

IBM 3090 Series

MANAGEMENT SUMMARY

UPDATE: In a move to boost year-end sales revenues, IBM finally introduced its much-anticipated 3090 performance enhancements. On July 26, the company brought out 10 new 3090 S models, a series that improves price/performance by 15 to 25 percent over the previous 3090 E models. The new S models are said to provide a 15-fold growth in performance from the entry-level Model 120S to the six-way Model 600S. The S models perform faster due to denser logic chips and improved thermal conduction module (TCM) packaging. Most of the models also feature larger memory and channel capacities than corresponding E models, wider data paths, and higher-capacity (128-kilobyte) cache buffers—double the size of the E models. (Models 120S, 150S, and 170S continue to use 64-kilobyte buffers.) Denser chip technology permits IBM to reduce CPU cycle time for most models from 17.2 nanoseconds to 15 nanoseconds.

In addition to mainframe enhancements, IBM improved the performance of its Vector Facility by up to 40 percent. Models 120S and 150S became available in September. The other eight models will be available during the fourth quarter. Customers with installed E models can horizontally upgrade to corresponding S models or upgrade to larger S models. In all, customers with 3090 base models, E models, or S models can now choose from 67 upgrade paths.

In the software area, IBM's new strategic mainframe operating system, Enterprise System Architecture (ESA)/370, became available in July, a month ahead of schedule. To take full advantage of 3090 S performance improvements, many of IBM's largest customers will have to migrate to ESA/370. In the software pricing area, IBM has added more graduated pricing levels, including Processor Group 50 pricing for Model 500 and 600 customers.

The 3090 Processor Complex is IBM's strategic top-end mainframe line and should continue to be so for the balance of this decade.

MODELS: 3090 Models 120E, 120S, 150E, 150S, 170S, 180E, 180S, 200E, 200S, 280E, 280S, 300E, 300S, 400E, 400S, 600E, 600S.

CONFIGURATION: Single, dual, three-way, four-way, and six-way systems; 32M to 512M bytes of main memory; up to 2G bytes of expanded storage; 16 to 128 channels.

COMPETITION: Amdahl 5890 Series and 5990 Series; Control Data Cyber 900 Series; Honeywell DPS 90 Series; NAS Alliance Series; and Unisys A 15, A 17 Series, and 1100/90.

PRICE: Base purchase prices range from \$715,000 for a Model 120E or 120S to \$11,754,000 for the Model 600S.

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, Old Orchard Road, Armonk, New York 10504. Contact your local IBM representative. In Canada, 1150 Eglinton Avenue, Don Mills, Ontario. Telephone (416) 443-2111.

MODELS: IBM 3090 Models 120E, 120S, 150E, 150S, 170S, 180E, and 180S, all single processors; Models 200E and 200S, dual processors; Models 280E and 280S, two-way multiprocessors; Models 300E and 300S, three-way processors; Models 400E and 400S, four-way processors; Models 500E and 500S, five-way processors; and Models 600E and 600S, six-way processors.



The newest IBM 3090 S models feature up to 512 megabytes of main memory, up to 2 gigabytes of Expanded Storage, and up to 128 channels.

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TABLE 1. SYSTEM COMPARISON

MODEL	Model 120S	Model 150S	Model 170S	Model 180S	Model 200S
SYSTEM CHARACTERISTICS					
Date announced	July 26, 1988				
Date first delivered	September 1988	September 1988	Fourth quarter 1988	Fourth quarter 1988	Fourth quarter 1988
Field upgradable to	Model 150S	Model 170S	Models 180S, 200S	Models 200S, 280S	Models 300S, 400S
Relative performance	Not specified				
Number of processors	1	1	1	1	2
Cycle time, nanoseconds	18.5	17.75	17.75	15	15
Word size, bits	32	32	32	32	32
Operating systems	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370				
MAIN MEMORY					
Type	1M-bit NMOS				
Minimum capacity, bytes	32M*	32M*	32M*	32M*	64M*
Maximum capacity, bytes	64M	64M	64M	128M	256M
Increment size, bytes	32M	32M	32M	32M, 64M	64M, 128M
Cycle time, nanoseconds	Not specified				
BUFFER STORAGE					
Minimum capacity	64KB/CPU	64KB/CPU	64KB/CPU	128KB/CPU	128KB/CPU
Maximum capacity	64KB/CPU	64KB/CPU	64KB/CPU	128KB/CPU	128KB/CPU
Increment size	0	0	0	0	0
INPUT/OUTPUT CONTROL					
Number of channels:					
Byte multiplexer	0-4	0-4	0-4	0-8	0-8
Block multiplexer	16, 24, 32	16, 24, 32	16, 24, 32	16, 24, 32	32, 40, 48, 64
Word	0	0	0	0	0
Other	0	0	0	0	0

*In addition to conventional main memories, all the models can be outfitted with optional expanded storage. Refer to expanded-storage chart in Characteristics section for more details.

➤ The 10 IBM S models represent the second so-called "mid-life kicker" for the 3090 product line since the series was first introduced in February 1985. The earlier E models, announced in January 1987, replaced the original 3090 base models.

Although IBM has been preoccupied with product launches within other volatile market segments (e.g., AS/400 midrange systems), it hasn't neglected the mainframe, its number one revenue producer. At the hardware level, the company brought out the two-processor Model 280E and the five-way Model 500E earlier this year and has since introduced S versions of these models. With the advent of the S models, the company also introduced the 170S, another uniprocessor positioned between the 150S and 180S. Besides new mainframes, the company brought out Processor Resource/Systems Manager (PR/SM), a hardware feature that allows 3090 E and S model users to set up logical partitions under ESA/370. It replaces a previous product that only ran under Virtual Machine/Extended Architecture System Product (VM/XA SP).

ESA/370 is the newest System/370 operating environment and evolutionary follow-on product to MVS/XA. ESA/370, first announced in February 1988, is now available. While ESA/370 may be an early precursor to an expected 3090 follow-on line, popularly known as the Summit, IBM officials hinted the 3090's days are far from numbered. More 3090 enhancements may still be in the pipeline.

Key hardware differences between 3090 S and E models center around cycle time, chip densities, memory, and channel capacities. Central memory capacity now ranges from 32 megabytes at the entry-level point to 512 megabytes for the top-end multiprocessors, double the maxi-

➤ DATA FORMATS

BASIC UNIT: Eight-bit byte. Each byte can represent one alphanumeric character, two BCD digits, or eight binary bits. Data can be represented as 32-bit words, 64-bit double words, and 128-bit extended words for floating-point arithmetic.

FIXED-POINT OPERANDS: Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; one half word (16 bits) or one word (32 bits) in binary mode.

FLOATING-POINT OPERANDS: One word, consisting of 24-bit fraction and 7-bit hexadecimal exponent in "short" format; two words, consisting of 56-bit fraction and 7-bit hexadecimal exponent in "long" format; or four words in "extended precision" format.

INSTRUCTIONS: Two, four, or six bytes in length, specifying zero, one, or two memory addresses, respectively.

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

MAIN STORAGE

STORAGE TYPE: 1-megabit memory chips; first-generation chips introduced in 1986 are used in expanded memory, and smaller, faster second-generation 1-megabit chips are used in central memory. They are manufactured using the silicon gate N-type Metal Oxide Semiconductor (NMOS) process.

CAPACITY: 32 to 512 megabytes. See Table 1 for capacities of individual models.

CYCLE TIME: See Table 1.

CHECKING: The processor controller plays a major role in error detection and recovery. Data paths between the central processor and central storage are parity-checked by byte. Parity bits are included in each command or data word. When the data are retrieved, single-bit errors are

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	Model 280S	Model 300S	Model 400S	Model 500S	Model 600S
SYSTEM CHARACTERISTICS					
Date announced	July 26, 1988				
Date first delivered	Fourth quarter 1988				
Field upgradable to	Model 400S	Models 400S, 500S, 600S	Models 500S, 600S	Model 600S	Not applicable
Relative performance	Not specified				
Number of processors	2	3	4	5	6
Cycle time, nanoseconds	15	15	15	15	15
Word size, bits	32	32	32	32	32
Operating systems	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370				
MAIN MEMORY					
Type	1M-bit NMOS				
Minimum capacity, bytes	64M*	64M*	128M*	128M*	128M*
Maximum capacity, bytes	256M	256M	512M	512M	512M
Increment size, bytes	64M, 128M	64M, 128M	128M, 256M	128M, 256M	128M, 256M
Cycle time, nanoseconds	Not specified				
BUFFER STORAGE					
Minimum capacity	128KB/CPU	128KB/CPU	128KB/CPU	128KB/CPU	128KB/CPU
Maximum capacity	128KB/CPU	128KB/CPU	128KB/CPU	128KB/CPU	128KB/CPU
Increment size	0	0	0	0	0
INPUT/OUTPUT CONTROL					
Number of channels:					
Byte multiplexer	0-8	0-8	0-8	0-8	0-8
Block multiplexer	32, 48, 64	32, 40, 48, 64	64, 80, 96, 128	64, 80, 96, 128	64, 80, 96, 128
Word	0	0	0	0	0
Other	0	0	0	0	0

*In addition to conventional main memories, all the models can be outfitted with optional expanded storage. Refer to expanded-storage chart in Characteristics section for more details.

➤ **mum memory capacity of the E models. The company also increased channel and expanded storage capacity for the Models 120S and 150s. (Please refer to Table 1 and the Expanded Storage chart for more details about each model.)**

With the introduction of S models in addition to earlier E model additions, IBM has drawn a complicated road map of upgrade possibilities. Users can upgrade "horizontally" from base models and E models to the same S models. Users can also "diagonally" upgrade from base 3090s or 3090 E models to higher S models. Lastly, users can upgrade "vertically" from smaller S models to larger S models. The so-called horizontal upgrades were particularly significant to IBM watchers. In 1987, owners of 3090 base models were not permitted to upgrade to the same corresponding E model. Users had to upgrade to the next highest E model, a potentially more expensive move, particularly for users who had only recently acquired their first 3090s.

Vertical upgrades will be available by the second quarter of 1989. Diagonal upgrades, beginning with the Models 180 and 180E and up, will be available during the first quarter of 1989. Upgrades involving the Models 120E, 150/150S, and 170S will be available December 1988. The horizontal upgrade of a 600E to a 600S will be available during the first quarter of 1989. Horizontal upgrades to Models 180S, 200S, 300S, 280S, 400S, and 500S will be available during the second quarter of 1989.

The latest round of enhancements pushes the 3090 line past the 100 million instructions per second (MIPS) threshold. The top-end Model 600S is rated at 102 MIPS, according to International Data Corporation (IDC) esti-

➤ **detected and corrected automatically, and most multiple-bit errors are detected and signaled so that appropriate program action can be taken. For processors using the expanded storage option, single-bit and double-bit errors are detected and corrected for all data read from expanded storage. Triple-bit errors and some multiple-bit errors are also detected, but not corrected. Unrecoverable errors are flagged.**

RESERVED STORAGE: Similar to the System/370, main memory is reserved for interrupt routines, program status words, CPU timer logout area, machine-check interrupt code, and register save area.

Key-controlled storage protection provides both store and fetch protection, preventing unauthorized access or modification of information in central storage. Store protection prevents the contents of main storage from being altered by storage addressing errors in programs or input from I/O devices. Fetch protection prevents the unauthorized fetching of data and instructions from main storage. Up to 15 programs and their associated main storage areas can be protected at one time. A seven-bit storage key, acting as a security lock, protects each 4K-byte block of storage. Key-controlled protection is standard on all System/370 models.

CENTRAL PROCESSORS

The 3090 Series consists of single processors and partitionable multiprocessors. Models 280E, 280S, 400E, 400S, 500E, 500S, 600E, and 600S can be configured for single-image operation or physically partitioned operation. In physically partitioned mode, the processing complex operates as two physically attached but independent configurations.

In addition to the central processor complex, which includes shared central storage, buffer memory, and 16 to 128 integrated channels, 3090 mainframes require at least one of the following components:

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	Model 120E	Model 150E	Model 180E	Model 200E	Model 280E
SYSTEM CHARACTERISTICS					
Date announced	May 19, 1987	January 26, 1987	January 26, 1987	January 26, 1987	February 1988
Date first delivered	October 1987	January 1987	January 1987	January 1987	Second quarter 1988
Field upgradable to	Models 150E, 150S	Models 170S, 180E, 180S	Models 180S, 200E, 200S, 280S	Models 200S, 300E, 300S, 400S	Models 280S, 400E, 400S
Relative performance	Not specified				
Number of processors	1	1	1	2	2
Cycle time, nanoseconds	18.5	17.75	17.2	17.2	17.2
Word size, bits	32	32	32	32	32
Operating systems	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370				
MAIN MEMORY					
Type	1M-bit NMOS, 288K-bit MOS	1M-bit NMOS, 288K-bit MOS, 64K-bit MOS	1M-bit NMOS, 288K-bit MOS	1M-bit NMOS, 288K-bit MOS	1M-bit NMOS, 288K-bit MOS
Minimum capacity, bytes	32M*	32M*	32M*	64M*	64M*
Maximum capacity, bytes	32M	64M	64M	128M	128M
Increment size, bytes	0M	32M	32M	64M	64M
Cycle time, nanoseconds	Not specified				
BUFFER STORAGE					
Minimum capacity	64KB	64KB	64KB	64KB/CPU	64KB/CPU
Maximum capacity	64KB	64KB	64KB	64KB/CPU	64KB/CPU
Increment size	0	0	0	0	0
INPUT/OUTPUT CONTROL					
Number of channels:					
Byte multiplexer	0-4	0-4	0-4	Not specified	Not specified
Block multiplexer	16, 24	16, 24	16, 24, 32	32, 40, 48, 64	32, 48, 64
Word	0	0	0	0	0
Other	0	0	0	0	0

*In addition to conventional main memories, all the models can be outfitted with optional expanded storage. Refer to expanded-storage chart in Characteristics section for more details.

► mates published in *Computerworld*. The five-way Model 500S is rated at 87.8 MIPS, the four-way Model 400S 72.2 MIPS, the three-way Model 300S 55.6 MIPS, the dual-processor Model 200S 39.8 MIPS, and the two-way 280S 38.2 MIPS. Single-processor 3090s range from 7.4 MIPS for the Model 120S to 20.5 MIPS for the Model 180S. The Model 180S is the basis for the larger multiprocessor configurations. Performance improvements put the 3090 on an even footing with the new Amdahl 5990 mainframes announced in May. The top-end Amdahl 5990 Model 1400 outperforms the previous IBM 3090 E series, according to industry MIPS estimates.

At the July announcement, IBM officials proclaimed 3090 performance improvements reflect improved hardware designs combined with the ESA/370 operating environment. ESA is implemented through the installation of MVS/SP Version 3 Release 1 and related core operating system software. According to IBM, the Model 600S running MVS/ESA SP 3.1 provides up to 56 percent greater internal throughput than the previous 600E operating under MVS/XA SP 2.2. In an IBM IMS data base environment, a Model 600S running under MVS/ESA provides about 56 percent greater internal throughput than the Model 600E running under MVS/XA.

A Model 180S running under MVS/ESA with CICS provides approximately 33 percent greater internal throughput than the 180E operating under MVS/XA with CICS.

A Model 600E operating under VM/XA SP 1 with Conversational Monitoring System (CMS)-intensive work loads provides up to 182 percent greater internal throughput than the Model 300S. A Model 300S running under

- • 3092 Processor Controller Models 1, 2, or 3;
- 3097 Power and Coolant Distribution Unit Models 1 or 2;
- 3370 Direct Access Storage Device (DASD) Model A2 with a string-switch feature;
- Access to a channel-attached IBM 3803 Tape Control Unit Model 2 or equivalent and its associated IBM 3420 Magnetic Tape Unit Models 4, 6, or 8; 3480 Cartridge Tape Models B11/B22; and 3422 Magnetic Tape Subsystem;
- 3864 Modem Model 2 with an automatic calling unit feature or equivalent;
- 3089 Power Unit Model 3 or other 400-Hz power source; and
- 3206 Model 100 Operator Display Station.

For a detailed rundown of how many of each component must be configured with each 3090 model, please refer to CONFIGURATION RULES.

Processor hardware technology is built around the use of Emitter Coupled Logic (ECL) and Thermal Conduction Modules (TCMs). To dissipate the heat, IBM makes extensive use of its TCM technology. TCMs are helium-filled, encapsulated modules covered by cold plates through which chilled water circulates to absorb heat. A TCM contains up to 132 silicon chips mounted on a multilayered ceramic substrate. Each central processor uses nine TCMs with the associated circuit board. Overall design makes external wiring or cabling unnecessary. With the IBM's 3090 S models introduce denser TCMs.

To improve system performance and throughput, the processors feature three memory hierarchies. They are shared central storage (main memory), a high-speed buffer memory, and optional expanded storage. Refer to Table 1 for a

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	Model 300E	Model 400E	Model 500E	Model 600E
SYSTEM CHARACTERISTICS				
Date announced	January 26, 1987	January 26, 1987	February 1988	January 26, 1987
Date first delivered	Third quarter 1987	January 1987	Third quarter 1988	Third quarter 1987
Field upgradable to	Models 300S, 400S, 500S, 600E, 600S	Models 400E, 400S, 500E, 500S	Models 500S, 600E, 600S	Model 600S
Relative performance	Not specified	Not specified	Not specified	Not specified
Number of processors	3	4	5	6
Cycle time, nanoseconds	17.2	17.2	17.2	17.2
Word size, bits	32	32	32	32
Operating systems	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370			
MAIN MEMORY				
Type	1M-bit NMOS, 288K-bit MOS			
Minimum capacity, bytes	64M*	128M*	128M*	128M*
Maximum capacity, bytes	128M	256M	256M	256M
Increment size, bytes	64M	128M	128M	128M
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE				
Minimum capacity	64KB/CPU	64KB/CPU	64KB/CPU	64KB/CPU
Maximum capacity	64KB/CPU	64KB/CPU	64KB/CPU	64KB/CPU
Increment size	0	0	0	0
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	0-4	Not specified	Not specified	0-8
Block multiplexer	32, 40, 48, 64	64, 80, 96, 128	64, 80, 96, 128	64, 80, 96, 128
Word	0	0	0	0
Other	0	0	0	0

*In addition to conventional main memories, all the models can be outfitted with optional expanded storage. Refer to expanded-storage chart in Characteristics section for more details.

▷ VM/XA SP 1 in a CMS-intensive environment provides up to 74 percent greater internal throughput than the Model 200E. The Model 200S running under VM/XA SP 1 in a CMS-intensive environment provides up to 24 percent greater internal throughput than the Model 200E operating under VM/High Performance Option 5 in a CMS-intensive environment.

ESA introduces two new operating system concepts: data spaces, which accept only user data, and high-performance spaces (hiperspaces), which reside in expanded storage.

Data spaces are hardware controlled and can hold up to 2 gigabytes of data at a time. Separate address spaces can also contain up to 2 gigabytes of code and data. Within a data space, all addresses are contiguous and available to the application, because virtual storage is not divided into a system and private area (as it is in an address space). Data spaces can reside anywhere in processor storage or on auxiliary storage.

Hiperspaces, designed for reading or writing data in 4-kilobyte blocks, come in two varieties. The first functions as an internal direct access storage device residing in expanded storage. It can only be accessed by authorized programs. This eliminates paging and contention associated with seeks to channel-attached devices. Data spaces, on the other hand, are subject to the usual storage contention and paging activity.

The second type of hiperspace is available to all applications and can be referenced from high-level languages ▷

▶ listing of central storage options for each processor model. In addition to main memory, each 3090 E processor and Models 120S, 150S, and 170S contain a 64-kilobyte buffer memory. All other 3090 S models feature one 128-kilobyte buffer per CPU. Buffer memory handles instructions, operands, and data fetches.

A third level of memory that's optionally available for all 3090 models is expanded storage. Expanded storage memory helps reduce paging and swapping loads to channel-attached paging devices in heavy paging environments with storage limitations. Controlled by the system control program, expanded storage transfers 4-kilobyte pages to and from central storage. Expanded storage options are listed in the following chart:

EXPANDED STORAGE BY MODEL	MINIMUM AND INTERMEDIATE	MAXIMUM
Model 120E	64 megabytes	128 megabytes
Model 120S	64, 128, 192 megabytes	256 megabytes
Model 150E	64 megabytes	128 megabytes
Model 150S	64, 128, 192 megabytes	256 megabytes
Model 170S	64, 128, 192 megabytes	256 megabytes
Model 180E	64, 128, or 192 megabytes	256 megabytes
Model 180S	64, 128, 192 megabytes	256 megabytes

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TABLE 2. MASS STORAGE

MODEL	3370	3375	3380	3380
Cabinets per subsystem	1 to 4	1 to 4	1 to 4	1 to 8
Disk packs/HDAs per cabinet	1	1	2	2
Capacity	729.8MB	819.7MB	2520/5040MB	2520/7560MB
Tracks/segments per drive unit	—	—	—	—
Average seek time, msec.	19	19	15/17	12/16
Average access time, msec.	29.1	29.1	23.3/25.3	20.3/24.3
Average rotational delay, msec.	10.1	10.1	8.3	8.3
Data transfer rate	1.859MB/sec.	1.859MB/sec.	3.0MB/sec.	3.0MB or 4.5MB/sec.
Controller model	3880 Models 1, 21	3880 Model 1	3880/3990	3880/3990
Comments	Models A2, B2, A12, B12	Models A1, B1, D1	Models AD4, BD4, AE4, BE4	Models AJ4, BJ4, AK4, BK4

A dash (—) indicates information was not available.

through new data windowing services. It can also be backed up by auxiliary devices. Data windowing services allow high-level language applications to access and scroll through large permanent data objects and large temporary data objects. The data is seen through virtual storage windows in an application program. A window is a user-defined area in the application that maps portions of the data object.

MVS/DFP Version 3 is installed with MVS/SP Version 3 to establish the ESA environment. MVS/DFP Version 3 allows users to take advantage of ESA/370's data space and hyperspace enhancements. DFP and related products make up the Data Facility Storage Management Subsystem (DFSMS). DFSMS improves storage management, simplifies device additions and migrations, and enhances hardware exploitation. Additionally, it provides centralized control over external storage resources and a common interactive interface for the use of storage management functions. Finally, it satisfies a user need to move from user-managed to system-managed storage.

COMPETITIVE POSITION

The timely summer introductions of 3090 S models and the AS/400 Series should improve IBM's hardware shipments and help it attain respectable (if not spectacular) profit margins this year. The days of double-digit growth, which IBM experienced during the early part of this decade, will surely not return in 1988.

Before the release of AS/400 and the latest 3090s, IBM had been experiencing a slowdown in shipments, resulting in disappointing second-quarter results. The company reported revenues were up 6 percent to \$13.6 billion from \$12.8 billion reported for the second quarter of 1987. Second-quarter net profits, however, were down. Net earnings dropped to \$964 million compared to \$1.18 billion for the same period last year.

The shipment slowdown was attributed to pent-up demand for the new 3090 S models and the AS/400, formerly known as Silverlake. Users were apparently holding off purchases of available 3090 E models and S/3X models while waiting for the introduction of these follow-on products.

EXPANDED STORAGE BY MODEL	MINIMUM AND INTERMEDIATE	MAXIMUM
Model 200E	64, 128, 192, 256 512 megabytes	1 gigabyte
Model 200S	64, 128, 192, 256 512 megabytes	1 gigabyte
Model 280E	128, 256, 384 megabytes	512 megabytes
Model 280S	128, 256, 384 megabytes	512 megabytes
Model 300E	64, 128, 192, 256, 512 megabytes	1 gigabyte
Model 300S	64, 128, 192, 256, 512 megabytes	1 gigabyte
Model 400E	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 400S	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 500E	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 500S	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 600E	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 600S	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes

Each central processor in a 3090 complex is microcode controlled and contains an Instruction Element (IE), Execution Element (EE), Control Storage Element (CSE), and Buffer Control Element (BCE).

The IE controls the sequencing of all instructions and can handle multiple instructions at the same time. The IE

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
3420:					
Model 3	7	556/800	NRZI	75	41,700/60,000
	9	800	NRZI	75	60,000
	9	1600	PE	75	120,000
Model 5	7	556/800	NRZI	125	69,500/100,000
	9	800	NRZI	125	100,000
	9	1600	PE	125	200,000
Model 7	7	556/800	NRZI	200	111,200/160,000
	9	800	NRZI	200	160,000
	9	1600	PE	200	320,000
Model 4	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
Model 6	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Model 8	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
3422	—	1600/ 6250	—	— 125	200,000 780,000
3430	9	1600	PE	50	80,000
	9	6250	GCR	50	312,500
3480					
Model B22	18	38,000 (bytes)	—	79	3,000,000
Model B11	18	38,000 (bytes)	—	79	1,500,000
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
3262:					
Model 3	252-650 lpm	132	10	6 or 8	3½ to 16 wide, 6 to 14 long
Model 5	252-650 lpm	132	10	6 or 8	3½ to 16 wide, 6 to 14 long
Model 13	125-325 lpm	132	10	6 or 8	3½ to 16 wide, 6 to 14 long
3800:					
Model 3	215 ppm	136, 163, 204	10, 12, 15	6, 8, 10, 12	6½ to 14¾ wide, 3½ to 11 long
Model 6	134 ppm	136, 163, 204	10, 12, 15	6, 8, 10, 12	6½ to 14¾ wide, 3½ to 11 long
3820	20 ppm	—	10, 12 other	—	7 to 8½ wide, 10½ to 14 long
3827:					
Model 1	92 ppm	—	Variable	Variable	8 to 8½ wide, 10 to 14 long
3835:					
Model 1	88 ppm	—	Variable	Variable	6.5 to 16 wide, 3 to 14 long
4245 Models 12 & D12	1,200 lpm (48 char. set)	132	10	6 or 8	3½ to 22 wide, 3 to 24 long
4245 Models 20 & D20	2,000 lpm	132	10	6 or 8	3½ to 22 wide, 3 to 24 long
4248 Model 2	2,200 to 4,000 lpm	132 std.; 168 opt.	10	6 or 8	3½ to 18¾ wide, 3 to 17 long
6262:					
Models D12, T12	1,200 lpm	132	10	3, 4, 6, or 8	3½ to 17.7 wide, 3 to 14 long
Model 14	1,400 lpm	132	10	6 or 8	3½ to 17.7 wide, 3 to 14 long
Models D14 & T14	1,400 lpm	132	10	3, 4, 6, or 8	3½ to 17.7 wide, 3 to 14 long

A dash (—) indicates information was not available.

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TABLE 4. TERMINALS

MODEL	316X	8775	3179	3180	3191
DISPLAY PARAMETERS					
Max. chars./screen	1,920	960, 1,920, 2,560, or 3,440	1,920 to 2,560	1,920 to 3,564	1,920
Screen size (lines x chars.)	24 x 80	12 x 80, 24 x 80, 32 x 80, 43 x 80	24 x 80, 32 x 80	24 x 80 to 27 x 132	24 x 80
Symbol formation	8 x 16	9 x 16, 9 x 15, or 9 x 12 dot matrix	7 x 14 dot matrix	8 x 11 to 8 x 8 dot matrix	7 x 14
Character phosphor	Amber or green	—	—	Monochrome	Green or amber
Total colors/no. simult. displayed	8 foreground/ 8 background	—	8 displayed	None	Monochrome
KEYBOARD PARAMETERS					
Style	102-key and opt. 84- key; 3162 only	Typewriter	Typewriter	Data entry or typewriter	102, 122, 104 key
Character/code set	128/ASCII	75 or 94/EBCDIC	94	—	94
Detachable	—	Yes	Yes	Yes	Yes
Program function keys	12 to 24	10, 12, or 24	24	24	24
OTHER FEATURES					
Buffer capacity	—	—	—	—	—
Tilt/swivel	Standard	—	Standard	Standard	Standard
Graphics capability	—	—	—	—	—
TERMINAL INTERFACE	RS-232, RS-422A	3725 Communica- tions Controller	3174, 3274 Controllers	3174, 3274, 3276 Controllers	3174, 3274 Controllers

A dash (—) indicates information was not available.

Of course, IBM's difficulties go well beyond the usual sales slumps associated with product cycle transitions. Single-digit industry growth through the mid-to-late 1980s has forced IBM during the last year to reduce its workforce, close several manufacturing facilities, and reorganize its sales and marketing operations.

The dramatic transformations overtaking IBM are due in large part to changes within the mainframe market. Since its introduction in 1985, the 3090 has not been as well received as previous mainframe generations. There are several reasons for this. When the 3090 was first introduced, many users saw little price/performance difference between the 308X Series, IBM's previous mainframe generation, and the 3090. Although this view was valid, the 1988 introduction of the ESA/370 operating environment begins to change the situation. ESA can only run on 3090 E and S models; the first 3090 base models cannot run ESA.

Externally, IBM continues to face pressures from plug-compatible manufacturers (PCMs) Amdahl and NAS. In May, for instance, Amdahl announced the 5990 Series, a new mainframe line that leapfrogged IBM's 3090 E technology. The 5990 Model 1400, a four-way multiprocessor, was the first S/370-compatible system to break the 100 MIPS barrier. The performance leap was only half the story. By introducing the new mainframes before IBM's anticipated 3090 S models, Amdahl hoped to turn a few heads that would normally be looking first at the latest IBM products. IBM, of course, with the 3090 S model introduction, eliminated Amdahl's marketing advantage and closed the performance gap.

Amdahl responded immediately. To maintain its traditional price/performance edge over IBM, Amdahl announced a new round of mainframe price reductions. In August, Amdahl reduced the prices of various models of its 5890 and 5990 processors by 10 to 14 percent and cut

decodes instructions; calculates addresses; sends fetch requests to the BCE in central storage; determines fetch priority; and controls storage requests. In addition, it provides the EE with operation codes, operands, and operand addresses.

The Execution Element executes instructions set up by the IE and operates in parallel with the IE. The EE processes instructions and interruptions, overlaps operations with the IE, initiates control functions, and performs various logic and arithmetic functions. Arithmetic results can include fixed point, fixed-point multiply, convert to binary, convert to decimal, floating point, and extended-precision floating point.

The Control Storage Element contains the microcode needed for controlling the EE. The CSE controls microcode execution in the central processor and contains the supporting control storage areas and registers that are used by the central processors.

The Buffer Control Element handles the movement of data to and from memory, performs dynamic address translation, and controls the high-speed buffer. The BCE contains the 64-kilobyte or 128-kilobyte high-speed buffer (depending on model), a buffer directory, a translation lookaside buffer (TLB), and dynamic address translation (DAT) hardware.

The high-speed buffer, as noted above, provides faster access to instructions. While data is being referenced during instruction execution, the high-speed buffer, the buffer directory, and the TLB are accessed at the same time for address comparison.

The buffer directory contains the absolute central storage addresses for data residing in the high-speed buffer. The TLB stores the real address of the referenced page for a translated virtual address in central storage, making subsequent translations for the same virtual address unnecessary, since the real address is immediately available in the TLB. The DAT translates virtual addresses to real addresses and loads them in the TLB.

The 3090 Series supports System/370, 370-XA, and Enterprise Systems Architecture (ESA)/370 operational modes. In System/370 mode, the 3090 supports S/370 extended facility, 3033 extension, and extended addressing. In 370-XA and ESA/370 modes, the 3090 supports Expanded

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TABLE 4. TERMINALS (Continued)

MODEL	3192-G, -C	3192-D	3193	3194	3278	3279
DISPLAY PARAMETERS						
Max. chars./screen	1,920 or 2,560	1,920, 2,560, 3,440, 3,564	3,840	1,920, 2,560, 3,440, 3,564	960 to 3,564	1,920 to 2,560
Screen size (lines x chars.)	24 x 80, 32 x 80	24 x 80, 32 x 80, 43 x 80, 27 x 132	48 x 80	24 x 80, 32 x 80, 43 x 80, 27 x 132	12 x 80 to 27 x 132	24 x 80 to 32 x 80
Symbol formation	—	—	11 x 24	—	7 x 12 or 7 x 14 dot matrix	9 x 12
Character phosphor	—	Green	Black or white background Monochrome	Green	—	—
Total colors/no. simult. displayed	7 colors	None	—	7 colors (C and H models)	None	4 to 7 colors
KEYBOARD PARAMETERS						
Style	Typewriter	Typewriter; modifiable	Typewriter; modifiable	Typewriter, data entry	Data entry or typewriter	Typewriter
Character/code set	EBCDIC	EBCDIC	EBCDIC	EBCDIC	—	—
Detachable	Yes	Yes	Yes	Yes	Yes	Yes
Program function keys	24	24	10/12	10/12	10/12	12
OTHER FEATURES						
Buffer capacity	—	—	—	—	—	—
Tilt/swivel	Standard	Standard	Standard	Standard	No	Standard
Graphics capability	Standard (3192 G models)	—	—	No	—	Standard (S3G model)
TERMINAL INTERFACE						
	3174, 3274 Controllers	3174, 3274 Controllers	3174, 3274 Controllers	3174, 3274/76 Controllers	3274, 3276 Controllers	3274, 3276 Controllers

A dash (—) indicates information was not available.

the cost of upgrades by 12 to 17 percent. The company also raised 5890 maintenance prices by 5 percent.

NAS, Amdahl's PCM rival, is expected to challenge the IBM 3090 S series with enhanced AS/XL models. Nonetheless, IBM holds a significant lead in the operating system software area. IBM's ESA/370 became available in July. NAS, on the other hand, announced it would support ESA by the end of 1989. For its part, Amdahl indicates it will announce ESA details when the company receives more information from IBM.

Similar to Amdahl's 5890 Series, the NAS AS/XL Series has been selling well during the last two years. Both PCMs have increased their respective market shares slightly at the expense of IBM.

While the traditional commercial mainframe market has remained flat, the engineering/scientific sector has become one of the hottest new markets to watch during the last few years. It's been particularly good for vendors selling high-end supercomputers, minisupers, and technical workstations.

IBM decided to pursue the technical computing market after determining that the potential customer base was too large to ignore. According to IBM, about 20 percent of the computing market, constituting 3 percent of the work force, is now involved in technical computing. By IBM estimates, this segment of the market is growing twice as fast as the other 80 percent. In 1985, after a long absence, IBM reentered the technical computing market with its Vector Facility (VF), a frame that can be attached to each processor of a 3090 mainframe complex. IBM has already installed more than 250 VFs. NAS, Amdahl, and Honeywell (in alliance with NEC of Japan) are selling Japanese systems.

Storage, 31-bit addressing, bimodal addressing, larger and more flexible I/O configurations, channel path selection under hardware control, and support for Start Interpretive Execution instructions by supporting guest S/370 or 370-XA virtual machines. What follows are larger explanations of some of the features available under either mode.

A modular unit that works closely with the 3090 complex is the 3092 Processor Controller. The 3092 is available in three models and performs many key monitoring and control functions for all 3090 models. Users migrating from smaller 3090 complexes to larger complexes must upgrade from a 3092 Controller Model 1 or 3 to a Model 2. Processor activities include:

- Power sequence control and initialization;
- Power on and off;
- Monitoring and control of power supplies, temperatures, and coolant flows;
- Support for S/370 or 370-XA modes of operation;
- Control of the configuration of hardware elements; and
- Control unit function for required and optional consoles and an optional printer.

Other functions include:

- Local and remote alarm capabilities;
- Error recovery;
- Execution of error analysis routines for isolation of failing field-replaceable units;
- Diagnostic capabilities; and
- Full processor complex remote service capability.

In addition, the controller collects information for three areas: system activity display frames, I/O problem determination frames, and status information for customer problem analysis frames.

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Engineering/scientific computing represents a potentially lucrative mainframe market, but Cray Research Inc., a firm that has become synonymous with supercomputing, dominates the high end of the business. In 1987, IBM launched an aggressive sales and marketing effort, calling on engineering/scientific customers outside the traditional IBM customer base, in an effort to penetrate that market.

In the peripherals area, IBM hopes its new triple-density 3380 DASDs and a new 3990 controller will stop market share erosion in the competitive high-end storage market. IBM's double-density DASDs did not sell as well as IBM had hoped, losing market share to vendors selling plug-compatible versions of IBM devices. Shortly after IBM's September 1987 announcement of the new DASDs, NAS announced its own triple-density IBM-compatible DASDs. During 1988, Amdahl, Memorex, and Storage Technology followed suit with their own IBM plug-compatible versions.

ADVANTAGES AND RESTRICTIONS

Ever since IBM began delivering 3090 models, company representatives were put on the defensive. Industry analysts contended that little price/performance difference exists between a new 3090 and the previous 308X Series—a used 308X continued to look like a better buy than a new 3090.

ESA/370 may finally put this issue to rest. IBM's new operating environment brings immediate relief to memory constraints. Total virtual memory spaces of up to 16 trillion bytes are 8,000 times the previous MVS/XA limit of 2 gigabytes. The three largest 3090 S models running under ESA/370 now offer a maximum real memory capacity of 512 megabytes, twice the previous E models. In addition to new capabilities, ESA continues to feature MVS/XA enhancements such as 31-bit addressing; the dynamic channel subsystem; and a number of reliability, availability, and serviceability (RAS) features. The expanded virtual address space under ESA/370 lets users run even larger applications faster and more efficiently. Data management involving memory-consuming relational data bases, network management, distributed processing involving PC-to-mainframe links, and engineering/scientific applications come immediately to mind.

Before ESA/370, IBM had been reemphasizing the differences between the 3090 and the previous 308X product line. Many of these differences were unveiled well into the 3090 product cycle. As the 3090 comes closer to the end of its marketing cycle, it's beginning to look a lot different than 308Xs. Most technology improvements have occurred at an evolutionary pace. Some of these improvements include faster CPU cycle times, denser memory chips and TCM packaging, expanded storage, the Vector Facility attachment, faster data transfer rates, and double- and triple-density DASDs. Additionally, users can now

Each controller model includes two processor elements (A side and B side) and requires the following for full-processor support: two 3370 DASD Model A2 units (each with a string-switch feature); access to a channel-attached 3803 Tape Control Unit Model 2 and its associated 3420 Magnetic Tape Unit Models 4, 6, or 8; 3480 Cartridge Tape Models B11/B22 or 3422 Magnetic Tape Subsystem; and one 3864 Modem Model 2 (or equivalent) with an automatic calling unit feature.

While one 3092 processor element remains active, the other processor acts as a backup. It also continues to monitor the active processor and stands ready should the active processor fail. In most cases, if the active processor fails, a switchover to the backup processor occurs.

The 3092 Controller contains a system power panel that includes power on and off switches, emergency power off, and power status and service mode indicators.

When the 3090 Processor Complex is initialized, the 3092 validates areas of central storage as error-free data locations, records failing storage locations, and assigns the hardware system area in central storage based on continuous error-free locations. When the power sequencing is completed, the processor controller performs an initial microprogram load.

Another major 3092 feature is error recovery. The controller logs errors as they occur and then analyzes and correlates multiple symptoms and isolates the failure to the failing field-replaceable units. When system attempts to correct errors fail or when errors occur frequently, an audible alarm is sounded to bring the problem to the attention of the operator. Other activities and features include enhancements to automate problem reporting and remote support access to assist with problem resolution.

Error detection and correction can be performed at several levels. Should automatic recovery procedures fail, a user has access to problem analysis frames and procedures to facilitate recovery and also has access to the remote service facility (RSF).

The 3092 Processor Controller usually plays a key role in error recovery. The controller both provides automatic recovery from many hardware malfunctions (such as errors in main storage) and reports machine or channel-check interruptions. When an error is detected, the 3092 automatically performs error analysis to pinpoint the error and isolate the field-replaceable unit or units that could be causing the problem. When detected, the controller logs in the problems and offers a diagnosis.

When errors cannot be corrected automatically, users can begin problem analysis procedures from the system console index frame. If the problem was caused by a power malfunction, the first of a set of power status problem analysis frames is displayed. If the problem lies elsewhere, the first of a second set of problem analysis frames is displayed. Problem analysis categories include non-I/O hardware errors; unsuccessful IPL; enabled or disabled wait state; interface control checks; I/O device errors; and operator console lockout.

When assistance from the RSF is required, the operator can initiate remote service from the problem analysis procedures or by invoking the RSF authorization frame and establishing the remote connection. When the service request is authorized, a telephone number is automatically dialed over the public switched network to establish a connection with a remote modem. The remote modem acknowledges the connection and activates the RSF. The RSF assumes control over the 3090 system and manipulates the processor unit through remote control.

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➤ configure up to six processors in a single complex and maintain a single image of the operating system.

In the memory chip technology area, IBM introduced 288-kilobit chips when the 3090s were first announced, a big improvement over the 64-kilobit chips used in the previous 308X mainframe generation. Now IBM uses 1-megabit chips in its latest mainframe versions, a dramatic technology leap that should improve processing speed and throughput. In 1987, IBM introduced a new generation of 1-megabit chips, faster and smaller than the first generation. The original 1-megabit chips are used in expanded storage, while the newest generation is used in central storage. In the logic gate area, IBM switched from the transistor-to-transistor logic (TTL) used in the 308X Series to the faster Emitter Coupled Logic (ECL). According to IBM, the enhanced 3090s using ECL chips have a machine cycle time up to 28 percent faster than 308X processors using TTL chips.

To improve throughput in highly interactive environments, IBM introduced triple-density DASDs and increased data transfer rates from 3 megabytes per second to 4.5 megabytes per second. The 3090 lets users define up to 48 control units per channel path, while 308X systems are limited to 16 control units.

Additionally, IBM has been increasing expanded storage capacity. Expanded storage, a special memory area reserved for system use only, is designed to bypass channel bottlenecks. This optional feature helps ease the paging and swapping load of the processor and reduces system overhead. It's now available to all the 3090 mainframes in varying degrees. A fully configured Model 400E/400S, Model 500E/500S, or Model 600E/600S can now have up to 2 gigabytes of expanded memory. Expanded storage takes advantage of the fact that the CPU complex can process data at a much faster rate than peripheral devices can send it. By moving data to this intermediate storage area, data can be made available to the CPU a lot quicker.

To take advantage of the expanded storage concept, users who haven't done so already will have to migrate to MVS/XA or ESA/370. Expanded storage and larger main memory capacities are not available under the earlier MVS/370 operating environment.

The Vector Facility clearly indicates that commercial mainframes of the future will incorporate specialized architectures to carry out specialized tasks, such as compute-intensive engineering/scientific applications, side by side with commercial applications. By adding a Vector Facility to each processor of a 3090 mainframe, users can introduce vector capabilities at a reasonable price. Along with the announcement of 3090 S models, IBM doubled the size of the VF register section from 128 to 256 data elements and introduced a faster divide instruction. VFs attached to 3090 S models can also take advantage of faster scalar performance achieved through improved CPU cycle times. Users running numerically intensive applications can achieve 40 percent improved

➤ The 3097 Power and Coolant Distribution Unit contains the power distribution functions, heat exchanger, pumps, and controls necessary to cool the liquid-cooled portion of the processor complex. Other features include an I/O Power Sequence Control capability for power on and off control of up to 128 I/O control units. The 3097 Model 2 has all the power and cooling distribution capabilities of the 3097 Model 1, but does not include the input/output power sequence control function. This provides flexibility to users who want to use I/O power sequencing on control units attached to their 3090. Model 2 users can upgrade to a Model 1.

The 3089 Power Unit Model 3 supplies 400-Hz power to the 3090 Processor Complex. The unit contains a motor-generator housed in a noise-suppressing frame and was designed for machine-room environments.

The 3206 Display Station Model 100 is used as either a system or maintenance console. The service support console must be placed within 33 feet of the 3092 controller, while the system display can be placed 4,921 feet from the 3092.

The 3864 Modem Model 2 is required to obtain service for the 3090 Processor Complex. A unit comes equipped with an Automatic Calling Unit (#5801) and a dedicated telephone line for the remote service facilities.

Two types of interrupts can be generated: normal and error. Normal interrupts include channel end, device end, attention status, and busy status. Error interrupts include those caused by data parity error, address parity error, invalid buffer address, keyboard, parity error, keyboard invalid address, command byte parity, and invalid command.

Reliability, availability, and serviceability (RAS) features are implemented throughout the 3090 Processor Complex. RAS capabilities include:

- TCM/ECL technology that provides a low intrinsic failure rate;
- A dual processor controller that can switch over to and initialize the functional side should the other side fail;
- Multiple security provisions for data integrity and system security;
- Alternate input for like functions using service language commands, display frames, and function keys; and
- Multiple consoles for monitoring functional console activity and for backup.

Availability features include:

- Automatic error detection and correction in both central storage and expanded storage;
- Storage deallocation;
- Ability to take a failing channel off-line;
- Automatic fault isolation concurrent with operation; and
- Operator problem analysis procedures to correct problems without the need for a service call.

Serviceability features include:

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▷ computing performance, according to IBM. Vector capabilities were not available for the 308X mainframe generation.

In addition to IBM's primary 3090 operating system environments, the company introduced VM/XA SP, a new version of the popular VM operating system that lets users take advantage of IBM's 31-bit extended architecture environment. VM users who were formally limited to 16 megabytes of virtual storage can now make use of 2 gigabytes of virtual storage. The improvement will help the system support more users and bigger application programs, a particular benefit for VM/CMS users who were limited to 24-bit addressing under the previous VM/XA SF release. As this report was prepared, VM/XA SP was still not generally available. According to published reports, IBM was having problems with the CMS component of the operating system. An IBM spokesperson explained that parts of the operating system are being released in phases. The CMS component will be available in a future unspecified phase.

To make its systems software more affordable to small and medium-size system users, IBM introduced a multi-level software pricing structure. Software now falls under graduated pricing categories ranging from Processor Groups 50 and 40 at the high end, Processor Groups 30 and 20 in the middle, to Processor Groups 15 and 10 at the low end. All 3090 machines except the entry-level Models 120E and 120S are Group 40 or 50 machines. The Models 120E and 120S are Group 30 machines. The Group 30 designation makes software less expensive for Model 120E/120S users migrating to their first 3090 system, but the move to a larger 3090 system could prove to be painful. When 120E/120S users migrate to Model 150E/150S machines or anything larger, the onetime graduated charge for MVS/XA with JES3 increases to \$281,385, a \$104,220 jump. Likewise, the new VM/XA SP Release 1 carries a Group 40 charge of \$216,000, a \$103,500 increase over the Group 30 price.

IBM is also notorious for pricing key hardware components separately. When making price comparisons between the new 3090 Series and competing systems, users should know what the 3090 Series includes and what additional hardware is required. The Model 200S, for instance, includes the central processors, 64 megabytes of main memory, two 128-kilobyte buffers, and 32 integrated channels. Priced separately are the 3092 Processor Controller Model 1, the 3097 Power and Coolant Distribution Unit, two 3089 Model 3 Power Units, two 3370 Model A2 DASDs, two 3206 Model 100 Display Stations, and the 3864 Model 2 Modem—all required components.

USER REACTION

The 1987 Datapro survey of general-purpose mainframes yielded responses from 85 IBM 3090 users. (The enhanced 3090 E and S models, announced well after the survey was done, are not included.) Of the 85, 37 said they installed a

- ▶
- On-site problem solving through use of field-replaceable unit isolation, trace tables, and logout error recording; and
 - Automatic remote service capability.

Other standard features on the 3090 Processor Complex include:

- Channel indirect addressing, which permits contiguous areas of virtual storage to be mapped into noncontiguous areas of real storage.
- Channel set switching, which (in S/370 mode only) dynamically switches channel sets between processors under program control should one of the central processors fail. Up to 32 channels for each channel set are supported, depending on the system control program used.
- Datastreaming, which permits data-transfer rates up to 3 megabytes or 4.5 megabytes per second on block multiplexer channels and cable lengths of up to 400 feet.
- Extended addressing, which (in S/370 mode only) permits the addressing of real storage of up to 256 megabytes of central storage on the 3090 operating under MVS/SP or VM/SP with the VM/SP High Performance Option.
- A 31-bit addressing capability, which (in 370-XA mode only) provides for a virtual storage addressing range of up to 2 gigabytes. In 370-XA and ESA/370 modes, bimodal addressing capabilities permit both 24-bit and 31-bit programs to execute concurrently.
- System/370 extended facility, which (standard in S/370 mode only) speeds up certain supervisor functions and improves the efficiency of dynamic address translation, CPU performance, and system integrity by providing special protection for low-address main storage vital to the system control program—all while operating under MVS/SP.
- A byte-oriented operand feature, which allows fixed-point, floating-point, and logical storage operands of most unprivileged instructions to appear on any byte boundary without causing a specification exception and a program interruption. This feature does not apply to instruction addresses, privileged instructions, or channel-command words.
- Virtual machine assist (VMA), which (standard in S/370 mode only) improves central processor performance when operating under VM/SP High Performance Option by reducing the amount of time in the real supervisor state.
- Preferred Machine Assist, which (standard in S/370 mode only) is designed to improve the performance of an MVS guest machine running under VM/SP. The feature allows any MVS/SP release that supports more than 16 megabytes of real storage to use real storage greater than 16 megabytes when operating as a virtual-equals-real (V=R) virtual machine.
- Start Interpretive Execution (SIE) Assist, which (standard in 370-XA mode only) provides improved performance of V=R preferred guests.
- 3033 Extension, which provides dual address-space facility to aid communications between virtual address spaces, faster I/O queuing, and a suspend-and-resume facility. This last feature allows the program to control the execution of a channel program.

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▷ 3090 Model 200 dual processor, 13 installed a Model 150 single processor, 9 installed a Model 180 single processor, and 8 installed a Model 400 four-way processor. The rest of the respondents did not specify a particular 3090 model.

At the time of the survey, these various 3090s had been installed an average of 14.66 months. Of those surveyed, 36.47 percent said they purchased the machines from IBM, 48.24 percent leased the hardware from a third party, and 10.59 percent leased the hardware from IBM. While the sites surveyed represented a variety of industries, banking/finance/securities and manufacturing clearly dominated. Sixteen respondents said they were involved with banking/finance/securities industries and fifteen said they were manufacturing concerns. Other industries mentioned less frequently were health care/medical (nine sites); government, insurance, utilities, and retail/wholesale (six sites each); education and chemical petroleum (five sites each); transportation (four sites); and service bureaus (two sites).

The primary application areas are consistent with overall large-system survey results. As usual, accounting/billing was rated as the top application area at 72.94 percent. Runner-ups included payroll/personnel (58.82 percent); purchasing (43.53 percent); and order processing/inventory control (38.82 percent). Other applications listed by percentage size included sales/distribution (24.71 percent); education/scheduling/administration (20.00 percent); engineering/scientific (18.82 percent); banking/check processing/loans/savings (17.65 percent); and health care/medical, insurance, and manufacturing (each 16.47 percent). Other applications such as math and statistics, petroleum and fuel analysis, construction, and process control were cited less frequently.

As would be expected, most of the Model 200s are part of large-scale configurations. Out of 79 users who answered the question, 43.04 percent said they had configured more than 64 megabytes of main memory. Another 44.30 percent had between 32 and 64 megabytes of memory, while 10.13 percent had between 16 and 32 megabytes of memory. Additionally, 85.88 percent of the respondents had more than 60 local workstations and 87.06 percent had more than 60 remote workstations.

During 1987, 67.06 percent of those surveyed said they planned to acquire additional software from the manufacturer, and 74.12 percent said they planned to purchase proprietary software from other suppliers. Only 3.53 percent said they planned to acquire an operating system based on UNIX. At the time the survey was taken, 90.59 percent said they obtained applications software from in-house personnel, 49.41 percent said they obtained it from contract programming, 5.88 percent said they obtained it from the manufacturer's personnel, 42.35 percent said they bought packaged programs from the manufacturer, and 49.41 percent said they obtained software from independent suppliers.

▶ The 3090 Series uses the System/370 Universal Instruction Set for binary, decimal, and floating-point arithmetic operations. The instruction set has arithmetic facilities for processing variable-length decimal and fixed-point binary operands, as well as instructions that handle loading, storing, comparing, branching, shifting, editing, radix conversion, code translation, logical operations, packing, and unpacking. In addition, a group of "privileged instructions," usable only by the operating system, handle input/output and various hardware control functions.

SPECIAL FEATURES: IBM offers the Vector Facility to address computationally intensive scientific and engineering applications. The VF is suited to such applications as structural design, reservoir modeling, fluid dynamics, and load flow. It's a field-installable option implemented in both hardware and software.

The facility can be added to each processor within a 3090 complex. Users who have installed the top-end Model 600E or 600S can add up to six VFs. It is supported by MVS/XA, ESA/370, VM/SP High Performance Option Releases 4.2 and 5, and AIX/370. The Vector Facility feature adds 171 new instructions and 16 vector registers, each containing 128 32-bit data elements. VFs installed on Model 180S and above feature 256 data elements. The doubling decreases the load and store overhead to boost performance by up to 10 percent for jobs with vector lengths greater than 128. Other features include binary, 32-bit, and 64-bit floating-point operands, using contiguous, noncontiguous, and random addressing.

The new features should produce results using fewer machine cycles. Multiplier and arithmetic/logic units using pipelining techniques can produce 32-bit or 64-bit sums, differences, or products during each cycle. Compound operations are able to produce both a product and sum during each cycle. Other features designed to improve the performance of engineering/scientific jobs include high-speed multiply, fast floating-point add/subtract, fast loop control execution, and 64-bit-wide data paths.

IBM enhanced the vector floating-point divide instruction for VFs installed on 180S models and greater. The enhancement provides a five-fold performance increase for single-precision division and about a three-fold increase for double-precision division. Overall job-level performance improvements depend on the usage of the divide instruction.

Another hardware option, Processor Resource/System Manager, enhances logical partitioning capabilities. PR/SM extends the functions of the Multiple High Performance Guest Support (MHPGS) feature. While MHPGS only operates under VM/XA SP, PR/SM operates under the new ESA/370 operating environment, eliminating the need for an additional VM/XA license.

Up to two optional PR/SM features are available on the 3090 S models, one per processor complex side. On the 3090 E models, up to six optional PR/SM features are available for the 3090 E models, one per central processor. One optional PR/SM feature can be installed on each 3090 Model 120S, 150S, 170S, 180S, 200S, and 300S. One optional PR/SM feature can be installed on each side of the Models 280S, 400S, 500S, and 600S. Both features are required when PR/SM is installed on S multiprocessor models.

PR/SM lets users set up four logically partitioned and independent operating environments on a single 3090 processor complex and up to eight logical partitions on 280E/280S, 400E/400S, 500E/500S, or 600E/600S multiple processors operating in a physically partitioned configuration. PR/SM is a hardware feature that lets users run a

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▷ Finally, 66.88 percent said they had a disaster recovery plan and 72.94 percent said they had an information center.

The following table shows how the 85 sites rated their 3090s. Interestingly, overall ratings results are quite strong in most categories. IBM did not do as well in the software categories, particularly within the applications software area.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	35	41	6	0	3.35
Reliability of mainframe	61	19	3	0	3.70
Reliability of peripherals	39	36	4	0	3.44
Maintenance service:					
Responsiveness	40	35	4	0	3.46
Effectiveness	40	37	1	0	3.50
Technical support:					
Troubleshooting	27	44	7	0	3.26
Education	19	38	20	1	2.96
Documentation	17	42	17	2	2.95
Manufacturer's software:					
Operating system	30	44	8	0	3.27
Compiler & assemblers	27	46	6	0	3.27
Application programs	12	43	16	3	2.86
Ease of programming	10	54	17	1	2.89
Ease of conversion	12	45	19	4	2.81
Overall satisfaction	26	50	6	0	3.24

*Weighted Average on a scale of 4.0 for Excellent.

When users were asked if their 3090s performed as expected, 91.76 percent said "Yes," 2.35 percent said "No," and 2.35 percent were undecided. When asked if they would recommend the 3090 to others, 94.12 percent said "Yes," 1.18 percent said "No," and 1.18 were undecided. □

▷ single processor as if it were four separate computers with different operating environments. PR/SM can be particularly useful for migrating applications from MVS/XA to ESA/370.

PR/SM can operate in S/370 mode, ESA/370 mode (supporting both MVS/XA and ESA/370), and Logically Partitioned (LPAR) mode. In LPAR mode, the operator can define what system resources, including memory and channel paths, will be specifically assigned to each partition.

PHYSICAL SPECIFICATIONS: Minimum power consumption for the ten 3090 S models ranges from 21.5kVAs at 400 Hz for the single-processor Model 120S to 76.4kVAs at 400 Hz for the six-processor Model 600S. Maximum power consumption ranges from 30.2kVAs to 105.8kVAs at 400 Hz. Combined heat output to air and water ranges from 73.1 Btu per hour for the Model 120S to 330.8 Btu per hour for the Model 600S.

Total hardware footprint including service clearances ranges from 482 square feet for the Model 120S to 974 square feet for the Model 600S. Square footage without service clearances ranges from 88 square feet to 215 square feet. Total weight for hardware complexes ranges from 11,535 pounds for the single-processor Model 120S to 31,590 pounds for the Model 600S.

CONFIGURATION RULES

A minimum 120E or 120S configuration includes the central processor complex, a 3092 Model 3 Processor Controller, a 3097 Model 1 or 2 Power and Coolant Distribution Unit, and a 3089 Model 3 Power Unit (or equivalent source of 400-Hz power). Other required hardware includes one 3370 Model A2 DASD with string switch (#8150), two to three IBM 3206 Model 100 display stations, and an IBM 3864 Model 2 Modem equipped with Automatic Calling (#5801).

The 3090 Models 150E, 150S, 170S, 180E, and 180S Processor Complexes consist of a single central processor, a 3092 Model 1, a 3097 Model 1 or 2, a 3089 Model 3, two 3370 Model A2 DASDs each with string switch (#8150), two to five 3206 Model 100s, and a 3864 Modem Model 2.

Models 200E and 200S consist of two central processors, a 3092 Model 1, and a 3097 Model 1 or 2. They also require two 3089 Model 3s or other appropriate 400 Hz power source, two IBM 3370 Model A2s, two to five 3206 Model 100s, and an IBM 3864 Modem Model 2.

Models 280E and 280S consist of two CPUs, a 3092 Model 2, two 3097s Models 1 or 2, two 3370s, two 3089s, three to six 3206s, and two 3864s.

Models 300E and 300S consist of three CPUs, a 3092 Model 1, a 3097 Model 1 or 2, two 3089 Model 3s, two 3370 Model A2s, two to five 3206 Model 100s, and a 3864 Model 2.

Models 400E/400S, 500E/500S, and 600E/600S consist of four, five, and six CPUs, respectively; a 3092 Model 2; and two 3097 Units Model 1 or 2. It also requires four 3089 Model 3s or other appropriate 400-Hz power source, two 3370 Model A2s, three to six 3206 Model 100s, and two 3864 Modem Model 2s.

INPUT/OUTPUT CONTROL

The channel subsystem (CSS) handles all I/O operations for the central processors. The CSS controls communications between a configured channel, control unit, and device. The I/O configuration data set (IOCDS), selected at system initialization, identifies channel, control unit, and device configurations to the channel subsystem. The I/O Configuration Program creates the IOCDS, which is stored on 3370 DASDs attached to the processor controller. During initialization, the IOCDS information is used to build necessary control blocks in the hardware system area of central storage. In addition, the CSS contains a channel control element (CCE), which interacts with central storage, the central processors, and the channels. In operation, the CCE initiates and ends channel operations, provides central storage access control, and assigns priorities for I/O operations.

In byte multiplexer operation, channels can be used either in byte multiplex or in burst mode. In byte multiplex mode, several relatively slow-speed I/O devices can operate concurrently. In block multiplex operation, channels can operate either in high-speed transfer mode or in datastreaming mode. In datastreaming mode, a block multiplexer channel can transfer at up to 3 megabytes per second—1.5 megabytes per second in high-speed transfer or DCI mode. Each byte multiplexer channel is capable of operating with an aggregate data rate in the range of 90 kilobytes to 300 kilobytes per second for data transfer burst sizes of 4 bytes or more. Configurations consisting of control units with faster I/O interface tags and larger data transfer burst sizes can achieve the higher performance. Up to 48 control units can be defined per channel path. ▶

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► The triple-density 3380 DASDs and 3990 Control Units can provide a data transfer rate of up to 4.5 megabytes per second.

Channels can operate in either System/370 or System/370 Extended Architecture (370-XA) mode. In 370-XA mode, up to four channel paths are available to any attached I/O device. During any I/O operation, one of the available channel paths to any specific I/O device is selected. Channel path selection is a hardware function rather than a system control program function. In System/370 mode, any channel can be assigned any valid channel address without concern for priority.

For user sites that must locate peripherals some distance away from a 3090 processor and channel subsystem, IBM offers the IBM 3044 fiber optic channel extender link. The product allows peripherals to be placed up to 6,600 feet (2 kilometers) away from IBM processors. According to IBM, remote printer displays and other low-to-medium speed peripherals using the fiber optic link almost match the speeds of devices locally connected to a central processor. The 3044 Models C2 and D2 support a data rate of 4.5 megabytes per second when attached to the 3088 Multi-System Channel Communication unit.

MASS STORAGE

IBM disk storage devices are covered in Table 2.

INPUT/OUTPUT UNITS

IBM tape drives and printers are covered in Table 3.

The 3814 Switching Management System is designed to aid in the management of complex DP configurations by providing centralized control of control-unit switching. The 3814 uses an integrated microcode-driven processor and features password authorization, stored configurations, and extensive self-diagnostic functions. For a more detailed report on the 3814 and its features, please refer to Report 70D9-504MK-101 in Volume 2.

TERMINALS

IBM terminals are covered in Table 4.

COMMUNICATIONS CONTROL

The 3090 is a host system in the IBM communications hierarchy, which includes the host mainframe with front-end communications controllers, terminal controllers, and terminal networks. Within the typical IBM communications hierarchy, terminals and remote systems communicate with the software residing within the communications processor, which in turn communicates with the access method residing in the central processor. The 3090 family supports the 3720 and 3725 Communications Processors and their predecessor, the 3705.

The 3725 *Communication Controller Models 1 and 2* consist of a central control unit that operates under control of the Advanced Communications Function/Network Control Program (ACF/NCP), Emulator Program, or Partitioned Emulator Program. Main storage ranges from 512 kilobytes to 3 megabytes, which can be added in 256-kilobyte increments. It can be attached to either byte or block multiplexer or selector channels on the host processor. Up to six channel adapters are available. The Model 1 can have up to six channel adapters in a single frame and the Model 2 can have up to four channel adapters. With the optional

two-processor switch feature, connection can be made to a maximum of eight processors, six of which can operate concurrently. The Maintenance and Operator Subsystem (MOSS) supplies host-independent maintenance. The 3727 Operator Console provides an operator interface to the MOSS. Communications scanners and line interfaces are provided by a transmission subsystem. The scanners are microprocessor based and can control eight Line Interface Couplers with up to 32 lines.

The 3725 supports X.25, X.21, and V.35 attachment and line speeds ranging from 50 bits per second (bps) to 256K bps. The 3725 can also be directly attached to the IBM Token-Ring Network using the IBM Cabling System.

The 3725 Model 1 consists of the 3725 Communication Controller and the 3726 Communication Controller Expansion. Up to 96 full-duplex or half-duplex lines can be attached to the Model 1. Model 2 supports up to 80 full-duplex or half-duplex lines. Model 2 is field upgradable to Model 1.

The 3720 *Communication Controller* and 3721 *Expansion Unit* are entry-level offerings within the 3725 family. They are said to have one-third the performance of the 3725. The 3720 can have up to four duplex 56K or 64K bps lines per scanner. The product line supports ACF/NCP Version 4 subset and supports IBM and non-IBM data terminal equipment (DTE) with X.25 interface when the X.25 SNA Interconnection PRPQ is used.

The 3720 provides up to 2 megabytes of main storage and up to 10 megabytes of hard disk storage. Up to 28 lines can be attached to the 3720 Models 1 and 2, expandable to up to 60 lines with the addition of the 3721 Expansion Unit. Additionally, up to 16 lines and up to two IBM Token-Ring Networks can be attached to the 3720 Models 11 and 12. With the 3721 Expansion Unit, up to 48 lines and up to two IBM Token-Ring Networks can be attached. The 3720 Models 1 and 11 can have a maximum of four host attachments using one or two channel adapters and up to two two-processor switches.

Similar to the 3725, the 3720 uses MOSS facilities that incorporate problem determination facilities. The MOSS hard disk stores an ACF/NCP load module and dump, allowing the 3720 to automatically reload itself after a failure, while preserving problem determination data.

SOFTWARE

OPERATING SYSTEMS: The 3090 Processor Complex is supported natively by the MVS/SP and VM/SP operating systems. Any program written for System/370, 370-XA, or ESA/370 modes can run on a 3090 using MVS/SP or VM/SP provided the program: 1) is not time dependent; 2) is not dependent on system facilities and peripherals that may be present or absent from a 3090 configuration; 3) does not depend on results or functions as defined in the System/370 Principles of Operation as being unpredictable, model dependent, or deviations; 4) does not depend (in 370-XA mode) on the contents of instruction parameter fields B and C on interception of the SIE; and 5) does not depend (in S/370 mode) on the presence of the 2-kilobyte page size or the presence of storage protection keys associated with 2-kilobyte blocks of storage.

MULTIPLE VIRTUAL STORAGE (MVS) is IBM's large-scale operating system, designed to handle multiprocessor configurations. MVS provides a virtual I/O (VIO) paging mechanism for temporary data sets and private virtual storage for up to 16 million bytes for individual Time Sharing Option users. Workload Management Routines monitor the use of processing resources and allocate

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► resources to jobs or time-sharing users. MVS also provides Resource-Use Routines, a set of algorithms that monitor the use of system resources and recommend scheduling changes to optimize the utilization of system resources. Deadline scheduling under Job Entry Subsystem (JES) 3 dynamically alters the scheduling priority of jobs in order to meet completion deadlines. Other MVS facilities include a network job processing capability that permits the transmission of program input and output between compatible JES3 installations and recovery capabilities for multiprocessing configurations, including alternate path retry, dynamic device reconfiguration, and manual switching of peripheral devices between central processors.

Communications support under MVS is provided by the Advanced Communication Function/Telecommunications Access Method (ACF/TCAM) and Advanced Communication Function/Virtual Telecommunications Access Method (ACF/VTAM).

Remote job entry under MVS is supported under the Job Entry Systems, JES2 and JES3. Facilities are included for multileaving transmission between the host computer and intelligent remote terminals.

MVS provides language translators for all of the System/370 programming languages: Assembler, RPG, Cobol, Fortran, PL/1, and Algol. Users of Assembler, Cobol, or Fortran are, in fact, offered a choice of two or more translators.

To improve certain performance characteristics of the MVS product, IBM introduced microcode-based enhancements such as MVS/System Extensions (MVS/SE). MVS/SE is made available through the System/370 Extended Facility feature, standard in all 308X and 3090 systems. Among its features, MVS/SE provides reduced processor time to execute certain frequently used control program functions, faster address translation by more efficient use of the translation lookaside buffer, improved system availability through storage protection, and improved system resource utilization.

MVS/System Product (MVS/SP), the next stage of MVS enhancements, is the current product targeted for use in the 308X and 3090 systems. Utilizing JES2 and JES3, MVS/SP is available in two versions and several releases, which are described below.

MVS/System Product Version 1: MVS/SP is a generic term referring to the various announced releases of MVS/SP-JES2 (5740-XY5) and MVS/SP-JES3 (5740-XYN).

MVS/SP-JES2/3 Version 1 Release 3.5 supports IBM 3090 Series processors in System/370 mode, simplifies global resource serialization processing, and provides stand-alone dump support for the 3480 Magnetic Tape Subsystem in full-function mode. This release does not support the expanded storage option available on 3090 processors.

MVS/SP-JES2 Version 1 Release 3.6 provides virtual storage constraint relief in the JES2 private area by using the 31-bit addressing and extended private virtual storage capabilities of MVS/XA. Release 3.6 also includes SPOOL restructuring and constraint removal, improved SPOOL off-load facility, and enhancements to the \$SCAN facility. Additionally, the release reduces planned outages through operator-modifiable initialization parameters and changes to JES2 initialization-definition statements.

MVS/System Product Version 2: MVS/SP Version 2 must be installed in conjunction with the Data Facility Product. The two programs are known collectively as MVS/Extended Architecture (MVS/XA) and are designed to support the System/370 Extended Architecture. The Data

Facility Product provides data management, device support, program library management, and utility functions. MVS/XA also requires Assembler H Version 2, a functional replacement for OS Assembler H Release 5, and SMP Release 4.

MVS/SP Version 2 includes all of the functions of Version 1 Release 3 plus a number of enhancements. Version 2 supports 31-bit real and virtual storage addressing. It also supports larger and more flexible I/O configurations. Some of the I/O processing previously performed by the operating system is now a hardware function. Channel path selection and I/O busy condition management provide up to four channel paths to each I/O device. The facility also increases I/O device accessibility by allowing each central processor to initiate operations with any of the I/O devices and to handle any I/O interruption conditions. Also included are improved RAS, including page protection for significant system areas; a new system trace facility; and improved dumping and formatting options.

MVS/SP-JES2 and JES3 Version 2 Release 2.0 and MVS/SP-JES3 Version 2 Release 2.1 are functionally equivalent at the basic control program level with previous releases of MVS/SP, but provide many usability and operational enhancements along with system constraint relief and some new functions. MVS/XA Data Facility Product Version 2 Release 3, described below, is a corequisite product. Major features of the new MVS release include I/O configuration definition; new PARMLIB parameters; data in virtual, virtual storage and system constraint relief; JES2/JES3 enhancements; TSO/E Release 3 support.

MVS/XA Data Facility Product Version 2 Release 1 supports IBM disk storage, tape, and printer devices, in addition to virtual storage constraint relief below the 16-megabyte line. Specifically, the release supports the IBM 3380 Extended Capability Models AD4/BD4 and AE4/BE4; the IBM 3430 Magnetic Tape Subsystem; and the IBM 4245, 4248, and 3262 Model 5 line printers. Also featured are Direct Access Device Space Management enhancements in allocation and partial release and increase available virtual storage below the 16-megabyte line.

MVS/XA DFP Version 2 Release 3 features an improved interactive storage management facility (ISMF) volume application and enhancements to the ISMF data set application. ISMF provides orderly and efficient use of storage management functions of MVS/XA DFP Version 2. The new ISMF volume application allows the storage administrator to analyze, manage, and report on DASD storage interactively. Other enhancements include improved device conversion performance, DASD space utilization and allocation, and backup and recovery. Release 3 also supports the IBM 3380 DASD enhanced subsystems models, the IBM 3990 Storage Controls, and the IBM 3380 Direct Attach Model.

MVS/System Product Version 3 supports ESA/370, IBM's newest mainframe operating environment. MVS/SP Version 3 expands addressing capabilities, simplifies operations, provides constraint relief, and improves MVS RAS characteristics. The fastest MVS version remains compatible with existing 24-bit and 31-bit addressing, user applications, and external interfaces. ESA/370 brings total virtual memory spaces to 16 trillion bytes, 8,000 times the previous MVS/XA limit of 2 gigabytes.

ESA introduces two new operating system concepts: data spaces, which accept only user data, and high-performance spaces (hiperspaces), which reside in expanded storage.

Data spaces are hardware controlled and can hold up to 2 gigabytes of data at a time. Separate address spaces can also contain up to 2 gigabytes of code and data. Within a ►

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► data space, all addresses are contiguous and available to the application, because virtual storage is not divided into a system and private area as it is in an address space. Data spaces can reside anywhere in processor storage or on auxiliary storage.

Hiperspaces, designed for reading or writing data in 4-kilobyte blocks, come in two varieties: the first type functions as an internal direct access storage device residing in expanded storage. It can only be accessed by authorized programs. This eliminates paging and contention associated with seeks to channel-attached devices. Data spaces, on the other hand, are subject to the usual storage contention and paging activity.

The second hiperspace type is available to all applications and can be referenced from high-level languages through new data windowing services. This hiperspace type can also be backed up by auxiliary devices. Data windowing services allow high-level language applications to access and scroll through large permanent data objects and large temporary data objects. This data is seen through virtual storage windows in an application program. A window is a user-defined area in the application that maps portions of the data object.

MVS/DFP Version 3 is installed with MVS/SP Version 3 to establish the ESA environment. MVS/DFP Version 3 allows users to take advantage of ESA/370's data space and hiperspace enhancements. DFP and related products make up the Data Facility Storage Management Subsystem (DFSMS). DFSMS improves storage management, simplifies device additions and migrations, and enhances hardware exploitation. Additionally, it provides centralized control over external storage resources and a common interactive interface for the use of storage management functions. Finally, it satisfies a user need to move from user-managed to system-managed storage.

VM is a system control program (SCP) that manages a computing system's resources (CPU, storage, and input/output devices) so that all are available to many users at the same time. Users have the functional equivalent of a real, dedicated computing system at their disposal. VM provides virtual machines with the ability to run multiple operating systems concurrently and with a conversational time-sharing system.

VM has four major elements: the control program (CP), which controls the resources of the real computer to provide multiple virtual machines; the Conversational Monitor System (CMS), a subsystem that gives users a range of conversational time-sharing facilities, including creation and management of files and compilation, testing, and execution of problem programs; the remote spooling communications system (RSCS), which permits users to transmit and receive files from remote stations; and the interactive problem control system (IPCS), which provides system diagnostics routines.

VM/SP High Performance Option Release 4.2 Support for Vector Facility contains all the functions of VM/SP HPO Releases 3.6 and 4. VM/SP HPO Release 4 supports the execution of vector applications while also supporting VS Fortran Version 2 on CMS, Assembler H, the Engineering and Scientific Subroutine Library, additional control program commands, and applications that use the Vector Facility. Such applications do not require special setups and programming.

VM/SP High Performance Option Release 5 is offered as an adjunct to VM/SP Release 5 and provides additional features. The product is designed to support large CMS-based interactive environments and facilitates the running of MVS/370 production systems under VM. The product

merges VM/SP Release 5 and VM/SP HPO Release 5 functions and supports up to 9,900 SPOOL files per user, exceeding the previous limitation of 9,900 SPOOL files per system.

In September 1987, IBM announced new functions in addition to these features. These include support for a national language support feature, improved system lock utilization, SPTAPE overflow toleration, and less-than-16-megabytes dynamic-paging-area load relief. National language support lets end users communicate with VM in selected languages.

VM Inter-System Facilities Release 1 now supports up to four processors in an environment using VM/SP HPO Release 4.2. This allows an increased number of users to participate in the same application environment, while the processing complex itself appears to function as one single, large system. The addition of up to four processors is a step towards relieving system growth constraints.

VM Inter-System Facilities Release 2 supports VM/SP HPO Release 5 and communicates with VM Inter-System Facilities Release 1 running with VM/HPO Release 4.2. Inter-System Release 2 can operate in mixed complex operations with Inter-System Release 1. Inter-System Release 2 provides a migration path for users also running Inter-System Release 1 and VM/SP HPO Release 4.2 who wish to upgrade to HPO Release 5.

The *VM/XA Systems Facility (SF)* supersedes the *VM/XA Migration Aid*, which was designed to ease the conversion from MVS/SP Version 1 to MVS/XA. The *VM/XA Systems Facility* incorporates all of the facilities of the *VM/XA Migration Aid Release 2*, including concurrent support for one MVS/SP Version 1, DOS/VSE, or OS/VS1 preferred virtual machine and one or more MVS/XA test machines with test and debugging facilities. In addition, the *VM/XA Systems Facility* supports the IBM 3090 processors and the Start Interpretive Execution (SIE) Assist feature. Additionally, it provides dedicated-only support of the 3090 expanded storage. Furthermore, dedicated support is provided for the 3880 Model 23 Storage Control, the 3380 Model AE4 and BE4 DASD units, the 3370 DASD, and the 3430 tape unit. The *VM/XA Systems Facility* exploits the full dyadic capabilities of the IBM 3090 Model 200E and 3090 Model 400E (in partitioned mode) by enabling V=R guest operating systems to simultaneously run on both instruction processors in full dyadic mode.

VM/XA Systems Facility Release 2 supports the Model 400E in four-way, single-image configuration; supports the Vector Facility; upgrades the CMS component to CMS 4; and extends CMS program product support. It also supports the 3800 Model 3 in Model 1 compatibility mode, provides load parameter support, and provides a dialed terminal test/normal reset capability. Serviceability enhancements include improvements to the control program trace and dump viewing facilities.

VM/XA Systems Facility Release 2 Additional Enhancements extends VM/XA support to the 3090 processor systems announced on January 26, 1987, including Models 300E and 600E. The product also provides support for IBM 3380 Models AE4 and BE4 and 3880 Models 11, 13, 21, and 23 Control Units; the IBM 5080 Graphics System; the IBM 3480 Magnetic Tape Subsystem; the IBM 3890 Document Processor; the IBM 3720 Communications Controller; and 3090 Expanded Storage. The product also supports a "Vary Channel Path" command, which lets operators make a channel path logically available or unavailable to one or more real devices.

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► VM/XA System Facility Release 2 enhancements include support for the IBM 3800 Models 3 and 6 using Advanced Function Printing software, IBM 3174 Subsystem Control Unit and various 3270 displays and display printers, and additional CMS license program support. Other enhancements include improvements to object code servicing, program update tapes on request, and partitionable Expanded Storage and Block Paging.

VM/XA Realtime Monitor/SP Release 2 complements the previous release of this product and provides additional support for 3090 processors announced on January 26, 1987. It also supports Vector Facility data gathering and provides additional user-friendly display command options in addition to changes made in VM/XA Systems Facility Release 2. The product only runs under VM/XA Systems Facility Release 2.

VM/XA System Product (SP) Release 1 supersedes all releases of VM/XA SF and provides a migration path for VM/XA SF users. Enhancements include an interactive environment capable of supporting large numbers of users. It also supports a bimodal CMS, which operates in either System/370 mode with 24-bit addressing or 370-XA mode with 24- or 31-bit addressing. Additionally, program interfaces have been defined to allow the development of applications that are portable between System/370 and 370-XA CMS virtual machines. The product is positioned as a growth path for VM/SP HPO users requiring larger processors running in single-image mode.

VM/XA SP Release 1 also lets users define up to four preferred guests to be executed concurrently on the same processor complex. Additionally, up to three Virtual = Fixed preferred guests can be defined, which will generally operate under the same considerations as Virtual = Real preferred guests. All guest operating systems that are supported by VM/XA as V=R preferred virtual machines are supported as V=F guests. The feature will be available by third-quarter 1988.

VM/XA SP Release 2, which will become available by first-quarter 1989, will let VM/XA SP users participate in SNA networks; it will also offer native support for SNA devices. VM/SP Release 2 no longer requires a guest such as VM/SP HPO or VCNA to handle SNA functions.

VM/SP Release 6 lets VM/CMS users develop applications using IBM System/370 Extended Architecture when the application is executed on the VM/XA System Product. Release 6 supports file sharing, bimodal CMS programming interfaces, enhanced connectivity, and Systems Application Architecture (SAA). Other features include saved segment management support, callable service library, base enhancements, and Department of Defense Security Statement of Direction.

VM/Interactive Productivity Facility (VM/IPF) Version 2 Release 3 is designed to simplify the user interface to the VM/SP system through the use of panels. This release includes support for VM/SP Release 6.

Advanced Interactive Executive/370 (AIX/370) is IBM's newest implementation of UNIX for the System/370 environment. AIX/370 is based on UNIX System V.2 and 4.3 Berkeley Software Distribution (BSD). AIX/370 runs as a guest operating system under VM (VM/SP, VM/SP HPO, and VM/XA SP). Communications support includes Transmission Control Protocol/Internet Protocol (TCP/IP) for IBM Token-Ring and Ethernet. Transparent Computing Facility provides distributed processing and file systems within a cluster of processors. AIX/370 functions include 24- and 31-bit addressing and 3090 Vector Facility

support. It will comply with Portable Operating System for Computer Environments (POSIX) after that standard is adopted.

PROGRAMMING LANGUAGES: Programming languages available with the 3090 Series include VS Cobol II; OS/VS Cobol compiler and library; Cobol Interactive Debug; VS Fortran Version 2 Compiler, Library, and Interactive Debug; Common LISP Application Environment for MVS; Common LISP Development Environment for MVS; VS Fortran Compiler and Library; Fortran Language Conversion Program; OS PL/1 Optimizing Compiler and Libraries; OS/VS PL/1 Checkout Compiler; IBM Basic; APL2; RPG II; Assembler H Version 2; and Pascal/VS.

DATA BASE MANAGEMENT: IBM's major data base management offerings are *Information Management System/VS-DB*, a hierarchical data base management system (DBMS), and *Database 2 (DB2)*, a relational DBMS. IMS/VS Version 2 Release 1, first announced in 1985, allows IMS to operate under both MVS/XA and MVS/370. In addition to all the functions of IMS/VS Version 1, Version 2 also supports the MVS/XA *Extended Recovery Facility (XRF)*, virtual storage constraint relief for Fast Path users, improved DL/1 I/O error processing, dynamic backout enhancements, DL/1 scheduling changes, data sharing improvements, and several other enhancements.

IMS/VS Version 2 Release 2, announced May 19, 1987, provides additional virtual storage constraint relief, availability, performance, and simpler user operation. IMS will also participate in IBM's SAA environment. For a description of SAA, please refer to the PROGRAM DEVELOPMENT section.

XRF, a major IMS addition, is an MVS/XA and SNA enhancement designed to increase the availability of IMS/VS Version 2 DB/DC transaction processing. XRF is now included in IMS/VS Version 2 and in MVS/SP Version 2 Release 1.3 with the Availability Enhancement. XRF uses additional hardware and software to create an alternate IMS/VS Version 2 subsystem; it also keeps the alternate subsystem synchronized with the active subsystem. Whenever service to end users is disrupted, the alternate IMS/VS subsystem takes over the work load of the active system, reducing the time that end users cannot access the system.

IMS lets users generate and access a data base with automatic cross-referencing among data records. IMS/VS offers on-line message processing with the optional Interactive Query Facility (IQF) or General Information System (GIS/VS) and batch inquiry with GIS or GIS/VS. Also provided is a data language (DL/1), whose function is to register user I/O coding with simpler commands to IMS.

The basic batch-oriented version of IMS (IMS/VS-DB) can be augmented with data communications capabilities to produce a transaction-driven system. This is achieved by combining IMS/VS-DB with either *IMS/VS Data Communication (IMS/VS-DC)* or *Customer Information Control System/VS (CICS/VS)*. The DB system is a prerequisite to IMS/VS-DC. The resulting full-scale IMS is known as the DB/DC system and can handle both batch and on-line operations concurrently. A DB/DC system supports a variety of physical terminals, each of which can have one or more logical or symbolic names. Individual security parameters can be associated with each terminal's logical name.

As an alternative to IMS/VS-DC, a DB/DC system can be put together using CICS. CICS generally provides similar functional capabilities with lower overhead in some environments. CICS was designed for relatively short program

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► modules of about 2 kilobytes to 6 kilobytes, while the IMS/VS-DC is better suited to 20-kilobyte or larger modules. (For more information about IMS and CICS software, please refer to Volume 3.)

Database 2 is IBM's relational data base product that runs under either MVS/XA or MVS/370. It's designed to coexist with or complement IMS/VS-DB. In addition to supporting IMS/VS, DB2 supports TSO and CICS/VS and uses a single high-level data access language, Structured Query Language (SQL), to program in either high-level language or interactive mode. To simplify DASD space allocation and VSAM data set definition, DB2 uses high-level interfaces to subsystems such as VSAM. DB2 also supports disk logging and optionally available dual logging for automated recovery and provides help facilities to assist all types of users. DB2 can be used to implement decision support systems and traditional applications. According to IBM, the product is particularly suited for environments in which application requirements and data structures are subject to frequent change.

DB2 Release 3, announced May 19, 1987, includes an SAA data base interface, SQL enhancements, and operational and performance enhancements. (Please refer to Page SW25-504MK-101 in Volume 3 for a full report on DB2.)

SQL/Data System (SQL/DS) is a full-scale relational data base management system with integrated query and report writing facilities; it is intended for use with DOS/VSE and VM/SP systems. SQL/DS includes the SQL and an on-line help facility. It is designed to address analytical environments, such as planning and prototyping, for which data structure and application requirements change frequently. Among its capabilities, SQL/DS provides blocking of data by application programs to improve performance in multiuser mode, offers an accounting facility for VM and VSE, and allows users to choose between two levels of read locking for their applications.

SQL/DS Version 2 Release 1 is the IBM relational data base management system for VM/SP with or without VM/SP HPO and VSE environments. SQL/DS Version 2 Release 1 includes the capabilities of SQL/DL Version 1 and provides additional productivity and usability enhancements for applications programmers and end users through the addition of new data types, enhanced programming language support, and other extensions to SQL. The release is a participant in SAA.

DATA MANAGEMENT: IBM systems employ several data management structures to organize, access, update, retrieve, catalog, store, and generally manage data resources in addition to application packages designed for specific functions and benefits. Data management access methods can use the queued access or basic access techniques. Basic access approaches permit access of all data organizations, while queued access applies only to sequential and indexed sequential data sets. Each access type uses several kinds of access methods that vary in function. *Virtual Storage Access Method (VSAM)* encompasses both access techniques. VSAM uses a modified basic and queued access technique and applies to direct and sequential data sets.

Data management tools and applications that can make use of these file structures include *DB/DC Data Dictionary* and *Query Management Facility (QMF)*.

DB/DC Data Dictionary provides a central source of information describing files, data bases, programs, and user-defined resources and how they all interrelate. The Data Dictionary can help enforce naming conventions and establish a central control point, particularly within organizations that permit remote locations to develop and run their

own data and programs. The application can be particularly beneficial to organizations planning to convert to a DL/1 data base system, according to IBM. The dictionary simplifies the entry of DL/1 data base definition and declaration for Cobol, PL/1, and Assembler language programs.

Query Management Facility (QMF) is an interactive data base facility designed for users with little or no processing experience. QMF operates with DB2 in MVS/XA and MVS/370 environments. In VM/370 environments, QMF works with data in SQL/DS. End-user functions handled by QMF include ad hoc query in SQL or QBE languages, report preparation, procedure definition and execution, data preparation for graphics presentations, and definitions of a data extract that can be invoked by Data Extract, a companion IBM program.

DATA COMMUNICATIONS: Communications support under MVS is provided by the Advanced Communications Function/Telecommunications Access Method (ACF/TCAM) and Advanced Communication Function/Virtual Telecommunications Access Method (ACF/VTAM). Other IBM cornerstone products within the communications area include CICS/OS/VS, the Transaction Processing Facility, Time Sharing Option (TSO), and NetView.

ACF/VTAM acts as an operating system for major IBM communications subsystems. It handles resource sharing and the logical handling of user requests. ACF/TCAM is a high-level access method that supports a variety of terminals and supports most applications under MVS/370 and MVS/XA.

The Customer Information Control System (CICS/OS/VS) is a general-purpose data communications monitor that operates in a single partition or region of an IBM 3090 system under MVS to control multiple on-line user terminals and applications. By consolidating the required communications interfaces and I/O and control functions, CICS isolates the user's applications programs from the communications environment and, to a considerable degree, from the operating system itself.

Written in Assembler language, CICS provides transaction processing support for data base management or file control programs written in Assembler, PL/1, or Cobol, thus allowing on-line applications to be developed without significantly greater difficulty than similar batch programs. In addition to supporting several external data base management structures (e.g., IMS/VS-DB's DL/1), CICS includes some native data management capabilities.

CICS/OS/VS also allows users to share network resources with other VTAM communications application programs. The system provides for more terminal I/O overlap by using VTAM's read-ahead capabilities and by providing a direct interface between the application program and the terminal control program. CICS/OS/VS Version 1 Release 6 allows command-level application programs assembled with Assembler H Version 2 to use 31-bit addressing. Up to 1-gigabyte virtual storage requests are supported.

CICS Version 1 Release 7, announced in 1985, was released in response to IBM users who requested several major enhancements. Key improvements center around the new Resource Definition On-line (RDO) facility and an automatic installation facility for VTAM terminals. RDO makes it possible to add additional devices while the system continues to run. It also eliminates the need to reassemble the terminal control table. Additionally, users can add a device without having to define it to CICS, if it has already been defined to VTAM. This feature reduces terminal definition, storage, and administration and programming requirements. Under Release 7, it is also possible to

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► define terminals and ship their definitions automatically to a CICS system, eliminating any need to define a device more than once.

Other Release 7 enhancements include improved VSAM and VTAM support, CICS monitoring enhancements, additional device support, improved task control, new command-level programming languages, and improved IMS/VS data base support. Other enhancements include intercommunications improvements, additional support for VS Cobol II and OS PL/1 Optimizing Compiler and Libraries, simpler installation and customization, and CICS library improvements. IBM announced in October 1987 that CICS will participate in SAA.

CICS/Virtual Machine (VM) provides transaction processing to the VM environment. CICS/VM supports a subset of the command-level Application Programming Interface (API) of CICS/VS and CICS/MVS products. The product also provides host connectivity, local and remote data, logging, backout and recovery, and system and application support.

NetView is a licensed network management program composed of a number of products now available as a single offering. NetView is a comprehensive network management product and is the basis for central control of both systems and network operations. It includes the functions of Network Communication Control Facility (NCCF), Network Logical Data Manager (NLDM), Network Problem Determination Application (NPDA), VTAM Node Control Application (VNCA), and Network Management Productivity Facility (NMPF). NetView components include a command facility, a session monitor, a hardware monitor, a status monitor, on-line help facility, help desk facility, and browse facility. Enhanced functions available under NetView include terminal access facility support of large screen and color applications; CLIST-driven applications messages; disk log enhancements; modem support; alerts; purge attached command; Token-Ring Network support; virtual route blockage indication; session setup failure notification; extended recovery facility in MVS/XA; automatic operations and recovery; realtime update of the domain status panel; and an important message indicator.

NetView Release 2 provides new automation capabilities that are applicable to both system and network automation. Additionally, it now supports peer-to-peer network (SNA Type 2.1) nodes and enhances IBM's commitment to open architecture by providing support for a new alert record and command service. NetView Release 2 also participates in SAA. (Please refer to Page SW20-504MK-301 in Volume 3 for a full report on NetView.)

Transaction Processing Facility (TPF) supports realtime transaction processing applications using a centralized data base. TPF performs work, main storage, program, and data management functions. TPF Version 2 Release 3 can be channel attached to an IBM 3725 Communication Controller running Network Control Program Version 4 Releases 1 and 2. TPF supports up to 64,000 resources via SNA extended network addressing. This addressing provides selection of the resources from a maximum of 255 subareas, each having 32,000 resources, up to a maximum of 64,000 resources in a TPF network. TPF Version 2 Release 4, based on System/370 Extended Architecture, replaces Release 3. Release 4 supports processors running in extended architecture modes. In addition, the release supports 3990 storage controllers, 3380 DASD, and tightly coupled extended architecture. The tightly coupled facility creates a multiprocessing environment within a multiprocessor system that runs with a single copy of TPF, permitting shared system data and resources. Extended Architecture/I/O

support extends current support from 16 physical channels to as many physical channels as are available on the user's IBM processors running XA.

Time Sharing Option (TSO), IBM's interactive facility, operates in large MVS/370 and MVS/XA environments. The facility allows each TSO user full access to MVS and a 16-megabyte address space through computer terminals. The facility supports a range of terminals that can be shared between TSO and other TCAM or VTAM applications. TSO is typically used by systems programmers who maintain system libraries, catalogs, and procedure libraries; application programmers working within batch, interactive, and DB/DC environments; program librarians who create, maintain, and control development support and production libraries; end users operating interactive programs; and Information Center users.

TSO Extensions (TSO/E) Release 4 extends the Enhanced Connectivity Facility and provides improved common applications services for the office and business professional environment. Additional enhancements include improved function in the CLIST language, improved debugging aids, the ability to print formatted datasets with TSO/E, and removal of some large processor growth constraints. TSO/E Release 4 is only available under MVS/XA.

PROGRAM DEVELOPMENT: To make it possible to write applications that are portable across designated hardware and software operating environments, IBM has introduced Systems Application Architecture (SAA). SAA is a framework for the development of consistent applications across these strategic IBM hardware platforms: IBM 370 systems, System/3X minicomputers, and Personal System/2 personal computers. After introducing SAA in March 1987, IBM began to designate which strategic software products will participate in SAA. It will take several years before most of the SAA components are in place and workable. SAA currently consists of four elements: a Common Programming Interface, Common Communications Support, Common User Access, and Common Applications. For a fuller explanation of SAA, please refer to "Connectivity: The IBM Way" (Page 70C-000DB-701) under the Computer System Overview tab.

In addition to SAA plans, IBM currently offers many tools to help programmers, end users, and various "knowledge workers" develop and maintain applications. IBM packages for the MVS/SP and MVS/XA environments include Application Prototype Environment (APE), the Screen Definition Facility/Customer Information Control System (SDF/CICS), Cross System Product Set (CSPS), Cross System Product/Application Development (CSP/AD), Cross System Product/Application Execution (CSP/AE), Interactive Instructional Authoring System (IIAS), Interactive System Productivity Facility (ISPF), Interactive System Productivity Facility/Program Development Facility (ISPF/PDF), IMS Application Development Facility II, Query Management Facility (QMF), Time Sharing Option (TSO), TSO Extensions (TSO/E), and Conversational Monitor System (CMS).

ISPF Version 2.1.2 for MVS is a common dialog manager for IBM-licensed programs and application development. Capabilities include support of an ISPF/GDDM environment, extensions to the table services, an interface to TSO/E Release 2, and support for the 3290 terminal. Version 2.1.2 uses 31-bit addressing mode and includes APL2 support.

ISPF/PDF Version 2.1.2 for MVS is used to create and maintain both source programs and text data. ISPF/PDF provides interfaces to many system facilities through user-friendly menus. Version 2.1.2 uses 31-bit addressing mode and supports the Kanji language. Both ISPF and ISPF/

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► PDF provide virtual storage constraint relief and allow growth of ISPF and ISPF/PDF by using the extended address space of MVS/XA.

Facilities available for VM/SP and VM/XA environments include APE, CSP/AD, CSP/AE, Cross System Product/Query (CSP/Q), IAS, Interactive Instructional Presentation System (IIPS), ISPF, ISPF/PDF, VM/Interactive Productivity Facility, and VM/IS-PF.

UTILITIES: Common IBM utilities include the IMS/VS Queue Loader, IMS/VS Message Requirer, Data Facility Sort (DFSORT), and DOS/VS Sort/Merge.

OTHER SOFTWARE: *Advanced Text Management System III (ATMS III)* allows users to enter, edit, and manage textual material. It runs under DOS/VSE and MVS/XA.

Storage and Information Retrieval System (Stairs) provides facilities for the storage and contextual retrieval of large amounts of text, as well as the creation of Stairs data bases from machine-readable formats. It runs under DOS/VSE and MVS/XA.

Distributed Office Support System/370 (DISOSS/370) is an office system support product that provides electronic mail and document processing facilities. It runs in MVS/VSE and DOS/VSE environments under the CICS/VS general-purpose data communications monitor. DISOSS/370 Version 3 Release 4 uses 31-bit addressing for MVS/XA environments, advanced function printing support, library maintenance enhancements, user exits, and the ability to specify a mailroom printer.

Professional Office System (PROFS) is a program product designed to help professionals and support personnel control job-related information. It provides facilities for document entry, processing, and distribution within a single system or across multiple systems; calendar management; and other end-user services, such as conference room scheduling and electronic messaging. PROFS runs in the VM/SP environment. The system interchanges both revisable-form and final-form documents with DISOSS users. PROFS notes can be sent to DISOSS users. Through the system's integrated interface to DisplayWrite/370 VM/SP, PROFS supports IBM's Document Content Architecture (DCA).

DisplayWrite/370 provides word processing functions for professional end users. It includes a full-screen text editor/formatter that provides basic and advanced text functions for creating and revising documents. Document printing is supported by creating print datastreams. The product provides multilanguage support for automatic hyphenation, spelling verification and correction assistance, and a grade-level analyzer and synonym support for English.

DisplayWrite/370 processes both revisable-form and final-form text documents, which can be exchanged between IBM office systems products and applications supporting the Document Content Architecture. DisplayWrite/370 operates under the control of MVS/SP (MVS/370 or MVS/XA) or VSE and CICS/VS, or as a VM/SP application. Either an IBM 3270 information display or an IBM 3270-PC display terminal can be used as an input device.

The Engineering and Scientific Subroutine Library (ESSL) Release 2 provides a set of mathematical subroutines using algorithms tailored to specific operational characteristics of the IBM 3090 with Vector Facility. According to IBM, performance gains are especially high for matrix multiplications, matrix-vector linear algebra subprograms, fast Fourier transforms, simultaneous linear algebraic equa-

tions, and symmetric eigensystems. Release 2 more than doubles the number of routines available with Release 1.

PRICING AND SUPPORT

POLICY: IBM 3090 machines are offered for purchase or rental. During the first six months following installation, 20 percent of the monthly rental charges can be applied as a credit towards the purchase of the machine (not to exceed 50 percent of the purchase price applicable at the time of purchase). The machines are covered under a one-year warranty.

SUPPORT: The IBM Agreement for Lease or Rental of IBM Machines defines four usage plans by which monthly charges are determined. IBM assigns each machine to one of these four plans.

IBM 3090 systems were covered under Plan D. On December 1, 1987, all Plan D machines were redesignated Plan B machines. Under Plan B, users are entitled to unlimited use of the machine, as was the case under Plan D. If the type of service is IBM On-Site Repair or IBM On-Site Exchange, the Period of Maintenance Service is 24 hours a day, 7 days a week. The IBM Maintenance Agreement provides at no additional charge 24-hour, 7-day coverage for machines for which Optional Periods of Maintenance Service (OPMS) were available. This change eliminates all OPMS charges for those machines and expands the Base Period of Maintenance Service from the current 11-hour period (7 a.m. to 6 p.m., Monday through Friday) to 24 hours per day, 7 days per week.

IBM hourly service is limited to normal business hours, Monday through Friday. Service outside normal hours will be available if machine failure is related to a federal, state, or local government emergency; if the failure is life or health threatening; or if proprietary IBM engineering information is required.

For users without a maintenance contract, the 3090 Series is maintained under per-call Class 3. Under this class, the per-call charge during regular hours is \$218 per hour and the per-call charge during off-hours is \$250 per hour.

Software support comes in several forms, which are described in the following paragraphs.

The price of the software depends on the model group to which a processor belongs. The defined groups (10, 15, 20, 30, 40, and 50) allow for a multitier processing structure for each applicable product. The 3090 Models 120E/120S are Processor Group 30 machines. The Models 150E/150S, 170S, 180E/180S, 200E/200S, 280E/280S, 300E/300S, and 400E/400S are Processor Group 40 machines. Models 500E/500S and 600E/600S are Processor Group 50 machines. Processor Group 50 machines pay the highest onetime fees for software. Users who upgrade to larger model groups will have to pay an upgrade charge for the software.

Users who have multiple systems controlled from a central site can pay the Basic License Fee for the central site and the Distributed Systems License Option (DSLO) fee for all other locations. Central Service, including the IBM Support Center, is provided through the customer location designated for the Basic License.

The centralized IBM Support Center provides 24-hour, 7-day customer access by telephone (an 800 number is provided). It utilizes the Software Support Facility data base, which incorporates every problem encountered and resolved (or unresolved) by the central support group. The

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customer is assisted in making out any APAR (program problem report) and gets advice on temporary fixes or bypasses.

The Support Center is the first level of support. If it cannot resolve a problem, the customer is put in touch with the Change Team Support Specialist, who is directly familiar with the section of coding relating to the problem being reported. If, after working with this individual, the problem still cannot be solved, the Program Support Representative (PSR) from the customer's local office will be dispatched to assist. Under the new support plan, many of the facilities that were previously provided by IBM support personnel at no charge have become billable activities.

EDUCATION: IBM "Professional Courses" are individually priced. System Features Instruction is offered to users of IBM data processing equipment at no charge. Customer Executive Seminars, Industry Seminars, and promotional sessions are still offered at no charge by IBM invitation.

TYPICAL CONFIGURATION: The following systems illustrate possible 3090 configurations. They include all the necessary control units and adapters, but do not include any specialized software.

SMALL CONFIGURATION:

3090 Model 150S Processor Complex; 32 megabytes of main memory, 16 integrated channels	\$1,250,000
One 3092 Processor Controller Model 1	200,000
One 3097-1 Power and Coolant Distribution Unit	121,000
One 3089 Model 3 Power Unit	38,000
Two 3370 Model A2 Direct Access Storage Devices (DASDs)	70,960
Two 3206 Model 100 Display Stations	5,390
Automatic Calling Unit for 3864-2 Modem	1,090
Ninety 3278 Model 2 Display Units	141,480
Three 3174-1L Cluster Controllers	38,850
Two 3880 Model 3 Disk Controllers	102,000
Four 3380-AE4 DASDs (5.04GB capacity per unit)	452,000
Twelve 3380-BE4 DASD Slave Units (5.04GB capacity per unit)	1,080,000
One 3480 A22 Tape Cartridge Control Units	65,430
Four B22 Cartridge Tape Units	172,480
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer (20,040 lpm)	289,000
TOTAL PURCHASE PRICE:	\$4,252,680

MEDIUM CONFIGURATION:

3090 Model 200S Processor Complex; 64 megabytes of main memory, 32 integrated channels	\$4,500,000
64 megabytes of additional central memory	540,000
384 megabytes of additional central memory (512 megabytes of central memory total)	3,240,000

128 megabytes of Expanded Storage	595,000
One 3092 Model 1 Processor Controller	200,000
One 3097-1 Power and Coolant Distribution Unit	121,000
Two 3089 Model 3 Power Units	76,000
Two 3370 Model A2 DASDs	70,960
Two 3206 Model 100 Display Stations	5,390
Automatic Calling Unit for 3864-2 Modem	1,090
Ninety 3278 Model 2 Display Units	141,480
Three 3174-1L Cluster Controllers	38,850
Two 3880 Model 3 Disk Controllers	102,000
Four 3380-AE4 DASDs (5.04GB capacity per unit)	452,000
Twelve 3380-BE4 DASD Slave Units (5.04GB capacity per unit)	1,080,000
Two 3422 Model A01 control units (unit contains one Tape Drive; 125 ips)	80,960
Fourteen 3422 Model B01 Tape Units (125 ips)	275,660
One 3005 Two-Channel Switch (2 by 16)	3,575
Two 3480 A22 Tape Cartridge Control Units	130,860
Eight B22 Cartridge Tape Units	344,960
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer; (20,040 lpm)	289,000
TOTAL PURCHASE PRICE:	\$12,513,785

LARGE CONFIGURATION:

3090 Model 600S Processor Complex; 128 megabytes shared central storage, 64 integrated channels	\$11,754,000
64 megabytes of additional central storage; A side	540,000
64 megabytes of additional central storage; B side	540,000
128 megabytes of additional central memory; A side	1,080,000
128 megabytes of additional central memory; B side (512 megabytes of central memory total)	1,080,000
512 megabytes of Expanded Storage; A side	1,945,000
512 megabytes of Expanded Storage; B side (1 gigabyte of Expanded Storage total)	1,945,000
First additional channel group; 8 channels, A side	130,000
Second additional channel group; 8 channels, A side	130,000
Third additional channel group; 16 channels, A side	260,000
First additional channel group; 8 channels, B side	130,000
Second additional channel group; 8 channels, B side	130,000
Third additional channel group; 16 channels, B side	260,000

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▶ One 3092 Processor Controller Model 2	235,000	Two 3422 Model A01 Control Units (unit contains one tape drive; 125 ips)	80,960
Two 3097-1 Power and Coolant Distribution Units	242,000	Fourteen 3422 Model B01 Tape Units (125 ips)	275,660
Four 3089 Model 3 Power Units	152,000	One 3005 Two-Channel Switch (2 by 16)	3,575
Two 3370 Model A2 DASDs	70,960	Two 3480 A22 Tape Cartridge Control Units	130,860
Three 3206 Model 100 Display Stations	8,085	Eight B22 Cartridge Tape Units	344,960
Two Automatic Calling Units for 3864-2 Modem	2,180	Three 4248 Model 2 printers (4,000 lpm)	225,000
Ninety 3278 Model 2 Display Units	141,480	One 3800 Model 3 laser printer (20,040 lpm)	289,000
Three 3174-1L Cluster Controllers	38,850	TOTAL PURCHASE PRICE:	\$24,615,570
Three 3880 Model 3 Disk Controllers	153,000		
Six 3380-AE4 DASDs (5.04GB capacity per unit)	678,000		
Eighteen 3380-BE4 DASD Slave Units (5.04GB capacity per unit)	1,620,000		

EQUIPMENT PRICES

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
PROCESSORS & FEATURES				
3090 S Models				
Model 120S	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-3, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3206 System Consoles, and 3864-2 Automatic Calling Unit	715,000	1,680	NA
Model 150S	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3206-100 System Consoles, and 3864-2 Automatic Calling Unit	1,250,000	2,520	NA
Model 170S	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3206-100 Display Consoles, and 3864-2 Modem	1,700,000	3,100	NA
Model 180S	Processor Complex consists of CPU, 32MB of central storage, 128KB of buffer memory, and 16 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3206-100 System Consoles, and 3864-2 Automatic Calling Unit	2,450,000	3,465	NA
Model 200S	Processor Complex consists of two CPUs, 64MB of main memory, 128KB buffer per CPU, and 32 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, two 3089-3 Power Units, two 3206-100 System Consoles, and 3864-2 Automatic Call Unit	4,500,000	6,895	NA
Model 280S	Processor Complex; consists of two CPUs, 64MB of main memory, 128KB buffer per CPU, and 32 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, two 3089-3 Power Units, two 3206-100 System Consoles, and 3864-2 Automatic Call Unit	4,844,000	7,360	NA
Model 300S	Processor Complex consists of three CPUs, 128KB buffer per CPU, 64MB of main memory, and 32 integrated channels; requires 3092 Model 1 Processor Controller, 3097 Model 1 or 2 Power/Coolant Distribution Unit, two 3089 Model 3 Power Units, two 3206 Model 100 System Consoles, and 3864-2 Modem	6,255,000	10,225	NA
Model 400S	Processor Complex consists of four CPUs, 128MB of main memory, 128KB buffer per CPU, and 64 integrated channels; requires 3092-2 Processor Controller, two 3097-1 or -2 Power/Coolant Dist. Units, four 3089-3 Power Units, three 3206-100 System Consoles, and two 3864-2 Automatic Call Units	8,944,000	14,465	NA

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

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3090 S Models (Continued)

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
Model 500S	Processor Complex consists of five CPUs, 128MB of main memory, 128KB buffer per CPU, and 64 integrated channels; requires 3092-2 Processor Controller, two 3097-1 or -2 Power/Coolant Dist. Units, four 3089-3 Power Units, three 3206-100 System Consoles, and two 3864-2 Automatic Call Units	10,349,000	17,000	NA
Model 600S	Processor Complex consists of six CPUs, 128KB buffer per CPU, 128MB of main memory, and 64 integrated channels; requires 3092 Model 2 Processor Controller, two 3097 Model 1 or 2 Power/Coolant Distribution Units, four 3089 Model 3 Power Units, three 3206-100 System Consoles, and two 3864-2s	11,754,000	20,490	NA

3090 E Models

Model 120E	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-3, 3097-1 or -2 Power/ Coolant Distribution Unit, 3089-3 Power Unit, two 3180 System Consoles, and 3864-2 Automatic Calling Unit	715,000	1,680	63,750
Model 150E	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3180-145 System Consoles, and 3864-2 Automatic Calling Unit	1,250,000	2,520	115,900
Model 180E	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3180-145 System Consoles, and 3864-2 Automatic Calling Unit	2,200,000	3,010	196,150
Model 200E	Processor Complex consists of two CPUs, 64MB of main memory, 64KB buffer per CPU, and 32 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, two 3089-3 Power Units, two 3180-145 System Consoles, and 3864-2 Automatic Call Unit	4,100,000	6,195	442,950
Model 280E	Processor Complex consists of two CPUs, 64MB of central storage, and 32 integrated channels	4,344,000	6,480	387,340
Model 300E	Processor Complex consists of three CPUs, 64KB buffer per CPU, 64MB of main memory, and 32 integrated channels; requires 3092 Model 1 Processor Controller, 3097 Model 1 or 2 Power/Coolant Distribution Unit, two 3089 3 Power Units, two 3180 Model 145 System Consoles, and 3864-2 Modem	5,600,000	8,975	512,700
Model 400E	Processor Complex consists of four CPUs, 128MB of main memory, 64KB buffer per CPU, and 64 integrated channels; requires 3092-2 Processor Controller, two 3097-1 or -2 Power/Coolant Dist. Units, four 3089-3 Power Units, three 3180-145 System Consoles, and two 3864-2 Automatic Call Units	7,819,000	12,505	841,950
Model 500E	Processor Complex consists of five CPUs, 128MB of central storage, and 64 integrated channels	9,049,000	14,725	806,870
Model 600E	Processor Complex consists of six CPUs, 64KB buffer per CPU, 128MB of main memory, and 64 integrated channels; requires 3092 Model 2 Processor Controller, two 3097 Model 1 or 2 Power/Coolant Distribution Units, four 3089 Model 3 Power Units, three 3180 Model 145 System Consoles, and two 3864-2s	10,344,000	17,745	975,800

Required 3090 Hardware

3092-1	Processor Controller; required for 150E, 150S, 170S, 180E, 180S, 200E, 200S, 300E, and 300S	200,000	1,180	19,260
3092-2	Processor Controller; required for 280E, 280S, 400E, 400S, 500E, 500S, 600E, and 600S	235,000	1,355	22,610
3092-3	Processor Controller; required for Models 120E and 120S	120,000	682	10,700
—	Upgrade from 3092 Model 1 to 3092 Model 2	35,000	—	—
—	Upgrade from 3092 Model 3 to 3092 Model 1	80,000	—	—
3097-1	Power and Coolant Distribution Unit	121,000	231	11,640
3097-2	Power and Coolant Distribution Unit; has same distribution capabilities as 3097 Model 1, but does not have I/O power sequence control function	111,000	210	9,895
—	Upgrade from 3097 Model 2 to 3097 Model 1	10,000	—	—
4650	I/O Power Sequence Control	8,000	52	770
3089-3	Power Unit	38,000	96	3,650

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

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		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
Expansion Frames				
7330	Expansion Frame for Models 120E, 120S, 150E, 150S, 170S, 180E, and 180S; requires 155	45,000	52	4,330
7330	Expansion Frame for Models 200E and 200S; requires 3854 or 1545	45,000	52	4,330
7330	Expansion Frame for Models 280E and 280S on A side; requires 1545	45,000	52	4,330
7331	Expansion Frame for Models 280E and 280S on B side; requires 1546	45,000	52	4,050
7330	Expansion Frame for Model 400E on A side; requires 3854 or 1545	45,000	50	4,330
7331	Expansion Frame for Model 400E on B side; requires 3856 or 1546	45,000	50	4,050
7330	Expansion Frame for Models 500E and 500S on A side; requires 7330	45,000	52	4,330
7331	Expansion Frame for Models 500E and 500S on B side; requires 1546 or 3856	45,000	52	4,330
7330	Expansion Frame for Models 600E and 600S on A side; requires 7330	45,000	52	4,330
7331	Expansion Frame for Models 600E and 600S on B side; requires 7331	45,000	52	4,330
Channel Groups: Models 120E and 150E				
3848	Eight additional channels	130,000	145	11,580
Channel Groups: Models 120S, 150S, 170S, 180E, and 180S				
3848	Eight additional channels	130,000	152	11,580
3849	Second additional channel group; 8 channels	130,000	152	10,830
Channel Groups: Models 200E and 200S				
3850	First additional channel group; 8 channels	130,000	152	12,500
3851	Second additional channel group; 8 channels	130,000	152	11,690
3854	Third additional channel group; 16 channels; requires 7330	260,000	304	23,010
Channel Groups: Models 280E and 280S				
	—A side:			
3848	First additional channel group; 8 channels	130,000	152	11,580
3849	Second additional channel group; 8 channels	130,000	152	10,830
	—B side:			
3858	First additional channel group; 8 channels	130,000	152	11,580
3859	Second additional channel group; 8 channels	130,000	152	11,580
Channel Groups: Models 300E and 300S				
3850	First additional channel group; 8 channels	130,000	152	11,690
3851	Second additional channel group; 8 channels	130,000	152	11,690
3854	Third additional channel group; 16 channels	260,000	304	23,380
Channel Groups: Models 400E and 400S				
	—A side:			
3850	First additional channel group	130,000	152	12,500
3851	Second additional channel group	130,000	152	12,500
3854	Third additional channel group; requires 7330	260,000	304	25,010
	—B side:			
3852	First additional channel group	130,000	152	12,500
3853	Second additional channel group	130,000	152	11,690
3856	Third additional channel group; requires 7331	260,000	304	25,010
Channel Groups: Models 500E and 500S				
	—A side:			
3850	First additional channel group; 8 channels	130,000	152	12,500
3851	Second additional channel group; 8 channels	130,000	152	12,500
3854	Third additional channel group; 16 channels	260,000	304	25,010
	—B side:			
3852	First additional channel group; 8 channels	130,000	152	12,500
3853	Second additional channel group; 8 channels	130,000	152	12,500
3856	Third additional channel group; 16 channels; requires 7331	260,000	304	25,010

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series



Channel Groups: Models 600E and 600S		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
—A side:				
3850	First additional channel group	130,000	152	12,500
3851	Second additional channel group	130,000	152	11,690
3854	Third additional channel group	260,000	304	23,380
—B side:				
3852	First additional channel group	130,000	152	12,500
3853	Second additional channel group	130,000	152	12,500
3856	Third additional channel group	260,000	304	25,010

Additional Central Storage

Models 120E, 120S, 150E, 150S, 170S, 180E, 180S				
4064	Additional 32 megabytes Model 200E	270,000	262	24,070
4128	Additional 64 megabytes Model 200S	540,000	525	48,150
4128	Additional 64 megabytes	540,000	500	48,150
4256	Additional 128 megabytes	1,080,000	1,050	NA
4257	Additional 192 megabytes Model 280E	1,620,000	1,575	NA
4064	Additional 32 megabytes for A side	270,000	250	24,070
4264	Additional 32 megabytes for B side Model 280S	270,000	250	24,070
4064	Additional 32 megabytes for A side	270,000	262	24,070
4128	Additional 64 megabytes for A side	540,000	525	48,150
4129	Additional 96 megabytes for A side	810,000	787	NA
4264	Additional 32 megabytes for B side	270,000	262	24,070
4228	Additional 64 megabytes for B side	540,000	525	48,150
4229	Additional 96 megabytes for B side Model 300E	810,000	787	NA
4128	Additional 64 megabytes Model 300S	540,000	525	48,150
4128	Additional 64 megabytes	540,000	500	48,150
4256	Additional 128 megabytes	1,080,000	1,050	NA
4257	Additional 192 megabytes Model 400E	1,620,000	1,575	NA
4128	Additional 64 megabytes for A side	540,000	525	48,150
4228	Additional 64 megabytes for B side Model 400S	540,000	525	48,150
4128	Additional 64 megabytes for A side	540,000	500	48,150
4256	Additional 128 megabytes for A side	1,080,000	1,050	NA
4257	Additional 192 megabytes for A side	1,620,000	1,575	NA
4228	Additional 64 megabytes for B side	540,000	525	48,150
4356	Additional 128 megabytes for B side	1,080,000	1,050	—
4357	Additional 192 megabytes for B side Model 500E	1,620,000	1,575	NA
4128	Additional 64 megabytes for A side	540,000	525	48,150
4228	Additional 64 megabytes for B side Models 500S	540,000	525	48,150
4128	Additional 64 megabytes for A side	540,000	500	48,150
4256	Additional 128 megabytes for A side	1,080,000	1,050	NA
4257	Additional 192 megabytes for A side	1,620,000	1,575	NA
4228	Additional 64 megabytes for B side	540,000	525	48,150
4356	Additional 128 megabytes for B side	1,080,000	1,050	NA
4357	Additional 192 megabytes for B side Model 600E	1,620,000	1,575	NA
4128	Additional 64 megabytes for A side	540,000	525	48,150
4228	Additional 64 megabytes for B side Model 600S	540,000	525	48,150
4128	Additional 64 megabytes for A side	540,000	525	48,150
4256	Additional 128 megabytes for A side	1,080,000	1,050	NA
4257	Additional 192 megabytes for A side	1,620,000	1,575	NA
4228	Additional 64 megabytes for B side	540,000	525	48,150
4356	Additional 128 megabytes for B side	1,080,000	1,050	NA
4357	Additional 192 megabytes for B side	1,620,000	1,575	NA

Expanded Storage: Models 120E and 150E

5064	First 64 megabytes	405,000	500	45,730
5128	First 128 megabytes	695,000	900	79,920
6128	Expansion from 64 megabytes to 128 megabytes; requires 5064	290,000	400	34,170

NA—Not applicable.
NC—No charge.
*Includes equipment maintenance.
**Four-year lease.



IBM 3090 Series



	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	
Expanded Storage: Models 120S, 150S, 170S, 180E, and 180S				
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
6128	Expansion from 64 megabytes to 128 megabytes; requires 5064	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes; requires 5064	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes; requires 5064	675,000	1,260	94,950
6193	Expansion from 128 megabytes to 192 megabytes; requires 5128 or 6128	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes; requires 5128 or 6128	450,000	840	63,300
6258	Expansion from 192 megabytes to 256 megabytes; requires 5192, 6192, or 6193	225,000	420	31,650

Expanded Storage: Model 200E

5024	1 gigabyte	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6028	Expansion from 512 megabytes to 1 gigabyte	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700

Expanded Storage: Models 200S and 300S

5024	1 gigabyte	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6024	Expansion from 64 megabytes to 1 gigabyte	3,375,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	3,150,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,925,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,700,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700

Expanded Storage: Model 280E

—A side:				
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
—B side:				
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.



IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
Expanded Storage: Model 280E (Continued)				
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
Expanded Storage: Model 300E				
5024	1024 megabytes	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
Expanded Storage: Model 400E				
—A side:				
5024	1 gigabyte	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
—B side:				
7024	1 gigabyte	3,745,000	6,825	558,650
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
7512	First 512 megabytes	1,945,000	3,465	285,100
8028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
8512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
8514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
8515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
Expanded Storage: Model 400S				
—A side:				
5024	1 gigabyte	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6024	Expansion from 64 megabytes to 1 gigabyte	3,375,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	3,150,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,925,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,700,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
—B side:				
7024	1 gigabyte	3,745,000	6,825	558,650
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
7512	First 512 megabytes	1,945,000	3,465	285,100
8028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	NA
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	NA
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	NA
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	NA
8256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	94,950
8512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
8514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
8515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
Expanded Storage: Model 500E				
—A side:				
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
5024	1 gigabyte	3,745,000	6,825	522,140
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
6028	Expansion from 512 megabytes to 1 gigabyte	1,800,000	3,360	273,400
—B side:				
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
7512	First 512 megabytes	1,945,000	3,465	285,100

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

Expanded Storage: Model 500E (Continued)

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
7024	1 gigabyte	3,745,000	6,825	558,650
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
8512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
8514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
8515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
8028	Expansion from 512 megabytes to 1 gigabyte	1,800,000	3,360	273,400

Expanded Storage: Model 500S

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
—A side:				
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
5024	1 gigabyte	3,745,000	6,825	522,140
6024	Expansion from 64 megabytes to 1 gigabyte	3,375,000	6,300	—
6025	Expansion from 128 megabytes to 1 gigabyte	3,150,000	5,880	—
6026	Expansion from 192 megabytes to 1 gigabyte	2,925,000	5,460	—
6027	Expansion from 256 megabytes to 1 gigabyte	2,700,000	5,040	—
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
6028	Expansion from 512 megabytes to 1 gigabytes	1,800,000	3,360	273,400
—B side:				
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
7512	First 512 megabytes	1,945,000	3,465	285,100
7024	1 gigabyte	3,745,000	6,825	558,650
8024	Expansion from 64 megabytes to 1 gigabyte	3,375,000	6,300	—
8025	Expansion from 128 megabytes to 1 gigabyte	3,150,000	5,880	—
8026	Expansion from 192 megabytes to 1 gigabyte	2,925,000	5,460	—
8027	Expansion from 256 megabytes to 1 gigabyte	2,700,000	5,040	—
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
8512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
8514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
8515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
8028	Expansion from 512 megabytes to 1 gigabyte	1,800,000	3,360	273,400

Expanded Storage: Model 600E

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
—A side:				
5024	1 gigabyte	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170

NA—Not applicable.
 NC—No charge.
 *Includes equipment maintenance.
 **Four-year lease.

IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
Expanded Storage: Model 600E (Continued)				
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
—B side:				
7024	1 gigabyte	3,745,000	6,825	558,650
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
7512	First 512 megabytes	1,945,000	3,465	285,100
8028	Expansion from 512 megabytes to 1 gigabyte	1,800,000	3,360	273,400
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
8512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,000
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	191,640
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
8514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
8515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
Expanded Storage: Model 600S				
—A side:				
5024	1 gigabyte	3,745,000	6,825	558,650
5064	First 64 megabytes	370,000	525	45,730
5128	First 128 megabytes	595,000	945	79,920
5192	First 192 megabytes	820,000	1,365	105,650
5256	First 256 megabytes	1,045,000	1,785	137,300
5512	First 512 megabytes	1,945,000	3,465	285,100
6024	Expansion from 64 megabytes to 1 gigabyte	3,375,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	3,150,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,925,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,700,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,800,000	3,360	273,400
6128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
6192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
6256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
6512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,200
6193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
6257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,300
6513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	205,050
6258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
6514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
6515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700
—B side:				
7024	1 gigabyte	3,745,000	6,825	558,650
7064	First 64 megabytes	370,000	525	45,730
7128	First 128 megabytes	595,000	945	79,920
7192	First 192 megabytes	820,000	1,365	105,650
7256	First 256 megabytes	1,045,000	1,785	137,300
7512	First 512 megabytes	1,945,000	3,465	285,100
8024	Expansion from 64 megabytes to 1 gigabyte	3,375,000	6,300	NA
8025	Expansion from 128 megabytes to 1 gigabyte	3,150,000	5,880	NA
8026	Expansion from 192 megabytes to 1 gigabyte	2,925,000	5,460	NA
8027	Expansion from 256 megabytes to 1 gigabyte	2,700,000	5,040	NA
8028	Expansion from 512 megabytes to 1 gigabyte	1,800,000	3,360	273,400
8128	Expansion from 64 megabytes to 128 megabytes	225,000	420	34,170
8192	Expansion from 64 megabytes to 192 megabytes	450,000	840	63,300
8256	Expansion from 64 megabytes to 256 megabytes	675,000	1,260	94,950
8512	Expansion from 64 megabytes to 512 megabytes	1,575,000	2,940	239,000
8193	Expansion from 128 megabytes to 192 megabytes	225,000	420	31,650
8257	Expansion from 128 megabytes to 256 megabytes	450,000	840	63,320
8513	Expansion from 128 megabytes to 512 megabytes	1,350,000	2,520	191,640
8258	Expansion from 192 megabytes to 256 megabytes	225,000	420	31,650
8514	Expansion from 192 megabytes to 512 megabytes	1,125,000	2,100	170,850
8515	Expansion from 256 megabytes to 512 megabytes	900,000	1,680	136,700

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)
VECTOR FACILITY				
1545	—For Models 120E, 120S, 150E, 150S, 170S, 180E, and 180S Vector Facility; requires 7330	325,000	315	31,280
1545	—For Models 200E and 200S First Vector Facility; requires 7330	325,000	315	31,280
1550	Second Vector Facility	230,000	183	22,140
1545	—For Models 280E and 280S Vector Facility for A side; requires 7330	325,000	315	31,280
1546	Vector Facility for B side; requires 7331 —For Models 300E and 300S	325,000	315	31,280
1545	First Vector Facility	325,000	345	31,280
1550	Second Vector Facility	230,000	183	22,140
1555	Third Vector Facility	230,000	183	22,140
1545	—For Models 400E and 400S First Vector Facility for A side; requires 7330	325,000	315	31,280
1550	Second Vector Facility for A side	230,000	183	22,140
1546	First Vector Facility for B side; requires 7331	325,000	315	31,280
1551	Second Vector Facility for B side —For Models 500E and 500S	230,000	183	22,140
1545	First Vector Facility for A side	325,000	315	31,280
1550	Second Vector Facility for A side	230,000	183	22,140
1555	Third Vector Facility for A side	230,000	183	22,140
1546	First Vector Facility for B side; requires 7331	325,000	315	31,280
1551	Second Vector Facility for B side —For Models 600E and 600S	230,000	183	22,140
1545	First Vector Facility for A side	325,000	315	31,280
1550	Second Vector Facility for A side	230,000	183	22,140
1555	Third Vector Facility for A side	230,000	183	22,140
1546	First Vector Facility for B side	325,000	315	31,280
1551	Second Vector Facility for B side	230,000	183	22,140
1556	Third Vector Facility for B side	230,000	183	22,140

Processor Resource/Systems Manager

—For 3090 E and S Models				
6851	CP-1 for A side; required for all 3090 E and S models	60,000	178	5,350
6852	CP-2 for A side; required for Models 200E, 300E, 400E, 500E, and 600E	20,000	55	1,785
6853	CP-0 for A side; required for Models 300E, 500E, and 600E	20,000	55	1,785
7851	CP-3 for B side; required for Models 280E, 280S, 400E, 400S, 500E, 500S, 600E, and 600S	60,000	178	5,350
7852	CP-4 for B side; required for Models 400E, 500E, and 600E	20,000	55	1,785
7853	CP-5 for B side; required for Model 600E	20,000	55	1,785
—For Model 280E				
6851	CP-1 for A side	60,000	178	5,350
7851	CP-3 for B side	60,000	178	5,350
—For Model 500E; requires 6851, 6852, 7851, and 7852				
6851	CP-1 for A side	60,000	170	5,350
6852	CP-2 for A side	20,000	55	1,785
6853	CP-0 for A side	20,000	55	1,785
7851	CP-3 for B side	60,000	170	5,350
7852	CP-4 for B side	20,000	55	1,785

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

SYSTEM UPGRADES

	Purchase Price (\$)
3090 Model 120E to Model 150E	535,000
3090 Model 150 to Model 180E	950,000
3090 Model 150E to Model 180E	950,000
3090 Model 180 to Model 200E; requires 3848, 3849, and 4064 on Model 180, and the Model 200E requires two 3089s or equivalent 400-Hz power source	1,370,000

IBM 3090 Series

SYSTEM UPGRADES (Continued)

	Purchase Price (\$)
3090 Model 180 to Model 280E; requires upgrade of installed 3092 Processor Controller and additional 3097 Power and Coolant Distribution Unit; Model 280E requires two, three, or four 3089 Power Units, depending on configuration	2,344,000
3090 Model 180E to Model 200E; requires 3848, 3849, and 4064 on the Model 180E, and the Model 200E requires two 3089s or equivalent 400-Hz power	1,370,000
3090 Model 180E to Model 280E; requires upgrade of installed 3092 and additional 3097; Model 280E requires two, three, or four 3089s, depending on configuration	2,144,000
3090 Model 200 to 300E; requires 7330 on Model 200	1,605,000
3090 Model 200E to 300E; requires 7330 on Model 200E	1,455,000
3090 Model 200 to Model 400E; upgrade to Model 400E and 600E requires that the B side maintain symmetry for central storage, expanded storage, and channels	3,719,000
3090 Model 200E to Model 400E; upgrade to Model 400E and 600E requires that the B side maintain symmetry for central storage, expanded storage, and channels	3,719,000
3090 Model 280E to Model 400E; upgrade requires 3848, 3849, 3858, 3859, 4064, and 4264 as pre-requisites; the Model 400E requires four 3089 Model 3s	2,415,000
3090 Model 300E to Model 400E; requires 3090 upgrade, additional 3097, and four 3089s	2,264,000
3090 Model 300E to Model 500E; requires 3092 upgrade, additional 3097, and four 3089 Model 3s	3,494,000
3090 Model 300E to Model 600E; upgrade to Model 400E and 600E requires that the B side maintain symmetry for central storage, expanded storage, and channels	4,744,000
3090 Model 400E to Model 500E; requires 7330	1,230,000
3090 Model 400 to Model 600E; upgrade to Model 400E and 600E requires that the B side maintain symmetry for central storage, expanded storage, and channels; also requires 7330 and 7331 on the Model 400	2,560,000
3090 Model 400E to Model 600E; upgrade to Model 400E and 600E requires that the B side maintain symmetry for central storage, expanded storage, and channels; also requires 7330 and 7331 on Model 400E	2,435,000
3090 Model 500E to Model 600E; requires 7331	1,205,000
3090 Model 120E to Model 150S	535,000
3090 Model 150E to Model 170S	650,000
3090 Model 150E to Model 180S	1,400,000
3090 Model 180E to Model 180S	1,000,000
3090 Model 180E to Model 200S; requires 3848, 3849, and 4064	2,070,000
3090 Model 180E to Model 280S	2,944,000
3090 Model 200E to Model 200S	1,400,000
3090 Model 200E to Model 300S; requires 7330	2,555,000
3090 Model 200E to Model 400S	5,144,000
3090 Model 280E to Model 280S	1,700,000
3090 Model 280E to Model 400S; requires 3848, 3858, 3849, 3859, 4064, and 4264	4,140,000
3090 Model 300E to Model 300S	1,900,000
3090 Model 300E to Model 400S	4,589,000
3090 Model 300E to Model 500S	5,194,000
3090 Model 300E to Model 600S; requires 7331	6,499,000
3090 Model 400E to Model 400S	2,500,000
3090 Model 400E to Model 500S; requires 7330	3,330,000
3090 Model 400E to Model 600S; requires 7330 and 7331	4,535,000
3090 Model 500E to Model 500S	3,000,000
3090 Model 500E to Model 600S; requires 7331	3,605,000
3090 Model 600E to Model 600S	2,700,000
3090 Model 120S to Model 150S	535,000
3090 Model 150S to Model 170S	450,000
3090 Model 170S to Model 180S	750,000
3090 Model 180S to Model 200S; requires 3848, 3849, and 4064	1,520,000
3090 Model 180S to Model 280S	2,394,000
3090 Model 200S to Model 300S; requires 7330	1,755,000
3090 Model 200S to Model 400S	4,444,000
3090 Model 280S to Model 400S; requires 3848, 3858, 3849, 3859, 4064, and 4264	3,040,000
3090 Model 300S to Model 400S	2,689,000
3090 Model 300S to Model 500S	4,094,000
3090 Model 300S to Model 600S; requires 7331	5,499,000
3090 Model 400S to Model 500S; requires 7330	1,405,000
3090 Model 400S to Model 600S; requires 7330 and 7331	2,810,000
3090 Model 500S to Model 600S; requires 7331	1,405,000

IBM 3090 Series



		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
MASS STORAGE					
3370	Direct Access Storage Model A2; 729.8MB; contains logic and power for up to three Model B2 units Model B2; connects to a 3370 Model A2	35,480 26,600	134.00 101.00	2,190 1,640	— —
3375	Direct Access Storage; 819.7MB per drive Model A1; contains logic and power for up to three Model B1 units Model B1; connects to a 3375 Model A1 Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	24,730 18,700 23,590	144.00 109.00 133.00	1,980 1,586 1,886	1,685 1,350 1,605
	4951 Model D1 Attachment for Model A1	2,590	6.00	119	101
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	3,795	1.50	212	180
	3375 Model B1 to D1 Upgrade	7,520	—	—	—
3380	Direct Access Storage Model AD4; 2.52 billion bytes of storage Model BD4; Direct Access Storage; connects to a Model AD4 or AE4 Model AE4; 5.04 million bytes per unit Model BE4; connects to a Model AE4 or AD4 unit	82,000 59,000 113,000 90,000	295.00 215.00 295.00 215.00	5,460 3,975 8,120 6,620	— — — —
3380	AD4 Conversion to AE4	40,000	—	—	—
3380	BD4 Conversion to BE4	40,000	—	—	—
	Model AJ4; 2.52 billion bytes of storage	82,000	225.00	4,625	—
	Model BJ4; 2.52 billion bytes of storage	59,000	165.00	3,330	—
	Model AK4; 7.56 billion bytes of storage	128,000	225.00	7,085	—
	Model BK4; 7.56 billion bytes of storage	105,000	165.00	5,790	—
	Model CJ2; 1.26 billion bytes of storage	70,000	230.00	3,990	—
3880 Storage Control Unit					
	Model 001 Storage Control Unit	51,000	176.00	4,124	3,510
	Model 003 Storage Control Unit	51,000	176.00	1,370	1,165
	Model D23 Storage Control Unit; 8 megabytes of memory	110,000	575.00	2,940	—
	Model E23 Storage Control Unit; 16 megabytes of memory	146,000	600.00	3,900	—
	Model G23 Storage Control Unit; 32 megabytes of memory	218,000	650.00	5,825	—
	Model H23 Storage Control Unit; 48 megabytes of memory	290,000	700.00	7,750	—
	Model J23 Storage Control Unit; 64 megabytes of memory	362,000	750.00	9,675	—
	Model E21 Storage Control Unit; 16 megabytes of memory	146,000	600.00	3,900	—
	Model G21 Storage Control Unit; 32 megabytes of memory	218,000	650.00	5,825	—
	Model H21 Storage Control Unit; 48 megabytes of memory	290,000	700.00	7,750	—
	Model J21 Storage Control Unit; 64 megabytes of memory	362,000	750.00	9,675	—
3880 Controller Model Upgrades					
	Model 001 to Model E21	95,000	—	—	—
	Model 001 to Model G21	167,000	—	—	—
	Model 001 to Model H21	239,000	—	—	—
	Model 001 to Model J21	311,000	—	—	—
	Model 003 to Model D23	59,000	—	—	—
	Model 003 to Model E23	95,000	—	—	—
	Model 003 to Model G23	167,000	—	—	—
	Model 003 to Model H23	239,000	—	—	—
	Model 003 to Model J23	311,000	—	—	—
	Model B13 to Model D23	59,000	—	—	—
	Model B13 to Model E23	95,000	—	—	—
	Model B13 to Model G23	167,000	—	—	—
	Model B13 to Model H23	239,000	—	—	—
	Model B13 to Model J23	311,000	—	—	—
	Model D11 to Model E21	95,000	—	—	—
	Model D11 to Model G21	167,000	—	—	—
	Model D11 to Model H21	239,000	—	—	—
	Model D11 to Model J21	311,000	—	—	—
	Model D13 to Model D23	59,000	—	—	—
	Model D13 to Model E23	95,000	—	—	—
	Model D13 to Model G23	167,000	—	—	—
	Model D13 to Model H23	239,000	—	—	—
	Model D13 to Model J23	311,000	—	—	—

NA—Not applicable.
NC—No charge.
*Includes equipment maintenance.
**Four-year lease.



IBM 3090 Series

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
3880 Controller Model Upgrades (Continued)				
3880 Features				
3005; 3880 Model 003 Support Feature for 3380 AJ4/AK4	5,000	—	5,000	—
3010; 3880 Model D23 Support Feature for 3380 AK4	5,000	—	5,000	—
6140; For 3880 Models D21/D23 4.5MB/Second Transfer Support Feature	3,000	—	80	—
9431; 3880 Attachment Feature	NC	NC	NC	NC
9432; 3990 Attachment Feature (2-path)	NC	NC	NC	NC
9433; 3990 Attachment Feature (4-path)	NC	NC	NC	NC
6550; Speed Matching Buffer for 3380	8,250	40.00	220	187
6560; Speed Matching Buffer	9,710	40.00	260	221
8170; Two-Channel Switch Pair	5,290	11.00	140	119
8171; Two-Channel Switch Pair, Additional	14,120	38.50	380	323
8172; Eight-Channel Switch	19,420	53.50	520	443
3990 Storage Control Unit				
Model 001; Storage Control Unit; 2-path	60,000	185.00	3,405	—
Model 002; Storage Control Unit; 4-path	110,000	370.00	6,280	—
Model G03; Storage Control Unit; 4-path, 32 megabytes of memory	200,000	800.00	11,550	—
Model J03; Storage Control Unit; 4-path, 64 megabytes of memory	312,000	875.00	17,620	—
Model L03; Storage Control Unit; 4-path, 128 megabytes of memory	536,000	1,025.00	29,770	—
Model Q03; Storage Control Unit; 4-path, 256 megabytes of memory	984,000	1,325.00	54,060	—
3990 Controller Model Upgrades				
Model 001 to Model 002	50,000	—	—	—
Model 001 to Model G03	170,000	—	—	—
Model 001 to Model J03	282,000	—	—	—
Model 001 to Model L03	506,000	—	—	—
Model 001 to Model Q03	954,000	—	—	—
Model 002 to Model G03	120,000	—	—	—
Model 002 to Model J03	232,000	—	—	—
Model 002 to Model L03	456,000	—	—	—
Model 002 to Model Q03	904,000	—	—	—
Model G03 to Model J03	112,000	—	—	—
Model G03 to Model L03	336,000	—	—	—
Model G03 to Model Q03	784,000	—	—	—
Model J03 to Model L03	224,000	—	—	—
Model J03 to Model Q03	672,000	—	—	—
Model L03 to Model Q03	448,000	—	—	—
8172; Four-Channel Switch; Additional	18,000	40.00	1,005	—
6149; Remote Switch Attachment (3880/3990)	NC	NC	NC	NC
6150; Remote Switch Attachment; Additional (3880/3990)	NC	NC	NC	NC
7149; Local Remote Switch Attachment	NC	NC	NC	NC
7150; Local Remote Switch Attachment; Additional	NC	NC	NC	NC
MAGNETIC TAPE EQUIPMENT				
3420	Magnetic Tape Units			
Model 3; 120,000 bytes/sec. at 1600 bpi; 75 ips	11,930	248.00	768	645
Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	16,870	248.00	1,075	989
Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	17,600	272.00	1,035	869
Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	19,710	272.00	1,235	1,136
Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	19,710	326.00	1,225	1,127
Model 8; 1250 bytes/sec. at 6250 bpi; 200 ips	21,860	401.00	1,465	1,348
6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	1,760	74.00	103	95
6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,425	99.00	151	139
6631 Single Density Feature (for Models 3, 5, and 7)	3,155	74.00	177	163
3550 Dual Density Feature (for Models 3, 5, and 7)	4,075	124.00	231	213
6407 7-Track Feature (for Models 3, 5, and 7)	3,155	107.00	177	163
3803	Tape Controller			
Model 1; for 3420 Model 3, 5, and 7 drives	20,680	158.00	1,335	1,121
Model 2; for 3420 Model 3 through 8 drives	30,300	218.00	1,945	1,789
5310 9-Track NRZI Feature (permits connection of 800 bpi drives to 3803-2)	3,385	2.00	186	171
6320 7-Track NRZI Feature (permits connection of 800 bpi drives to 3803-2; 5310 is prerequisite)	1,665	2.00	92	85

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

MAGNETIC TAPE EQUIPMENT (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives between up to four 3803 control units)					
	1792 For 2 Tape Controls	6,740	15.00	388	357
	1793 For 3 Tape Controls	8,600	25.00	504	464
	1794 For 4 Tape Controls	10,110	25.00	590	543
	3551 Dual Density Feature (for 3803-1)	2,530	3.50	139	128
	6148 Remote Switch Attachment	1,000	—	55	51
	6408 7-Track Feature (for 3803-1)	2,530	3.50	139	128
	8100 Two-Channel Switch	5,060	6.50	288	265
3422	Magnetic Tape Subsystem				
	Model A1 Control Unit	40,480	440.00	2,630	—
	Model B1 Magnetic Tape Unit	19,690	181.00	1,245	—
	3005 Two Channel Switch	3,575	4.00	195	—
	3010 Two-Control Unit Switch, primary	8,085	20.00	454	—
	3015 Two-Control Unit Switch, secondary	5,775	20.00	331	—
	3020 Data Streaming	1,730	35.00	130	—
3430	Magnetic Tape Subsystem				
	Model A1; Tape Unit and Control	33,400	251.00	2,755	—
	Model B1; Tape Unit Only	16,900	176.00	1,460	—
4991	Multidrive Attachment	600	5.00	49	—
3480	Model A11 Tape Controller	49,080	355.00	3,005	—
	Model B11 Tape Unit	38,810	220.00	2,310	—
	Model A22 Tape Controller	65,430	423.00	4,925	—
	Model B22 Magnetic Tape Unit	43,120	264.00	3,225	—
	1511 Channel Attachment, First	5,785	21.00	381	—
	1512 Channel Attachment, Second	5,785	21.00	381	—
	1513 Channel Attachment, Third	5,785	21.00	381	—
	2511 Automatic Cartridge Loader	8,900	40.00	518	—
	3211 A11/A22 Control Unit Coupler	4,045	—	—	—
	3480 Upgrades				
	Model A11 to Model A22; 3201 required for conversion to Model A22	14,000	—	—	—
	Model B11 to Model B22	11,000	—	—	—
PRINTERS					
3262	Model 3; band printer; 252 to 650 lpm	15,040	202.50	733	624
	Model 5; band printer; 252 to 650 lpm	17,000	202.50	1,016	865
	Model 13; band printer; 325 lpm	12,620	148.00	539	459
	5450 OCR Feature	3,990	42.00	136	116
	1090 Audible Alarm	201	—	6	5
3800	Model 3; high-speed laser printer; prints up to 215 pages per minute (ppm)	289,000	1,500.00	16,520	—
	Model 6; high-speed laser printer; prints up to 134 ppm	175,000	1,500.00	10,335	—
	1010 Accumulator	21,250	138.00	1,130	—
	1021 Accumulator Expansion	5,445	42.00	288	—
	1490 Burster-Trimmed-Stacker	52,500	372.00	2,630	2,020
	5401 127 Writable Character Generator Storage Positions (Additional)	4,695	29.00	174	144
	5410 Raster Pattern Storage (Additional)	8,655	8.00	461	—
	8180 Two-Channel Switch (Model 3)	10,270	23.00	501	427
3820	Model 1; Page Printer; laser-based machine prints up to 20 pages per minute	31,185	356.00	1,970	—
	3010 Pattern Storage Memory, 512KB	1,700	23.00	119	—
	3020 Pattern Storage Memory, 1024KB	3,000	46.00	216	—
	3025 Pattern Storage Memory, 2048KB	6,000	92.00	432	—
	3030 Pattern Storage Memory, 3072KB	9,000	138.00	649	—
	3040 EIA Interface Cable 12m	125	—	—	—
	3045 EIA Interface Cable 6m	90	—	—	—
	3050 EIA Interface Attachment	500	11.00	39	—
	3055 S/370 Channel Interface Attachment	2,600	46.00	192	—
	3065 Pattern Storage Memory, 4096KB	12,000	184.00	865	—
3827	Model 1; page printer; up to 92 ppm	185,000	2,645.00	11,895	—
4020	Two Channel Switch	9,500	45.00	520	—
4030	Additional 2M Pattern Store	6,000	92.00	392	—
3835	Model 1; page printer; up to 88 ppm	135,000	1,250.00	8,000	—
4020	Two Channel Switch	9,500	45.00	520	—
4030	Additional 2M Pattern Storage	6,000	92.00	392	—

NA—Not applicable.
NC—No charge.
*Includes equipment maintenance.
**Four-year lease.

IBM 3090 Series

ASCII Display Stations (Continued)

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
Model A30 Display with 104-key typewriter keyboard; 1,920 characters; green	1,295	40.00	—	—
Model B10 Display with 122-key keyboard; 1,920 characters; amber	1,295	40.00	—	—
Model B20 Display with 102-key keyboard; 1,920 characters; amber	1,295	40.00	—	—
Model B30 Display with 104-key typewriter keyboard; 1,920 characters; amber	1,295	40.00	—	—
3192 Color Display for 3270 Subsystem; attaches to 3174, 3274, or 3276				
Model C10 Display with 122-key typewriter keyboard; 1,920 or 2,560 characters	1,895	85.00	—	—
Model C20 Display with 102-key enhanced keyboard; 1,920 or 2,560 characters	1,895	85.00	—	—
Model C30 Display with 104-key typewriter keyboard; 1,920 characters; 7 colors	1,895	85.00	—	—
Model D10 Display with 122-key typewriter keyboard; 1,920, 2,560, 3,440, or 3,560 characters; 7 colors	1,795	60.00	—	—
Model D20 Display with 102-key enhanced keyboard; 1,920, 2,560, 3,440, or 3,564 characters; 7 colors	1,795	60.00	—	—
Model D30 Display with 104-key typewriter keyboard; 1,920, 2,560, 3,440, or 3,564 characters; 7 colors	1,795	60.00	—	—
Model DDO Display with 122-key typewriter keyboard; 1,920, 2,560, 3,440, or 3,564 characters; 7 colors; 3-year warranty	1,895	60.00	—	—
Model DEO Display with 102-key enhanced keyboard; 1,920, 2,560, 3,440, or 3,564 characters; 7 colors; 3-year warranty	1,895	60.00	—	—
Model DFO Display with 104-key typewriter keyboard; 1,920, 2,560, 3,440, or 3,564 characters; 7 colors; 3-year warranty	1,895	60.00	—	—
Model G10 Color Graphics Display with 122-key typewriter keyboard; 1,920 or 2,560 characters, 8 colors	2,795	110.00	—	—
Model G20 Color Graphics Display with 122-key/APL typewriter keyboard; 89 colors; 2,560 characters	2,795	110.00	—	—
Model G30 Color Graphics Display with 104-key enhanced keyboard; 1,920 or 2,560 characters; 8 colors	2,795	110.00	—	—
Model G40 Color Graphics Display with 104-key/APL enhanced keyboard; 2,560 characters; 8 colors	2,795	110.00	—	—
Model GDO Color Graphics Display with 122-key typewriter keyboard; 2,560 characters; 8 colors; 3-year warranty	2,995	110.00	—	—
Model GEO Color Graphics Display with 122-key/APL typewriter keyboard; 1,920 or 2,560 characters; 8 colors; 3-year warranty	2,995	110.00	—	—
Model GFO Color Graphics Display with 104-key enhanced keyboard; 1,920 or 2,560 characters; 8 colors	2,995	110.00	—	—
Model GGO Color Graphics Display with 104-key/APL typewriter keyboard; 1,920 or 2,560 characters; 8 colors; 3-year warranty	2,995	110.00	—	—
3193 Advanced Monochrome Displays for 3270 Subsystems; attaches to 3174, 3274, 8 partitions, 2 logical terminals, combines characters and images; 880 x 1200 dots				
Model 10 Display with 122-key keyboard; 3,840 characters; 100 pels	2,495	75.00	—	—
Model 10 Display with 102-key enhanced keyboard; 3,840 characters; 100 pels	2,495	75.00	—	—
3194 Color Display for 3270 Subsystems; attaches to 3174, or 3274				
Model C10 Display with 122-key keyboard	2,495	125.00	—	—
Model C20 Display with 102-key keyboard	2,495	125.00	—	—
3178 Model C10; 1,920 char., w/75-key Data Entry keyboard	1,040	—	—	—
Model C20; 1,920 char., w/87-key Typewriter keyboard	1,095	—	—	—
Model C30; 1,920 char., w/87-key Typewriter keyboard and numeric pad	1,095	—	—	—
Model C40; 1,920 char., w/87-key Typewriter keyboard and numeric pad	1,095	—	—	—
3276 Integrated Display/Control Unit; can support additional 3270-type displays				
Model 2; 1,920-character display; for BSC transmissions	5,535	37.00	356	303
Model 12; 1,920-character display; for SNA/SDLC transmissions	5,535	33.00	356	303
1009 Address Keylock	95	—	62	—
1067 APL/Text Control	560	1.00	55	47
1068 Extended Function Base; allows attachment of features 1067, 5656, or 1950	190	1.00	6	5
1950 Color Display Attachment	758	0.50	46	39
3255 Terminal Adapter 1; allows attachment of 2 terminals	530	1.50	26	23
3256 Terminal Adapter 2; allows attachment of 2 terminals above 3255	530	1.50	26	23
3257 Terminal Adapter 3; allows attachment of 2 terminals above 3256	530	1.50	26	23
3620 Character Set Extension; allows display of APL/Text 222-character set, which includes the 94-character EBCDIC set	644	3.00	29	25
3680 Encrypt/Decrypt	1,600	2.00	94	80
3701 External Modem Interface	337	3.00	18	16
4621 75-key EBCDIC Typewriter keyboard	463	2.00	22	19
4622 75-key EBCDIC Data Entry keyboard	463	3.00	22	19
4623 75-key EBCDIC Data Entry keyboard; keypunch layout	463	3.00	22	19
4624 75-key ASCII Typewriter keyboard	463	2.00	22	19

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

ASCII Display Stations (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
4626	87-key EBCDIC Typewriter/APL keyboard	632	2.50	27	24
4627	87-key EBCDIC Typewriter keyboard	632	2.50	27	24
4628	87-key ASCII Typewriter keyboard	632	2.50	27	24
4629	87-key EBCDIC Typewriter/Text keyboard	632	2.50	27	24
4999	Magnetic Reader Control	379	3.50	17	15
5500	Integrated 1200 bps Modem; nonswitched	535	5.50	34	29
5501	Integrated 1200 bps Modem; switched, auto answer	714	2.50	46	39
5502	Integrated 1200 bps Modem; manual answer	535	3.00	34	29
5507	Integrated 1200 bps Modem; nonswitched with SNBU	766	5.50	49	42
5508	Integrated 1200 bps Modem; nonswitched with SNBU and auto answer	855	3.00	55	47
5650	DDS Adapter for point-to-point operations	840	1.50	41	36
5651	DDS Adapter; multipoint operation	840	1.50	41	36
5655	X.21 Adapter; for nonswitched networks	800	1.50	38	33
5656	X.21 Adapter; for switched networks	884	2.00	47	40
6302	Communications Adapter without clock	365	2.00	15	13
6315	SDLC/BSC Switch	682	3.00	36	31
6360	Light Pen	548	0.50	24	20
3278	Model 1; 960 char.	1,484	10.00	115	98
	Model 2; 1,920 char.	1,572	10.00	119	102
	Model 3; 2,560 char.	1,716	10.50	146	124
	Model 4; 3,440 char.	1,804	11.50	149	127
	Model 5; 3,564 char.	2,060	13.00	175	149
3610	Extended Character Set Adapter	—	—	17	15
3620	Character Set Extension	464	2.50	30	26
4621	Keyboard; 75-key EBCDIC Ty	334	2.00	22	19
4622	Keyboard; 75-key EBCDIC De	334	3.00	22	19
4623	Keyboard; 75-key EBCDIC De/Kp	334	3.00	22	19
4624	Keyboard; 75-key ASCII Ty	334	2.00	22	19
4626	Keyboard; 87-key EBCDIC Typ/APL	455	2.50	27	24
4627	Keyboard; 87-key EBCDIC Ty	455	2.50	27	24
4628	Keyboard; 87-key ASCII Ty	455	2.50	27	24
4629	Keyboard; 87-key EBCDIC Typ/Text	455	2.50	27	24
3620	Character Set Extension	464	2.50	30	26
6360	Selector Light Pen	394	0.50	24	20
4999	Magnetic Reader Control	273	3.50	17	15
3290	Information Panel Display For 3270 Subsystems; plasma panel technology				
	Model 220 Slim Profile Display; 9,920 characters; data/typewriter keyboards; multiple screens/windows, optional 5300 large character format	6,500	288.00	—	—
	Model 230 Slim Profile Display; 9,920 characters; modifiable data/typewriter keyboard with integrated numeric pad; similar to 3179; 3180; multiple screens/windows, optional 5300 large character format	6,500	288.00	—	—
	Model T30 TEMPEST Specification Display; similar to 230, but not modifiable	9,300	360.00	—	—
8775	Display Terminal with control logic for standalone remote operation; highly compatible with 3270 cluster datastreams				
	Model 11 Display; 960, 1,920, or 2,560 characters in 9 x 16 format	3,070	27.00	147	125
	Model 12 Display; 3,440 characters in 9 x 12 format as well as 960, 1,920, or 2,560 characters in 9 x 16 format	3,450	27.00	165	140
1009	Setup Keylock	63	—	63	—
1090	Audible Alarm	93	—	2	2
1488	Business Machine Clock	234	1.50	6	5
3623	Extended Feature Storage; needed for 3624, 3626, 5110, or IDIF	848	4.00	44	35
3701	External Modem Interface	374	3.50	17	15
3905	Feature Adapter; provides logic to perform 3624, 3626, or IDPF	424	2.00	17	15
4621	75-key EBCDIC Typewriter keyboard	417	2.00	21	18
4622	75-key EBCDIC Data Entry keyboard	417	3.00	21	18
4623	75-key EBCDIC Data Entry keyboard; keypunch layout	417	3.00	21	18
4626	87-key EBCDIC Typewriter/APL keyboard	569	2.50	26	23
4627	87-key EBCDIC Typewriter keyboard	569	2.50	26	23
4640	87-key EBCDIC Typewriter Overlay keyboard	569	2.50	26	23
4670	87-key EBCDIC Typewriter/Text Entry and Edit keyboard	632	3.50	25	22
4999	Magnetic Reader Control	364	2.00	17	15
5500	Integrated 1200 bps Modem	563	6.50	30	26
5580	Printer Adapter	1,440	4.50	56	48
5650	DDS Adapter; for point-to-point operations	840	1.50	39	34
5651	DDS Adapter; multipoint operation	840	1.50	36	31
5655	X.21 Adapter; for nonswitched networks	800	1.50	35	30
5781	Programmed Symbols; two 190-symbol sets	202	1.50	6	5
5782	Programmed Symbols; adds four 190-symbol sets to 5781	324	2.50	16	14
6340	Security Keylock	40	—	40	—

NA—Not applicable.
NC—No charge.
*Includes equipment maintenance.
**Four-year lease.

IBM 3090 Series

PRINTERS (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
4245	Model 12/D12 Band printers; 1,200 lpm. Model 12 attaches to IBM byte, block, or selector channels. The Model D12 attaches via 3274 or 4700 controllers.	31,000	250.00	2,050	—
	Model 20/D20 Band printers; 2,000 lpm. Model 20 attaches to IBM byte, block, or selector channels. The Model D20 attaches via 3274 or 4700 controllers.	35,000	400.00	2,340	—
	4245 Upgrades Model 12/D12/T12 to Model 20/D20/T20	10,000	—	—	—
4248	Model 2; Variable-speed band printer; 2,200, 3,200, and 4,000 lpm	75,000	800.00	6,635	—
	3751 36 additional print positions; plant installed	10,000	110.00	658	—
	3753 36 additional print positions; field installed	15,000	110.00	615	—
6262	Models D12 and T12; band printers; 1200 lpm	22,600	185.00	1,500	—
	Models D14 and T14; band printers; 1400 lpm	26,500	235.00	1,775	—
	Model 14; band printer; 1400 lpm	26,500	235.00	1,775	—
TERMINALS					
Cluster Controllers					
3174	Nonprogrammable Control Unit for 3270 Subsystems; includes 1 megabyte of control storage, expandable to 3 megabytes, diskette drive, microcode equivalent of 3274-41A/C/D with Configuration Support D.				
	Model 1L Control Unit with Channel Interface; supports 4 to 32 terminals or PCs with appropriate emulation features; attaches to byte or block multiplexer channel, 4381/9370 SOEMI interface, 3814 Switching Management System; supports Token Ring via optional feature	12,950	264.00	—	—
	Model 1R Control Unit with RS-232-C Remote Link Attachment; supports 4 to 32 terminals or PCs with appropriate emulation features; attaches to SNA or X.25 networks; 64K bps data rate	9,950	240.00	—	—
	Model 2R Control Unit with X.21 Remote Link Attachment; supports 4 to 32 terminals or PCs with appropriate emulation features; attaches to SNA or X.25 networks; 64K bps data rate	9,950	240.00	—	—
	Model 3R Control Unit with Interface for Token-Ring Attachment; supports 4 to 32 terminals or those PCs with appropriate emulation features; standard attachment interface is for IEEE 802.5/802.2 standard baseband Token Ring; can also attach to 3174 1L with 3025 feature	11,450	300.00	—	—
	Model 81R Small Cluster Control Unit with RS-232-C Remote Link Attachment; supports up to eight terminals; for SNA or X.25 networks	3,500	168.00	—	—
	Model 82R Small Cluster Control Unit with X.21 Remote Link Attachment; supports up to eight terminals; for SNA or X.25 networks	3,500	168.00	—	—
1011	Storage Expansion; 512 kilobytes	1,300	40.00	—	—
1012	Storage Expansion; 1 megabyte	2,300	80.00	—	—
1046	Diskette Drive; 1.2 megabytes	650	120.00	—	—
3020	Asynchronous Emulation Adapter (2-way); microprocessor-based; allows attachment or emulation of IBM 3101, Digital Equipment VT100, other ASCII terminals and ASCII pass-through	2,250	144.00	—	—
3025	Token-Ring Network 3270 Gateway; for 3174 1L, supports up to 140 ring-attached PU Type 2.0 cluster controllers (LUs are transparent); downstream devices can be PCs, 3174 3Rs, or S/36s	5,000	162.00	—	—
3103	Terminal Multiplexer Adapter; 8 ports; maximum of 4 attachable	500	20.00	—	—
3680	Encrypt/Decrypt Adapter	1,780	24.00	—	—
3274	Model 41A; local, SNA mode	18,230	62.00	1,369	1,165
	Model 41C; remote; requires 3701	13,840	43.00	1,040	885
	Model 41D; local, 3272 mode	18,230	62.00	1,369	1,165
	Model 51C; remote; requires 3701	4,885	40.00	356	303
	Model 61C; remote; requires 3701	7,600	29.00	548	467
1550	CCITT V.35 Interface	525	1.50	26	23
1800	Extended Function Storage, D2 CSE	2,430	19.00	176	150
1801	Control Storage Expansion	790	4.00	62	53
3101	Internal Disk Drive Enhancement	1,620	15.00	125	107
3622	Extended Function Storage, Ty C1	950	8.50	103	88
3623	Extended Function Storage, Ty C2	1,265	10.50	135	115
3625	Extended Function Storage, Ty C3	950	8.50	103	88
3627	Extended Function Storage, Ty D1	950	8.50	103	88
3631	Extended Function Storage, Ty D3	820	7.00	62	53
3650	Extended Function Storage, Ty C1	1,640	15.00	125	107
3660	Extended Function Storage, DS	1,550	2.00	106	90
3680	Encrypt/Decrypt; -1C, 3274, -21C, -31C, -41C, -51C, and -61C only	1,780	2.00	105	89
3701	External Modem Interface; requires 6302 or 6303	337	3.00	19	17
5101	Internal Disk Drive Enhancement	1,530	14.00	116	99
5550	Power Expansion	341	1.50	19	17
5650	Dataphone Digital Service; point-to-point; -21C, -31C, -41C, -51C, and -61C only	840	1.50	43	38

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

Cluster Controllers (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
5651	Dataphone Digital Service; multipoint; -21C, -31C, or -51C only	840	1.50	43	38
5655	X.21 Adapter; nonswitched networks; -41C or -61C only	800	1.50	40	35
5656	X.21 Adapter; switched networks; -41C or -61C only	800	2.00	49	42
	Terminal Adapters (for Models -21X, -31X, and -51C only)—				
6901	Type A1; devices 9 through 16	918	2.00	63	54
6902	Type A2; devices 17 through 24	918	2.00	63	54
6903	Type A3; devices 25 through 32	918	2.00	63	54
7801	Type B; requires 5550	986	4.00	75	64
7802	Type B1; devices 1 through 4	986	4.00	75	64
7803	Type B2; devices 5 through 8	831	2.50	63	54
7804	Type B3; devices 9 through 12	831	2.50	63	54
7805	Type B4; devices 13 through 16	831	2.50	63	54
6302	Common Communications Adapter; SDLC or BSC; up to 9600 bps with Type A only Terminal Adapters and up to 7200 bps with Type B or mix; -21C, -31C, -41C, -51C, and -61C only	365	2.00	15	13
6303	High Performance Communications Adapter; SDLC or BSC; 9600 bps with Type B Terminal Adapters or mix; -21, -31C, -41C, -51C, and -61C only	1,010	8.50	71	60
8801	Watertight Power Connector; -21A/B/D, -31A/D, and -41A/D	NC	NC	NC	NC

Note: IBM no longer accepts lease/rental orders for any model of the 3274 Control Unit. Listed lease/rental prices apply to hardware installed prior to August 24, 1984.

ASCII Display Stations

Model 316X Display Stations

3161	Model 1 ASCII Display Station; 1,920 characters, emulates 3101-881; emulates additional non-IBM models through added features	695	35.00	—	—
8001	Additional Read Command	15	—	—	—
8501	Extended Emulation, including ADDS Viewpoint, Hazeltine 1500, TeleVideo 910, and Lear Siegler ADM-3A and ADM-5	35	—	—	—
8901	Five TeleVideo Emulation, includes 910, 912, 920, 925, and 925E	35	—	—	—
3162	Model 110 Microcoded Display; full keyboard, green, RS-232-C interface	610	45.00	—	—
	Model 120 Microcoded Display; full keyboard, green, RS-232-C and RS-422-A interfaces	724	45.00	—	—
	Model 210 Microcoded Display; full keyboard, amber, RS-232-C interface	645	45.00	—	—
	Model 220 Microcoded Display; full keyboard, amber, RS-232-C and RS-422-A interfaces	724	45.00	—	—
	Model 310 Microcoded Display; short keyboard, green, RS-232-C interface	645	45.00	—	—
	Model 320 Microcoded Display; short keyboard, green, RS-232-C and RS-422-A interfaces	724	45.00	—	—
	Model 410 Microcoded Display; short keyboard, amber, RS-232-C interface	645	45.00	—	—
	Model 420 Microcoded Display; short keyboard, amber, RS-232-C and RS-422-A interfaces	724	45.00	—	—
8222	Digital Equipment VT220 Emulation	—	—	—	—
8232	Digital Equipment VT220 Emulation with hot key/3708	—	—	—	—
8502	TeleVideo 950 Emulation	—	—	—	—
8922	10 ASCII Terminal Emulation	—	—	—	—
3163	Model 1 Standard Microcoded Display	895	60.00	—	—
860	ALA Display; displays diacritic characters in separate position	976	60.00	—	—
861	ALA Display; displays diacritic characters combined with letters	985	45.00	—	—
8103	Digital Equipment VT100/52 Emulation	50	—	—	—
8953	TeleVideo 950 Emulation	38	—	—	—
3164	Model 1 Standard Microcoded Display	1,295	55.00	—	—
860	ALA Display; displays diacritic characters in separate position	1,376	75.00	—	—
861	ALA Display; displays diacritic characters combined with letters	1,385	75.00	—	—
3180	Monochrome Display for 3270 Subsystems; attaches to 3174, 3274, or 3276				
	Model 110 Display with 4 user-selectable screen formats; up to 3,564 characters	2,095	—	—	—
	Model 120 Display with 4 user-selectable screen formats; up to 3,564 characters	2,095	—	—	—
	Model 130 APL Display with 4 user-selectable screen formats; up to 3,564 characters	2,095	—	—	—
8191	Switch Control Unit; permits switching operation between two control units	168	—	—	—
3191	Monochrome Display for 3270 Subsystems; attaches to 3174, 3274, or 3276				
	Model A10 Display with 122-key typewriter keyboard; 1,920 characters; green	1,295	40.00	—	—
	Model A20 Display with 102-key enhanced keyboard; 1,920 characters; green	1,295	40.00	—	—

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

SYSTEM MANAGEMENT

IBM 3814 Switching Management System, Models

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
A1	Controller Unit (4 x 4)	47,480	159.00	2,630	**2,105
A2	Controller Unit (4 x 8)	60,420	189.00	3,350	**2,680
A3	Controller Unit (8 x 4)	64,740	185.00	3,595	**2,875
A4	Controller Unit (two 4 x 4s)	69,570	203.00	3,875	**3,095
B1	Remote Unit (4 x 4)	39,710	98.00	2,205	**1,765
B2	Remote Unit (4 x 8)	52,660	143.00	2,920	**2,335
B3	Remote Unit (8 x 4)	56,970	138.00	3,165	**2,530
B4	Remote Unit (two 4 x 4s)	61,800	156.00	3,435	**2,745
C1	Expansion Unit (4 x 4)	37,980	95.00	2,105	**1,680
C2	Expansion Unit (4 x 8)	50,930	139.00	2,820	**2,255
C3	Expansion Unit (8 x 4)	55,240	134.00	3,065	**2,450
C4	Expansion Unit (two 4 x 4s)	60,070	153.00	3,340	**2,670

Additional Hardware and Options

Upgrades	Model A1 to A4, Model B1 to B4, or Model C1 to C4	22,090	—	—	—
3178-C20	Display Station	1,095	—	—	—
3278-2	Display Station	1,572	10.00	119	102
3287-1	Hard Copy Printer	3,355	41.00	—	—
3287-2	Hard Copy Printer	3,580	52.00	—	—
1410	Expanded Storage Unit	4,800	21.50	246	**196
1420	Printer and Display Station Attachment	1,990	3.00	103	**83
1430	Alternate Controller	1,990	3.00	103	**83
1440	System Attachment Feature	5,700	15.00	307	**248
1520	Internal Channel Expansion; four controller unit interfaces	1,550	1.00	86	**69
1521	Internal Channel Expansion; eight controller unit interfaces	3,100	1.00	168	**135
1531	External Channel Expansion; first 4 x 4 interface	5,350	1.00	294	**235
1532	External Channel Expansion; second 4 x 4 interface	5,350	1.00	294	**235
1811	Control Unit Power Sequencing; provides sequencing for first group of control units	518	1.00	27	**21
1812	Control Unit Power Sequencing; provides sequencing for second group of control units	518	1.00	27	**21
1813	Control Unit Power Sequencing; provides sequencing for third group of control units	518	1.00	27	**21
1814	Control Unit Power Sequencing; provides sequencing for fourth group of control units	518	1.00	27	**21
6350	Additional System Power Sequencing	207	—	8	**6
6010	Remote Two-Channel Switch Control—Basic	5,180	19.50	284	**226
6011	Additional Remote Two-Channel Switch Control	2,415	14.50	133	**106
6012	Second Additional Remote Two-Channel Switch Control	2,415	14.50	133	**106
6013	Third Additional Remote Two-Channel Switch Control	2,415	14.50	133	**106

CHANNEL EXTENSION

3044	Model C01 Fiber-Optic Channel Extender Link; channel unit	8,500	27.00	—	—
	Model D01 Fiber-Optic Channel Extender Link; downstream unit	8,500	27.00	—	—
	Model C02 Channel Attachment Fiber-Optic Channel Extender Link; 4.5 mega-bytes per second transfer rate	28,000	—	—	—
	Model D02 Control Unit Attachment Fiber-Optic Channel Extender Link	28,000	—	—	—

COMMUNICATIONS EQUIPMENT

3720	Communications Controller				
	Model 1 Communications Controller; local base	36,500	2,090.00	2,865	—
	Model 2 Communications Controller; remote base	26,000	1,705.00	2,040	—
	Model 11 Communications Controller	42,500	2,135.00	3,335	—
	Model 12 Communications Controller	32,000	1,705.00	2,510	—
3725	Communications Controller				
	Model 1; up to six channel adapters and from 512K to 1024K bytes of main storage capacity	75,000	2,795.00	4,420	—
	Model 2; up to two channel adapters and 512K bytes of main storage capacity (Model 2 to Model 1 Upgrade charge is \$16,000)	60,500	2,495.00	3,330	—
	1561 Channel Adapter	6,750	106.00	399	—
	4666 Internal Clock Control	1,500	24.00	85	—
	4771 Line Attachment Base Type A	19,000	212.00	1,115	—

NA—Not applicable.

NC—No charge.

*Includes equipment maintenance.

**Four-year lease.

IBM 3090 Series

COMMUNICATIONS EQUIPMENT (Continued)

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
4772 Line Attachment Base Type B	26,400	361.00	1,560	—
4911 Line Interface Coupler Type 1	2,600	24.00	155	—
4921 Line Interface Coupler Type 2	3,000	24.00	174	—
4931 Line Interface Coupler Type 3	3,000	24.00	174	—
4941 Line Interface Coupler Type 4A	2,600	24.00	155	—
4942 Line Interface Coupler Type 4B	3,000	24.00	174	—
7100 Storage Increment 256K	4,375	249.00	257	—
8320 Two Processor Switch	4,000	37.00	237	—
3726 Communications Controller Expansion	32,000	524.00	1,880	—
3727 Operator Console	2,390	336.00	230	—

NA—Not applicable.
NC—No charge.
*Includes equipment maintenance.
**Four-year lease.

SOFTWARE PRICES

	Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)	
Operating Systems					
5685-001	MVS/SP Version 3; Enterprise Systems Architecture/370 (ESA/370) with JES2	NA	4,080	163,200	NA
	Graduated Charge: Processor Group 30	NA	4,800	259,200	NA
	Graduated Charge: Processor Group 40	NA	5,520	336,700	NA
	Graduated Charge: Processor Group 50	NA	5,520	336,700	NA
5685-002	MVS/SP Version 3; Enterprise Systems Architecture/370 (ESA/370) with JES3	NA	4,590	183,600	NA
	Graduated Charge: Processor Group 30	NA	5,400	291,600	NA
	Graduated Charge: Processor Group 40	NA	6,210	378,800	NA
	Graduated Charge: Processor Group 50	NA	6,210	378,800	NA
5740-XC6	MVS/SP Version 2 Releases 1.2 through 1.7, Release 2.0 and up (MVS/XA with JES2)	12,840	4,280	157,645	673
	Graduated Charge: Processor Group 20	12,840	4,280	157,645	673
	Graduated Charge: Processor Group 30	12,840	4,280	250,380	673
	Graduated Charge: Processor Group 40	12,840	4,280	250,380	673
5740-XYN	MVS/SP Version 1 Releases 3 through 6 and up (MVS/370 with JES3)	NA	2,150	NA	117
5740-XYS	MVS/SP Version 1 Releases 3 through 6 and up (MVS/370 with JES2)	NA	2,150	NA	240
5665-291	MVS/SP Version 2 Releases 1.2 through 1.7 and up (MVS/XA with JES3)	14,430	4,810	177,165	1,335
	Graduated Charge: Processor Group 20	14,430	4,810	177,165	1,335
	Graduated Charge: Processor Group 30	14,430	4,810	177,165	1,335
	Graduated Charge: Processor Group 40	14,430	4,810	281,385	1,335
5665-432	SRTOS Special Realtime Operating System Version 2; Version 2 requires MVS/SP or MVS/XA	NA	NA	40,000	NA
	Graduated Charge: Processor Group 20	NA	NA	40,000	NA
	Graduated Charge: Processor Group 30	NA	NA	40,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5664-167	VM/SP Releases 3 through 5 and up	NA	500	13,540	69
	Graduated Charge: Processor Group 20	NA	500	19,345	69
	Graduated Charge: Processor Group 30	NA	500	30,950	69
	Graduated Charge: Processor Group 40	NA	500	30,950	69
5664-169	VM/XA Systems Facility Release 1 and up	11,220	4,110	NA	623
5664-308	VM/XA System Product Release	NA	4,500	NA	—
	Graduated Charge: Processor Group 20	NA	4,500	112,500	—
	Graduated Charge: Processor Group 30	NA	4,500	216,000	—
	Graduated Charge: Processor Group 40	NA	4,500	216,000	—
5664-308	VM/XA System Product Release 2; available first quarter 1989	NA	4,500	NA	—
	Graduated Charge: Processor Group 20	NA	4,500	112,500	—
	Graduated Charge: Processor Group 30	NA	4,500	216,000	—
	Graduated Charge: Processor Group 40	NA	4,500	216,000	—
5664-173	VM/SP HPO High Performance Option Releases 3.2 through 5.0 and up; optional on 4381, but really needed if VM/SP is to fully utilize 4381 characteristics	5,325	1,775	NA	136
	Graduated Charge: Processor Group 20	5,325	1,775	57,665	136
	Graduated Charge: Processor Group 30	5,325	1,775	92,265	136
	Graduated Charge: Processor Group 40	5,325	1,775	92,265	136
5667-126	IX/370 Interactive Executive Version 1 Release 1.3 requires VM/SP Release 3.0 or up	NA	NA	10,000	495
	4506 pricing feature for IX/370: asset assignment, to 16 currently signed-on terminal users (CSTUs)	NA	NA	10,000	495
	Graduated Charge: Processor Group 20	NA	NA	—	495
	Graduated Charge: Processor Group 30	NA	NA	—	495
	Graduated Charge: Processor Group 40	NA	NA	—	495

NA—Not applicable.

IBM 3090 Series

Operating Systems (Continued)

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
	4507 pricing feature for IX/370: supports up to 32 CSTUs; requires 4506				
	Graduated Charge: Processor Group 20	NA	NA	10,000	NA
	Graduated Charge: Processor Group 30	NA	NA	10,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
	4508 pricing feature for IX/370: supports up to 64 CSTUs; requires 4506 and 4507				
	Graduated Charge: Processor Group 20	NA	NA	20,000	NA
	Graduated Charge: Processor Group 30	NA	NA	20,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
	4509 pricing feature for IX/370: supports more than 65 CSTUs; requires 4506, 4507, and 4508				
	Graduated Charge: Processor Group 20	NA	NA	35,000	NA
	Graduated Charge: Processor Group 30	NA	NA	35,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5748-T12	TPF2.3 Transaction Processing Facility Version 2 Release 3; Version 2 requires MVS/SP or MVS/XA for batch facilities	32,100	13,540	NA	NA
Utilities, Installation Management, Performance Analysis					
5665-XA3	MVS/Data Facility Product (MVS/DFP) Version 3				
	Graduated Charge: Processor Group 20	NA	1,800	54,000	NA
	Graduated Charge: Processor Group 30	NA	1,800	54,000	NA
	Graduated Charge: Processor Group 40	NA	1,800	86,400	NA
5665-XA2	Data Facility Product Version 2 Release 3; for MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,150	34,500	342
	Graduated Charge: Processor Group 30	NA	1,150	34,500	342
	Graduated Charge: Processor Group 40	NA	1,150	55,200	342
5665-266	INFO/Access Information Access Version 3; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	800	24,000	NA
	Graduated Charge: Processor Group 30	NA	800	24,000	NA
	Graduated Charge: Processor Group 40	NA	800	24,000	NA
5665-274	RMF Resource Measurement Facility Version 3 Release 5; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	2,250	750	24,375	67
	Graduated Charge: Processor Group 30	2,250	750	24,375	67
	Graduated Charge: Processor Group 40	2,250	750	39,000	67
5665-294	Library/MVS; for MVS/370, MVS/XA	399	146	NA	NA
5665-295	DFP Data Facilities Product Version 1 Release 1.0; for MVS/370, MVS/XA	1,590	670	NA	186
5665-371	OPC/A Operations Planning and Control/Advanced Event Manager Subsystem Version 1; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	820	18,000	NA
	Graduated Charge: Processor Group 30	NA	820	18,000	NA
	Graduated Charge: Processor Group 40	NA	820	—	NA
5665-372	OPC/A Operations Planning and Control/Advanced Production Control System Version 1; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	2,270	50,000	NA
	Graduated Charge: Processor Group 30	NA	2,270	50,000	NA
	Graduated Charge: Processor Group 40	NA	2,270	—	NA
5665-373	OPC/A Operations Planning and Control/Advanced Network Event Communicator Version 1; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	980	21,600	NA
	Graduated Charge: Processor Group 30	NA	980	21,600	NA
	Graduated Charge: Processor Group 40	NA	980	—	NA
5665-383	INFO/Mgt Information/Management Version 3; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	500	11,000	58
	Graduated Charge: Processor Group 30	NA	500	11,000	58
	Graduated Charge: Processor Group 40	NA	500	11,000	58
5665-384	INFO/Sys Information/System Version 3; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	450	10,000	49
	Graduated Charge: Processor Group 30	NA	450	10,000	49
	Graduated Charge: Processor Group 40	NA	450	10,000	49
5665-950	INFO/Access; for MVS/370, MVS/XA	3,300	362	NA	28
5664-191	VMMAP Performance Monitor Analysis Program Release 1.1; for VM/SP				
	Graduated Charge: Processor Group 20	NA	270	2,800	NA
	Graduated Charge: Processor Group 30	NA	270	4,000	NA
	Graduated Charge: Processor Group 40	NA	270	4,000	NA
5664-322	INFO/Mgt Information/Management Version 3; for VM/SP				
	Graduated Charge: Processor Group 20	NA	500	7,700	44
	Graduated Charge: Processor Group 30	NA	500	11,000	44
	Graduated Charge: Processor Group 40	NA	500	11,000	44
5664-323	INFO/Sys Information/System Version 3; for VM/SP				
	Graduated Charge: Processor Group 20	NA	450	7,000	52
	Graduated Charge: Processor Group 30	NA	450	10,000	52
	Graduated Charge: Processor Group 40	NA	450	10,000	52
5664-364	VM Batch Facility				
	Graduated Charge: Processor Group 20	NA	150	3,150	NA
	Graduated Charge: Processor Group 30	NA	150	4,500	NA
	Graduated Charge: Processor Group 40	NA	150	7,200	NA

NA—Not applicable.

IBM 3090 Series

Utilities, Installation Management, Performance Analysis (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Overtime Charge (\$)	Licensed Program Support Charge (\$)
5668-002	DASD Migration Aid Release 1.1; for MVS/370, MVS/XA, VS1	NA	NA	1,450	19
	Graduated Charge: Processor Group 20	NA	NA	1,450	19
	Graduated Charge: Processor Group 30	NA	NA	—	19
	Graduated Charge: Processor Group 40	NA	NA	—	19
5668-897	INFO Center/1 Release 1.1; for VM/SP, MVS/370, MVS/XA	NA	1,390	15,400	NA
	Graduated Charge: Processor Group 20	NA	1,390	22,000	NA
	Graduated Charge: Processor Group 30	NA	1,390	22,000	NA
	Graduated Charge: Processor Group 40	NA	1,390	22,000	NA
5740-SM1	Data Facility Sort (DFSORT) Release 10.0	NA	247	8,400	19
	Graduated Charge: Processor Group 20	NA	247	8,400	19
	Graduated Charge: Processor Group 30	NA	247	13,340	19
	Graduated Charge: Processor Group 40	NA	247	13,340	19
5664-325	DFSORT/CMS Release 1	NA	NA	825	NA
	Graduated Charge: Processor Group 20	NA	NA	1,200	NA
	Graduated Charge: Processor Group 30	—	—	1,900	—
	Graduated Charge: Processor Group 40	—	—	1,900	—
5740-SM1	DFSORT Data Facility Sort; for MVS/370, MVS/XA, VS1	NA	247	8,400	19
	Graduated Charge: Processor Group 20	NA	247	8,400	19
	Graduated Charge: Processor Group 30	NA	247	13,340	19
	Graduated Charge: Processor Group 40	NA	247	13,340	19
5740-XT9	OPC Installation Management/Operations Planning and Control; for MVS/370, MVS/XA, VS1	NA	1,745	38,390	NA
	Graduated Charge: Processor Group 20	NA	1,745	38,390	NA
	Graduated Charge: Processor Group 30	NA	1,745	38,390	NA
	Graduated Charge: Processor Group 40	NA	1,745	38,390	NA
5740-XXH	RACF Resource Access Control Facility Version 1 Release 7; for MVS/370, MVS/XA, VM/SP (with 5767 VM/RACF PRPQ)	NA	841	25,230	43
	Graduated Charge: Processor Group 20	NA	841	25,230	43
	Graduated Charge: Processor Group 30	NA	841	40,365	43
	Graduated Charge: Processor Group 40	NA	841	40,365	43
5740-XXH	RACF Resource Access Control Facility Version 1 Release 7; for VM only	—	695	14,595	—
	Graduated Charge: Processor Group 20	—	695	20,850	—
	Graduated Charge: Processor Group 30	—	695	33,360	—
	Graduated Charge: Processor Group 40	—	695	33,360	—
5740-XY4	RMF Resource Measurement Facility Version 2 Release 4; for MVS/370	NA	406	NA	17
5796-PNA	VM/RTM Real Time Monitor; for VM/SP	NA	50	700	NA
	Graduated Charge: Processor Group 20	NA	50	1,000	NA
	Graduated Charge: Processor Group 30	NA	50	1,000	NA
	Graduated Charge: Processor Group 40	NA	50	1,000	NA
5798-BDW	CMS SORT and Extensions; for VM/SP	NA	NA	1,025	NA
	Graduated Charge: Processor Group 20	NA	NA	1,025	NA
	Graduated Charge: Processor Group 30	NA	NA	—	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5798-CQQ	GTFPARS Generalized Trace Facility/Performance Analysis; for VS1, MVS/370, MVS/XA	NA	94	2,310	NA
	Graduated Charge: Processor Group 20	NA	94	2,310	NA
	Graduated Charge: Processor Group 30	NA	94	—	NA
	Graduated Charge: Processor Group 40	NA	94	—	NA
5798-DPH	JCL Conversion Aid; for VSE, MVS/370, MVS/XA	NA	500	11,000	NA
	Graduated Charge: Processor Group 20	NA	500	11,000	NA
	Graduated Charge: Processor Group 30	NA	500	—	NA
	Graduated Charge: Processor Group 40	NA	500	—	NA
5798-DWD	VM/XA RTM/SF Real Time Monitor/Systems Facility Version 2; for VM/XA	NA	NA	7,500	NA
	Graduated Charge: Processor Group 20	NA	NA	7,500	NA
	Graduated Charge: Processor Group 30	NA	NA	—	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
Languages and Language-Specific Programming Aids					
5665-433	Algorithm Generation Language Version 2; for MVS/370, SRTOS	NA	NA	11,000	NA
	Graduated Charge: Processor Group 20	NA	NA	11,000	NA
	Graduated Charge: Processor Group 30	NA	NA	—	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5665-948	Basic; for MVS/370, MVS/XA	4,170	695	NA	42
5668-786	Cobol Structuring Facility; for MVS/370, MVS/XA, VS1, VM/SP	NA	12,500	125,000	NA
	Graduated Charge: Processor Group 20	NA	12,500	125,000	NA
	Graduated Charge: Processor Group 30	NA	12,500	—	NA
	Graduated Charge: Processor Group 40	NA	12,500	—	NA
5668-805	Fortran (VS) Library Only Version 2 Release 2; for MVS/370, MVS/XA, VM/XA, VM/SP	NA	200	4,200	NA
	Graduated Charge: Processor Group 20	NA	200	6,000	NA
	Graduated Charge: Processor Group 30	NA	200	9,600	NA
	Graduated Charge: Processor Group 40	NA	200	9,600	NA

NA—Not applicable.

IBM 3090 Series

Languages and Language-Specific Programming
Aids (Continued)

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5668-806	Fortran (VS) Compiler, Library and Debug Version 2 Release 2; for MVS/370, MVS/XA, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	NA	750	15,750	NA
	Graduated Charge: Processor Group 30	NA	750	22,500	NA
	Graduated Charge: Processor Group 40	NA	750	36,000	NA
5668-864	Fortran Language Conversion Program; for MVS/370, MVS/XA, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	NA	NA	28,000	NA
	Graduated Charge: Processor Group 30	NA	NA	28,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5668-899	APL2 Release 2.0; for MVS/370, VS1, MVS/XA, VM/IS, VM/SP				
	Graduated Charge: Processor Group 20	4,170	695	9,800	37
	Graduated Charge: Processor Group 30	4,170	695	14,000	37
	Graduated Charge: Processor Group 40	4,170	695	14,000	37
5668-903	Fortran IAD Interactive Debug Release 2; for VM/IS, VM/SP, VM/XA, MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	1,920	320	7,835	26
	Graduated Charge: Processor Group 30	1,920	320	11,195	26
	Graduated Charge: Processor Group 40	1,920	320	17,915	26
5668-940	Cobol II (VS) Library only Version 1 Release 2; for MVS/370, MVS/XA, VS1, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	2,550	425	10,410	53
	Graduated Charge: Processor Group 30	2,550	425	14,870	53
	Graduated Charge: Processor Group 40	2,550	425	23,795	53
5668-958	Cobol II (VS) Compiler and Library Version 1 Release 2; for MVS/370, VS1, MVS/XA, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	6,420	1,070	26,210	53
	Graduated Charge: Processor Group 30	6,420	1,070	37,445	53
	Graduated Charge: Processor Group 40	6,420	1,070	59,915	53
5668-962	Assembler H Version 2 Release 1; for VM/SP, VM/XA, VS1, MVS/370, MVS/XA, TPF2				
	Graduated Charge: Processor Group 20	465	155	3,525	7
	Graduated Charge: Processor Group 30	465	155	5,035	7
	Graduated Charge: Processor Group 40	465	155	8,060	7
5668-996	Basic/VM Release 2; for VM/SP				
	Graduated Charge: Processor Group 20	1,125	375	4,900	38
	Graduated Charge: Processor Group 30	1,125	375	7,000	38
	Graduated Charge: Processor Group 40	1,125	375	7,000	38
5713-AAG	C for System/370; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	313	5,000	NA
	Graduated Charge: Processor Group 30	NA	313	5,000	NA
	Graduated Charge: Processor Group 40	NA	313	—	NA
5713-AAH	C for System/370; for VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	NA	313	5,000	NA
	Graduated Charge: Processor Group 30	NA	313	5,000	NA
	Graduated Charge: Processor Group 40	NA	313	—	NA
5713-AAR	Development System for the Ada Language; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,875	30,000	NA
	Graduated Charge: Processor Group 30	NA	1,875	30,000	NA
	Graduated Charge: Processor Group 40	NA	1,875	—	NA
5713-AAT	Development System for the Ada Language; for VM/SP				
	Graduated Charge: Processor Group 20	NA	1,565	25,000	NA
	Graduated Charge: Processor Group 30	NA	1,565	25,000	NA
	Graduated Charge: Processor Group 40	NA	1,565	—	NA
5734-CB4	Cobol Interactive Debug; for MVS/370, MVS/XA, VS1, VM/SP				
	Graduated Charge: Processor Group 20	NA	375	7,875	NA
	Graduated Charge: Processor Group 30	NA	375	11,250	NA
	Graduated Charge: Processor Group 40	NA	375	18,000	NA
5734-CP1	Cobol Prompter (TSO); for MVS/370, MVS/XA, TSO				
	Graduated Charge: Processor Group 20	NA	38	NA	7
5734-CP2	Assembler Prompter (TSO); for MVS/370, MVS/XA, TSO				
	Graduated Charge: Processor Group 20	NA	29	1,200	NA
	Graduated Charge: Processor Group 30	NA	29	1,200	NA
	Graduated Charge: Processor Group 40	NA	29	—	NA
5734-CP3	Fortran Prompter (TSO); for MVS/370, TSO, MVS/XA				
	Graduated Charge: Processor Group 20	NA	32	1,200	NA
	Graduated Charge: Processor Group 30	NA	32	1,200	NA
	Graduated Charge: Processor Group 40	NA	32	—	NA
5734-LM4	PL/1 Resident Library Only Release 5.1; for VM/IS, VM/SP, VM/XA, MVS/370, VS1, MVS/XA				
	Graduated Charge: Processor Group 20	NA	64	1,340	7
	Graduated Charge: Processor Group 30	NA	64	1,920	7
	Graduated Charge: Processor Group 40	NA	64	3,070	7
5734-LM5	PL/1 Transient Library Only Release 5.1; for VM/SP, VM/XA, MVS/370, VS1, MVS/XA				
	Graduated Charge: Processor Group 20	NA	37	775	7
	Graduated Charge: Processor Group 30	NA	37	1,110	7
	Graduated Charge: Processor Group 40	NA	37	1,775	7

NA—Not applicable.

IBM 3090 Series

Languages and Language-Specific Programming
Aids (Continued)

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5734-PL1	PL/1 Optimizing Compiler and Libraries, Release 5.1; for VM/SP, VM/XA, MVS/370, VS1, MVS/XA Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	296 296 296	6,215 8,880 14,205	39 39 39
5734-PL2	PL/1 Checkout Compiler; for VM/SP, VS1, MVS/370	NA	575	NA	7
5734-PL3	PL/1 Optimizing Compiler Only R.5.1; for VM/SP, VM/XA, MVS/370, VS1, MVS/XA, TPF2 Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	398 398 398	8,355 11,940 19,100	53 53 53
5740-CB1	Cobol (VS) Compiler and Library; for MVS/370, MVS/XA, VS1, VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	365 365 365	7,665 10,950 17,520	15 15 15
5740-LM1	Cobol (VS) Library Only; for MVS/370, MVS/XA, VS1, VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	118 118 118	2,475 3,540 5,660	7 7 7
5740-RG1	RPG II Report Program Generator; for MVS/370, VS1	663	221	NA	13
5746-CB1	Cobol (DOS/VS) Compiler and Library; for VSE, VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	184 184 184	3,860 5,520 8,830	15 15 15
5746-LM4	Cobol (DOS/VS) Library Only; for VSE, VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	33 33 33	690 990 1,580	7 7 7
5748-F03	Fortran (VS) Compiler, Library Release 4.1; for VSE, VS1, MVS/370, MVS/XA, VM/IS, VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	747 747 747	249 249 249	5,660 8,090 12,945	18 18 18
5785-ABH	Prolog Programming In Logic; for VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	NA NA NA	8,000 8,000 —	NA NA NA
5785-ABJ	Cobol/CICS/VS to Cobol II Command Level Conversion Aid; for MVS/370, MVS/XA Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	385 385 385	7,000 7,000 —	NA NA NA
5796-PNQ	Pascal/VS Release 2.2; for VM/IS, VM/SP, MVS/370, VS1 Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	247 247 247	4,410 6,300 6,300	NA NA NA
5796-PWC	INTELLECT for MVS/VSAM; for MVS/370, MVS/XA Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	3,050 3,050 3,050	57,000 57,000 —	NA NA NA
5796-PWE	INTELLECT for VM-VSAM; for VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	3,050 3,050 3,050	57,000 57,000 —	NA NA NA
5796-PWJ	General CICS/VS ADA Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	NA NA NA	12,100 12,100 —	NA NA NA
5796-PYH	INTELLECT for VM-SQL/DS; for VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	3,050 3,050 3,050	57,000 57,000 —	NA NA NA
5798-DFH	Fortran Utilities Version 2.2.; for VM/IS, VM/SP, VM/XA Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	NA NA NA	1,100 1,575 1,575	NA NA NA
5798-DQZ	LISP/VM List Processing; for VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	325 325 325	7,150 7,150 —	NA NA NA
5798-DXJ	Fortran (VS) Execution Analyzer; for MVS/370, MVS/XA, VM/SP Graduated Charge: Processor Group 20 Graduated Charge: Processor Group 30 Graduated Charge: Processor Group 40	NA NA NA	NA NA NA	12,500 12,500 —	NA NA NA

NA—Not applicable.

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Data Base Management and File Handling		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5664-189	STAIRS Storage and Information Retrieval System; for VM/SP	1,650	575	NA	NA
5664-327	CMS Servers; for VM/SP				
	Graduated Charge: Processor Group 20	NA	850	17,850	NA
	Graduated Charge: Processor Group 30	NA	850	25,500	NA
	Graduated Charge: Processor Group 40	NA	850	40,800	NA
5665-292	QMF Query Management Facility; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	NA	25,000	23
	Graduated Charge: Processor Group 30	NA	NA	25,000	23
	Graduated Charge: Processor Group 40	NA	NA	25,000	23
5665-327	DFDSS Data Facility/Data Set Services Version 2 Release 2; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	240	7,200	38
	Graduated Charge: Processor Group 30	NA	240	7,200	38
	Graduated Charge: Processor Group 40	NA	240	11,520	38
5665-329	DFHSM Data Facility Hierarchical Storage Manager Version 2 Release 2.1; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	800	24,000	141
	Graduated Charge: Processor Group 30	NA	800	24,000	141
	Graduated Charge: Processor Group 40	NA	800	38,400	141
5665-332	IMS/VS Information Management System Version 2 Release 2; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	3,900	117,000	825
	Graduated Charge: Processor Group 30	NA	3,900	117,000	825
	Graduated Charge: Processor Group 40	NA	3,900	187,200	825
5665-354	DB2 Performance Monitor; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	975	29,000	NA
	Graduated Charge: Processor Group 30	NA	975	29,000	NA
	Graduated Charge: Processor Group 40	NA	975	—	NA
5665-396	TSO/E Servers; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,350	40,500	NA
	Graduated Charge: Processor Group 30	NA	1,350	40,500	NA
	Graduated Charge: Processor Group 40	NA	1,350	64,800	NA
5668-788	DXT Data Extract Version 2 Release 1; for MVS/370, MVS/XA, VM/SP				
	Graduated Charge: Processor Group 20	NA	300	6,300	NA
	Graduated Charge: Processor Group 30	NA	300	9,000	NA
	Graduated Charge: Processor Group 40	NA	300	—	NA
5668-937	IMS ADF II Application Development Facility; for MVS/370, MVS/XA	3,950	1,445	NA	214
5740-UT3	DFDSS Data Facility/Data Set Services Version 1 Release 2.0; for MVS/370, MVS/XA, VS1	NA	98	NA	40
5740-XR1	STAIRS Storage and Information Retrieval System; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	1,280	28,160	NA
	Graduated Charge: Processor Group 30	NA	1,280	28,160	NA
	Graduated Charge: Processor Group 40	NA	1,280	—	NA
5740-XXF	DB/DC Data Dictionary Release 6; for VS1, MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,110	15,000	115
	Graduated Charge: Processor Group 30	NA	1,110	15,000	115
	Graduated Charge: Processor Group 40	NA	1,110	—	115
5740-XX2	IMS/VS Information Management System Version 1 Release 3.0; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	2,593	77,790	240
	Graduated Charge: Processor Group 30	NA	2,593	77,790	240
	Graduated Charge: Processor Group 40	NA	2,593	124,460	240
5740-XYF	DB/DC Dictionary; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	349	7,675	50
	Graduated Charge: Processor Group 30	NA	349	7,675	50
	Graduated Charge: Processor Group 40	NA	349	—	50
5740-XYR	DB2 Database 2; for MVS/XA, MVS/370				
	Graduated Charge: Processor Group 20	16,050	2,675	93,625	374
	Graduated Charge: Processor Group 30	16,050	2,675	93,625	374
	Graduated Charge: Processor Group 40	16,050	2,675	149,800	374
5748-XXC	VM/IFS Interactive File Sharing; for VM/SP	NA	52	NA	NA
5748-XXJ	SQL/DS Structured Query Language/Data System Release 3.5; for VM/SP,				
	Graduated Charge: Processor Group 20	NA	510	9,740	144
	Graduated Charge: Processor Group 30	NA	510	13,920	144
	Graduated Charge: Processor Group 40	NA	510	22,270	144
5796-ATP	IMS Message Requeueing; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	154	4,950	NA
	Graduated Charge: Processor Group 30	NA	154	4,950	NA
	Graduated Charge: Processor Group 40	NA	154	—	NA
5798-CHJ	IMSASAP II; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	165	3,675	NA
	Graduated Charge: Processor Group 30	NA	165	3,675	NA
	Graduated Charge: Processor Group 40	NA	165	—	NA

NA—Not applicable.

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Data Base Management and File Handling (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5798-CQP	IMSPARS; for MVS/370, MVS/XA, VS1	NA	203	4,155	NA
	Graduated Charge: Processor Group 20	NA	203	4,155	NA
	Graduated Charge: Processor Group 30	NA	203	—	NA
	Graduated Charge: Processor Group 40	NA	203	—	NA
5798-DLL	Data Base Edit Facility; for VM/SP, MVS/370, MVS/XA	NA	NA	4,235	NA
	Graduated Charge: Processor Group 20	NA	NA	6,050	NA
	Graduated Charge: Processor Group 30	NA	NA	6,050	NA
	Graduated Charge: Processor Group 40	NA	NA	6,050	NA
5798-DZP	DXTA Data Extract Assist Tool	NA	NA	7,000	NA
	Graduated Charge: Processor Group 20	NA	NA	7,000	NA
	Graduated Charge: Processor Group 30	NA	NA	7,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
Data Communications, Time-Sharing, Transaction Processing, Terminal Control					
5662-262	TPNS Teleprocessing Network Simulator Version 2 Release 3.0; for VM/SP, MVS/XA, MVS/370	NA	1,875	NA	NA
5664-175	NCCF Network Comm. Control Facility Version 2; for VM/SP	1,920	352	NA	33
5664-183	3270 Display Option; for VM/XA	2,400	800	NA	42
5664-188	RSCS Networking Version 2 Release 2; for VM/SP	NA	337	6,300	38
	Graduated Charge: Processor Group 20	NA	337	6,300	38
	Graduated Charge: Processor Group 30	NA	337	6,300	38
	Graduated Charge: Processor Group 40	NA	337	6,300	38
5664-190	NPDA Network Problem Determination Application Version 3 Release 2.0; for VM/SP	1,350	225	NA	20
5664-202	NETDA Network Design and Analysis; for VM/SP	NA	750	15,000	NA
	Graduated Charge: Processor Group 20	NA	750	15,000	NA
	Graduated Charge: Processor Group 30	NA	750	—	NA
	Graduated Charge: Processor Group 40	NA	750	—	NA
5664-204	NetView; for VM/SP	NA	940	19,740	90
	Graduated Charge: Processor Group 20	NA	940	28,200	90
	Graduated Charge: Processor Group 30	NA	940	45,120	90
	Graduated Charge: Processor Group 40	NA	940	45,120	90
5664-280	ACF/VTAM Virtual Telecomm. Access Method Version 3 Release 1.1; for VM/SP	3,535	1,175	19,660	247
	Graduated Charge: Processor Group 20	3,535	1,175	28,090	247
	Graduated Charge: Processor Group 30	3,535	1,175	44,940	247
	Graduated Charge: Processor Group 40	3,535	1,175	44,940	247
5664-281	3270 PC File Transfer Version 1.0 for VM/SP	NA	NA	600	NA
	Graduated Charge: Processor Group 20	NA	NA	600	NA
	Graduated Charge: Processor Group 30	NA	NA	—	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5664-289	ACF/SSP System Support Program Version 3 Release 1.0; for VM/SP	960	320	15,360	44
5664-298	PC Bond: PC Connectivity to VM, Release 2.0; for VM/IS, VM/SP	NA	135	2,000	NA
	Graduated Charge: Processor Group 20	NA	135	NA	NA
	Graduated Charge: Processor Group 30	NA	135	—	NA
	Graduated Charge: Processor Group 40	NA	135	—	NA
5664-315	FTP File Transfer Program Version 2 Release 2.0; for VM/SP only	NA	450	7,875	NA
	Graduated Charge: Processor Group 20	NA	450	11,250	NA
	Graduated Charge: Processor Group 30	NA	450	11,250	NA
	Graduated Charge: Processor Group 40	NA	450	11,250	NA
5664-319	VM/PC Host Server for VM/IS, VM/SP	NA	135	2,000	NA
	Graduated Charge: Processor Group 20	NA	135	2,000	NA
	Graduated Charge: Processor Group 30	NA	135	—	NA
	Graduated Charge: Processor Group 40	NA	135	—	NA
5665-279	BTAM/SP Basic Telecommunications Access Method/System Product; for MVS/XA, MVS/370	NA	NA	5,950	13
	Graduated Charge: Processor Group 20	NA	NA	5,950	13
	Graduated Charge: Processor Group 30	NA	NA	5,950	13
	Graduated Charge: Processor Group 40	NA	NA	—	13
5665-285	TSO/E TSO Extensions Release 3				
	For MVS/370				
	Graduated Charge: Processor Group 20	1,500	500	17,900	87
	Graduated Charge: Processor Group 30	1,500	500	17,900	87
	Graduated Charge: Processor Group 40	1,500	500	28,640	87
	For MVS/XA				
	Graduated Charge: Processor Group 20	1,500	555	17,900	108
	Graduated Charge: Processor Group 30	1,500	555	17,900	108
	Graduated Charge: Processor Group 40	1,500	555	28,640	108
5665-288	OCCF/MVS Operator Console Communications Facility; for MVS/370, MVS/XA	1,050	350	NA	8
5665-289	ACF/VTAM Virtual Telecomm. Access Method Version 3 Release 1.1; for MVS/XA				
	Graduated Charge: Processor Group 20	6,255	2,085	67,760	302
	Graduated Charge: Processor Group 30	6,255	2,085	67,760	302
	Graduated Charge: Processor Group 40	6,255	2,085	108,420	302
5665-313	ACF/VTAM Virtual Telecomm. Access Method Version 3 Release 1.1; for MVS/370	5,130	1,710	NA	275

NA—Not applicable.

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Data Communications, Time-Sharing, Transaction Processing, Terminal Control (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5665-314	ACF/TCAM Telecommunications Access Method Version 3; for MVS/370, MVS/XA only	8,025	2,675	NA	330
5665-316	NCCF Network Comm. Control Facility Version 2 Release 2.0; for MVS/XA (31-bit mode)	2,730	500	NA	66
5665-321	NPDA Network Problem Determination Application Version 3 Release 2; for MVS/XA (31-bit)	2,040	374	NA	30
5665-333	NPM NetView Performance Monitor; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	3,210	615	22,950	57
	Graduated Charge: Processor Group 30	3,210	615	22,950	57
	Graduated Charge: Processor Group 40	3,210	615	36,720	57
5665-338	ACF/SSP System Support Program Version 3 Release 3.0; for MVS/370, MVS/XA	1,605	535	NA	71
5665-345	SAMON SNA Applications Monitor; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	NA	9,000	NA
	Graduated Charge: Processor Group 30	NA	NA	9,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5665-361	NetView; for MVS/370	NA	1,060	NA	124
5665-362	NetView; for MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,255	37,650	128
	Graduated Charge: Processor Group 30	NA	1,255	37,650	128
	Graduated Charge: Processor Group 40	NA	1,255	60,240	128
5665-403	CICS/MVS Version 2 Release 1; for MVS/XA				
	Graduated Charge: Processor Group 20	NA	2,485	74,550	NA
	Graduated Charge: Processor Group 30	NA	2,485	74,550	NA
	Graduated Charge: Processor Group 40	NA	2,485	119,280	NA
5665-411	DTNL Direct Telecommunication Network Link/CICS; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,250	25,000	NA
	Graduated Charge: Processor Group 30	NA	1,250	25,000	NA
	Graduated Charge: Processor Group 40	NA	1,250	—	NA
5665-412	DTNL Direct Telecommunication Network Link/IMS; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,500	30,000	NA
	Graduated Charge: Processor Group 30	NA	1,500	30,000	NA
	Graduated Charge: Processor Group 40	NA	1,500	—	NA
5665-463	CICS/DDM Distributed Data Management Target; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	NA	4,000	NA
	Graduated Charge: Processor Group 30	NA	NA	4,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5668-754	ACF/NCP Network Control Program Subset, Version 4; for VM/SP, MVS/370, MVS/XA, VSE	NA	275	NA	48
5668-795	CICS/CMS Customer Information Control System; for VM/SP				
	Graduated Charge: Processor Group 20	NA	835	15,000	NA
	Graduated Charge: Processor Group 30	NA	835	15,000	NA
	Graduated Charge: Processor Group 40	NA	835	—	NA
5668-854	ACF/NCP Network Control Program Version 4 Release 2; for MVS/370, MVS/XA, VM/SP, VSE, VS1	2,085	695	NA	148
5668-915	DSX Distributed System Executive Version 3 Release 2.0; for MVS/370, MVS/XA, VSE	2,700	1,200	NA	88
5668-920	NPDA Network Problem Determination Application Version 3 Release 2.0; for MVS/370, MVS/XA	1,650	290	NA	22
5668-932	FTP File Transfer Program Version 2 Release 2.0; for MVS/370, MVS/XA, VM/SP, VSE				
	Graduated Charge: Processor Group 20	1,500	310	7,385	90
	Graduated Charge: Processor Group 30	1,500	310	10,550	90
	Graduated Charge: Processor Group 40	1,500	310	16,880	90
5668-947	NCCF Network Comm. Control Facility Version 2 Release 2.0; for MVS/370, MVS/XA	2,250	412	NA	55
5668-948	BTS Batch Terminal Simulator; for MVS/370, MVS/XA, VS1	1,030	433	NA	28
5668-951	NSI Non-SNA Interconnect Release 4.0; for MVS/370, MVS/XA, VS1	1,605	511	NA	40
5668-963	NRF Network Routing Facility Release 2; for VS1, MVS/370, MVS/XA	3,525	NA	NA	NA
5668-971	NLDM Network Logical Data Manager Release 3.0; for MVS/370, MVS/XA	1,305	227	NA	24
5668-981	NPSI NCP X.25 Packet Switching Interface, Release 4.3; for MVS/370, MVS/XA, VS1, VSE	770	295	NA	40
5735-RC3	ACF/TCAM Telecommunications Access Method Version 2 Release 4.0; for VS1 as well as MVS/370, MVS/XA	2,420	961	NA	91
5735-XX7	NTO Network Terminal Option Release 3.0; for MVS/370, MVS/XA, VM/SP, VSE, VS1	660	226	NA	12
5735-XXB	EP Emulation Program Release 4.0; for VSE, MVS/370, VS1, VM/IS, VM/SP, MVS/XA	1,365	281	NA	40
5740-XX1	CICS/OS/VS Customer Information Control, Release 7.0; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	5,730	1,910	62,075	160
	Graduated Charge: Processor Group 30	5,730	1,910	62,075	160
	Graduated Charge: Processor Group 40	5,730	1,910	99,320	160
5740-XYF	SDF/CICS Screen Definition Release 3.0; for MVS/370, MVS/XA	NA	349	7,675	50
5748-RC1	PVS VM Pass-Through Facility Release 3; for VM/IS, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	NA	185	3,000	90
	Graduated Charge: Processor Group 30	NA	185	3,000	90
	Graduated Charge: Processor Group 40	NA	185	3,000	90

NA—Not applicable.

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▶
Data Communications, Time-Sharing, Transaction Processing,
Terminal Control (Continued)

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5748-XP1	RSCS Networking Version 1 Release 3; for VM/SP, VM/XA	NA	111	2,160	38
5798-DFE	VTAMPARS II Performance Analysis Reporting System II; for VM/370, MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	504	198	5,570	NA
	Graduated Charge: Processor Group 30	504	198	5,570	NA
5798-DMJ	RSCS/SNA Extension to VM/SP Version 1 Release 3.0; for VM/SP				
	Graduated Charge: Processor Group 20	NA	NA	4,950	NA
	Graduated Charge: Processor Group 30	NA	NA	4,950	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5799-BZJ	XI X.25 SNA Interconnection PRPO; for MVS/370, MVS.XA				
	Graduated Charge: Processor Group 20	NA	NA	37,200	NA
	Graduated Charge: Processor Group 30	NA	NA	37,200	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5799-CDX	NEF Network Extension Facility Version 2; for TPF2				
	Graduated Charge: Processor Group 20	NA	NA	70,000	NA
	Graduated Charge: Processor Group 30	NA	NA	70,000	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA

NA—Not applicable. ■