availability of an Integrated Communications Adapter. The ICA provides three functions on the Model 8:

- Two local line interfaces, neither requiring a modem; one is rated at 8000 bps for 3270 terminals, the other at 2400 bps for attaching 3741 communications stations. ▷

▶ A maximum of two 5445 drives (one Model 1 and one Model 2) can be connected to a 5410 (Model 10) Processing Unit. The 5410 must be equipped with the appropriate 5445 Disk Attachment and Processing Unit Expansion features. A maximum of four 5445 drives (or 81.92 million bytes of storage) can be connected to a 5415 (Model 15 A series only) Processing Unit equipped with the appropriate attachment features. The 5415's Scan/Read feature permits an index in 5445 Disk Storage to be scanned and read during a single revolution of the disk. Deliveries of the 5445 drives began in June 1972.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table.

COMMUNICATIONS CONTROL

BINARY SYNCHRONOUS COMMUNICATIONS ADAPTER (BSCA): For Models 6, 8, 10, and 15. Enables a System/3 to function as a processor terminal communicating with any of the following IBM devices:

- Another similarly equipped System/3.
- An 1130 Computing System.
- Any System/360 or System/370 computer equipped with appropriate communications control facilities.
- A 2770 Data Communications System.
- A 2780 Data Transmission Terminal.
- A 3735 Programmable Buffered Terminal.
- A 3741 Model 2 Data Station.
- A System/7 equipped with the BSCA.

Transmission is in half-duplex binary synchronous mode over a switched, leased, or private line. Either ASCII or EBCDIC transmission code can be used. Transmission over a non-switched data link can occur at 600, 1200, 2000, 2400, 3600, 4800, 7200, 19,200, 40,800 or 50,000 bits per second. When switched lines are used, transmission speed is limited to 600, 1200, 2000, 2400, or 3600 bits per second. BSCA operations are overlapped with computing and other I/O operations.

The BSCA alternatively enables a System/3 to operate as a tributary station on a multipoint leased or private line in conjunction with a central System/360 or 370 computer using either OS TCAM or OS or DOS BTAM. In this case the System/3 operates as a compatible member of the IBM family of BSC terminals at transmission rates of 1200 to 7200 bps.

Finally, the BSCA can equip the System/3 to function as the control station for a leased or private multipoint communications line supporting the following IBM BSC terminals:

- 3270 Information Display System terminals in single-station or multi-station configurations at 1200 to 7200 bps.
- 3735 Programmable Buffered Terminals at 1200, 2000, 2400 bps, or 4800 bps. ▶

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- ● One remote synchronous line for transmission at up to 7200 bps.

Only one of these three can be operating at once, but all three may be present on a Model 8.

The Model 8 offers the optional Dual Program feature, permitting two separate programs to run concurrently and share the processing unit facilities. This is the same feature offered for the Model 10.

The System/3 Model 8 differs from its nearest counterpart, the Model 10, in the following capabilities:

- No card equipment; instead, the 3741 is used.
- No magnetic tape I/O.
- Availability of the ICA.
- Use of only the higher-performance A models of the 5444 Disk Storage Drives.
- No card Program Products.
- No Application Customizer or Programming Services initially available. ➤



In the System/3 Model 10, the compact 5444 Disk Storage Drive and its removable single-disk cartridge are conveniently housed in a drawer beneath the 5424 Multi-Function Card Unit.

- ● 2980 General Banking Terminal System at 600 to 4800 bps.

- System/7 with BSCA.

The BSCA is an optional feature for the 5406, 5408, 5410, or 5415 Processing Unit; the appropriate Processing Unit Expansion feature is a prerequisite. Several optional features, in turn, are available to enhance the capabilities of the BSCA. The Text Transparency feature permits transmission and reception of data in 8-bit binary image form as well as in EBCDIC code. The Station Selection feature enables the BSCA-equipped System/3 to operate as one of a number of IBM BSC terminals on a multipoint line. The Internal Clock feature generates timing signals for use with modems that lack a clocking facility. The Auto Call feature enables the System/3 to dial and initiate a call to a remote BSC terminal under program control. The EIA Local Attachment permits one 3275 Display Station or one 3271 Display Control Unit to be cable-connected directly to the BSCA without the use of a modem or data communications line.

SECOND BSCA: This optional feature enables a System/3 Model 10 or Model 15 to control transmission simultaneously over two communications lines. Either the first BSCA or the Local Communications Adapter is a prerequisite. The Second BSCA has the same capabilities, options, and limitations as the First BSCA except that its range of transmission speeds is limited to 600 to 7200 bps; no broadband facilities are available for the Second BSCA.

INTEGRATED COMMUNICATIONS ADAPTER (ICA): For Model 8. This optional adapter allows a single remote communications line to coexist with two local communications lines. Either of these line types is manually switch-selectable. The ICA supports the following three options:

- Synchronous line, medium-speed communications—data set clocking, switched or non-switched line in either a point-to-point or multipoint network up to 7200 bps.
- 8000-bps local interface—EIA attachment, requiring no modem, to attach multiple 3277 Display Stations with associated printers or a single 3275 Display Station.
- 2400-bps local interface—EIA attachment, requiring no modem, for such devices as the 3741-2 or 3741-4.

More than one ICA function can be attached to a System/3 Model 8, but only one ICA function can operate at a time. The functions are switch-selectable.

LOCAL COMMUNICATIONS ADAPTER (LCA): For Models 10 and 15. This optional feature for the 5410 and 5415 Processing Units permits direct, local attachment of either one 3741 Model 2 Data Station, one 3271 Control Unit, or one 3275 Display Station. Data is transferred at 2400 bps in non-transparent EBCDIC mode. The LCA requires the appropriate Processing Unit Expansion feature, and cannot be installed in combination with the First BSCA. IBM now allows direct attachment of the 3741 to the System/3 Models 6, 8, 10 Disk, and 15.

MULTIPLE LINE TERMINAL ADAPTER (MLTA): For Model 15. This RPQ feature for the 5415 Processing Unit permits connection of up to eight communications lines, ➤

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▷ The 5408 Processing Unit for the Model 8 has the same architecture, instruction set, memory cycle time, and access time as the Model 10 Processing Unit. However, the Model 8 main memory is the MOSFET semiconductor type, as used in the Model 15; memory is available in four steps from 16K bytes to a maximum of 64K, in increments of 16K. Logic circuitry in the processor is based on IBM's Monolithic Systems Technology like the rest of the System/3 product line.

Programming support comes from the same SCP as that of the Model 10. Model 8 SCP includes the Communications Control Program (CCP) and Multi-Leaving Remote Job Entry Work Station (MRJE/WS). CCP allows users to develop communications systems using one of the Model 8-supported languages: Basic Assembler, COBOL, FORTRAN IV, or RPG II. MRJE/WS enables the Model 8 to act as a tributary system to a central System/370 and submit RJE OS jobstreams.

Model 8 Program Products comprise, in addition to the languages listed above, Disk RPG II, Disk Sort, DATA/3, and 1255 Utility. DATA/3, in particular, is an applications Program Product, used to generate RPG II programs supporting the 3270 Information Display Systems.

The Model 10 Application Customizer and Application Programming Services were not announced as available for the Model 8. However, it is anticipated that sufficient demand for them will soon result in their availability. One point not sufficiently emphasized by GSD in its announcement materials on the Model 8 is the fact that multiple 3741's can be put on-line to the 5408 through the ICA. This point is critical for those users with voluminous data requirements which would normally dictate the use of magnetic tape. However, with up to three 3741's attachable via the ICA and one directly attachable to the Processing Unit, the transfer speed of the 3741's will generally balance that of the magnetic tape.

Another point is that the Model 8 currently supports only binary synchronous communications and not the new Synchronous Data Link Control (SDLC) technology of the System/370. However, the older binary synchronous technology will amply support the tele-processing needs of System/3 users. The most common terminals on the Model 8 will be the 3741 for on-line processing and the 3270 Information Display Stations for inquiry or data entry.

The Model 8 will also support communications with the following:

1130 Computing System
2770 Data Communication System
2780 Transmission Terminal



▶ with multiple low-speed terminals on each line. The MLTA accommodates the following IBM start/stop terminals: 1050 Data Communications System, 2740 and 2741 Communications Terminals, Communicating Magnetic Card Selectric Typewriter (CMCST), and System/7 (supported as a 2740 Model 1).

SOFTWARE

SYSTEM CONTROL PROGRAMMING: SCP is IBM's designation for the programs that perform the system control functions which are basic to every installation. These programs are supplied with the system at no additional charge, whereas all other IBM software for the System/3 is separately priced.

MODEL 6 SYSTEM CONTROL PROGRAMMING (SCP): These programs perform the system control functions that are basic to an RPG II-oriented System/3 Model 6 installation. All of the basic SCP programs can function with the minimum Model 6 configurations: 5406 Processing Unit with 8K bytes of core storage, one 5444 Disk Storage Drive, and one printer. All other standard I/O units are also supported.

It should be noted that every program executed on a System/3 Model 6 requires a set of Operation Control Language (OCL) statements to provide the system with information about the job to be run (such as what program to load, what files to use, what date to use, etc.). OCL for the System/3 Model 6 is called conversational OCL because the operator keys in the control statements one at a time in response to queries (in the form of "keywords") from the system. (It is also possible to enter OCL statements via the optional Data Recorder.)

There are three sequences of OCL statements to be learned by the System/3 Model 6 operators: LOAD, for running a job whose OCL statements are not catalogued; BUILD, for cataloging OCL statements into a library; and CALL, for running a job whose OCL statements have been previously catalogued. Both the LOAD and the BUILD sequences contain a string of 20 keywords which must be individually responded to by the operator. The CALL sequence contains only four queries requiring operator response.

There are four categories of basic SCP routines for the Model 6:

- **SYSTEM MANAGEMENT PROGRAMS:** Generate and maintain a disk-resident system capable of compiling, generating, and executing user programs. These SCP programs consist of a supervisor and a scheduler, which provide the user with selective program loading from disk, program roll-in/roll-out capability, I/O control, and execution of programs from OCL procedures. Job-to-job transition is automatic.
- **LIBRARY MAINTENANCE PROGRAM:** Permits the user to generate, maintain, and service the system disk and the source and object program libraries. The libraries can reside on any drive, but the system disk must reside on either the fixed or removable disk of Drive 1. Functions include library add, delete, display, and copy.
- **COPY/DUMP PROGRAM:** Provides the user with the capability of copying his disk files onto another disk drive or printing them on the printer. Printing can be specified to occur between certain limits, and any portions of the original file can be deleted. ▶

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- 3735 Buffered Terminal
System/7
System/360
System/370

SYSTEM/3 MODEL 10

Model 10, the original member of the System/3 family, was announced in July 1969. It offers file-oriented data processing, in contrast to the transaction-oriented data processing orientation of the System/3 Model 6. Moreover, the Model 10 provides substantially higher throughput rates in most applications and a greater choice of peripheral devices.

Nearly all of the associated peripheral equipment announced with the System/3 Model 10 was completely new. The key input/output device, required in all non-disk System/3 Model 10 installations, is the 5424 Multi-Function Card Unit (MFCU). The MFCU, like the 2560 Multi-Function Card Machine used in the System/360 Model 20, can perform the functions of card reading, punching, collating, and interpreting. Consolidation of all these functions into a single compact unit leads to reduced equipment costs and card handling time, but the complexity of the unit has caused maintenance problems and frequent card jams in some installations. The recent availability of direct attachment for the diskette-oriented 3741 Data Station will go a long way toward satisfying those users looking to replace the 5424 MFCU.

The basic Model 10 system—consisting of processing unit, printer, and MFCU—requires only 150 square feet of floor space. Moreover, the units are interconnected by concealed, above-the-floor cables, eliminating the need for a raised floor. The optional disk storage drives are housed in drawers under the MFCU. The system console, MFCU, disk drives, and optional printer—keyboard are all within reach of a seated operator.

The most surprising aspect of the original System/3 announcement was the complete absence of any data communications facilities. This serious limitation on the system's sales appeal was removed in February 1970, when IBM announced a Binary Synchronous Communications Adapter (BSCA) for the System/3. The BSCA can turn the System/3 into a low-cost and highly flexible terminal computer, able to process data locally and communicate with other IBM computers at speeds ranging from 600 to 50,000 bits per second. The BSCA can be field-installed on any card or disk System/3. Deliveries began in the first quarter of 1971. The RPG II Telecommunications Feature facilitates the programming of BSCA applications—at an additional software cost of \$37 per month.

- ● **UTILITY PROGRAMS:** Permit the user to prepare and maintain his disk files. The programs provided include Disk Initialization, Alternate Track Assignment, Alternate Track Rebuild, File and Volume Display, and File Delete.

The Overlay Linkage Editor Feature is an optional extension of the basic System Control Programming that creates loadable programs from multiple relocatable modules. Overlay structures can be created automatically or as designated by the user. Output from the Overlay Linkage Editor can be cataloged in the Object Library on disk and/or punched into cards. The feature requires a 12K 5406 Processing unit, one 5444 Disk Storage Drive, and a printer.

The Multi-Leaving Remote Job Entry Work Station Feature permits a System/3 Model 6 system equipped with a Binary Synchronous Communications Adapter to function as a remote job entry work station to a System/370 system operating under OS/360, Release 2 of OS/VS1, or Release 2 of OS/VS2. Work station input can be entered through the console keyboard, a 5496 or 129 On-Line Data Recorder, a 5444 Disk Storage Drive, or through a combination of these devices. Operator messages are printed on the Model 5213 or Model 2222 Printer. Output data sets can be directed to a printer, a Model 5496 or Model 129 On-Line Data Recorder, or written to disk. Output may also be routed to another work station or directed to central system input/output devices. All files created by the work station programs are standard System/3 consecutive files and can be accessed by the Disk Copy/Dump Program or a user-written RPG II or FORTRAN program. This feature requires a 12K 5406 Processing Unit with a Binary Synchronous Communications Adapter with EBCDIC Transmission mode, a Model 5444 Disk Storage Drive, and a printer.

MODEL 8 SYSTEM CONTROL PROGRAMMING: At the time of its announcement, the Model 8 was supported by the SCP for the Model 10 Disk System. This is described below.

MODEL 10 CARD-ORIENTED SYSTEM CONTROL PROGRAMMING: IBM supplies two principal SCP's for card-oriented systems: a Program Maintenance Program, which facilitates maintenance of program decks, and a System Initialization Program, which initializes a communication area in core storage at the beginning of each day. These programs require a minimum System/3 Model 10 configuration (8K bytes, printer, and MFCU).

Also available for card-oriented systems is a Remote Job Entry Work Station Support routine that permits a System/3 equipped with a Binary Synchronous Communications Adapter to transmit OS/360 jobs to a central System/360 or 370 computer (256K Model 40 or above) and receive output from the central system upon completion of each job.

MODEL 10 DISK-ORIENTED SYSTEM CONTROL PROGRAMMING: For disk-oriented systems, i.e., Model 8 and 10, IBM supplies four basic types of SCP's: Disk System Management Programs, a Library Maintenance Program, Disk Utility Programs, and a Disk Copy/Dump Program. The Disk System Management Programs include a supervisor and scheduler which provide automatic job-to-job transition, selective retrieval of object programs from a disk library, data management and input/output

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▷ In October 1970, IBM added the 300-line-per-minute 5203 Model 3 Printer and the 750-document-per-minute 1255 Model 2 and 3 Magnetic Character Readers to the System/3 product line. Each of these units provides a 50 percent speed increase over the previously available models.

Then, in February 1971, IBM announced a number of new products for the Model 10 that greatly alleviated many of its remaining limitations and broadened its spectrum of practical applications. The new 5410 Model A7 (card) and A17 (disk) Processing Units have 49,152 bytes of core storage, or 50 percent more than the previous maximum capacity. The 5444 Model A1, A2, and A3 Disk Storage Drives offer much faster access time (at higher prices) than the earlier 5444 Model 1, 2, and 3 Drives. The 5545 Disk Storage Drives provide greatly increased capacity—20.48 million bytes per 2316 Disk Pack—together with fast access and data compatibility with the System/360 and 370 computers. The 5421 Printer Control Unit permits the connection of a 600-lpm or 1100-lpm 1403 Printer in place of the much slower 5203 Printer. And finally, the COBOL and FORTRAN compilers offer System/3 users a much wider choice of programming languages and improved program compatibility with other computers.

In October 1971, IBM brought magnetic tape capabilities to the System/3 Model 10 by introducing the compact, low-cost 3410/3411 Magnetic Tape Subsystem and a variety of supporting software facilities. At the same time, IBM upgraded the system's communications facilities by adding a Second BSCA and support for the 3270 Information Display System.

In November 1971, IBM announced that customers who need 80-column card I/O on a System/3 Model 10 Disk System will henceforth be able to install a 1442 Card Read Punch in place of the 96-column 5424 Multi-Function Card Unit, which had previously been a required component in every System/3 Model 10 installation. This capability expands the System/3's sales appeal by making it a suitable choice for users who need to retain the traditional 80-column cards for compatibility with existing systems and equipment.

In July 1971, IBM added the 3881 Optical Mark Reader to the complement of on-line I/O equipment for the System/3. The 3881 reads ordinary pencil marks or machine-printed marks from documents of widely varying sizes at a speed of 4000 or 6000 documents per hour.

In August 1974, IBM added the facility for direct attachment of the 3741 Data Station to Model 10 Disk Systems. The 3741 performs effectively as a high-speed I/O device and is supported under RPG II and ▷

▶ control, program overlays, a program roll-in/roll-out capability that facilitates the processing of inquiries, and support of the optional Dual Program feature. The Library Maintenance Program creates and updates source and object program libraries in disk storage. The Disk Utilities and Disk Copy/Dump facilitate the initialization and maintenance of disk files. These programs require a System/3 with at least 12K bytes of core storage, one 5444 Disk Storage Drive, a 5203 or 1403 Printer, and (on Model 10) a 5424 MFCU or 1442 Card Read Punch. Main memory residence requirements for the Disk System Supervisor range from about 3K to 4.75K bytes, depending upon the system configuration.

Optional SCP facilities for the Model 8 and for disk-oriented Model 10 systems include:

- Remote Job Entry Work Station: Enables a System/3 equipped with a BSCA to transmit OS/360 jobs to a central System/360 or 370 computer (256K Model 40 or above) and receive output from the central system upon completion of each job. Support of the 5444 Disk Storage Drive as a remote job entry I/O device is included. Requires about 5,120 bytes of main memory.
- IBM 5445 Disk Storage Drive Feature: Provides software support for the 5445 Disk Storage Drive as an I/O and data storage device—but not as a system or library residence device. Includes disk utility and copy/dump routines to facilitate the creation and maintenance of disk files.
- Magnetic Tape Support Feature: Provides for the initialization and use of magnetic tape files. The feature will accommodate fixed or variable-length records, blocked or unblocked records, ANSI or IBM label formats, and ASCII or EBCDIC data codes. It will also accumulate and record tape error statistics.
- IBM 3881 Optical Mark Reader Feature: Provides system subroutines to handle data management and input control functions associated with on-line use of 3881.
- Macros Feature: Permits the use of user-coded macroinstructions for the control of nonstandard data management and I/O functions.
- BSCA Multiline/Multipoint Feature: Provides communications support for a point-to-point switched, point-to-point nonswitched, or multipoint configuration with the System/3 as a multidropped terminal or control station. Can support two BSCA's with different configurations. The Macros Feature (above) is a prerequisite.
- Communications Control Program: Provides control facilities for multi-terminal communications systems. IBM 3270 Information Display Systems or 3735 Programmable Buffered Terminals can be connected to the System/3 via a BSCA, and the System/3, in turn, can operate as a tributary terminal to a host System/360 or 370 computer. At least 48K bytes of dedicated storage is required in the System/3.
- Multi-Leaving Remote Job Entry Work Station Program: Permits a System/3 disk system equipped with a Binary Synchronous Communications Adapter to function as a remote job entry work station to a System/370 processor operating under control of ▶

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➤ Assembler, but not for COBOL or FORTRAN object programs. In effect, the 3741 replaces a card reader and card punch.

IBM software support for the System/3 Model 10, while far from sophisticated, is well tailored to complement the system's modest hardware capabilities. A set of System Control Programs, designed to handle basic operating and data management functions, is supplied to Model 10 users at no extra charge. The System Control Programs for disk-oriented systems include a supervisor and scheduler that perform the functions of a simple operating system. All other System/3 software is separately priced.

IBM is encouraging most System/3 users to do their application programming in the RPG II language. RPG II is available for both card and disk systems. The language is an extended version of System/360 RPG that is capable of handling most business programming requirements quite effectively. As a significant step toward improved compatibility between the System/3 and the larger IBM computers, IBM in early 1971 announced a DOS RPG II compiler for the System/360 and 370. The DOS version supports all the facilities of System/3 RPG II except the telecommunications and automatic program overlay functions.

The ANS COBOL and FORTRAN compilers for the System/3 Model 10, announced in February 1971, provide alternative ways to bridge the compatibility gap. Both compilers offer upward language compatibility with their DOS and OS counterparts for the System/360 and 370.

Thus, System/3 Model 10 users can now elect to write their programs in any of three languages—RPG II, COBOL, or FORTRAN—without fear that they may have to start over if and when it becomes necessary to move up to a larger computer. Even so, the compatibility problems still have not been fully resolved. There are numerous differences in system control, data management, and operational characteristics which could hamper conversions from the System/3 to the System/370.

IBM's Application Customizer Service was first offered with the System/3 Model 10. Users with Model 10 card-based systems can utilize the service for accounts receivable, inventory accounting, order writing and invoicing, sales analysis, payroll, general ledger, accounts payable, and labor distribution. For Model 10 disk-based systems, the service is available for order writing and invoicing, inventory accounting, and management, accounts receivable, and sales analysis. Using questionnaires defining the user's requirements as its input, the Application Customizer program produces detailed documentation to guide the user's programmer in ➤

➤ HASP II, ASP, OS/VS2 JES, and OS/VS2 JES2/JES3. Work station input may be read from a 5424 MFCU, a 1442 Card Reach Punch, a 5471 Printer-KeyBoard, a 5444 or 5445 Disk Storage Drive, a 3410/3411 Magnetic Tape Subsystem, or any combination of these devices. A printer or the 5471 Printer-KeyBoard can be used for operator messages, and output can be used for operator messages, and output can be directed to a printer, the 5424 MFCU, the 1442 Card Read Punch, or written to disk or magnetic tape. Output can also be routed to another work station or directed to the central host computer system's I/O devices. All files created by the work station program can be accessed by user-written RPG II, COBOL, FORTRAN, and Assembler programs and by the Disk Copy/Dump Program. A minimum partition size of 8.25K bytes is required.

- **Dual Programming Feature:** Supports a limited dual-partition multiprogramming capability. The 5471 Printer-KeyBoard can be used by both program partitions for object program input/output or to enter operations control information, but neither the printer, a 3881 Optical Mark Reader, a multi-function card unit, or a 1442 Card Read Punch can be shared by two programs. Data files on disk can be shared, but only one program at a time can write to a shared file. The Assembler Program, the Utility Program for the IBM 1255 Magnetic Character Reader, and library maintenance routines require a dedicated system.

MODEL 15 SYSTEM CONTROL PROGRAMMING: The IBM software for the System/3 Model 15 is a compatible superset of the software for System/3 Model 10 disk systems. Therefore, the emphasis in the following paragraphs is on the new software facilities and features which are unique to the Model 15. Except where otherwise indicated, all announced Model 15 software facilities were scheduled for availability in March 1974 and are usable on a minimum Model 15 system.

The Model 15 System Control Programs are functionally compatible with their Model 10 counterparts, with additions to support two-partition multiprogramming, disk spooling, and the new Model 15 CPU features and peripheral devices. Source programs written for a System/3 Model 6, Model 8, or Model 10 must be recompiled prior to operation under Model 15 SCP, but data files and OCL (Operation Control Language) are directly compatible. To further ease the transition from a Model 10 to a Model 15, it is possible to operate a Model 15 system under Model 10 software; when this is done, the new features of the Model 15 are not used and the system operates in the same manner as a Model 10.

The most significant new feature of the Model 15 SCP is its capability to support multiprogramming in any of three environments: single batch with spooling, dual batch with spooling, or batch, communications, and spooling. The Supervisor controls the allocation of CPU time, giving Partition 2 (communications) priority over Partition 1 (batch). When an interrupt occurs, the Supervisor seizes control, processes the interrupt, and transfers control to the highest-priority program that is in a ready state. A high-priority program gives up control whenever it encounters a condition that prevents further processing. The processing of a low-priority program is suspended upon completion of an event (e.g., an I/O operation) for which a higher-priority program is waiting. ➤

IBM System/3

▷ writing the necessary RPG II coding. A high degree of user dissatisfaction with the original Application Customizer Service led IBM to offer two optional extensions: users of disk-oriented systems can elect to receive customized, computer-generated RPG II source code (which they must then compile and debug), while users of card-oriented systems can contract with IBM for the design, programming, and documentation of complete applications at fixed prices.

System/3 Model 10 users can also choose from the rapidly growing array of packaged application programs. IBM offers its own Program Products plus a variety of Field Developed Programs and Installed User Programs (all on a separately priced basis), and several System/3 user groups are promoting the interchange of programs among their members. A nationwide network of IBM Basic System Support Centers provides System/3 users with educational courses and computer time for pre-installation testing and debugging.

IBM's 96-column card, introduced originally with the System/3 Model 10, is about one-third the size of the familiar 80-column card and holds 20 percent more information. The card is 3.25 inches wide and 2.63 inches high. The upper portion of the card can accommodate up to 4 printed lines, each containing up to 32 characters. The lower portion consists of 3 "tiers" of punching positions; each tier can hold 32 characters of data. Punched data is expressed as a 6-bit code and represented by tiny round holes.

The 6-bit code restricts the card character set to 64 characters—a startling backward step in the era of expanded character sets. The restricted card code is all the more surprising in view of IBM's use of EBCDIC, which can accommodate up to 256 different characters, as the System/3's internal code.

The 96-column card is clearly easier to handle, less expensive, and more compact to store than the 80-column card. Nonetheless, its introduction aroused considerable controversy. The EDP industry has made significant progress toward standardization and data compatibility during the past few years, with the 80-column card being accepted as an almost universal standard. The 96-column card is incompatible with all previous punched card equipment. Its introduction by the industry leader, seconded by its use in the impressive Burroughs B 1700 systems, may well make it the card of the future—but both IBM and Burroughs are hedging their bets by offering 80-column card equipment as well.

Along with the System/3, IBM introduced two off-line devices for use with the 96-column card. The 5496 Data Recorder is a buffered unit that performs the functions of both a keypunch and verifier, at a rather stiff rental price of \$171 per month. The 5486 Card Sorter is a ▷

▶ When the Communications Control Program (CCP) is used, the communications partition can be further divided into smaller subpartitions ranging from 2K to 32K bytes in size. Multiple communications-oriented application programs can be executed concurrently in these subpartitions under CCP control. A detailed description of the CCP is presented below.

Spooling is another important new feature of the Model 15 SCP. Spooling can increase system throughput by reducing the amount of time the CPU must spend awaiting the completion of card and printer I/O operations. Moreover, it enables a single input or output device to serve both partitions. When spooling is employed, each job's normal card input (including OCL) is read by the card reader and stored in an input queue on a 5445 Disk Storage Drive, where it can be accessed at disk I/O speed when the job is processed. Similarly, the job's output is stored in a disk output queue and then printed and/or punched at a later time. Spooling on the Model 15 requires a 5445 Disk Storage Drive and from 8K to 20K bytes of main storage, depending on the options selected.

Other new or improved facilities of the Model 15 SCP include: (1) device-independent data management, which allows a sequential file to be assigned at execution time to any one of numerous I/O devices; (2) system-assigned half defaults, which reduce the need for operator intervention when errors are encountered; (3) reduced system overhead through improved transient handling, reduced interpartition interlock time, and faster operator communication via the CRT console; and (4) additional OCL statements and options, which define program processing in the multiprogramming and spooling environments.

The Model 15 SCP supports all the peripheral devices available for the system. It also supports the following new features of the Model 15 CPU: I/O Operation End Interrupt, Program Check Interrupt, Storage Protection, console CRT display, and expanded main storage capacities to 131K bytes.

The following software facilities which were optional for the Model 10 are standard features of the Model 15 SCP: Magnetic Tape and 5445 Disk Storage Support, Macros, Overlay Linkage, Editor, Checkpoint/Restart, and BSCA Multiline/Multipoint. The Macros facility permits the use of user-coded macro-instructions to control nonstandard data management and I/O functions. The Overlay Linkage Editor creates loadable programs from multiple relocatable modules. The Checkpoint/Restart facility aids users in writing checkpoint records and in restarting interrupted programs from the last checkpoint rather than from the beginning. The BSCA Multiline/Multipoint facility provides communications support for a point-to-point switched, point-to-point nonswitched, or multipoint configuration with the System/3 as a multidropped terminal or control station; it can support two BSCA's with different configurations.

The Model 15 SCP can be used on the minimum Model 15 system, as defined in the "Configuration Rules" paragraph of this report. Spooling, however, requires the addition of a 5445 Disk Storage Drive. The minimum main storage requirement for the Supervisor is 18K bytes, and this can expand to as much as 24K bytes when a variety of peripheral devices must be supported. Spooling adds another 8K to 20K bytes to the residence requirement, depending on the options selected. Batch partitions can range from 8K to 49K bytes in size. ▶

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▷ table-top unit that has six stackers and requires one and one-half card passes for each numeric column sorted—another curious step backward. The sorter is offered in a 1000-cpm model at \$98 per month and 1500-cpm model at \$133 per month.

SYSTEM/3 MODEL 15

The System/3 Model 15, introduced on July 10, 1973, greatly increases the functional capabilities of IBM's popular small-scale computer line while retaining the proven architecture and software facilities of the earlier System/3 models. Thus, the availability of the Model 15 should ease the minds of thousands of current and prospective System/3 users by eliminating—or at least postponing—the need for a costly, traumatic conversion to a noncompatible system when their needs outgrow the capabilities of their present installations.

The Model 15 represents, in most respects, a bigger, better, and more costly System/3 Model 10. The new model offers up to 131,072 bytes of MOSFET main storage and 164 million bytes of disk storage, whereas the Model 10 is limited to a maximum of 49,152 bytes of core storage and 50.8 million bytes of disk storage. The Model 15 systems software is a compatible superset of the Model 10 software, enhanced to support dual-partition multiprogramming, spooling, device-independent data management, expanded communications control, and other throughput-boosting features (but not virtual storage—at least not yet). Moreover, in addition to accommodating most of the Model 10 peripheral devices, the Model 15 uses a new CRT operator console and can support the 80-column 2560 Multi-Function Card Machine and 2501 Card Reader. Thus, the Model 15 offers Model 10 users a natural and highly welcome growth path with minimum conversion effort.

The Model 15 became even more attractive as a result of IBM's September 1974 announcement of native attachment of three models of the 3340 Direct Access Storage Facility. The widely publicized "Winchester" disk technology, originally available only to System/370 computer users, brings with it twice to four times the capacity of the largest disk previously available, the 5445. The minimum 3340 disk configuration allowed on the Model 15 is the 3340 A2, containing two drives with a total of 82.08 million bytes of storage. One or two additional drives can be added to raise the total storage capacity to 123.13 or 164.17 million bytes.

The System/3 data formatting for the 3340 precludes interchanging data modules with a System/370-formatted 3340. In addition, only one of the two removable 3348 Data Modules, the Model 70, from the System/370 will be available on the System/3. Finally, only 50.87 million bytes will be available on each Model ▷

▶ **COMMUNICATIONS CONTROL PROGRAM (CCP):** This optional SCP component provides control facilities for multi-terminal communications systems connected to a System/3 via either the BSCA or the MLTA (see "Communication Control," above). The System/3, in turn, can operate as a tributary terminal to a host System/360 or 370 computer. The CCP: (1) permits programs coded in COBOL, FORTRAN, or RPG II to access the terminals; (2) handles resource management to reduce contention between programs accessing the same files; (3) monitors the terminals and responds to their commands; and (4) controls the concurrent execution of multiple application programs within the CCP partition. The CCP can occupy a partition larger than the normal 49K-byte maximum size, but individual programs running under CCP control are limited to 32K bytes. When used with a BSCA-equipped System/3, the CCP supports the following IBM terminals: other System/3's (in point-to-point switched or non-switched arrangement, as a multipoint control station, or as a multipoint tributary), 3270 Information Display Systems (in a multipoint nonswitched arrangement), 3735 Programmable Buffered Terminals (in switched or multipoint arrangements), and System/7 computers (in point-to-point switched or non-switched and multipoint arrangements). The CCP was scheduled to become available to Model 15 users in September 1974.

RPG II (REPORT PROGRAM GENERATOR): This is the principal programming system for all models of the IBM System/3. The programmer, using five different types of preprinted specification sheets, prepares a set of specifications that describe the form of the input data, the calculations to be performed, and the format of the desired output. These specifications are transcribed into punched cards and fed into the MFCU. The RPG processor then generates a machine-language object program to perform the specified functions.

The RPG II language is an extended version of earlier IBM RPG languages. It provides the facilities of System/360 RPG plus at least 20 useful extensions, including the ability to define and execute closed subroutines, to use dual input/output areas, and to debug programs at the source-language level.

The RPG II compiler for the System/3 Model 6 operates under control of the System Control Programming (SCP) software. Minimum system size for compilation and execution includes one 5406 Processing Unit with 8K bytes of core storage, a 5444 Model 1 Disk Storage Drive, and a 5213 or 2222 Printer. RPG II for the Model 6 will also support the 5496 Data Recorder or the 129 Card Data Recorder, and object programs will support the 2265 Display Station and a ledger card device. The 1255 Magnetic Character Reader is not supported.

System/3 Model 6 RPG II is source-language-compatible with Disk RPG II for the System/3 Models 10 and 15 except for differences originating from different I/O devices.

Two different versions of RPG II are offered for the System/3 Model 10. The second or disk-oriented version is also offered for the System/3 Model 8.

● Card RPG II. Can be used on a minimum Model 10 configuration consisting of an 8K 5410 Processing Unit, a 5203 or 1403 Printer, and a 5424 MFCU. If 80-column cards are to be utilized as program data or source statements, a 1442 Card Read Punch is ▶

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▷ 70 Data Module, with 9.83 million bytes of that needed for program support.

Adding the 3340 disks to a Model 15 greatly increases its auxiliary storage at costs ranging from \$1,059 to \$1,806 in monthly rental and from \$40,000 to \$68,000 in purchase price. By comparison, two 5445 disk drives with 81.5 million bytes price out to \$1,508 for monthly rental and \$62,800 for purchase. The \$29,000 differential for the new Model 15 B processors required to support the 3340 is largely offset by the \$20,000 attachment feature required on the Model 15 A processors for the 5445 drives. Thus, for comparable storage capacities the 3340 will cost less than the 5445. The 3340 high-density disks will be available for the Model 15 beginning in June 1975.

IBM is also promoting the Model 15 as an appropriate growth system for System/360 Model 20 users who have rebelled against the comparatively high cost of even the smallest System/370 configuration. The Model 15 supports the 2560 MFCM, which is the key peripheral device in most 360/20 installations, and a field-developed program is available to aid in converting 360/20 RPG programs into Model 15 RPG II.

Typical Model 15 systems will range from \$3,500 to over \$7,000 in monthly rental, with purchase prices ranging from \$141,000 to \$295,000. The basic \$3,500 per month will buy a 49K CPU with CRT display console, a single 4.9-million-byte disk drive, a 465-lpm printer, and a 5424 Multi-Function Card Unit that reads 250 cpm and punches or prints at 60 cpm. Customer shipments of the Model 15 began in March 1974, with the 131K CPU starting in June 1974.

The 5415 Processing Unit, the central component of every Model 15 system, is available with 48K, 65K, 98K, or 131K bytes of main storage. It is also available in the same four sizes in new models that support native attachment of the 3340 disk storage facility. The cost differential for these new B-level processors ranges from 33 to 46 percent above the original A-level processors, which cannot support the 3340. (The earlier 5444 and 5445 disk drives cannot be connected to the B-level processors, it should be noted.)

IBM's MOSFET (metal oxide semiconductor field effect transistor) storage technology is used, as in the latest System/370 models, and up to 2048 bits of data are stored on a single chip. Cycle time of the Model 15 memory is the same as that of the Model 10: 1.52 microseconds per byte. automatic correction of single-bit memory errors is a standard feature. On a cost-per-byte basis, the new MOSFET memory is offered at approximately one-fourth the price of the core memory used in the System/3 Model 10—bad news for the several

▶ required. The only limitations on the number of input and/or output files are those imposed by the number of physical I/O devices available. Object programs are produced in the form of punched card decks which can be loaded for immediate execution; there are no associated control programs. The optional Magnetic Tape Feature enables Card RPG II programmers to handle sequential input and output files on magnetic tape; the records must be of fixed length, and may be either blocked or unblocked and in either EBCDIC or ASCII code.

- **Disk RPG II:** Requires a 16K 5408 or a 12K 5410 Processing Unit, one 5444 Disk Storage Drive, a 5203 or 1403 Printer, and a 5424 MFCU, 1442 Card Read Punch, or 3741 Data Station (on the Model 8). It provides disk-file data management facilities, automatic overlays for programs which exceed core storage capacity, and three types of file organization: sequential, indexed, and direct. All three types of files can be processed either sequentially or randomly. The optional Magnetic Tape Feature enables Disk RPG II programmers to handle sequential input and output files on magnetic tape; the records may be fixed or variable in length, blocked or unblocked, and in either EBCDIC or ASCII code. The 5445 Disk Storage Drive Feature allows RPG II users to process sequential, indexed, or direct data files on 5445 Drives.

Model 15 RPG II provides all the facilities of Model 10 Disk RPG II plus device-independent data management, variable-length magnetic tape records, support of the 2501 Card Reader, 2560 MFCM, and 3277 Display Station, and several other new facilities. In addition, four features which are separately priced options for the Model 10 are included in the price of Model 15 RPG II: Telecommunications, Auto Report, Magnetic Tape support, and 5445 Disk Storage support.

RPG II AUTO REPORT FEATURE: This optional enhancement of Model 6, Model 8, or Model 10 Disk RPG II is a precompiler that reduces the coding effort required to prepare report programs. A single Auto Report output field specification written by the programmer can result in the generation of RPG II statements to indicate printing with editing, insert column headings, control spacing and horizontal alignment of the data, define total fields, accumulate totals by control levels, and flag total lines with asterisks. The Auto Report functions may be specified for only one printer file in any RPG II program. Auto Report also provides a COPY statement that permits RPG II source statements to be copied from a disk library into source programs that are about to be compiled.

RPG II TELECOMMUNICATIONS FEATURE: This optional extension of Model 6, Model 8, or Model 10 RPG II facilitates the transmission and reception of binary synchronous data over voice-grade or high-speed communications lines. The programmer fills out an RPG II Telecommunications Specification Sheet, which specifies the functions to be performed. The feature permits a System/3 equipped with the BSCA to operate in any of the following communications modes: receive only, transmit only, receive with conversational reply, transmit with conversational reply, or alternate transmit and receive file. The System/3 can function as a terminal in one of three types of networks: point-to-point switched, point-to-point nonswitched, or multipoint. ▶

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▷ companies that are currently offering add-on memory units for the System/3.

The 5415 Processing Unit has the same basic architecture, instruction set, and cycle time as its Model 10 counterpart, the 5410. Thus, the Model 15's greater throughput is not derived through an increase in raw CPU power (the System/3 has always boasted surprisingly high internal speed), but through its increased storage capacity and more powerful software. To support the improved software, IBM has added a number of new facilities to the 5415 Processing Unit:

- Storage Protection, which prevents users' programs from interfering with one another or with the Supervisor.
- I/O Operation End Interrupt, which facilitates multi-programming by enabling the Model 15 to operate as an interrupt-driven system.
- Program Check Interrupt, which makes it unnecessary to halt the entire system when an error occurs in one partition.
- 2-byte-wide data path for 5444 or 5445 Disk Storage Drives, which reduces the interference with CPU operations imposed by disk input and output.
- Scan/Read for 5445 Disk Storage Drives, which permits a disk index to be scanned and retrieved in a single rotation instead of two.
- An Address Translation Table (ATT), which consists of 32 registers and enables the Model 15 to address up to 131K bytes of storage.

The System/3 Model 15 supports all of the Model 10 peripheral devices except the 5444 Model 1, 2, 3, and A1 Disk Storage Drives, the 5203 Printer, the 5471 Printer-Keyboard, and the 5475 Data Entry Keyboard. The original 5444 Disk Storage Drive models are replaced by the newer 5444 Models A2 and A3, with their faster head positioning mechanisms, and by up to four of the 20.48-million-byte 5445 Disk Storage Drives (or on the B-level processors, by from two to four 3340 drives). The 5203 Printer is replaced by the faster 1403, available in three models with rated speeds of 465, 600, and 1100 lines per minute. The 5471 and 5475 are replaced by the 3277 Display Station, which provides improved communication between the system and its operator. The 1255 Magnetic Character Reader or the 3881 Optical Character Reader can be connected to a Model 15 via the optional Serial I/O Channel.

As alternatives to the 5424 Multi-Function Card Unit, which uses IBM's compact new 96-column cards and was ▷

▶ **BASIC:** System/3 BASIC is a conversational, stand-alone computing system designed for mathematical problem solving on a System/3 Model 6. The System/3 BASIC programming language is fully compatible with the BASIC language co-developed by GE and Dartmouth College and currently used with most time-sharing systems.

Programs and data files are created at the keyboard in a conversational mode. (The 5496 or 129 Card Data Recorder can also be used to load source programs into the system). There are four types of lines that can be entered: BASIC source program statements, data-file lines, comment lines, and system commands. All statements are checked for proper syntax as they are entered.

The system commands specify an immediate system action, such as saving a program or data file, executing a program, modifying a work file, etc. These system commands constitute a control language that is entirely different from the OCL statements used to control the System/3 when operating under the System Control Programming software.

Debugging aids are provided to assist in checking programs at execution time. Also a number of utility functions are provided to perform such support functions as system generation, disk initialization, disk copy, etc.

BASIC also provides another mode of service, called the Desk Calculator mode, utilizing the console's Command Keys rather than any detailed programming language. Operating in this mode, the user can add, subtract, multiply, divide, compute powers and roots, and use built-in logarithmic and trigonometric functions.

BASIC is a stand-alone computing system. However, it can co-reside on the same system disk cartridge as the SCP software. In such co-residence situations, control can be easily transferred back and forth between the two operating systems.

Data and program files are prepared in a manner unique to the BASIC system. Thus, an RPG-prepared object program cannot use the data files prepared by a BASIC program, and vice versa. These incompatible disk files can be made compatible by converting them with the Data Interchange Utility (DIU), one of the optionally available "Conversational Utilities."

Source Programs, data files, and systems programs are all stored on disk for direct accessibility. The system uses a 64K-byte "virtual memory," implemented through software paging, to permit the compilation and execution of large programs that otherwise would not fit into main memory. A 500-statement BASIC program can be compiled from disk in about 30 to 35 seconds, once all the statements have been entered and verified. BASIC programs can be listed at the rate of about 60 statements per minute on a 5213 Model 1 Printer.

The minimum System/3 Model 6 configuration will support the use of BASIC. Fully expanded configurations can also be used to advantage. Both the 5213 and 2222 Printers are supported, as well as the 5496 Data Recorder, the 129 Card Data Recorder, and the 2265 Display Station.

COBOL: The System/3 Subset ANS COBOL Compiler, for Models 8, 10, and 15, supports these six modules of the American National Standard COBOL language: ▶

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▷ at one time the only card I/O device available for the System/3, Model 15. Users can elect to use either of two 80-column card units: the 1442 Card Read/Punch or the 2560 Multi-Function Card Machine. Alternatively, with the direct attachment of the 3741 Data Station, magnetic diskettes can be substituted for the 5424 or 2560 Multi-Function Card devices on a Model 15. In addition, a 2501 Card Reader can be used as an auxiliary 80-column input unit. Support for both the 80-column and 96-column card units is provided by all of the Model 15 systems software facilities announced to date. Thus, IBM's strong initial commitment to the 96-column card as a key feature of the System/3 approach to data processing has now been heavily diluted.

The IBM software support for the Model 15 is a largely upward-compatible and greatly improved version of the Model 10 software. The no-charge System Control Programming (SCP) lets Model 15 users enjoy numerous "big computer" capabilities that were previously unknown to System/3 users, including real dual-partition multiprogramming, disk spooling of unit record input and output data, a task dispatcher, interrupt handlers, and the ability to assign sequential files to specific types of devices at execution time. The Model 15's multi-programming facility replaces the optional Dual Programming Feature of the Model 8 and Model 10 and offers far more operational flexibility. A Model 15 user can operate his system either with two batch partitions or with one batch partition and one communications partition, with concurrent spooling in either case. Each batch partition can occupy from 8K to 49K bytes of main storage.

Predictably, the Model 15 user will pay a fairly high price for this "big computer" software in terms of main storage residence requirements. The Supervisor will normally occupy from 18K to 24K bytes, and spooling will require another 8K to 20K bytes, depending on the options selected by the user. Fortunately, the price of Model 15 main storage is low enough to make these rather lavish software requirements a matter of small concern to most users; another 32K bytes of main storage can be added for a modest \$200 to \$250 per month.

Also available for the Model 15 are improved versions of the following System/3 Program Products; RPG II, COBOL, FORTRAN, Basic Assembler, Disk Sort, Tape Sort, and Card Utilities. All of these products support the new Model 15 peripheral devices, and the RPG II and COBOL compilers offer a number of other worthwhile new facilities.

Two communications-oriented programs that deserve special attention are DATA/3, a new Program Product that generates interactive terminal-control programs for CRT displays used in inquiry or data entry applications, ▷

▷ **Nucleus (Level 1), Sequential Access (Level 1), Random Access (Level 1), Table Handling (Level 2), Segmentation (Level 1), and Library (Level 1).** The compiler also supports certain elements of higher-level ANS COBOL modules and some IBM extensions. The ANS Sort and Report Writer modules, however, are not implemented. System/3 COBOL is upward-compatible with the ANS COBOL compilers for the System/360 and 370, and is a superset of IBM 1130 COBOL.

For the System/3 Module 8, COBOL compilation requires a 16K 5408 Processing Unit, a 5471 Printer-Keyboard or 3741 Data Station, and at least one 5444 Disk Storage Drive and a 5203 Printer.

For the System/3 Model 10, COBOL compilation requires a 16K 5410 Processing Unit with at least one 5444 Disk Storage Drive, a 5203 or 1403 Printer, and a 5424 MFCU or 1442 Card Read Punch. Also supported are the 5445 Disk Storage Drives and the 5471 Printer-Keyboard. Processing of magnetic tape files with fixed- or variable-length records, blocked or unblocked formats, and EBCDIC or ASCII data codes also is supported.

The Model 15 COBOL compiler provides all the facilities of System/3 Model 10 COBOL, plus the ability to use the SCP Roll-out/Roll-in routines, support of multi-volume indexed disk files, and support of the 2501 Card Reader, 2560 MFCM, and 3277 Display Station with operator console keyboard.

FORTRAN: The System/3 Disk FORTRAN IV compiler accepts source programs written in the IBM System/360 Basic FORTRAN IV language, which encompasses American National Standard Basic FORTRAN. It also accepts programs written in IBM 1130 Basic FORTRAN IV with minor modifications. Language extensions beyond the Basic FORTRAN level include the DEBUG facility, the IMPLICIT statement, the relational IF statement, and explicit length specification for the INTEGER and REAL Type statements. Also included are commercial subroutines which perform essentially the same functions as the IBM 1130 Commercial Subroutine Package.

The Compiler runs on a System/3 Model 6, Model 8, Model 10, or Model 15 disk system, providing full FORTRAN compatibility among the models except for changes that may be necessitated by differences in their I/O equipment. Compilation requires at least a 12K processing unit with at least one 5444 Disk Storage Drive and a printer. A program of about 150 source cards can be compiled and executed on a 12K system. Also supported for the Model 10 are the 5445 Disk Storage Drives and the 5471 Printer-Keyboard, as well as I/O support for both formatted and unformatted records on magnetic tape. The Model 15 FORTRAN compiler provides all the facilities of Model 6, Model 8, and Model 10 FORTRAN and also supports the new I/O devices available for the Model 15.

BASIC ASSEMBLER: Converts programs coded in a symbolic assembly language into executable object programs. Creates stand-alone programs that have no defined interfaces with the other System/3 software support. May be used to assemble relocatable subroutines for use with Card or Disk RPG II, COBOL, or FORTRAN programs. For the Model 8, the minimum configuration includes a 5408 Processing Unit with 16K bytes of main storage, a 5203 Printer, and one 5444 Disk Storage Drive. ▶

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▷ and the Communications Control Program (CCP), and SCP extension that can control the concurrent execution multiple application programs within a single partition. At the hardware level, the Model 15 offers essentially the same remote communications control facilities as the Model 10. In addition, a new Local Communications Adapter (LCA) permits direct connection of either a 3741 Model 2 Data Station (IBM's new "floppy disk" data entry unit) or a 3270 Information Display System.

The System/3 Model 15 is generally upward-compatible with the earlier Model 6 and Model 10 systems, but there are a few important caveats. Disk and tape data files and Operational Control Language (OCL) are directly compatible, but all source programs written for a Model 6 or Model 10 must be recompiled before they can be executed under Model 15 SCP. Model 10 programs written in Basic Assembler language may require changes prior to reassembly. In all cases, naturally, the Model 15 system must include an adequate complement of peripheral equipment.

To make the conversion from a Model 10 disk system to a Model 15 even easier, Model 15 users can elect to operate their system under the control of Model 10 software. When this "Model 10 mode" is used, the new features of the Model 15 are ignored and the system operates in the same manner (and, presumably, at about the same speed) as a Model 10.

And what will a System/3 Model 15 user do when he has outgrown the capabilities of his system? At present, he's faced with the same old problem of converting to the System/370 or a competitive computer line. And, despite the availability of upward-compatible System/370 compilers for RPG II, COBOL, and FORTRAN, there are still numerous differences in system control, data management, and operational characteristics which make nearly any System/3-to-370 conversion a costly, time-consuming task. But by the time Model 15 users begin demanding a still bigger and better version of the System/3, the odds are good that IBM will be ready to provide it. System/3 users are making it increasingly clear that they tend to be independent souls who are unwilling to be stampeded into a costly conversion effort to a costly system/370—and there are so many System/3 users that IBM simply must accommodate them. Therefore, the only reasonable solution seems to be continued expansion and development of the System/3 product line. If IBM doesn't do it, others will.

USER REACTION

IBM is often credited with opening up an important new segment of the computer market with the announcement of the System/3 in 1969. Certainly IBM's concept ▷

► For the Model 10, the minimum configuration includes a 5410 Processing Unit with 12K bytes of core storage, a 5424 MFCU or 1442 Card Read Punch, a 5203 or 1403 Printer with the Universal Character Set feature and a 60-character chain, and one 5444 Disk Storage Drive. For the Model 15, the minimum configuration includes a 5415 Processing Unit with 48K bytes of main storage, a 3277 Display System with an Operator Console Keyboard, a 5444 Disk Storage Drive, a 1403 Printer with the Universal Character Set Feature and a 60-character chain, and either a 5424 MFCU, 2560 MFCM, 1442 Card Read Punch, or 2501 Card Reader.

CONVERSATIONAL UTILITY PROGRAMS: There are three optionally available disk-resident utility programs for use under the System/3 Model 6 SCP software: Keyboard Data Entry, Keyboard Source Entry, and Data Interchange Utility.

Keyboard Data Entry allows the operator to use the System/3 console keyboard as a key-to-disk data entry station. Data files can be prepared and organized for direct usage by RPG II and Disk Sort programs. Ten batch and ten final totals can be utilized.

Keyboard Source Entry enables the user to key RPG II source statements or other procedures directly into the source program library on disk. Compilation can then take place from disk.

Data Interchange Utility permits the user to convert RPG-produced data files into BASIC data files, and vice versa.

DISK SORT: Sorts disk files into either ascending or descending sequence. Accepts files organized in sequential, indexed, or direct fashion. Can perform a full-record sort, a tag sort (yielding a file of 3-byte record addresses arranged in the desired sequence), or a "tagalong" sort (yielding a sequenced file of records containing only the key fields and data fields specified by the user).

The function and syntax of specifications sheets for the System/3 Model 6 Disk Sort program are identical to those used with the System/3 Model 8 or Model 10 Disk Sort. Output data files created by the Model 6 Disk Sort can be processed by the Model 8 or Model 10 Disk Sort, and conversely.

The Disk Sort functions under control of the SCP software. On the Model 6, it requires the minimum 8K-byte processing unit, one 5444 Disk Storage Drive, and one printer. Minimum configuration for a Model 8 includes a 16K processor, one 5444 Disk Storage Drive, a 5203 Printer, and a 3741 Data Station. Minimum configuration for a Model 10 is a 12K processing unit, one 5444 Disk Storage Drive, a 5203 or 1403 Printer, and a 5424 MFCU or 1442 Card Read Punch. The Disk Sort 5445 Disk Storage Drive Feature provides all functions available with the Disk Sort for System/3 Model 10 users of the 5445 Disk Storage Drive.

The Model 15 Disk Sort program is functionally identical to the Model 10 Disk Sort with the 5445 Disk Storage Drive feature. Up to four 5445 drives are supported for use as input, output, or work files. Minimum configuration for a Model 15 is a 48K processor, a 3277 Display Station with operator console keyboard, a 5444 Disk Storage Drive, a 1403 Printer, and a card reader. ►

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▷ of an inexpensive, easy-to-use entry-level computer system has been enormously successful. By the end of 1973, more than 20,000 systems had been installed, making the System/3 the most widely used computer ever produced outside the scientific minicomputer area.

Another important measure of the success of a computer system is the degree of satisfaction expressed by its users. In a Datapro survey of 69 System/3 users, the overwhelming majority rated the overall performance of their systems as good or excellent. The ratings assigned by these 12 System/3 Model 6 users, 44 System/3 Model 10 users, and 13 users of unspecified System/3 models are summarized below:

	Excellent	Good	Fair	Poor	W.A.*
Overall performance	31	31	4	1	3.4
Ease of programming	6	12	2	0	3.2
Ease of conversion	10	27	5	5	2.9
Ease of operation	43	23	2	0	3.6
Hardware reliability	44	20	4	1	3.6
Maintenance service	38	25	4	0	3.5
Technical support	22	31	13	2	3.1
Manufacturer's software	23	32	8	1	3.2

*Weighted Average on a basis of 4.0 for excellent.

Thus, for most users, the System/3's performance has lived up to their expectations. The lone user who expressed strong dissatisfaction with the overall performance of the system found it unsuitable to handle the volume of input required in his applications. What the users liked most about the System/3 was that it was easy to use and required relatively little training for operators or for programmers. Users also gave the System/3 high ratings for reliability, although a few had experienced some mechanical problems with peripherals.

The most commonly recurring complaints concerned performance limitations caused by slow peripheral devices and main memory capacity restrictions. For the Model 6, the slow card reading speeds, the lack of a line printer, and the main memory limitation were cited as particular disadvantages. Model 10 users also felt somewhat constrained by main memory limitations, and they criticized the disks and disk software more often than other input/output devices for having slow access times and for performing somewhat inefficiently. In addition, some Model 10 users felt limited by the total amount of disk storage available and by the software restrictions limiting the number of files on a disk pack for the Model 5445 Disk Pack Drives.

Users of BASIC on the System/3 gave mixed responses as to their satisfaction with that language. One user stated that the System/3 BASIC is better than that available in most time-sharing arrangements, but added that the documentation would be difficult to understand ▷

▶ **DISK-RESIDENT MAGNETIC TAPE SORT:** Sorts fixed-length records on magnetic tape files, in either blocked or unblocked format and EBCDIC or ASCII data code. The Model 10 and Model 15 versions are functionally identical. Requires a 12K Model 10 processor or a 48K Model 15 processor with at least one 5444 Disk Storage Drive and three magnetic tape units.

CARD SYSTEM UTILITIES: A set of utility programs is provided for both Model 10 and Model 15 card-oriented systems.

- **Model 10:** A set of six programs designed for operation on an 8K card-oriented System/3. The Reproduce/Interpret Program handles the reproduction and/or interpretation of 96-column cards, with or without reformatting. The 96-Column List Program lists cards on the printer without reformatting. The MFCU Sort/Collate Program performs a variety of sorting, merging, matching, selecting, and sequence-checking functions. The Data Recording and Data Verification Programs enable a System/3 equipped with a 5475 Data Entry Keyboard to be used for on-line punching and verification of 96-column cards. The 80-96 Conversion Program allows a System/3 equipped with a 1442 Card Read Punch to read 80-column cards and punch the information into 96-column cards, with reformatting.

- **Model 15:** A set of four disk-resident programs designed to handle a variety of punched card utility functions. The Sort/Collate Program supports either the 5424 MFCU or the 2560 MFCM and performs numerous sorting, merging, matching, selecting, and sequence-checking functions. The Card List Program lists 80-column or 96-column cards on the printer without reformatting. The Reproduce/Interpret Program handles the reproduction and/or interpretation of 80-column or 96-column cards, with or without reformatting. The Gang-punch Program (new for the Model 15) handles interspersed master card gang-punching, count-controlled gang-punching, and punching based on matching control fields in master and detail cards. Three of the Model 10 Card Utilities programs are not included in the Model 15 Card Utilities: Data Recording, Data Verification, and 80-96 Conversion.

1255 MAGNETIC CHARACTER READER UTILITY: Controls the reading and sorting of MICR-encoded documents, accumulates appropriate totals, and places selected data from the documents on disk and/or printer files. It requires a 12K-byte System/3 Processing Unit and functions under control of the SCP software. Device control and data management services are provided as part of the SCP for the Model 15. The subroutines are used with a user-written RPG II or Assembler program. The new Model 8 supports the 1255 Utility.

DATA/3: This System/3 Program Product, introduced along with the Model 15 and available for the Model 8, generates terminal control programs for the following types of applications: inquiry, inquiry with update, data entry, and data entry with master file input. The programmer fills out two RPG-like forms: a data description form and a program definition form. DATA/3 uses this information to generate RPG II source programs, which are subsequently compiled and executed. Programs generated by DATA/3 support the 3270 Information ▶

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▷ by an individual who is not familiar with the language. The current lack of availability of BASIC for the System/370 is particularly frustrating to the user who has outgrown the processing capabilities of the System/3.

User complaints about performance limitations on both the Model 6 and the Model 10 reflect the amount of growth many small businesses have experienced since the initial introduction of the System/3. Although some Model 10 users expressed an interest in eventually upgrading to the Model 15 to take advantage of its multiprogramming capabilities and enhanced input/output capabilities, Model 15 deliveries are just beginning, and no Model 15 users responded to this survey. However, Datapro did find two users who were utilizing System/3 Model 10 systems as remote batch terminals on-line to large central processors—IBM's other prescribed growth path for System/3 installations. Both expressed satisfaction with the performance of the System/3 as a remote job entry terminal, although the capability to transmit to and from disks, due for release with the Multi-Leaving Remote Entry Work Station Program, was cited as a much-needed improvement.

IBM support was a sore point for some System/3 users, but was also mentioned as a plus for IBM by quite a few others. Overall, even among those individuals who expressed complaints about specific aspects of the system, the message is clear that IBM has managed to please a great many first-time computer users with the System/3's reliability and ease of use. □

▶ **Display System and both the 5444 and 5445 Disk Storage Drives.** DATA/3 can be used on a System/3 Model 8, Model 10, or Model 15, in connection with either the Multiline/Multipoint software or the Communications Control Program. The planned availability date is June 1975 for the Model 8.

APPLICATION CUSTOMIZER SERVICE: As an alternative to the usual "packaged" application programs, IBM offers a novel service called the Application Customizer, which is designed to assist users in preparing programs to handle the most common data processing applications.

The user defines his requirements by completing application-oriented questionnaires and report specification sheets. These are keypunched and fed into a computer at an IBM Basic Systems Center. The resulting output consists of detailed application documentation, from which the user's own programmer writes the necessary System/3 programs (usually in the RPG II language).

Documentation produced by the Application Customizer includes a data dictionary, a listing of the contents and format of each record, an application flowchart, an RPG-oriented description of each program, and a sample of each report.

Customized Source Code is now available as an optional additional output from the Application Customizer Service. The user who elects this option receives raw, machine-generated RPG II source code on a 5440 Disk Cartridge; he must then add various constants and indicators, compile the programs, and test and debug them in the usual fashion.

For the System/3 Model 6, the Application Customizer Service currently covers four applications, available with or without Customized Source Code:

- Order Writing and Invoicing
- Inventory Accounting
- Accounts Receivable
- Sales Analysis

For card-oriented System/3 Model 10 computers, the Application Customizer Service currently covers eight applications:

- Order Writing and Invoicing
- Inventory Accounting
- Accounts Receivable
- Sales Analysis
- Payroll
- General Ledger
- Accounts Payable
- Labor Distribution

For disk-oriented System/3 Model 10 computers, the Application Customer Service currently includes the following, with or without Customized Source Code:

- Order Writing and Invoicing
- Inventory Accounting and Management
- Accounts Receivable
- Sales Analysis

APPLICATION PROGRAMMING SERVICE: This IBM service, introduced in September 1971, enables System/3 Model 6 and Model 10 users to have their basic business application programs designed, generated, tested, and documented by IBM Systems Engineers at fixed prices. The service currently covers four applications: Order Writing and Invoicing, Accounts Receivable, Inventory Accounting and Management, and Sales Analysis.

The Application Programming Service consists of four main steps. First, the user and an IBM representative fill out questionnaires defining the application and the formats of the required reports. Second, IBM processes the information at its Application Customizing Center to generate the required programs. Third, IBM tests the programs to make sure they produce the agreed-upon results, using test data and machine time provided by the user. Fourth, IBM turns over the tested application programs and associated documentation to the user.

APPLICATION PROGRAMS: In addition to the two services described above, IBM offers a limited number of packaged programs for specific applications. The current Application Program Products, which receive centralized IBM support, are listed in the price list at the end of this report. Also available are a variety of Field Developed Programs (FDP's) and Installed User Programs (IUP's). Support for the FDP's and IUP's is limited to pertinent error-correction information during the first six months after initial availability of each program. ▶

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► Other sources of programs, technical information, and education are the System/3 user groups. Two IBM-affiliated user groups, COMMON and Guidance International, are open to System/3 users. Moreover, at least two independent organizations, Group 3 and the National Association of IBM System/3 Users, have been formed specifically to aid System/3 users.

PRICING

POLICY: IBM offers the System/3 on a purchase or rental basis. The standard IBM rental contract includes equipment maintenance and entitles the customer up to 176 hours of billable time per month. Time used in excess of that amount is billed, for most System/3 components, at an extra-use rate of 10% of the basic hourly rate (i.e., 10% of 1/176 of the monthly rental for each hour of extra use). The rental prices given below are effective January 1, 1975.

SOFTWARE: System/3 users receive the basic System Control Programs at no additional cost. All other IBM software, including compilers and utility routines, is priced separately. Prices of the current IBM Program Products are listed at the end of this report.

SUPPORT: IBM Systems Engineering assistance is available to System/3 users at a basic charge of \$28.00 per hour.

EDUCATION: Two-day introductory courses are offered at no charge. Various other System/3 courses are available at cost.

EQUIPMENT: The following typical purchase and rental prices include controllers and adapters.

System/3 Model 6

MINIMUM SYSTEM: Consists of 8K 5406 Processing Unit, 5213 Model 1 Printer, and 5444 Model 1 Disk Storage Drive (2.45 million bytes). Monthly rental, \$1,078. Purchase price, \$47,830. Adding RPG II, Conversational Utilities, and Disk Sort would raise the monthly rental by \$63 for the commercial user. Adding BASIC for mathematical processing raises the monthly rental by \$121. Using the 5213 Model 2 Printer with vertical forms control increases the monthly rental by \$43 and the purchase price by \$1,840.

MINIMUM LEDGER CARD SYSTEM: Consists of 8K 5406 Processing Unit, 2222 Model 1 Printer, and 5444 Model 1 Disk Storage Drive. Monthly rental, \$1,283. Purchase price, \$58,310.

TYPICAL COMMERCIAL CARD SYSTEM: Consists of 12K 5406 Processing Unit, 5496 Data Recorder, 5213 Model 3 Printer, and 5444 Model 2 Disk Storage Drive (4.92 million bytes). Monthly rental, \$1,682. Purchase price, \$69,430. Substitution of a 16K-byte Processing

Unit in this configuration raises the monthly rental by \$126 and the purchase price by \$700.

System/3 Model 8

MINIMUM SYSTEM: Consists of 16K 5408 Processing Unit, 5444 Model A1 Disk Storage Drive, 5203-1 Printer, and 5471 Printer-Keyboard. Monthly rental, \$1,599. Purchase price, \$62,525.

MINIMUM DATA STATION SYSTEM: Consists of 16K 5408 Processing Unit, 5444 Model A1 Disk Storage Drive, 5203-2 Printer, and 3741 Data Station attached via ICA. Monthly rental, \$1,849. Purchase price, \$72,075.

System/3 Model 10

MINIMUM CARD SYSTEM: Consists of 8K 5410 Processing Unit, 5424 Model A1, MFCU, and 5203 Model 1 Printer (with 96 print positions). Monthly rental, \$1,092. Purchase price, \$45,690.

For the above configuration with the faster 5424 Model A2 MFCU and 5203 Model 2 Printer: Monthly rental, \$1,417. Purchase price, \$51,510.

TYPICAL DISK SYSTEM: Consists of 12K 5410 Processing Unit, 5424 Model A2 MFCU, 5203 Model 2 Printer (with 120 print positions), 5471 Printer-Keyboard, and one 5444 Model 2 Disk Storage Drive (4.90 million bytes). Monthly rental, \$2,203. Purchase price, \$83,520.

For the above configuration with a 32K Processing Unit: Monthly rental \$2,866. Purchase price, \$102,520.

EXPANDED DISK SYSTEM: Consists of 49K 5410 Processing Unit, 5424 Model A2 MFCU, 1403 Model N1 Printer, 5471 Printer-Keyboard, two 5444 Model A2 Disk Storage Drives (9.8 million bytes), and two 5444 Disk Storage Drives (41 million bytes). Monthly rental, \$6,089. Purchase price, \$230,360.

System/3 Model 15

MINIMUM SYSTEM: The basic configuration required to utilize the Model 15 processing support consists of a 5415 Model A17 Processing Unit (49K bytes), 3277 Model 1 Display Station, 1403 Model 5 Printer, 5424 Model A1 MFCU, and one 5444 Model A2 Disk Storage Drive, plus all necessary attachments and control units. Monthly rental (including maintenance), \$3,555. Purchase price, \$142,640.

EXPANDED SYSTEM: A typical large Model 15 disk system consists of a 5415 Model A20 Processing Unit (131K bytes), 3277 Model 1 Display Station, 1403 Model N1 Printer, 2560 Model A1 MFCU, 2501 Model A2 Card Reader, one 5444 Model A2 Disk Storage Drive, and four 5445 Disk Storage Drives, plus all necessary attachments and control units. Monthly rental (including maintenance), \$8,292. Purchase price, \$297,430. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
PROCESSORS AND MAIN STORAGE				
5406	Processing Unit (for Model 6 systems):			
	Model B2; 8,192 bytes	\$ 29,300	\$137	\$ 649
	Model B3; 12,288 bytes	35,200	143	777
	Model B4; 16,384 bytes	35,900	143	903
1550	Command Keys (9-16)	999	0.50	21
5732	Processing Unit Expansion (for 5406)	1,750	6.50	37
5408	Processing Unit (for Model 8 systems):			
	Model A14; 16,384 bytes	26,100	115	650
	Model A16; 32,768 bytes	30,100	120	750
	Model A17; 49,152 bytes	34,100	150	850
	Model A18; 65,536 bytes	38,100	155	950
3500	Dual Program Feature (for 5408)	5,830	1	127
5732	Processing Unit Expansion Feature (for 5408)	1,750	6.50	37
4645	Integrated Communications Adapter (ICA)	5,900	18	140
7081	Serial I/O Channel (SIOC)	7,940	5	175
5410	Processing Unit (for Model 10 non-disk systems):			
	Model A2; 8,192 bytes	16,400	42	361
	Model A3; 12,288 bytes	21,700	46	477
	Model A4; 16,384 bytes	22,400	46	611
	Model A5; 24,576 bytes	40,000	61.50	881
	Model A6; 32,768 bytes	40,700	61.50	1,145
	Model A7; 49,152 bytes	59,000	85.50	1,490
5410	Processing Unit (for Model 10 disk systems):			
	Model A12; 8,192 bytes	23,000	92	508
	Model A13; 12,288 bytes	28,300	96	622
	Model A14; 16,384 bytes	29,100	96	754
	Model A15; 24,576 bytes	46,600	112	1,025
	Model A16; 32,768 bytes	47,300	112	1,285
	Model A17; 49,152 bytes	65,600	136	1,630
3500	Dual Program Feature (for 5410)	5,830	1	127
5732	Processing Unit Expansion Feature A (for 5410)	1,850	3	40
5415	Processing Unit (for Model 15 systems without 3340):			
	Model A17; 49,152 bytes	63,000	227	1,630
	Model A18; 65,536 bytes	67,000	232	1,740
	Model A19; 98,304 bytes	78,000	238	2,010
	Model A20; 131,072 bytes	86,000	248	2,225
5415	Processing Unit (for Model 15 systems with 3340):			
	Model B17; 49,152 bytes	92,000	235	2,310
	Model B18; 65,536 bytes	96,000	240	2,410
	Model B19; 98,304 bytes	107,000	245	2,660
	Model B20; 131,072 bytes	115,000	255	2,860
5501	Power Supply Expansion	2,250	1.00	54
5733	Processing Unit Expansion 1	800	0.50	21
5734	Processing Unit Expansion 2 (5733 is prerequisite)	2,200	1.00	59
5735	Processing Unit Expansion 3 (5734 is prerequisite)	800	1.00	21
	Note: The above four features provide additional CPU power supply and connections; they are required for certain combinations of peripheral, communications, and/or RPQ equipment.			
CONSOLE				
3277	Display Station, Model 1 (required in Model 15 systems)	3,460	7.50	81
4632	78-key Operator Console Keyboard (required on 3277)	1,420	11.50	37
MASS STORAGE				
3340	Direct Access Storage Facility:			
	Model A-2 (2-drives plus control); 82.08 million bytes	40,000	80	1,059
	Model B-1 (additional drive); 123.13 million bytes total	22,000	43	592
	Model B-2 (2 additional drives); 64.17 million bytes total	28,000	69	747

* Rental prices include equipment maintenance.

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EQUIPMENT PRICES (Continued)

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
MASS STORAGE (Continued)				
3348	Data Module (for 3340 drives): Model 70; 41.04 million bytes plus 9.83 million bytes exclusively for program support	\$ 2,200	Time & Mat'l	\$ 82
5444	Disk Storage Drive:			
	Model A1; 2.46 million bytes	8,610	71.50	220
	Model A2; 4.92 million bytes	10,200	71.50	330
	Model A3; 2.46 million bytes	8,610	71.50	220
	Model 1; 2.46 million bytes	8,720	51.50	180
	Model 2; 4.92 million bytes	10,400	51.50	297
	Model 3; 2.46 million bytes	8,720	51.50	180
5540	Disk Cartridge (for 5444 drives)	175	Time & Mat'l.	Purch. only
5422	Disk Enclosure (required for attachment of 5444 Disk Storage Drives when 5424 MFCU is not used)	4,990	13	110
6378	Second Disk Attachment (required on 5406 for a 5444 Mod. 3 or a second 5444 Mod. 2)	2,420	5	48
6378	Second Disk Attachment (required on 5408 for 5444 Mod. A)	3,559	6	71
6378	Second Disk Attachment (required on 5410 for a 5444 Mod. 3 or A3 or a 2nd 5444 Mod. 2 or A2)	2,560	5	50
4501	Higher-Performance First Disk Attachment	999	1	21
4502	Higher-Performance Second Disk Attachment (required on 5410 for a 5444 Mod. A3 or a 2nd 5444 Mod. A2; No. 6378 is a prerequisite)	999	1	21
6378	Second Disk Attachment (required on 5415 for a 5444 Mod. A3 or a 2nd 5444 Mod. A2)	3,495	6	71
5445	Disk Storage Drive:			
	Model 1; first 5445 on 5410 or 5415; 20.48 million bytes	16,000	93	386
	Model 2; second 5445 on 5410 or 5415; 20.48 million bytes	15,300	87.50	368
	Model 3; dual-pack 5445, 40.76 million bytes	31,400	181	754
3901	First 5445 Disk Attachment (for 5410); required for Model 1 and 3.	20,400	36	551
3902	Second 5445 Disk Attachment for 5410; required for Model 2 and 3.	612	1	16
5732	Processing Unit Expansion A (required on 5410 for connection of # 3901)	1,850	3	40
5733	Processing Unit Expansion B (required on 5410 if both # 3901 and # 2074, BSCA, are installed)	816	0.50	21
3901	First 5445 Attachment (required on 5415 for first 5445 Mod. 1)	20,000	33.50	540
3903	Second 5445 Attachment (required on 5415 for second 5445 Mod. 1)	3,000	1	81
INPUT/OUTPUT UNITS				
3410	Magnetic Tape Unit:			
	Model 1; 20 KB	7,850	49.50	199(1)
	Model 2; 40/20 KB	10,500	55	264(1)
	Model 3; 80/40 KB	13,000	60.50	330(1)
3411	Magnetic Tape Unit and Control:			
	Model 1; 20 KB	17,300	6.50	437(1)
	Model 2; 40/20 KB	21,900	82	557(1)
	Model 3; 80/40 KB	26,700	87.50	675(1)
3211	Single Density Feature (for 3410 & 3411, Models 2 & 3 only)	2,550	8	58(1)
3221	Dual Density Feature (for 3410 & 3411, Models 2 & 3 only)	3,670	29.50	86(1)
7003	System/3 Attachment (required on 3411)	3,210	3	81(1)
7951	3411 Magnetic Tape Attachment (required on 5410 Processing Unit)	4,890	10.50	176
7951	3411 Magnetic Tape Attachment (required on 5415 Processing Unit)	4,800	10.50	173
3741	Data Station:			
	Model 1	6,000	42	168
	Model 2	7,250	54	206
3741	Programmable Work Station:			
	Model 3	8,600	63.50	268
	Model 4	9,850	70	306
3741	Attachment (on 5406, 5408, 5410, or 5415)	8,200	17	205
—	I/O Adapter (on 3741)	2,650	8	71

*Rental prices include equipment maintenance.

(1) A discount of 8% or 16% from these rental prices is available under a 12-month or 24-month Fixed-Term Lease, respectively.

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EQUIPMENT PRICES (Continued)

INPUT/OUTPUT UNITS (Continued)		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
5424	Multi-Function Card Unit: Model A 1; reads 250 cpm, punches and prints 60 cpm	\$ 10,200	\$ 153	\$ 314
	Model A 2; reads 500 cpm, punches and prints 120 cpm	13,500	220	472
4100	MFCU Attachment (required on 5410 for 5424 Mod. A 1)	4,530	15	92
4101	MFCU Attachment (required on 5410 for 5424 Mod. A 2; 4100 is prerequisite)	5,750	15	110
4100	MFCU Attachment (required on 5415 for 5424 Mod. A 1)	4,450	15	91
4101	MFCU Attachment (required on 5415 for 5424 Mod. A 2; 4100 is prerequisite)	900	2	17
1442	Card Read Punch: Model 6; reads 300 cpm punches 80 cols/sec.	15,260	60.50	286
	Model 7; reads 400 cpm, punches 160 cols/sec.	16,430	71.50	416
3950	5410/5415 Coupling (required on 1442)	1,590	1	32
4130	1442 Attachment (required on 5410)	8,870	16.50	208
4130	1442 Attachment (required on 5415)	8,700	16	205
2501	Card Reader (for Model 15 only): Model A 1; 600 cpm	11,870	38	210
	Model A 2; 1,000 cpm	12,080	53.50	276
3630	1501 Coupling (required on 2501)	162	NC	5
8090	2501 Attachment (required on 5415)	6,700	8	162
2560	Multi-Function Card Machine (for Model 15 only): Model A 1; reads 500 cpm, punches 160 col/sec.	29,150	106	665
	Model A 2; reads 310 cpm, punches 120 col/sec.	21,410	106	518
8100	2560 MFCM Attachment (required on 5415)	6,300	17	162
1580	Card Print Control (for 5415)	1,250	3	27
Card Print Feature for 2560 Model A 1:				
1575	First Two Lines (requires 1580 on 5415)	6,350	15	145
1576	Second Two Lines	6,350	15	145
1577	Third Two Lines	6,350	15	145
5213	Printer (for Model 6 only): Model 1; pin-feed platen	6,320	52.50	173
	Model 2; vertical forms control	8,160	71.50	216
	Model 3; vertical forms control, bidirectional printing	8,360	82.00	270
3901	Printer Attachment (required on 5406 for 5213 Mod. 1)	3,490	20.50	76
3902	Printer Attachment (required on 5406 for 5213 Mod. 2)	3,490	20.50	76
3903	Printer Attachment (required on 5406 for 5213 Mod. 3)	3,490	20.50	76
3960	Enhanced Print Rate Attachment (required on 5406 for printing at 115 cps with 5213 Mod. 3; replaces 3903 Attachment)	4,890	23.00	132
2222	Printer (with ledger card device; for Model 6 only): Model 1; unidirectional printing	16,800	115	378
	Model 2; bidirectional printing	17,000	126	416
7951	Printer Attachment (required on 5406 for 2222 Mod. 1)	3,490	20.50	76
7952	Printer Attachment (required on 5406 for 2222 Mod. 2)	3,490	20.50	76
5203	Printer (for Model 8 and Model 10 only): Model 1; 100 lpm, 96 positions	11,400	73.50	262
	Model 2; 200 lpm, 96 positions	12,700	83	319
	Model 3; 300 lpm, 96 positions	17,700	139	470
3475	Dual-Feed Carriage (for 5203)	3,960	21.50	85
4730	Additional Chain Cartridge (for 5203 Mod. 1 & 2)	3,960	1	85
4740	Additional Chain Cartridge (for 5203 Mod. 3)	2,960	36	119
5558	24 Additional Print Positions (for 5203)	1,620	2	57
5560	36 Additional Print Positions (for 5203)	2,420	2	85
8639	Universal Character Set Attachment (for 5203)	324	1	10
3970	Printer Attachment (required for 5203 Mod. 1)	3,160	10.50	63
3971	Printer Attachment (required for 5203 Mod. 2)	3,160	10.50	63
3972	Printer Attachment (required for 5203 Mod. 3)	4,610	14	104
3480	Dual Feed Carriage Control (required on 5410 for # 3475 on 5203)	1,310	1	28
8642	Universal Character Set Control (required on 5410 for # 6639 on 5203)	486	1	16

*Rental prices include equipment maintenance.

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EQUIPMENT PRICES (Continued)

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
INPUT/OUTPUT UNITS (Continued)				
1403	Printer:			
	Model 2; 600 lpm, 132 positions	\$ 30,210	\$ 188	\$ 810(1)
	Model 5; 465 lpm, 132 positions	28,940	135	626(1)
	Model N1; 1100 lpm, 132 positions	36,680	216	946(1)
1416	Interchangeable Train Cartridge (for 1403 Mod. N1)	2,960	Time & Mat'l.	98
1376	Auxiliary Ribbon Feeding (for 1403 Mod. 2 or 5)	2,745	17	78(1)
4740	Interchangeable Chain Cartridge Adapter (for 1403 Mod. 2 or 5)	2,790	NC	78(1)
8640	Universal Character Set Feature (for 1403 Mod. N1)	410	1.75	10(1)
8641	Universal Character Set Feature (for 1403 Mod. 2)	410	1.75	10(1)
5421	Printer Control Unit (required for 1403 Mod. 2, 5, or N1)	12,900	28.50	286
4140	5410 Attachment for 1403 Mod. 2	5,250	23	132
4150	5410 Attachment for 1403 Mod. N1	5,760	23	192
4135	1403 Model 5 Printer Attachment (for 5415)	4,700	22.50	119
4140	1403 Model 2 Printer Attachment (for 5415)	5,150	22.50	130
4150	1403 Model N1 Printer Attachment (for 5415)	5,650	22.50	189
1255	Magnetic Character Reader:			
	Model 1; 500 dpm, 6 stackers	39,400	231	870
	Model 2; 750 dpm, 6 stackers	45,100	368	1,060
	Model 3; 750 dpm, 12 stackers	61,400	484	1,400
3215	Dash Symbol Transmission (for 1255)	35	NC	54(1)
4380	51-column Card Sorting (for 1255)	734	NC	16
4520	High-Order Zero & Blank Selection (for 1255 Mod. 3 only)	1,460	5	32
6303	System/3 Adapter (required on 1255)	5,930	4	130
7060	Self-Checking Numbers (for 1255)	2,370	2.50	52
7081	Serial I/O Channel (required on 5406 for connection of 1255)	7,490	5	165
7081	Serial I/O Channel (required on 5408, 5410 for connection of 1255 or 3881)	7,940	5	175
7081	Serial I/O Channel (required on 5415 for connection of 1255 or 3881)	7,790	6.50	172
3881	Optical Mark Reader:			
	Model 1; for on-line use	57,100	153	1,451(2)
	Model 2; for off-line use	52,000	121	1,322(2)
1471	BCD Read (for 3881)	2,390	1.50	60(2)
3450	Document Counters (for 3881)	948	2	23(2)
3550	Dual Density (for 3881 Model 2 only)	6,010	0.50	150(2)
3801	Expanded Storage (for 3881)	2,390	0.50	60(2)
6451	Serial Numbering (for 3881)	7,030	27.50	177(2)
5486	Card Sorter:			
	Model 1; 1000 cpm	4,780	42	98
	Model 2; 1500 cpm	5,470	63.50	133
5496	Data Recorder	7,750	59.50	171
3210	Data Recorder Attachment (required on 5406)	1,990	2	43
7501	System/3 Attachment (required on 5496)	2,240	11.50	48
129	Card Data Recorder:			
	Model 1; Punch-Verifier (non-print)	6,240	42	135
	Model 2; Printing Punch (non-verifier)	6,990	46	151
	Model 3; Printing Punch Verifier	7,490	47	162
7503	Card I/O Attachment (required on 129)	2,670	11.50	81
3610	Expansion Feature (required on 129)	499	10	NC
3210	Data Recorder Attachment (required on 5406)	1,990	2	43
2265	Display Station	5,530	44	183
7960	Display Station Attachment (required on 5406)	3,740	1.50	82
5471	Printer-Keyboard	5,070	35	117
4110	Printer-Keyboard Attachment (required on 5408, 5410)	3,020	5	54
5475	Data Entry Keyboard	2,420	7.50	45
4120	Data Entry Keyboard Attachment (required on 5410)	2,720	1	50

*Rental prices include equipment maintenance.

(1) A discount of 8% or 16% from these rental prices is available under a 12-month or 24-month Fixed-Term Lease, respectively.

(2) A discount of 15% from these rental prices is available under a 24-month Extended-Term Lease.

IBM System/3
EQUIPMENT PRICES (Continued)

	<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-year lease)*</u>
COMMUNICATIONS EQUIPMENT			
2074 Binary Synchronous Communications Adapter (requires # 5732 on 5406 Processing Unit)	\$ 13,200	\$ 71.50	\$ 292
1315 Auto Call Feature (for # 2074)	1,990	1	43
4703 Internal Clock Feature (for # 2074)	1,240	1	27
7477 Station Selection Feature (for # 2074)	999	1	21
7850 Text Transparency Feature (for # 2074)	999	1	21
2074 Binary Synchronous Communications Adapter (requires # 5732 on 5408, 5410 Processing Unit)	12,500	71.50	308
1315 Auto Call Feature (for # 2074)	2,110	1	45
3601 EIA Local Attachment (for # 2074)	1,020	1	27
4703 Internal Clock Feature (for # 2074)	1,320	1	28
7477 Station Selection Feature (for # 2074)	1,050	1	22
7850 Text Transparency Feature (for # 2074)	1,050	1	22
2084 Binary Synchronous Communications Adapter, Second (# 2074 is a prerequisite)	12,500	71.50	308
1325 Auto Call Feature (for # 2084)	2,110	1	45
3602 EIA Local Attachment (for # 2084)	1,020	1	27
4723 Internal Clock (for # 2084)	1,320	1	28
7487 Station Selection Feature (for # 2084)	1,050	1	22
7851 Text Transparency Feature (for # 2084)	1,050	1	22
2074 Binary Synchronous Communications Adapter (requires # 5733 on 5415 Processing Unit)	12,300	70	302
1315 Auto Call Feature (for # 2074)	2,075	1	45
3601 EIA Local Attachment (for # 2074)	1,000	1	27
4703 Internal Clock Feature (for # 2074)	1,295	1	28
7477 Station Selection Feature (for # 2074)	1,035	1	22
7850 Text Transparency Feature (for # 2074)	1,035	1	22
2084 Binary Synchronous Communications Adapter, Second (# 2074 is a prerequisite)	12,300	70	302
1325 Auto Call Feature (for # 2084)	2,075	1	45
3602 EIA Local Attachment (for # 2084)	1,000	1	27
4723 Internal Clock (for # 2084)	1,295	1	28
7487 Station Selection Feature (for # 2084)	1,035	1	22
7851 Text Transparency Feature (for # 2084)	1,035	1	22
4645 Integrated Communications Adapter (ICA, for 5408)	5,900	18	40
4765 Local Communications Adapter (permits local attachment of a 3741 Model 2 Data Station, a 3271 Control Unit, or a 3275 Display Station)	6,500	30	162

*Rental prices include equipment maintenance.

SOFTWARE PRICES

SYSTEM/3 MODEL 6

Program Products — Systems

	Monthly License Fee
BASIC	121
Disk FORTRAN IV	110
RPG II	37
Auto Report Feature (for RPG II)	16
Telecommunications Feature (for RPG II)	37
Conversational Utilities	16
Disk Sort	10
1255 Magnetic Character Reader Utility	87

Program Products — Applications

	Monthly License Fee
Business Analysis/BASIC	55
MATH/BASIC	48
STAT/BASIC	48

IBM System/3
SOFTWARE PRICES (Continued)

**Application Customizer Service
(Without Customized Source Code)**

Single-Use Charge

Order Writing and Invoicing	\$ 732
Inventory Accounting and Management	732
Accounts Receivable	732
Sales Analysis	732

**Application Customizer Service
(With Customized Source Code)**

Single-Use Charge

Order Writing and Invoicing	842
Inventory Accounting and Management	842
Accounts Receivable	842
Sales Analysis	842

Application Programming Service

Single-Use Charge

Order Writing and Invoicing	**
Inventory Accounting and Management	**
Accounts Receivable	**
Sales Analysis	**

SYSTEM/3 MODEL 8

Program products announced with the Model 8 include Model 10 SCP and Disk RPG II, COBOL, Basic Assembler, FORTRAN IV, Disk Sort, 1255 Utility, and DATA/3. Most of the applications program products for Model 10 Disk systems will be supported on the Model 8. Prices are generally the same as for Model 10 products, as a result.

SYSTEM/3 MODEL 10

Program Products – Systems

Monthly License Fee

ANS COBOL Subset Compiler	82
Card RPG II	37
Magnetic Tape Feature	30
Telecommunications Feature	37
Card System Utilities	10
Card Magnetic Tape Sort Programs	76
Disk FORTRAN IV	110
Disk RPG II	48
Telecommunications Feature	37
5445 Disk Storage Drive Feature	32
Auto Report Feature	16
Magnetic Tape Feature	32
Disk Sort	10
5445 Disk Storage Drive Feature	55
Disk Magnetic Tape Sort Programs	76
Disk-Resident Card Utilities	10
1255 Magnetic Character Reader Utility	66
Basic Assembler	82

Program Products – Applications

Monthly License Fee

Apparel Business Control (card)	82
Appropriation Accounting System (card)	132
Bill of Material Processor (disk)	55
Card Bill of Material and Requirements Planning	71
Citation Processing System (card)	132
EPIC: Educational Administration (4 programs)	504
Hospital Accounts Receivable (card)	37
Hospital Patient Billing (card)	70
Inventory and Requirements Planning (disk)	82
Job Analysis System (disk)	76
Law Enforcement System (card)	87
Optimum Blending (card)	98

** Price is \$1,480 for any one application, \$2,860 for any two, \$4,020 for any three, and \$5,065 for all four.

IBM System/3
SOFTWARE PRICES (Continued)

SYSTEM/3 MODEL 10 (Continued)

Order Point Technique for Inventory Mgmt (card)	\$ 55
Property and Liability Agency Accounting (card)	71
Retail Unit Inventory Techniques (card)	82
Utility Billing System (card)	87

Application Customizer Service — Card Systems:

Single-Use Charge

Order Writing and Invoicing	386
Inventory Accounting	357
Accounts Receivable	357
Sales Analysis	336
Payroll	451
General Ledger	308
Accounts Payable	407
Labor Distribution	407

Application Customizer Service — Disk Systems:

Single-Use Charge

Order Writing and Invoicing	777*
Inventory Accounting and Management	748*
Accounts Receivable	721*
Sales Analysis	693*

Application Development Service — Card Systems:

Single-Use Charge

Order Writing and Invoicing	1,675
Inventory Accounting	1,175
Accounts Receivable	1,535
Sales Analysis	1,425

SYSTEM/3 MODEL 15

Program Products — Systems

Monthly License Fee

ANS COBOL Subset Compiler	82
Basic Assembler	81
Card Utilities	16
Disk Sort	43
FORTRAN IV	108
Magnetic Tape Sort	75
RPG II	81

Program Products — Applications

Monthly License Fee

Bill of Material Processor	55
DATA/3	130
Health, Welfare and Pension Funds	189
Inventory and Requirements Planning	82
Property and Liability Agency Accounting System	71
System for Television and Radio	413

*\$100 additional for Customized Source Code.