IBM ES/3090 Series

MANAGEMENT SUMMARY

UPDATE: *IBM has spent much of 1989 trying to encourage its mainframe customers to trade up to ES/3090 S models and the new MVS/ESA operating system, strategic product lines introduced in 1988. Since the beginning of this year, IBM has introduced two new ES/3090 S models and has also announced new sort and transaction processing software to show off the power of ESA. To encourage users to install additional Central and Expanded Storage—a key ESA component—the company lowered memory pricing in February. In April, IBM lowered pricing again under a special incentive program. To further sweeten the offer, IBM announced a 3090 asymmetry feature. With asymmetry, users buy only the Expanded Storage and channels they need, which can amount to a considerable savings. Finally, IBM announced 5 percent across-the-board price increases for most products and services, excluding memory features previously reduced in price. The increases became effective July 1989.*

IBM now markets two lines of 3090 mainframes, the earlier E versions and the more powerful S versions announced on July 26, 1988. Earlier this year, the company withdrew the original base 3090 models. Effective May 5, IBM discontinued the Models 150, 180, 200, and 400. IBM now sells only the E and S versions of these models.

Compared to E models, the 3090 S models offer 15 to 25 percent better price/performance. The 13 S models provide more than a 21-fold growth in performance from the entry-level Model 100S to the six-way Model 600S. The S models perform faster because of 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 kilobytes) cache buffers—double the size of ▷

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 100S, 120E, 120S, 150E, 150S, 170S, 180E, 180S, 200E, 200S, 250S, 280E, 280S, 300E, 300S, 380S, 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 and 5990 Series; Control Data Cyber 900 Series; Bull HN 9000 Series; NAS Alliance Series; and Unisys A 15, A 17 Series, and 2200/600.
PRICE: Base purchase prices range from $525,000 for a Model 100S to $12,314,700 for the Model 600S.

CHARACTERISTICS

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

MODELS: IBM now markets 3090 S models and earlier E versions. Refer to Table 1 for specific models. ▶
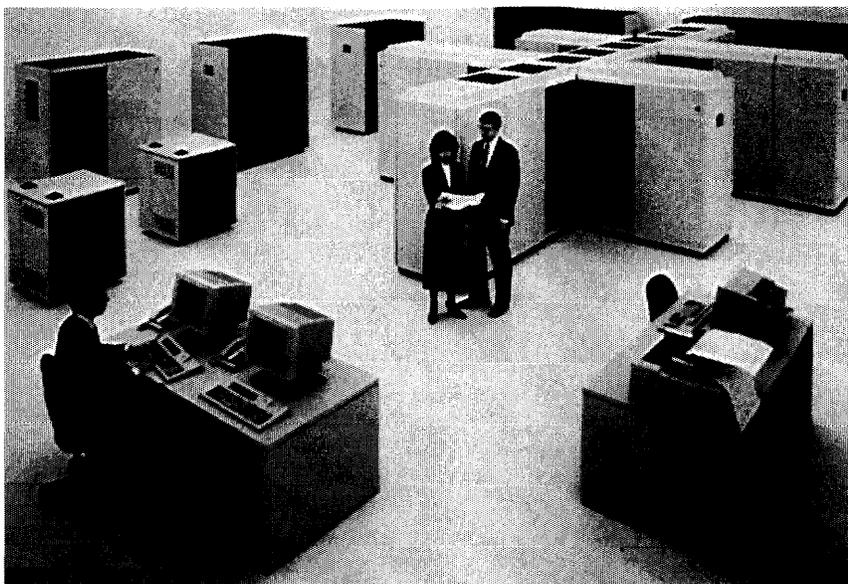
The newest IBM 3090 S models feature up to 512 megabytes of main memory, up to 2 gigabytes of Expanded Storage, and up to 128 channels.

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TABLE 1. SYSTEM COMPARISON

MODEL	Model 100S	Model 120S	Model 150S	Model 170S	Model 180S
SYSTEM CHARACTERISTICS					
Date announced	February 1989	July 26, 1988	July 26, 1988	July 26, 1988	July 26, 1988
Date first delivered	April 1989	September 1988	September 1988	Fourth-quarter 1988	Fourth-quarter 1988
Field upgradable to	Model 120S	Model 150S	Model 170S	Models 180S, 200S	Models 200S, 280S
Relative performance	Not specified	Not specified	Not specified	Not specified	Not specified
Number of processors	1	1	1	1	1
Cycle time, nanoseconds	18.5	18.5	17.75	17.75	15
Word size, bits	32	32	32	32	32
Operating systems	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370
MAIN MEMORY					
Type	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS
Minimum capacity, bytes	32M*	32M*	32M*	32M*	32M*
Maximum capacity, bytes	64M	64M	64M	64M	128M
Increment size, bytes	32M	32M	32M	32M	32M, 64M
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE					
Minimum capacity	64KB/CPU	64KB/CPU	64KB/CPU	64KB/CPU	128KB/CPU
Maximum capacity	64KB/CPU	64KB/CPU	64KB/CPU	64KB/CPU	128KB/CPU
Increment size	0	0	0	0	0
INPUT/OUTPUT CONTROL					
Number of channels:					
Byte multiplexer	Not specified	0-4	0-4	0-4	0-4
Block multiplexer	16, 24, 32	16, 24, 32	16, 24, 32	16, 24, 32	16, 24, 32
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 E models. (Models 100S, 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 15.0 nanoseconds.

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 maximum memory capacity of the E models. (Please refer to Table 1 and the Expanded Storage chart for more details about each model.)

At the software level, IBM's new strategic mainframe operating system, Enterprise System Architecture (ESA)/370, became available in July 1988. To take full advantage of 3090 S performance improvements, many of IBM's largest customers will have to migrate to ESA/370. ESA/370 is an evolutionary follow-on product to MVS/XA. While ESA/370 may be an early precursor to an expected 3090 follow-on line, popularly known as the Summit, IBM officials hinted that the 3090's days are far from numbered. More 3090 enhancements may still be in the pipeline.

The 3090 S models push the series 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) estimates. The five-way Model 500S is rated at 87.8 MIPS, the four-way Model 400S at 72.2 MIPS, the three-way Model 300S at 55.6 MIPS, the dual-processor Model 200S at 39.8 MIPS, and the two-way 280S at 38.2 MIPS. Single-processor 3090s range from 5.2 MIPS for the Model 100S to 20.5 MIPS for the Model 180S. The Model 180S is the basis for the larger ▷

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: One-megabit memory chips; first-generation chips introduced in 1986 are used in expanded memory, and smaller, faster second-generation one-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. ▶

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	Model 200S	Model 250S	Model 280S	Model 300S	Model 380S
SYSTEM CHARACTERISTICS					
Date announced	July 26, 1988	October 4, 1988	July 26, 1988	July 26, 1988	April 4, 1989
Date first delivered	Fourth-quarter 1988	Second-quarter 1989	Fourth-quarter 1988	Fourth-quarter 1988	November 1989
Field upgradable to	Models 300S, 400S	Model 280S	Model 400S	Models 400S, 500S, 600S	Model 400S
Relative performance	Not specified	Not specified	Not specified	Not specified	Not specified
Number of processors	2	2	2	3	3
Cycle time, nanoseconds	15	17.75	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	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370
MAIN MEMORY					
Type	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS
Minimum capacity, bytes	64M*	64M*	64M*	64M*	128M*
Maximum capacity, bytes	256M	128M	256M	256M	512M
Increment size, bytes	64M, 128M	64M	64M, 128M	64M, 128M	128M, 256M
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE					
Minimum capacity	128KB/CPU	64KB/CPU	128KB/CPU	128KB/CPU	128KB/CPU
Maximum capacity	128KB/CPU	64KB/CPU	128KB/CPU	128KB/CPU	128KB/CPU
Increment size	0	0	0	0	0
INPUT/OUTPUT CONTROL					
Number of channels:					
Byte multiplexer	0-8	0-4	0-8	0-8	0-16
Block multiplexer	32, 40, 48, 64	32, 48, 64	32, 48, 64	32, 40, 48, 64	48, 64, 80, 96
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.

▷ multiprocessor configurations. Performance improvements put the 3090 on an even footing with the Amdahl 5990 mainframes announced in May 1988.

Since introducing the 3090 S models in 1988, IBM has added three models: the 100S, 250S, and 380S. IBM lowered the entry point into the ES/3090 S Series with the February 1989 introduction of the Model 100S single processor. The company now offers five uniprocessor models.

The Model 100S overlaps the price/performance of IBM's strategic ES/4381 midrange mainframe series and eases migration into the company's large-systems environments. The new model is expected to have 1.0 to 1.3 times the internal throughput of the ES/4381 Model Group 91E. The Model 100S can be field upgraded to the Model 120S, another uniprocessor. With a base purchase price of $525,000, the Model 100S is the lowest-priced 3090 offered to date. The Model 100S became available in April. The Model 120S upgrade option will be available by the third quarter of this year.

Undoubtedly, IBM wants to lure more 4381 and 308X users into the 3090 camp. The new Model 100S probably means IBM will delay announcing a new 4381 follow-on series until the end of the year or until IBM can move more 3090 boxes. A 4381 replacement series is expected to hurt low-end 3090 sales.

The Model 380S, introduced in April, has about 1.8 to 1.9 times the internal throughput of an ES/3090 Model 200E operating under MVS/SP Version 3.1. It has about 1.4 to 1.5 times the internal throughput of a Model 280S. Unlike ▷

▶ When the data are retrieved, single-bit errors are 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 250S, 280E, 280S, 380S, 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:

• 3092 Processor Controller Models 1, 2, 3, 4, or 5; ▶

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	Model 400S	Model 500S	Model 600S
SYSTEM CHARACTERISTICS			
Date announced	July 26, 1988	July 26, 1988	July 26, 1988
Date first delivered	Fourth-quarter 1988	Fourth-quarter 1988	Fourth-quarter 1988
Field upgradable to	Models 500S, 600S	Model 600S	Not applicable
Relative performance	Not specified	Not specified	Not specified
Number of processors	4	5	6
Cycle time, nanoseconds	15	15	15
Word size, bits	32	32	32
Operating systems	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370
MAIN MEMORY			
Type	1M-bit NMOS	1M-bit NMOS	1M-bit NMOS
Minimum capacity, bytes	128M*	128M*	128M*
Maximum capacity, bytes	512M	512M	512M
Increment size, bytes	128M, 256M	128M, 256M	128M, 256M
Cycle time, nanoseconds	Not specified	Not specified	Not specified
BUFFER STORAGE			
Minimum capacity	128KB/CPU	128KB/CPU	128KB/CPU
Maximum capacity	128KB/CPU	128KB/CPU	128KB/CPU
Increment size	0	0	0
INPUT/OUTPUT CONTROL			
Number of channels:			
Byte multiplexer	0-8	0-8	0-8
Block multiplexer	64, 80, 96, 128	64, 80, 96, 128	64, 80, 96, 128
Word	0	0	0
Other	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 Model 300S, also a triple processor, the 380S can take advantage of the new asymmetric configuration options explained below.

The 380S can be configured as a single image or may be physically partitioned with two processors on one side of the partition and one processor on the other. In physically partitioned mode, processors on each side of the partition are established as physically attached but independent environments.

Along with the April introduction of the Model 380S, IBM announced asymmetrical processing, a feature designed to make the 3090 S models more attractive to 3090 E users and base model users. The option is not available for E models.

IBM introduced new asymmetrical configuration options for Models 250S, 280S, 380S, 400S, 500S, 600S, and related upgrades involving these models. The option lets users configure channels and Expanded Storage within multiprocessor configurations with more flexibility. Channels and Expanded Storage no longer have to balance on either side of a partition. When upgrading, however, channel and Expanded Storage features must meet minimum requirements. An asymmetric Expanded Storage configuration requires a minimum of 64 megabytes of storage on the A and B sides of the processor complex. And asymmetry does not apply to central storage and Processor Resource/Systems Manager (PR/SM) features. The asymmetry feature lets users purchase just the amount of extra channels and Expanded Storage they need. Evidently, IBM is hoping the new configuration flexibility will stimulate more busi- ▷

- 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 introduction of the 3090 S models, IBM brought out 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 listing of central storage options for each processor model. In addition to main memory, each 3090 E processor and Mod- ▶

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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	Not specified	Not specified	Not specified	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	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	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	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	Not specified	Not specified	Not specified	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.

ness, particularly among customers who have been putting off additional 3090 purchases.

At the July 1988 announcement, IBM officials proclaimed that 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 database environment, a Model 600S running under MVS/ESA provides about 56 percent greater internal throughput than the Model 600E running under MVS/XA.

To show off the power of MVS/ESA, IBM introduced a faster version of Data Facility Sort (DFSORT) and enhanced CICS/MVS. IBM contends that DFSORT Release 11, the newest release, reduces sorting time by 25 percent, CPU-busy time by 17 percent, and channel-busy time by 46 percent. The company achieved the performance improvement using a new "hipersorting" feature that takes advantage of faster mainframe memory. Hipersorting lets users sort data within an Expanded Storage data space called hiperspace. IBM introduced the hiperspace concept in February 1988 with the initial introduction of ESA/370. By moving sort data into processor memory rather than accessing it on a disk, users can sort large amounts of data at higher speeds.

CICS/MVS 2.1 running in an ESA/370 environment includes a new, optional feature called Data Tables. IBM claims that this newest feature helps increase on-line trans-

els 100S, 120S, 150S, 170S, and 250S 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 is 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 RANGE	MAXIMUM
Model 100S	64, 128, 192 megabytes	256 megabytes
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
Model 200E	64, 128, 192, 256 512 megabytes	1 gigabyte

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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	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	MVS/SP, MVS/XA, ESA/370, VM/HPO, VM/XA, AIX/370	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	1M-bit NMOS, 288K-bit MOS	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.

action processing rates by up to 95 percent. The Data Tables feature provides users with faster access to frequently used data in virtual storage. Pricing information, descriptive data, and routing codes are IBM examples of high-access data that can be maintained under the new feature. Data Tables lets users construct, maintain, and access data in virtual storage above the 16-megabyte line, bypassing normal CICS file processing. The newest release provides for CICS-maintained and user-maintained Data Tables.

CICS/MVS participates in IBM Systems Application Architecture (SAA), a strategy for making applications portable across otherwise incompatible IBM hardware platforms using common interfaces and protocols.

COMPETITIVE POSITION

The 1988 delivery of several strategic new product lines helped Big Blue bring the year to a close with a strong finish. Results for the first quarter of this year were also strong enough to please Wall Street. During 1988, earnings increased to $5.81 billion, a 10 percent increase over the $5.26 billion the company earned in 1987. Revenues for the year were $59.68 billion compared to $55.26 billion earned the previous year. During the first quarter of this year, IBM logged net earnings of $950.0 million on revenues of $12.7 billion, an earnings increase of 1.8 percent compared to the same period last year.

Strong sales of the midrange AS/400 and ES/3090 S models together with the MVS/ESA operating system all contrib-

EXPANDED STORAGE BY MODEL	MINIMUM AND INTERMEDIATE RANGE	MAXIMUM
Model 200S	64, 128, 192, 256 512 megabytes	1 gigabyte
Model 250S	128, 256, 384 megabytes	512 megabytes
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 380S	A side: 64, 128, 192, 256 256 megabytes B side: 64, 128, 192	1 gigabyte 256 megabytes 1.28 gigabytes total
Model 400E	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 400S	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes

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uted to the healthy results. The departure of about 6,500 employees under an early retirement incentives program also helped cut expenses.

But IBM is still struggling to return to the big growth years the company enjoyed at the beginning of this decade. Single-digit 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.

Many of IBM's problems are related to the changing role of the mainframe. IBM has grown to be a near $60 billion company primarily on the strength (and also weakness) of the venerable mainframe. Mainframe sales still constitute a substantial part of the business. When mainframe sales lag, as they have during the last few years, IBM has problems. The growth of more powerful workstations that rival the power of mainframes as well as the growth of local area networks (LANs) have threatened the mainframe.

To protect its mainframe business, meet profit goals, and return to the days of double-digit growth, IBM has had to rethink its basic mainframe strategies. A tall order indeed.

Within the last few years, IBM has developed several key make-or-break strategies for the long term. During the next decade and beyond, IBM believes the mainframe will play a key role in enterprise networking. It will be the central repository of data and information for the enterprise. Users at workstations will interface with mainframes and minis and transparently retrieve data and information without having to know exactly where the data resides. The concept is called cooperative processing.

To achieve this vision, IBM announced its Systems Application Architecture (SAA) strategy in 1987. SAA will make applications compatible across key hardware platforms (PS/2, AS/400, System/370 mainframes) using consistent interfaces and protocols. In May 1989, IBM introduced the first piece of the SAA puzzle, OfficeVision, an applications package that runs on four strategic IBM software platforms: MVS, VM, OS/400, and OS/2. The product lets PS/2 users easily extract information from IBM minis and mainframes. Initially, the product will provide users with basic office applications such as mail, address book, calendar management, library services, document processing, and decision support. The various pieces of OfficeVision will become available over the next two years.

SAA will tie together IBM's various proprietary operating environments. For users who want open systems, particularly users in the technical computing world, IBM has brought out AIX, its implementation of UNIX. IBM now has AIX versions for the PS/2 Model 80 PC, the IBM RT technical workstation, and the System/370 environment, including the 3090 Series. AIX users can work in a compatible operating system environment from IBM PCs to mainframes, making it possible to port applications from one AIX-based hardware platform to another. The UNIX- ▷

EXPANDED STORAGE BY MODEL	MINIMUM AND INTERMEDIATE RANGE	MAXIMUM
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 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 interrupts, 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 ▶

IBM ES/3090 Series

TABLE 2. MASS STORAGE

MODEL	3370 Model A2	3380 Models D, E	3380 Models J, K
Cabinets per subsystem	1 to 4	1 to 4	1 to 8
Disk packs/HDAs per cabinet	1	2	2
Capacity	729.8MB	2520/5040MB	2520/7560MB
Tracks/segments per drive unit	—	—	—
Average seek time, msec.	19	15/17	12/16
Average access time, msec.	29.1	23.3/25.3	20.3/24.3
Average rotational delay, msec.	10.1	8.3	8.3
Data transfer rate	1.19MB/sec.	3.0MB, 4.5MB/sec.	3.0MB or 4.5MB/sec.
Controller model	3880 Models 1, 21	3880/3990	3880/3990
Comments	All other 3370 DASDs were withdrawn	3380 D and E models were withdrawn effective February 28, 1989	Single- and triple-density models

A dash (—) indicates information was not available.

based system is also compatible with industry-recognized standard interfaces such as TCP/IP and the Network File System.

IBM announced AIX/370 versions for the mainframe in March 1988 and planned to deliver the product in March 1989, but development problems have forced IBM to revise its delivery date. The company now plans to phase in AIX/370 throughout 1989.

Externally, IBM continues to face pressures from plug-compatible manufacturers (PCMs) Amdahl and NAS. In May 1988, 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.

In April 1989, Amdahl added three more models to its 5990 lineup, giving its PCM customers more price/performance choices and an easier entry into its top-end product line. The new Amdahl models consist of the Model 350 single processor ($3,806,250), the Model 500 dual processor ($4,620,000), and the Model 1100 three-way multiprocessor ($9,870,000). Currently, the company sells five 5990 models and seven of the earlier 5890 models. By contrast, IBM sells 13 ES/3090 S models and 9 of the earlier 3090 E models, giving customers many more price/performance increments and upgrade paths. Of course, Amdahl, as a PCM, still maintains its traditional 15 to 20 percent price/performance edge.

In addition to Amdahl, IBM must now contend with a revitalized National Advanced Systems (NAS), the other PCM. Last spring Hitachi Ltd. and Electronic Data Systems (EDS) purchased the NAS unit from National Semiconductor for $398 million. Under the deal, Hitachi owns 80 percent, and EDS owns 20 percent. Under its former ownership, NAS sold IBM-compatible mainframes it acquired from Hitachi. A Japanese company comparable in ▷

and ESA/370 modes, the 3090 supports Expanded 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 five 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, or a Model 4 to a Model 5. 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.

Each Model 1, 2, or 3 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 ▶

IBM ES/3090 Series

TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
3422	9	1600/ 6250	PE/ GCR	— 125	200,000 780,000
3430	9 9	1600 6250	PE GCR	50 50	80,000 312,500
3480 Model B22	18	38,000 (bytes)	AXP	79	3,000,000
Model B11	18	38,000 (bytes)	AXP	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 14⅞ wide, 3½ to 11 long
Model 6	134 ppm	136, 163, 204	10, 12, 15	6, 8, 10, 12	6½ to 14⅞ wide, 3½ to 11 long
3820	20 ppm	Variable	10, 12 other	—	7 to 8½ wide, 10½ to 14 long
3827: Model 1	92 ppm	Variable	Vari-able	Vari-able	8 to 8½ wide, 10 to 14 long
3835: Model 1	88 ppm	Variable	Vari-able	Vari-able	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.

▷ size to IBM, Hitachi certainly has the financial resources and R&D muscle to compete effectively with IBM financially and technologically. Observers believe the NAS alliance will alter the power balances within the IBM mainframe world during the next few years.

► Tape Models B11/B22 or 3422 Magnetic Tape Subsystem; and one 3864 Modem Model 2 (or equivalent) with an automatic calling unit feature.

▷ The newer and smaller Models 4 and 5 feature an integrated DASD and optical disk. The integrated devices eliminate the need for ordering the 3370 DASDs and tape devices required for the Models 1, 2, and 3. The Model 4 supports Models 100S, 120S, and 120E. The Model 5 supports the rest of the 3090 E and S Series.

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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 Communications Controller	3174, 3274 Controllers	3174, 3274, 3276 Controllers	3174, 3274 Controllers

A dash (—) indicates information was not available.

ADVANTAGES AND RESTRICTIONS

Before the announcement of the ES/3090 S models and the new ESA/370 architecture, IBM was on the defensive. Industry analysts contended that little price/performance difference existed between a 3090 and the previous 308X Series. The marketplace also seemed to confirm this perception. Many users continued to prefer a used 308X to 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 that of 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 databases, network management, distributed processing involving PC-to-mainframe links, and engineering/scientific applications come immediately to mind.

IBM contends ESA/370 and other ongoing enhancements are all part of a grand plan to phase in technological improvements at an easy and less disruptive "evolutionary" pace. Major improvements include faster CPU cycle times, denser memory chips and TCM packaging, Expanded Storage, the Vector Facility attachment, faster data transfer rates (3.0 to 4.5 megabytes per second), and double- and triple-density DASDs. Moreover, users can now configure ▷

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 switch-over 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. ▶

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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	Green	—	—
Total colors/no. simult. displayed	7 colors	None	Monochrome	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.

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

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 on the processor and reduces system overhead. It is now available on 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 two 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.

But to take advantage of the Expanded Storage concept, users 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. VFs attached to ES/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 computing performance, according to IBM. Vector capabilities were not available for the 308X mainframe generation.

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.

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 design 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.

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▷ 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 formerly 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.

To make its systems software more affordable to small and medium-size system users, IBM introduced a multilevel software pricing structure. Software now falls under graduated pricing categories: Processor Groups 10, 15, and 18 at the low end, Processor Groups 20 and 30 in the middle, and Processor Groups 40 and 50 at the high end. All 3090 machines, except the entry-level Models 100S, 120E, and 120S, are Group 40 or 50 machines. The Models 100S, 120E, and 120S are Group 30 machines. The designation makes software less expensive for Model 100S and 120E/120S users migrating to their first 3090 system, but a later move to a larger 3090 system could prove 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 1988 Datapro survey of general-purpose mainframes brought responses from 49 IBM 3090 users. (The enhanced ES/3090 S models, announced after the survey was done, are not included.) Of the 49 respondents, 14 say they have a 3090 Model 150 single processor, 22 have either a Model 200 dual processor or 300 triple processor, and 13 have a Model 400 four-way processor or Model 600 six-way processor.

At the time of the survey (Summer 1988), the model 150s had been installed for an average 13.4 months, the 200/300s for 13.2 months, and the 400/600s for 9.0 months. ▷

▷ 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:

* 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. ▶

IBM ES/3090 Series

Of those surveyed, 15 purchased their machines from IBM, 10 are leasing them from the company, and 23 are leasing through a third party.

While the sites surveyed represented a variety of industries, insurance, banking/finance/securities, utilities, and manufacturing were cited the most. Insurance firms and utilities tended to use IBM's largest multiprocessors. Four 150 users said they are in manufacturing, while two said they are in the banking/finance/securities industries. Of the 200/300 users, eight are insurance companies and three are utilities. Of the 400/600 users, five are insurance companies and two are utilities.

Accounting/billing, payroll/personnel, order processing, and purchasing tend to be the top applications among most of the users surveyed. After basic accounting applications, insurance applications were numerous among users with the larger multiprocessor systems.

As would be expected, most of the 3090s are part of large-scale configurations; 36 users say they have more than 64 megabytes of main memory, while 13 have between 16 and 64 megabytes of memory. Of the 46 who answered the question about disk capacity, 42 have more than 10 gigabytes of capacity and only 4 have less than 10 gigabytes. Twenty-seven respondents have between 10 and 150 gigabytes, and fifteen have more than 150 gigabytes.

Additionally, 33 respondents have more than 240 local workstations and more than 240 remote workstations, and 16 respondents said they have between 17 and 240 local workstations and between 1 and 240 remote workstations.

During 1988, 39 of those surveyed said they planned to acquire additional software from the manufacturer, while another 39 said they planned to purchase proprietary software from other suppliers. Only three said they planned to acquire an operating system based on UNIX. On the hardware side, 38 said they planned hardware expansions, and 40 said they planned to expand data communications equipment. Twenty-two planned to acquire laser printers, eleven planned to acquire image processing equipment, seven planned to acquire optical disk devices, and six planned to acquire power conditioning equipment.

Finally, 34 respondents said they had an information center, 12 said they did not, and 2 said they planned to create a center in the near future.

The following tables shows how responding users rated their 3090s. The results are broken down by designated model groups. Users were asked to rate their systems using a 10-point scale in which a score of 10 is excellent and a score of 1 is poor. Interestingly, overall rating results appear fairly consistent among the three model groupings. Of course, there are exceptions. Model 200/300 users appear less satisfied with the reliability of their peripherals than do the Model 150 and 400/600 users. Model 150 users appear less happy with IBM operating systems than Model 400/600 users. Model 150 and 200/300 customers give IBM ▷

• 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.

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 is 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. ▶

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lower grades for "ease of programm'ing" than Model 400/600 users. The results are summarized in the following three tables.

IBM 3090 150 Ratings

Ease of operation	7.0
Reliability of system	9.0
Reliability of peripherals	8.8
Maintenance service:	
Responsiveness	8.6
Effectiveness	8.4
Technical support:	
Troubleshooting	7.9
Education	7.9
Documentation	7.7
Vendor's software:	
Operating system	7.8
Compilers & assemblers	7.9
Application programs	7.2
Ease of programming	6.6
Ease of conversion	7.0
Overall satisfaction	8.2

IBM 3090 200/300 Ratings

Ease of operation	7.3
Reliability of system	9.1
Reliability of peripherals	8.0
Maintenance service:	
Responsiveness	8.5
Effectiveness	8.5
Technical support:	
Troubleshooting	8.1
Education	8.0
Documentation	7.4
Vendor's software:	
Operating system	8.2
Compilers & assemblers	8.0
Application programs	7.3
Ease of programming	6.6
Ease of conversion	6.9
Overall satisfaction	7.9

IBM 3090 400/600 Ratings

Ease of operation	7.5
Reliability of system	9.3
Reliability of peripherals	8.8
Maintenance service:	
Responsiveness	8.0
Effectiveness	8.3
Technical support:	
Troubleshooting	7.6
Education	7.2
Documentation	7.1
Vendor's software:	
Operating system	8.8
Compilers & assemblers	8.4
Application programs	7.0
Ease of programming	7.3
Ease of conversion	6.6
Overall satisfaction	8.3

When users were asked if their 3090s performed as expected, 46 said "Yes," none said "No," and 2 were undecided. When asked if they would recommend the 3090 to others, 44 said "Yes," a single Model 150 user said "No," and 3 were undecided. □

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 100S, 120S, 150S, 170S, 180S, 200S, 250S, 300S, and 380S. One optional PR/SM feature can be installed on each side of the Models 280S, 400S, 500S, and 600S.

PR/SM lets users set up 7 logically partitioned and independent operating environments on a single 3090 processor complex and up to 14 logical partitions on multiple processors operating in a physically partitioned configuration. PR/SM is a hardware feature that lets users run a 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.

In addition to PR/SM, IBM introduced asymmetrical configuration options for Models 250S, 280S, 380S, 400S, 500S, 600S, and related upgrades involving these models. The option lets users configure channels and Expanded Storage within multiprocessor configurations with more flexibility. Under this option, channels and Expanded Storage no longer have to balance on either side of a partition. But an asymmetric Expanded Storage configuration requires a minimum of 64 megabytes of storage on the A and B sides of the processor complex before asymmetry can be exploited. Asymmetry does not apply to central storage and PR/SM features.

PHYSICAL SPECIFICATIONS: Please refer to the following chart for physical and environmental information about IBM 3090 S models.

PHYSICAL CHARACTERISTICS

Floor space in square feet:
(includes service clearances)

Model 120S	482 to 547
Model 150S	540 to 605
Model 170S	540 to 605
Model 180S	540 to 605

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Floor space in square feet:
(includes service clearances)

Model 280S	796 to 926
Model 200S	540 to 629
Model 300S	584 to 629
Model 400S	796 to 974
Model 500S	840 to 974
Model 600S	885 to 974

Weight (lb):

Model 120S	11,535 to 14,460
Model 150S	12,615 to 15,540
Model 170S	12,615 to 15,540
Model 180S	12,615 to 15,540
Model 280S	22,320 to 28,170
Model 200S	12,995 to 16,870
Model 300S	14,675 to 17,250
Model 400S	23,080 to 30,830
Model 500S	24,760 to 31,210
Model 600S	26,440 to 31,590

**Power consumption;
kVA at 400 Hz:**

Model 120S	21.5 to 30.2
Model 150S	21.5 to 30.2
Model 170S	21.5 to 30.2
Model 180S	22.6 to 31.0
Model 280S	43.8 to 60.6
Model 200S	31.8 to 44.5
Model 300S	38.9 to 53.2
Model 400S	62.2 to 87.6
Model 500S	69.3 to 96.3
Model 600S	76.4 to 105.8

Heat output; Kbtu/hr:

Model 120S	73.1 to 96.3
Model 150S	73.1 to 96.3
Model 170S	73.1 to 96.3
Model 180S	75.7 to 100.0
Model 280S	146.0 to 194.6
Model 200S	101.7 to 139.7
Model 300S	123.6 to 168.1
Model 400S	198.0 to 274.0
Model 500S	219.9 to 275.7
Model 600S	241.8 to 330.8

CONFIGURATION RULES

A minimum 100S, 120E, or 120S configuration includes the central processor complex, a 3092 Model 3 or 4 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 or 5, 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 or 5, 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 250S, 280E, and 280S consist of two CPUs, a 3092 Model 2 or 5, 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 or 3, 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.

The Model 380S consists of three CPUs, a 3092 Model 2 or 5, two 3097s Models 1 or 2, three 3089 Model 3, 3370 Model A2s, 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 or 5; and two 3097 Units Model 1 or 2. They also require 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 in either byte multiplex or 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 to 4.5 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.

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 ▶

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► 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 aids in managing 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 more information on the 3814 and its features, please refer to the "Guide to Peripheral Switches and Channel Extenders" report on Page 70D9-000EK-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 3745, the 3720, and 3725 Communication Controllers.

The *3745 Communication Controller* consists of the Models 210 and 410 controllers and the 3746 Series of expansion units. The controllers operate under the Advanced Communications Function/Network Control Program (ACF/NCP) or Partitioned Emulator Program (PEP). They can be configured with four to eight megabytes of memory and up to 16 channel adapters which connect the controllers to IBM mainframe channels. It comprises up to 32 scanners, each of them monitoring up to 32 lines. A 3745/3746 combination lets users attach up to 512 duplex lines. Users can attach up to 128 duplex lines to a Model 210 or 410-base frame. Up to 256 duplex lines can be attached to the 3746 Model L13 or 128 duplex lines to the 3746 Model L14.

The 3745 supports up to 16 T1 connections and up to eight IBM Token-Ring attachments. Token-ring attachments operate at 4 or 16 megabits per second.

The *3725 Communication Controller Models 1* and *2* consist of a central control unit that operates under control of ACF/NCP, Emulator Program, or PEP. 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.

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 and AS/400 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. ►

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▶ *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 resources to jobs or timesharing 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-XYS) 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 standalone 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 offload 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, known collectively as MVS/Extended Architecture (MVS/XA), 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 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.

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 ▶

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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 type functions as an internal direct access storage device, can only be accessed by authorized programs, and eliminates the 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 (DF-SMS). 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 capability to run multiple operating systems concurrently and with a conversational timesharing 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 timesharing 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 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.

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.

VM/XA System Product (SP) Release 1 supersedes all releases of VM/XA Systems Facility (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.

VM/XA SP Release 2 lets VM/XA SP users participate in SNA networks and offers 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.

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.

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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.

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 database 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 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.)

IMS/ESA Version 3 Release 1, announced in October 1988, will operate only in an MVS/ESA environment. IMS/ESA contains the functions of IMS/VS version 2 in addition to new enhancements. These include DL/I Virtual Storage Constraint Relief and Fastpath High-Speed Sequential Processing improvements. The product will become available in October 1989.

Database 2 is IBM's relational data base product that runs under MVS/XA, MVS/ESA, 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 database definition and declaration for Cobol, PL/1, and Assembler language programs.

Query Management Facility (QMF) is an interactive database facility designed for users with little or no processing experience. QMF operates with DB2 in MVS/XA, MVS/ESA, 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, and NetView.

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► 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/VS) is a general-purpose data communications monitor for terminal-oriented transaction programming. CICS/VS provides an interface between user-written applications and common IBM access methods, such as VTAM and ACF/VTAM, and data managers (DL/1, DOS/VS, SQL/DS in DOS/VS, IMS/VS/DB, and DB2 in MVS). Multiregion operation (MRO) lets users run multiple connected CICS/VS regions within a system, while sharing terminals, transactions, and other resources.

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.

CICS/MVS 2.1 running in an ESA/370 environment includes a new, optional feature called Data Tables. IBM claims that this newest feature helps increase on-line transaction processing rates by up to 95 percent. The Data Tables feature provides users with faster access to frequently used data in virtual storage. Pricing information, descriptive data, and routing codes are IBM examples of high-access data that can be maintained under the new feature. Data Tables lets users construct, maintain, and access data in virtual storage above the 16-megabyte line, bypassing normal CICS file processing. The newest release provides for CICS-maintained and user-maintained Data Tables.

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 Control-

ler 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.

PROGRAM DEVELOPMENT: IBM currently offers many tools to help programmers and end users 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 Conversional Monitor System (CMS).

Facilities available for VM/SP and VM/XA environments include APE, CSP/AD, CSP/AE, Cross System Product/Query (CSP/Q), IIAS, 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 Requeuer, 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 databases 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 and includes advanced function printing support, library maintenance enhancements, user exits, and the capability 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 ►

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► 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 equations, and symmetric elgensystems. 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, 18, 20, 30, 40, and 50) allow for a multitier processing structure for each applicable product. The 3090 Models 100S, 120E/120S are Processor Group 30 machines. The Models 150E/150S, 170S, 180E/180S, 200E/200S, 250S, 280E/280S, 300E/300S, 380S, 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 database, which incorporates every problem encountered and resolved (or unresolved) by the central support group. The 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	$1,312,500
One 3092 Processor Controller Model 1	200,000
One 3097-1 Power and Coolant Distribution Unit	121,000
One 3089 Model 3 Power Unit	39,900
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

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➤ SMALL CONFIGURATION:

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	56,930
Four B22 Cartridge Tape Units	159,360
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer (20,040 lpm)	289,000
TOTAL PURCHASE PRICE:	**$4,295,460**

MEDIUM CONFIGURATION:

3090 Model 200S Processor Complex; 64 megabytes of main memory, 32 integrated channels	$4,711,500
64 megabytes of additional central memory	540,000
384 megabytes of additional central memory (512 megabytes of central memory total)	2,940,000
128 megabytes of Expanded Storage	515,000
One 3092 Model 1 Processor Controller	200,000
One 3097-1 Power and Coolant Distribution Unit	121,000
Two 3089 Model 3 Power Units	79,800
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)	93,100
Fourteen 3422 Model B01 Tape Units (125 ips)	316,960
One 3005 Two-Channel Switch (2 by 16)	4,110
Two 3480 A22 Tape Cartridge Control Units	113,860
Eight B22 Cartridge Tape Units	318,720
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer; (20,040 lpm)	289,000
TOTAL PURCHASE PRICE:	**$12,359,820**

LARGE CONFIGURATION:

3090 Model 600S Processor Complex; 128 megabytes shared central storage, 64 integrated channels	$12,314,700
64 megabytes of additional central storage; A side	490,000
64 megabytes of additional central storage; B side	490,000
128 megabytes of additional central memory; A side	980,000
128 megabytes of additional central memory; B side (512 megabytes of central memory total)	980,000
512 megabytes of Expanded Storage; A side	1,625,000
512 megabytes of Expanded Storage; B side (1 gigabyte of Expanded Storage total)	1,625,000
First additional channel group; 8 channels, A side	136,500
Second additional channel group; 8 channels, A side	136,500
Third additional channel group; 16 channels, A side	273,000
First additional channel group; 8 channels, B side	136,500
Second additional channel group; 8 channels, B side	136,500
Third additional channel group; 16 channels, B side	273,000
One 3092 Processor Controller Model 2	235,000
Two 3097-1 Power and Coolant Distribution Units	242,000
Four 3089 Model 3 Power Units	159,600
Two 3370 Model A2 DASDs	70,960
Three 3206 Model 100 Display Stations	8,085
Two Automatic Calling Units for 3864-2 Modem	2,180
Ninety 3278 Model 2 Display Units	141,480
Three 3174-1L Cluster Controllers	38,850
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
Two 3422 Model A01 Control Units (unit contains one tape drive; 125 ips)	93,100
Fourteen 3422 Model B01 Tape Units (125 ips)	316,960
One 3005 Two-Channel Switch (2 by 16)	4,110
Two 3480 A22 Tape Cartridge Control Units	113,860
Eight B22 Cartridge Tape Units	318,720
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer (20,040 lpm)	289,000
TOTAL PURCHASE PRICE:	**$24,306,605** ➤

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EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)

PROCESSORS & FEATURES

3090 S Models

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Model 100S	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-3 Processor Controller, 3097-1 or -2 Power & Coolant Distribution Unit, and 3089-3 Power Unit	525,000	1,680	NA
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	750,750	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	1,312,500	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	1,785,000	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	2,572,500	3,465	NA
Model 200S	Processor Complex consists of two CPUs, 64MB of central storage, 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 Unit, 3206-100 System Consoles, and 3864-2 Automatic Call Unit	4,711,500	6,895	NA
Model 250S	Processor Complex consists of two CPUs, 64MB of central storage, 64KB buffer per CPU, and 16 integrated channels; requires 3092-2 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, 3206 System Console, and 3864-2 Automatic Calling Unit	2,828,700	5,910	NA
Model 280S	Processor Complex; consists of two CPUs, 64MB of central storage, 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 Unit 3206-100 System Consoles, and 3864-2 Automatic Call Unit	5,086,200	7,360	NA
Model 300S	Processor Complex consists of three CPUs, 128KB buffer per CPU, 64MB of central storage, 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	6,554,200	10,225	NA
Model 380S	Processor Complex consists of three CPUs, 128MB of central storage, 128KB of buffer memory per CPU, and 48 integrated channels; requires 3092-5 Processor Controller, two 3097-1 or -2 Power & Coolant Distribution Units, and three 3089-3 Power Units	7,469,000	11,389	NA
Model 400S	Processor Complex consists of four CPUs, 128MB of central storage, 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, 3206-100 System Consoles, and two 3864-2 Automatic Call Units	9,364,200	14,465	NA
Model 500S	Processor Complex consists of five CPUs, 128MB of central storage, 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, 3206-100 System Consoles, and two 3864-2 Automatic Call Units	10,839,400	17,000	NA
Model 600S	Processor Complex consists of six CPUs, 128KB buffer per CPU, 128MB of central storage, 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	12,314,700	20,490	NA

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

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
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	750,700	1,680	66,930
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	1,312,500	2,520	121,650
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	2,310,000	3,010	205,950
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	4,291,500	6,195	465,050
Model 280E	Processor Complex consists of two CPUs, 64MB of central storage, and 32 integrated channels	4,561,200	6,480	406,700
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	5,819,200	8,975	533,750
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	8.182,900	12,505	884,000
Model 500E	Processor Complex consists of five CPUs, 128MB of central storage, and 64 integrated channels	9,474,400	14,725	847,200
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	10,739,700	17,745	1,015,400
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
3092-4	Processor Controller; required for Models 100S, 120S, and 120E	155,400	817	NA
3092-5	Processor Controller; required for Models 150S, 170S, 180E, 180S, 250S, 280E, 280S, 200E, 200S, 300E, 300S, 400E, 400S, 500E, 500S, 600E, and 600S	278,600	1,450	NA
—	Upgrade from 3092 Model 1 to 3092 Model 2	35,000	NA	NA
—	Upgrade from 3092 Model 3 to 3092 Model 1	80,000	NA	NA
—	Upgrade from 3092 Model 4 to 3092 Model 5	123,200	NA	NA
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	NA	NA
4650	I/O Power Sequence Control	8,000	52	770
3089-3	Power Unit	39,900	96	3,650
Expansion Frames				
7330	Expansion Frame for Models 100S, 120E, 120S, 150E, 150S, 170S, 180E, and 180S; requires 155	47,250	52	4,545
7330	Expansion Frame for Models 200E, 200S, and 380S; requires 3854 or 1545	47,250	52	4,545
7331	Expansion Frame for B side; requires feature 1546	47,250	52	

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 (Continued)				
7330	Expansion Frame for Models 280E and 280S on A side; requires 1545	47,250	52	4,545
7331	Expansion Frame for Models 280E and 280S on B side; requires 1546	47,250	52	4,545
7330	Expansion Frame for Model 400E on A side; requires 3854 or 1545	47,250	50	4,545
7331	Expansion Frame for Model 400E on B side: requires 3856 or 1546	47,250	52	4,545
7330	Expansion Frame for Models 500E and 500S on A side; requires 7330	47,250	52	4,545
7331	Expansion Frame for Models 500E and 500S on B side; requires 1546 or 3856	47,250	52	4,545
7330	Expansion Frame for Models 600E and 600S on A side; requires 7330	47,250	52	4,545
7331	Expansion Frame for Models 600E and 600S on B side; requires 7331	47,250	52	4,545
Channel Groups: Models 120E and 150E				
3848	Eight additional channels	136,500	152	11,580
Channel Groups: Models 100S, 120S, 150S, 170S, 180E, and 180S				
3848	Eight additional channels	136,500	152	12,150
3849	Second additional channel group; 8 channels	136,500	152	12,150
Channel Groups: Models 200E and 200S				
3850	First additional channel group; 8 channels	136,500	152	13,120
3851	Second additional channel group; 8 channels	136,500	152	13,120
3854	Third additional channel group; 16 channels; requires 7330	273,000	304	25,010
Channel Groups: Models 250S, 280E and 280S				
	—A side:			
3848	First additional channel group; 8 channels	136,500	152	12,150
3849	Second additional channel group; 8 channels	136,500	152	12,150
	—B side:			
3858	First additional channel group; 8 channels	136,500	152	12,150
3859	Second additional channel group; 8 channels	136,500	152	12,150
Channel Groups: Models 300E and 300S				
3850	First additional channel group; 8 channels	136,500	152	13,120
3851	Second additional channel group; 8 channels	136,500	152	13,120
3854	Third additional channel group; 16 channels	273,000	304	26,260
Channel Groups: Model 380S				
	—A side:			
3850	First Additional Channel Group; 8 channels	136,500	152	13,120
3851	Second Additional Channel Group; 8 channels	136,500	152	13,120
3854	Third Additional Channel Group; requires 7330	273,000	304	26,260
	—B side:			
3858	First Additional Channel Group; 8 channels	136,500	152	12,150
3859	Second Additional Channel Group; 8 channels	136,500	152	12,150
Channel Groups: Models 400E and 400S				
	—A side:			
3850	First additional channel group	136,500	152	13,120
3851	Second additional channel group	136,500	152	13,120
3854	Third additional channel group; requires 7330	273,000	304	26,260
	—B side:			
3852	First additional channel group	136,500	152	13,120
3853	Second additional channel group	136,500	152	13,120
3856	Third additional channel group; requires 7331	273,000	304	26,260
Channel Groups: Models 500E and 500S				
	—A side:			
3850	First additional channel group; 8 channels	136,500	152	13,120

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

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Channel Groups: Models 500E and 500S (Continued)				
3851	Second additional channel group; 8 channels	136,500	152	13,120
3854	Third additional channel group; 16 channels	273,000	304	26,260
	—B side:			
3852	First additional channel group; 8 channels	136,500	152	13,120
3853	Second additional channel group; 8 channels	136,500	152	13,120
3856	Third additional channel group; 16 channels; requires 7331	273,000	304	26,260
Channel Groups: Models 600E and 600S				
	—A side:			
3850	First additional channel group	136,500	152	13,120
3851	Second additional channel group	136,500	152	13,120
3854	Third additional channel group	273,000	304	26,260
	—B side:			
3852	First additional channel group	136,500	152	13,120
3853	Second additional channel group	136,500	152	13,120
3856	Third additional channel group	273,000	304	26,260
Additional Central Storage				
	Models 100S, 120E, 120S, 150E, 150S, 170S, 180E, 180S			
4064	Additional 32 megabytes	270,000	262	25,270
	Model 200E			
4128	Additional 64 megabytes	490,000	525	50,550
	Model 200S			
4128	Additional 64 megabytes	490,000	500	50,550
4256	Additional 128 megabytes	980,000	1,050	NA
4257	Additional 192 megabytes	1,470,000	1,575	NA
	Models 250S and 280E			
4064	Additional 32 megabytes for A side	270,000	262	25,270
4264	Additional 32 megabytes for B side	270,000	262	25,270
	Model 280S			
4064	Additional 32 megabytes for A side	270,000	262	25,270
4128	Additional 64 megabytes for A side	490,000	525	50,550
4129	Additional 96 megabytes for A side	760,000	787	NA
4264	Additional 32 megabytes for B side	270,000	262	25,270
4228	Additional 64 megabytes for B side	490,000	525	50,550
4229	Additional 96 megabytes for B side	760,000	787	NA
	Model 300E			
4128	Additional 64 megabytes	490,000	525	50,550
	Model 300S			
4128	Additional 64 megabytes	490,000	525	50,550
4256	Additional 128 megabytes	980,000	1,050	NA
4257	Additional 192 megabytes	1,470,000	1,575	NA
	Models 380S and 400E			
4128	Additional 64 megabytes for A side	490,000	525	50,550
4228	Additional 64 megabytes for B side	490,000	525	50,550
	Model 400S			
4128	Additional 64 megabytes for A side	490,000	525	50,550
4256	Additional 128 megabytes for A side	980,000	1,050	NA
4257	Additional 192 megabytes for A side	1,470,000	1,575	NA
4228	Additional 64 megabytes for B side	490,000	525	50,550
4356	Additional 128 megabytes for B side	980,000	1,050	NA
4357	Additional 192 megabytes for B side	1,470,000	1,575	NA
	Model 500E			
4128	Additional 64 megabytes for A side	490,000	525	50,550
4228	Additional 64 megabytes for B side	490,000	525	50,550
	Models 500S			
4128	Additional 64 megabytes for A side	490,000	525	50,550
4256	Additional 128 megabytes for A side	980,000	1,050	NA
4257	Additional 192 megabytes for A side	1,470,000	1,575	NA
4228	Additional 64 megabytes for B side	490,000	525	50,550
4356	Additional 128 megabytes for B side	980,000	1,050	NA
4357	Additional 192 megabytes for B side	1,470,000	1,575	NA
	Model 600E			
4128	Additional 64 megabytes for A side	490,000	525	50,550
4228	Additional 64 megabytes for B side	490,000	525	50,550
	Model 600S			

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

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Additional Central Storage (Continued)				
4128	Additional 64 megabytes for A side	490,000	525	50,550
4256	Additional 128 megabytes for A side	980,000	1,050	NA
4257	Additional 192 megabytes for A side	1,470,000	1,575	NA
4228	Additional 64 megabytes for B side	490,000	525	50,550
4356	Additional 128 megabytes for B side	980,000	1,050	NA
4357	Additional 192 megabytes for B side	1,470,000	1,575	NA
Expanded Storage: Models 120E and 150E				
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
6128	Expansion from 64 megabytes to 128 megabytes; requires 5064	185,000	420	35,870
Expanded Storage: Models 100S, 120S, 150S, 170S, 180E, and 180S				
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
6128	Expansion from 64 megabytes to 128 megabytes; requires 5064	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes; requires 5064	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes; requires 5064	555,000	1,260	99,690
6193	Expansion from 128 megabytes to 192 megabytes; requires 5128 or 6128	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes; requires 5128 or 6128	370,000	840	66,460
6258	Expansion from 192 megabytes to 256 megabytes; requires 5192, 6192, or 6193	185,000	420	33,230
Expanded Storage: Model 200E				
5024	1 gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6028	Expansion from 512 megabytes to 1 gigabyte	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
Expanded Storage: Models 200S and 300S				
5024	1 gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6024	Expansion from 64 megabytes to 1 gigabyte	2,775,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	2,590,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,405,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,220,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500

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

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IBM ES/3090 Series

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Expanded Storage: Model 250S				
	—A side:			
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
	—B side:			
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
Expanded Storage: Model 280E				
	—A side:			
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
	—B side:			
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
Expanded Storage: Model 300E				
5024	1024 megabytes	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500

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

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Expanded Storage: Model 380S				
	—A side:			
5024	First gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6024	64 megabytes to 1 gigabyte	2,775,000	6,300	NA
6025	128 megabytes to 1 gigabyte	2,590,000	5,880	NA
6026	192 megabytes to 1 gigabyte	2,405,000	5,460	NA
6027	256 megabytes to 1 gigabyte	2,220,000	5,040	NA
6028	512 megabytes to 1 gigabyte	1,480,000	3,360	287,050
6128	64 megabytes to 128 megabytes	185,000	420	35,870
6192	64 megabytes to 192 megabytes	370,000	840	66,460
6193	128 megabytes to 192 megabytes	185,000	420	33,230
6256	64 megabytes to 256 megabytes	555,000	1,260	99,690
6257	128 megabytes to 256 megabytes	370,000	840	66,460
6258	192 megabytes to 256 megabytes	185,000	420	33,230
6512	64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6513	128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6514	192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	256 megabytes to 512 megabytes	740,000	1,680	143,500
	—B side:			
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
8128	64 megabytes to 128 megabytes	185,000	420	35,870
8192	64 megabytes to 192 megabytes	370,000	840	66,460
8193	128 megabytes to 192 megabytes	185,000	420	33,230
8256	64 megabytes to 256 megabytes	555,000	1,260	99,690
8257	128 megabytes to 256 megabytes	370,000	840	66,480
8258	192 megabytes to 256 megabytes	185,000	420	33,230
Expanded Storage: Model 400E				
	—A side:			
5024	1 gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
	—B side:			
7024	1 gigabyte	3,105,000	6,825	586,550
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
7512	First 512 megabytes	1,625,000	3,465	299,350
8028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
8515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500

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

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)

Expanded Storage: Model 400S

	—A side:			
5024	1 gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6024	Expansion from 64 megabytes to 1 gigabyte	2,775,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	2,590,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,405,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,220,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
	—B side:			
7024	1 gigabyte	3,105,000	6,825	586,550
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
7512	First 512 megabytes	1,625,000	3,465	299,350
8028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
8515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500

Expanded Storage: Model 500E

	—A side:			
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
5024	1 gigabyte	3,105,000	6,825	586,550
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
6028	Expansion from 512 megabytes to 1 gigabyte	1,480,000	3,360	287,050
	—B side:			
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900

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

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AUGUST 1989

IBM ES/3090 Series

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)

Expanded Storage: Model 500E (Continued)

7256	First 256 megabytes	885,000	1,785	144,150
7512	First 512 megabytes	1,625,000	3,465	299,350
7024	1 gigabyte	3,105,000	6,825	586,550
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
8515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
8028	Expansion from 512 megabytes to 1 gigabyte	1,480,000	3,360	287,050

Expanded Storage: Model 500S

—A side:

5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
5024	1 gigabyte	3,105,000	6,825	586,550
6024	Expansion from 64 megabytes to 1 gigabyte	2,775,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	2,590,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,405,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,220,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
6028	Expansion from 512 megabytes to 1 gigabytes	1,480,000	3,360	287,050

—B side:

7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
7512	First 512 megabytes	1,625,000	3,465	299,350
7024	1 gigabyte	3,105,000	6,825	586,550
8024	Expansion from 64 megabytes to 1 gigabyte	2,775,000	6,300	NA
8025	Expansion from 128 megabytes to 1 gigabyte	2,590,000	5,880	NA
8026	Expansion from 192 megabytes to 1 gigabyte	2,405,000	5,460	NA
8027	Expansion from 256 megabytes to 1 gigabyte	2,220,000	5,040	NA
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
8515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
8028	Expansion from 512 megabytes to 1 gigabyte	1,480,000	3,360	287,050

Expanded Storage: Model 600E

—A side:

5024	1 gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910

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

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IBM ES/3090 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Expanded Storage: Model 600E (Continued)				
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
	—B side:			
7024	1 gigabyte	3,105,000	6,825	586,550
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
7512	First 512 megabytes	1,625,000	3,465	299,350
8028	Expansion from 512 megabytes to 1 gigabyte	1,480,000	3,360	287,050
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
8515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
Expanded Storage: Model 600S				
	—A side:			
5024	1 gigabyte	3,105,000	6,825	586,550
5064	First 64 megabytes	330,000	525	48,010
5128	First 128 megabytes	515,000	945	83,910
5192	First 192 megabytes	700,000	1,365	110,900
5256	First 256 megabytes	885,000	1,785	144,150
5512	First 512 megabytes	1,625,000	3,465	299,350
6024	Expansion from 64 megabytes to 1 gigabyte	2,775,000	6,300	NA
6025	Expansion from 128 megabytes to 1 gigabyte	2,590,000	5,880	NA
6026	Expansion from 192 megabytes to 1 gigabyte	2,405,000	5,460	NA
6027	Expansion from 256 megabytes to 1 gigabyte	2,220,000	5,040	NA
6028	Expansion from 512 megabytes to 1024 megabytes	1,480,000	3,360	287,050
6128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
6192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
6256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
6512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
6193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
6257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,460
6513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
6258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
6514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
6515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
	—B side:			
7024	1 gigabyte	3,105,000	6,825	586,550
7064	First 64 megabytes	330,000	525	48,010
7128	First 128 megabytes	515,000	945	83,910
7192	First 192 megabytes	700,000	1,365	110,900
7256	First 256 megabytes	885,000	1,785	144,150
7512	First 512 megabytes	1,625,000	3,465	299,350
8024	Expansion from 64 megabytes to 1 gigabyte	2,775,000	6,300	NA
8025	Expansion from 128 megabytes to 1 gigabyte	2,590,000	5,880	NA
8026	Expansion from 192 megabytes to 1 gigabyte	2,405,000	5,460	NA
8027	Expansion from 256 megabytes to 1 gigabyte	2,220,000	5,040	NA
8028	Expansion from 512 megabytes to 1 gigabyte	1,480,000	3,360	287,050

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

IBM ES/3090 Series

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)
Expanded Storage: Model 600S (Continued)				
8128	Expansion from 64 megabytes to 128 megabytes	185,000	420	35,870
8192	Expansion from 64 megabytes to 192 megabytes	370,000	840	66,460
8256	Expansion from 64 megabytes to 256 megabytes	555,000	1,260	99,690
8512	Expansion from 64 megabytes to 512 megabytes	1,295,000	2,940	251,150
8193	Expansion from 128 megabytes to 192 megabytes	185,000	420	33,230
8257	Expansion from 128 megabytes to 256 megabytes	370,000	840	66,480
8513	Expansion from 128 megabytes to 512 megabytes	1,110,000	2,520	215,300
8258	Expansion from 192 megabytes to 256 megabytes	185,000	420	33,230
8514	Expansion from 192 megabytes to 512 megabytes	925,000	2,100	179,350
8515	Expansion from 256 megabytes to 512 megabytes	740,000	1,680	143,500
VECTOR FACILITY				
	—For Models 100S, 120E, 120S, 150E, 150S, 170S, 180E, and 180S			
1545	Vector Facility; requires 7330	341,250	315	32,840
	—For Models 200E and 200S			
1545	First Vector Facility; requires 7330	341,250	315	32,840
1550	Second Vector Facility	241,500	183	23,240
	—For Models 250S, 280E, 280S, 380S			
1545	Vector Facility for A side; requires 7330	341,250	315	32,840
1546	Vector Facility for B side; requires 7331	341,250	315	32,840
	—For Models 300E and 300S			
1545	First Vector Facility	341,250	315	32,840
1550	Second Vector Facility	241,500	183	23,240
1555	Third Vector Facility	241,500	183	23,240
	—For Models 400E and 400S			
1545	First Vector Facility for A side; requires 7330	341,250	315	32,840
1550	Second Vector Facility for A side	241,500	183	23,240
1546	First Vector Facility for B side; requires 7331	341,250	315	32,840
1551	Second Vector Facility for B side	241,500	183	23,240
	—For Models 500E and 500S			
1545	First Vector Facility for A side	341,250	315	32,840
1550	Second Vector Facility for A side	241,500	183	23,240
1555	Third Vector Facility for A side	241,500	183	23,240
1546	First Vector Facility for B side; requires 7331	341,250	315	32,840
1551	Second Vector Facility for B side	241,500	183	23,240
	—For Models 600E and 600S			
1545	First Vector Facility for A side	341,250	315	32,840
1550	Second Vector Facility for A side	241,500	183	23,240
1555	Third Vector Facility for A side	241,500	183	23,240
1546	First Vector Facility for B side	341,250	315	32,840
1551	Second Vector Facility for B side	241,500	183	23,240
1556	Third Vector Facility for B side	241,500	183	23,240
Processor Resource/Systems Manager				
	—For 3090 E and S Models			
6851	CP-1 for A side; required for all 3090 E and S models	63,000	178	5,615
6852	CP-2 for A side; required for Models 200E, 300E, 400E, 500E, and 600E	21,000	57	1,870
6853	CP-0 for A side; required for Models 300E, 500E, and 600E	21,000	57	1,870
7851	CP-3 for B side; required for Models 250S, 280E, 280S, 380S, 400E, 400S, 500E, 500S, 600E, and 600S	63,000	178	5,615
7852	CP-4 for B side; required for Models 400E, 500E, and 600E	21,000	57	1,870
7853	CP-5 for B side; required for Model 600E	21,000	57	1,870
	—For Model 280E			
6851	CP-1 for A side	63,000	178	5,615
7851	CP-3 for B side	63,000	178	5,615
	—For Model 500E; requires 6851, 6852, 7851, and 7852			
6851	CP-1 for A side	63,000	178	5,615
6852	CP-2 for A side	21,000	57	1,870
6853	CP-0 for A side	21,000	57	1,870
7851	CP-3 for B side	63,000	178	5,615
7852	CP-4 for B side	21,000	57	1,870

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

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IBM ES/3090 Series

	Purchase Price ($)
SYSTEM UPGRADES	
3090 Model 100S to 3090 Model 120S	190,000
3090 Model 150 to 3090 Model 250S	1,844,000
3090 Model 150E to 3090 Model 250S	1,744,000
3090 Model 150E to 3090 Model 250S	1,744,000
3090 Model 150S to Model 250S	1,444,000
3090 Model 250S to Model 280S	2,150,000
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
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 prerequisites; 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 200 to 3090 Model 380S; central storage and PR/SM features must be symmetrical	4,819,000
3090 Model 200E to 3090 Model 380S; central storage and PR/SM features must be symmetrical	3,604,000
3090 Model 280E to 3090 Model 380S; central storage and PR/SM features must be symmetrical; requires 3848, 3849, 4064, and 4264	2,827,000
3090 Model 200S to 3090 Model 380S; central storage and PR/SM features must be symmetrical	2,757,500
3090 Model 280S to 3090 Model 380S; central storage and PR/SM features must be symmetrical; requires 3848, 3849, 4064, 4264	1,569,800
3090 Model 380S to 3090 Model 400S; central storage and PR/SM features must be symmetrical; requires 3858 and 3859	1,622,200
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

IBM ES/3090 Series

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	Purchase Price ($)
SYSTEM UPGRADES (Continued)	
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

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly Charge (2-Year Lease)* ($)
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	—	—

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

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IBM ES/3090 Series

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly Charge (2-Year Lease)* ($)
Cluster Controllers (Continued)					
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
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	—	—	—

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

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AUGUST 1989

IBM ES/3090 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly Charge (2-Year Lease)* ($)
ASCII Display Stations (Continued)					
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	—	—
	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	—	—

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

IBM ES/3090 Series

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ASCII Display Stations (Continued)	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly Charge (2-Year Lease)* ($)
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	56	—	62	—
1067 APL/Text Control	950	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
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

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

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IBM ES/3090 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly Charge (2-Year Lease)* ($)
ASCII Display Stations (Continued)					
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 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	—

SYSTEM MANAGEMENT

IBM 3814 Switching Management System, Models

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

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

IBM ES/3090 Series

		Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
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 megabytes 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	—
	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.

IBM ES/3090 Series

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				
	Graduated Charge: Processor Group 30	NA	4,080	163,200	NA
	Graduated Charge: Processor Group 40	NA	4,800	259,200	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				
	Graduated Charge: Processor Group 30	NA	4,590	183,600	NA
	Graduated Charge: Processor Group 40	NA	5,400	291,600	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)				
	Graduated Charge: Processor Group 20	12,840	4,280	157,645	673
	Graduated Charge: Processor Group 30	12,840	4,280	157,645	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)				
	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				
	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				
	Graduated Charge: Processor Group 20	NA	500	13,540	69
	Graduated Charge: Processor Group 30	NA	500	19,345	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				
	Graduated Charge: Processor Group 20	NA	4,500	NA	—
	Graduated Charge: Processor Group 30	NA	4,500	112,500	—
	Graduated Charge: Processor Group 40	NA	4,500	216,000	—
5664-308	VM/XA System Product Release 2; available first quarter 1989				
	Graduated Charge: Processor Group 20	NA	4,500	NA	—
	Graduated Charge: Processor Group 30	NA	4,500	112,500	—
	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				
	Graduated Charge: Processor Group 20	5,325	1,775	NA	136
	Graduated Charge: Processor Group 30	5,325	1,775	57,665	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				
	4506 pricing feature for IX/370: asset assignment, to 16 currently signed-on terminal users (CSTUs)				
	Graduated Charge: Processor Group 20	NA	NA	10,000	495
	Graduated Charge: Processor Group 30	NA	NA	10,000	495
	Graduated Charge: Processor Group 40	NA	NA	—	495
	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

NA—Not applicable.

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		Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
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
5668-002	DASD Migration Aid Release 1.1; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	NA	1,450	19
	Graduated Charge: Processor Group 30	NA	NA	1,450	19
	Graduated Charge: Processor Group 40	NA	NA	—	19
5668-897	INFO Center/1 Release 1.1; for VM/SP, MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,390	15,400	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				
	Graduated Charge: Processor Group 20	NA	247	8,400	19
	Graduated Charge: Processor Group 30	NA	247	8,400	19
	Graduated Charge: Processor Group 40	NA	247	13,340	19
5664-325	DFSORT/CMS Release 1				
	Graduated Charge: Processor Group 20	NA	NA	825	NA
	Graduated Charge: Processor Group 30	NA	NA	1,200	NA
	Graduated Charge: Processor Group 40	—	—	1,900	—

NA—Not applicable.

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	Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)

Utilities, Installation Management, Performance Analysis (Continued)

5740-SM1 DFSORT Data Facility Sort; for MVS/370, MVS/XA, VS1				
Graduated Charge: Processor Group 20	NA	247	8,400	19
Graduated Charge: Processor Group 30	NA	247	8,400	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				
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)				
Graduated Charge: Processor Group 20	NA	841	25,230	43
Graduated Charge: Processor Group 30	NA	841	25,230	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				
Graduated Charge: Processor Group 20	—	695	14,595	—
Graduated Charge: Processor Group 30	—	695	20,850	—
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				
Graduated Charge: Processor Group 20	NA	50	700	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				
Graduated Charge: Processor Group 20	NA	NA	1,025	NA
Graduated Charge: Processor Group 30	NA	NA	1,025	NA
Graduated Charge: Processor Group 40	NA	NA	—	NA
5798-CQQ GTFPARS Generalized Trace Facility/Performance Analysis; for VS1, MVS/370, MVS/XA				
Graduated Charge: Processor Group 20	NA	94	2,310	NA
Graduated Charge: Processor Group 30	NA	94	2,310	NA
Graduated Charge: Processor Group 40	NA	94	—	NA
5798-DPH JCL Conversion Aid; for VSE, MVS/370, MVS/XA				
Graduated Charge: Processor Group 20	NA	500	11,000	NA
Graduated Charge: Processor Group 30	NA	500	11,000	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				
Graduated Charge: Processor Group 20	NA	NA	7,500	NA
Graduated Charge: Processor Group 30	NA	NA	7,500	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				
Graduated Charge: Processor Group 20	NA	NA	11,000	NA
Graduated Charge: Processor Group 30	NA	NA	11,000	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				
Graduated Charge: Processor Group 20	NA	12,500	125,000	NA
Graduated Charge: Processor Group 30	NA	12,500	125,000	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				
Graduated Charge: Processor Group 20	NA	200	4,200	NA
Graduated Charge: Processor Group 30	NA	200	6,000	NA
Graduated Charge: Processor Group 40	NA	200	9,600	NA
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

NA—Not applicable.

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Languages and Language-Specific Programming Aids (Continued)	Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
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	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
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	NA	296	6,215	39
Graduated Charge: Processor Group 30	NA	296	8,880	39
Graduated Charge: Processor Group 40	NA	296	14,205	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	NA	398	8,355	53
Graduated Charge: Processor Group 30	NA	398	11,940	53
Graduated Charge: Processor Group 40	NA	398	19,100	53

NA—Not applicable.

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		Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
Languages and Language-Specific Programming Aids (Continued)					
5740-CB1	Cobol (VS) Compiler and Library; for MVS/370, MVS/XA, VS1, VM/SP				
	Graduated Charge: Processor Group 20	NA	365	7,665	15
	Graduated Charge: Processor Group 30	NA	365	10,950	15
	Graduated Charge: Processor Group 40	NA	365	17,520	15
5740-LM1	Cobol (VS) Library Only; for MVS/370, MVS/XA, VS1, VM/SP				
	Graduated Charge: Processor Group 20	NA	118	2,475	7
	Graduated Charge: Processor Group 30	NA	118	3,540	7
	Graduated Charge: Processor Group 40	NA	118	5,660	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	NA	184	3,860	15
	Graduated Charge: Processor Group 30	NA	184	5,520	15
	Graduated Charge: Processor Group 40	NA	184	8,830	15
5746-LM4	Cobol (DOS/VS) Library Only; for VSE, VM/SP				
	Graduated Charge: Processor Group 20	NA	33	690	7
	Graduated Charge: Processor Group 30	NA	33	990	7
	Graduated Charge: Processor Group 40	NA	33	1,580	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	747	249	5,660	18
	Graduated Charge: Processor Group 30	747	249	8,090	18
	Graduated Charge: Processor Group 40	747	249	12,945	18
5785-ABH	Prolog Programming In Logic; for VM/SP				
	Graduated Charge: Processor Group 20	NA	NA	8,000	NA
	Graduated Charge: Processor Group 30	NA	NA	8,000	NA
	Graduated Charge: Processor Group 40	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	NA	385	7,000	NA
	Graduated Charge: Processor Group 30	NA	385	7,000	NA
	Graduated Charge: Processor Group 40	NA	385	—	NA
5796-PNQ	Pascal/VS Release 2.2; for VM/IS, VM/SP, MVS/370, VS1				
	Graduated Charge: Processor Group 20	NA	247	4,410	NA
	Graduated Charge: Processor Group 30	NA	247	6,300	NA
	Graduated Charge: Processor Group 40	NA	247	6,300	NA
5796-PWC	INTELLECT for MVS/VSAM; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 30	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 40	NA	3,050	—	NA
5796-PWE	INTELLECT for VM-VSAM; for VM/SP				
	Graduated Charge: Processor Group 20	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 30	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 40	NA	3,050	—	NA
5796-PWJ	General CICS/VS ADA				
	Graduated Charge: Processor Group 20	NA	NA	12,100	NA
	Graduated Charge: Processor Group 30	NA	NA	12,100	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
5796-PYH	INTELLECT for VM-SQL/DS; for VM/SP				
	Graduated Charge: Processor Group 20	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 30	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 40	NA	3,050	—	NA
5798-DFH	Fortran Utilities Version 2.2.; for VM/IS, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	NA	NA	1,100	NA
	Graduated Charge: Processor Group 30	NA	NA	1,575	NA
	Graduated Charge: Processor Group 40	NA	NA	1,575	NA
5798-DQZ	LISP/VM List Processing; for VM/SP				
	Graduated Charge: Processor Group 20	NA	325	7,150	NA
	Graduated Charge: Processor Group 30	NA	325	7,150	NA
	Graduated Charge: Processor Group 40	NA	325	—	NA
5798-DXJ	Fortran (VS) Execution Analyzer; for MVS/370, MVS/XA, VM/SP				
	Graduated Charge: Processor Group 20	NA	NA	12,500	NA
	Graduated Charge: Processor Group 30	NA	NA	12,500	NA
	Graduated Charge: Processor Group 40	NA	NA	—	NA
Data Base Management and File Handling					
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

NA—Not applicable.

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		Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
Data Base Management and File Handling (Continued)					
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, MSV/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
5798-CQP	IMSPARS; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	203	4,155	NA
	Graduated Charge: Processor Group 30	NA	203	4,155	NA
	Graduated Charge: Processor Group 40	NA	203	—	NA

NA—Not applicable.

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	Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
Data Base Management and File Handling (Continued)				
5798-DLL Data Base Edit Facility; for VM/SP, MVS/370, MVS/XA				
Graduated Charge: Processor Group 20	NA	NA	4,235	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				
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, Timesharing, 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				
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				
Graduated Charge: Processor Group 20	NA	750	15,000	NA
Graduated Charge: Processor Group 30	NA	750	15,000	NA
Graduated Charge: Processor Group 40	NA	750	—	NA
5664-204 NetView; for VM/SP				
Graduated Charge: Processor Group 20	NA	940	19,740	90
Graduated Charge: Processor Group 30	NA	940	28,200	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				
Graduated Charge: Processor Group 20	3,535	1,175	19,660	247
Graduated Charge: Processor Group 30	3,535	1,175	28,090	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				
Graduated Charge: Processor Group 20	NA	NA	600	NA
Graduated Charge: Processor Group 30	NA	NA	600	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				
Graduated Charge: Processor Group 20	NA	135	2,000	NA
Graduated Charge: Processor Group 30	NA	135	NA	NA
Graduated Charge: Processor Group 40	NA	135	—	NA
5664-315 FTP File Transfer Program Version 2 Release 2.0; for VM/SP only				
Graduated Charge: Processor Group 20	NA	450	7,875	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				
Graduated Charge: Processor Group 20	NA	135	2,000	NA
Graduated Charge: Processor Group 30	NA	135	2,000	NA
Graduated Charge: Processor Group 40	NA	135	—	NA
5665-279 BTAM/SP Basic Telecommunications Access Method/System Product; for MVS/XA, MVS/370				
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, Timesharing, 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

NA—Not applicable.

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		Initial Basic License Charge ($)	Monthly Basic* License Charge ($)	Graduated Onetime Charge ($)	Licensed Program Support Charge ($)
Data Communications, Timesharing, Transaction Processing, Terminal Control (Continued)					
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
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 PRPQ; 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. ■