

# IBM 3090 Series

## MANAGEMENT SUMMARY

**UPDATE:** In an attempt to end a three-year-old profit slump, IBM revamped its strategic hardware lines during 1987. The company got off to a strong start with the announcement of new 3090 models and performance enhancements to existing models. To tie all its new and existing offerings together, the company unleashed dozens of connectivity products and network management products such as NetView 2. In March 1987, IBM announced the centerpiece of its new distributed processing and system connectivity strategy, Systems Application Architecture (SAA), a framework for developing a common application software interface across strategic IBM micro, mini, and mainframe architectures. In April, the company replaced its aging line of IBM PCs with a new generation of personal computers, the Personal System/2 (PS/2). In May, the company replaced all existing 4381 models with higher performing models, and continued to deliver its new 9370 Information System line of superminis. In the operating software area, IBM introduced Virtual Machine/Extended Architecture System Product (VM/XA SP) Release 1, which supersedes its current VM/XA Systems Facility. Finally, IBM announced the anticipated triple-density 3380 Direct Access Storage Devices (DASDs) and increased channel speeds to 4.5 megabytes per second.

IBM's new marketing strategies appear to be producing positive results for the first time since 1985, even though several of the new hardware products were not available until the fourth quarter of last year or later. IBM reported third-quarter earnings of \$1.208 billion on revenues of \$12.727 billion, the first quarterly gain in six quarters. Earnings for the first nine months of 1987, however, continued on the downside—\$3.17 billion compared to \$3.4

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

**MODELS:** 3090 Models 120E, 150E, 180E, 200E, 300E, 400E, 600E.

**CONFIGURATION:** Single, dual, three-way, four-way, and six-way systems; 32M to 256M bytes of main memory; up to 2G bytes of expanded storage; 16 to 128 channels.

**COMPETITION:** Amdahl 5890; Control Data Cyber 180 Models 990E and 995E; Digital Equipment Corporation VAX 8974 and VAX; 8978, Honeywell DPS 90 Series; NAS Alliance Series; and Unisys A 15, A 17 Series, and 1100/90.

**PRICE:** Base purchase prices range from \$715,000 for the Model 120E to \$10,344,000 for the Model 600E.

## CHARACTERISTICS

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

**MODELS:** IBM 3090 Model 120E, Model 150E, Model 180E, all single processors; Model 200E, dual processor; Model 300, three-way processor; Model 400E, four-way processor; Model 600, six-way processor.



The IBM 3090 Model 200E dual processor, shown here, and the other 3090 models feature Emitter Coupled Logic and Thermal Conduction Modules and achieve a cycle time of 17.75 nanoseconds.

## IBM 3090 Series

TABLE 1. SYSTEM COMPARISON

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

\*In May 1987, IBM modified these models to bring them up to full performance potential.

\*\*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.

➤ billion reported for the first nine months of the previous year. Results for the year were not available at press time.

To stimulate 3090 sales, in January 1987 the company announced E models, which provide more power for the same price. The company even lowered the price of four models. IBM also brought out three- and six-way processor systems. When E model sales level off, IBM is expected to unveil its new F models and a revamped MVS operating system that will extend virtual addressing beyond the current 31-bit addressing and expand virtual memory beyond the current 2-gigabyte ceiling.

As part of the E model announcements, IBM brought out the Model 300E three-processor and Model 600E six-processor versions of the 3090 to push performance levels closer to the 100 million-instructions-per-second (MIPS) range. Other enhancements include faster CPU cycle times, larger maximum central memories, the use of a new generation of 1-megabit memory chips, larger channel capacities, and up to 2 gigabytes of expanded storage on the two top-end models. Main memories now range from 32 megabytes to 256 megabytes. Channel capacity now ranges from 16 to 128 channels. In January, IBM reduced the price of the Models 150E and 400E, and in July it also lowered the price of the new Models 300E and 600E just as they were about to be shipped.

Most of the 3090 hardware enhancements also became available after May 1987. Previous 3090 users were able to upgrade to the corresponding E models. Upgrades became available by third-quarter 1987, depending on models.

### ➤ 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 256 megabytes. See Table 1 for capacities of individual models.

➤ **CYCLE TIME:** See Table 1. ➤

## IBM 3090 Series

TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	Model 300E	Model 400E	Model 600E
<b>SYSTEM CHARACTERISTICS</b>			
Date announced	January 26, 1987	January 26, 1987	January 26, 1987
Date first delivered	Third quarter 1987	January 1987*	Third quarter 1987
Field upgradable to	Model 600E	Model 600E	—
Relative performance	Not specified	Not specified	Not specified
Number of processors	3	4	6
Cycle time, nanoseconds	17.2	17.2	17.2
Word size, bits	32	32	32
Operating systems	MVS/SP, MVS/XA, VM/ HPO, VM/XA	MVS/SP, MVS/XA, VM/ HPO, VM/XA	MVS/SP, MVS/XA, VM/ HPO, VM/XA
<b>MAIN MEMORY</b>			
Type	1M-bit chips	1M-bit chips	1M-bit chips
Minimum capacity, bytes	64M**	128M**	128M**
Maximum capacity, bytes	128M	256M	256M
Increment size, increment	64M	128M	128M
Cycle time, nanoseconds	—	—	—
<b>BUFFER STORAGE</b>			
Minimum capacity	192KB	256KB	384KB
Maximum capacity	192KB	256KB	384KB
Increment size	—	—	—
<b>INPUT/OUTPUT CONTROL</b>			
Number of channels:			
Byte multiplexer	0-4	Not specified	0-8
Block multiplexer	32, 40, 48, 64	64, 80, 96, 128	64, 80, 96, 128
Word	—	—	—
Other	—	—	—

\*In May 1987, IBM modified these models to bring them up to full performance potential.

\*\*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.

➤ IBM followed its E model announcements with the May 1987 announcement of the Model 120E, which established a lower cost entry point into the 3090 Series. The 3090-120E single-processor complex is the first 3090 priced for less than \$1 million. A minimally configured Model 120E sells for \$715,000 and became available in October 1987. Additionally, under a new graduated software pricing scheme, Model 120E users will be charged less for system software than users who have the bigger 3090 machines installed. The Model 120E features 32 megabytes of central storage, 64 megabytes to 128 megabytes of optional expanded storage, and 16 channels, expandable to 24 channels. Model 120E CPU cycle time is 18.5 nanoseconds, slower than the rest of the 3090 Series. The Model 120E is expected to have 0.7 to 0.8 times the instruction execution rate of the 3090 Model 150E operating under MVS/XA, MVS/370, and VM/SP HPO in typical commercial environments. The Model 120E is field upgradable to the 3090 Model 150E.

In September 1987, IBM introduced new single- and triple-capacity 3380 DASDs and a new family of 3990 Storage Control Units. The new DASDs include the triple-capacity Models 3380 AK4 and BK4, each with a storage capacity of 7.56 gigabytes, and the single-capacity Models AJ4 and BJ4, each with a capacity of 2.52 gigabytes. The new J models are positioned to replace the 3380 AD4 and BD4 models and the K models are positioned as a follow-on to the double-capacity AE4 and BE4 models.

The 3990 Storage Control Unit includes the Models 1, 2, and 3. The Model 1 features two storage paths and has a ➤

➤ **CHECKING:** The processor controller plays a major role in error detection and recovery. Data paths between the central processor and central storage are parity-checked by byte. Parity bits are included in each command or data word. When the data are retrieved, single-bit errors are 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 the Models 120E, 150E, and 180E, all single processors; the Model 200E, a dyadic processor; the Model 300E, a three-way processor; the Model 400E, a four-way processor; and the Model 600E, a six-way processor. The Model 400E can be partitioned to ➤

## IBM 3090 Series

▷ DASD attachment capability similar to the 3880 Model 3. The Model 2 features four storage paths with twice the DASD attachment capability of the Model 1. The Model 3 features four storage paths with four cache sizes ranging from 32 megabytes to 256 megabytes. Additionally, the Model 3 features all the cache functions of the 3880 Model 23 plus fast write and a transfer rate of up to 4.5 megabytes per second when configured with a 3090 mainframe. Other features include nonvolatile storage and 4 megabytes of battery-backed storage. A Model 1 can be upgraded to a Model 2 or 3. Since the 3990 won't be available until the third quarter of this year, the new DASDs can be attached to upgraded 3880 Control Units for the time being.

In the operating system software area, IBM announced a new VM extended architecture product (VM/XA SP Release 1) and related products; it also announced enhancements to the existing VM/XA offering, VM/XA SF Release 2.

VM/XA SP Release 1 supersedes all releases of VM/XA SF and provides a migration path for VM/XA SF users. Enhancements include an interactive environment capable of supporting large numbers of users. It also supports a bimodal Conversational Monitor System (CMS) which will operate 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 which are portable between System/370 and 370-XA CMS virtual machines. IBM believes the product enhancements will be an attractive growth path to VM/SP HPO users requiring larger processors running in single-image mode and will provide relief to user growth constraints.

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 (V=F) preferred guests can be defined, which will generally operate under the same considerations as Virtual = Real (V=R) preferred guests. All guest operating systems which are supported by VM/XA as V=R preferred virtual machines are supported as V=F guests. The feature will be available by the third quarter of 1988.

VM/XA SP Release 2, which will become available by first-quarter 1989, will let VM/XA SP users participate in SNA networks and also 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. VM/XA SP Releases 1 and 2 carry a onetime graduated charge of \$112,500 for Group 30 machines and \$216,000 for Group 40 machines. The monthly license charge is \$4,500.

VM/XA System Facility Release 2 enhancements include support for the IBM 3800 Models 3 and 6 using Advanced Function Printing software, IBM 3174 Subsystem Control Unit and various 3270 displays and display printers, and

▶ approximate the performance of a Model 200E on each side of the partition. Likewise, a Model 600E can be partitioned to approximate the performance of a Model 300E on either side of the partition. If one of the processors within a Model 200E or Model 400E complex fails, the remaining central processors can continue to operate. 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, or 3;
- 3097 Power and Coolant Distribution Unit Models 1 or 2;
- 3370 Direct Access Storage Device 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
- Operator display station for system control program communications.

For a detailed rundown of how many of each component must be configured with the 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.

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 processor contains a 64-kilobyte buffer memory, which handles instruction, operand, and data fetches.

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

## IBM 3090 Series

➤ additional CMS license program support. Other enhancements include improvements to object code servicing, program update tapes on request, and partitionable Expanded Storage and Block Paging, a feature that became available in 1987. The product was released on June 26 and carries a basic initial license charge of \$11,220 and a basic monthly license charge of \$4,110.

VM Inter-System Facilities Release 1 now supports up to four processors in an environment using VM/SP HPO Release 4.2. This means an increased number of users can 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. Release 1 carries a graduated onetime charge of \$63,000 for Processor Group 30 machines and a onetime charge of \$100,800 for Group 40 machines. The monthly license charge is \$2,100. Release 1 became available on June 26, 1987.

VM Inter-System Facilities Release 2 supports VM/SP HPO Release 5 and communicates with VM Inter-System Facilities Release 1 running with VM/SP 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. Release 2 has a basic monthly license charge of \$2,100 and a basic onetime charge of \$63,000 for Group 30 machines and \$100,800 for Group 40 machines.

The hardware and software enhancements announced within the last year remove growth restraints and provide MIS directors managing large data processing centers with additional price/performance options including increased storage capacity, faster channels, and the ability to handle more applications and users at the same time. For a growing data center, such additions are always welcomed.

### COMPETITIVE POSITION

Much of the computer industry has begun to emerge from the financial doldrums that prevailed for the last few years. Although IBM results were not as good as industry watchers had hoped, the company appeared to have turned the corner by the third quarter of 1987, when it posted a 12 percent gain over 1986 third-quarter results.

IBM began 1987 ominously. Profits had been on the decline during both 1985 and 1986, the first back-to-back declines for IBM since the modern computer era began. What at first seemed like a temporary aberration was turning into a chronic malaise. To turn its failing fortunes around, IBM proclaimed 1987 the "Year of the Customer." As part of this new public relations rallying point, IBM vowed to listen to customer needs and promised to be more open about product plans to help its big customers plan future acquisitions.

➤ in the following chart:

EXPANDED STORAGE BY MODEL	MINIMUM AND INTERMEDIATE	MAXIMUM
Model 120E	64 megabytes	128 megabytes
Model 150E	64 megabytes	128 megabytes
Model 180E	64, 128, or 192 megabytes	256 megabytes
Model 200E	64, 128, 192, 256, 512 megabytes	1 gigabyte
Model 300E	64, 128, 192, 256, 512 megabytes	1 gigabyte
Model 400E	128, 256, 384, 512 megabytes, 1 gigabyte	2 gigabytes
Model 600E	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 interruptions, overlaps operations with the IE, initiates control functions, and performs various logic and arithmetic functions. Arithmetic results can include fixed point, fixed-point multiply, convert to binary, convert to decimal, floating point, and extended-precision floating point.

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

The Buffer Control Element handles the movement of data to and from memory, performs dynamic address translation, and controls the high-speed buffer. The BCE contains the 64-kilobyte high-speed buffer, 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 ➤

## IBM 3090 Series

TABLE 2. MASS STORAGE

MODEL	3370	3375	3380	3380
Cabinets per subsystem	1 to 16	1 to 16	1 to 16	1 to 16
Disk packs/HDAs per cabinet	1	1	2	2
Capacity	729.8MB	819.7MB	1260/2520MB	1260/3780MB
Tracks/segments per drive unit	—	—	—	—
Average seek time, msec.	19	19	15/17	12/16
Average access time, msec.	29.1	29.1	23.3/25.3	20.3/24.3
Average rotational delay, msec.	10.1	10.1	8.3	8.3
Data transfer rate	1.859MB/sec.	1.859MB/sec.	3.0MB/sec.	3.0MB or 4.5MB/sec.
Controller model	3880 Models 1, 21	3880 Model 1	3880/3990	3880/3990
Comments	Models A2, B2, A12, B12	Models A1, B1, D1	Models AD4, BD4, AE4, BE4	Models AJ4, BJ4, AK4, BK4

➤ To stimulate sales and make the 3090 line more attractive to 308X users, IBM brought out higher performing 3090 E models without increasing basic purchase prices. The company also brought out a new low-end processor, the Model 120E, the first 3090 system to sell for less than \$1 million. Rated at 7.5 MIPS, it overlaps the performance of the new IBM 4381 Model 24. The new model erases the performance gap between IBM's 3090 and 4381 systems and provides one of the smoothest transitions ever offered between IBM medium- and large-scale systems. As a Processor Group 30 machine, users will pay less for system software. Other 3090 machines are Group 40 machines. When E model sales bottom out, IBM is expected to bring out a new round of 3090 performance enhancements.

Despite new product introductions and ambitious promotional efforts, observers believe mainframers will have to get use to single-digit growth projections for the near term instead of than the 20 and 30 percent growth enjoyed during the 1970s and early 1980. International Data Corporation, the Framingham, Massachusetts market research firm, is currently projecting that large-scale shipments will have an annual compound growth rate of 3 percent worldwide between now and 1991 and a 2 percent growth rate for the U.S. for the same period.

In addition to general market trends, analysts are looking at several specific reasons for the slowdown in IBM sales, a company that enjoys more than a 70 percent share of the large-scale market. First, many big mainframe users are not clamoring at the moment for more raw horsepower as measured in MIPS. Secondly, IBM now relies more heavily on outright hardware sales rather than lease income, making it more vulnerable to cyclical changes in the mainframe world. With relatively flat revenues from hardware, IBM has been relying more heavily on growth in the software and services segments of its businesses.

Other computer customers are exploring ways to run their applications on smaller systems that have better price/performance than mainframes. IBM has responded to this with the introduction of the 9370 departmental systems together with promised connectivity options. A major piece of its connectivity strategy is SAA, which will provide common programming interfaces across three designated hardware families, System/370 mainframes and superminis, System/3X minis, and OS/2 PCs. While this approach could make applications written for these three

➤ 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 both System/370 and 370-XA operational modes. In System/370 mode, the 3090 supports S/370 extended facility, 3033 extension, and extended addressing. In 370-XA mode, the 3090 supports 31-bit addressing, bimodal addressing, larger and more flexible I/O configurations, channel path selection under hardware control, and support for Start Interpretive Execution instructions by supporting guest S/370 or 370-XA virtual machines. What follows are larger explanations of some of the features available under either mode.

A modular unit that works closely with the 3090 complex is the 3092 Processor Controller. The 3092 is available in three models and performs many key monitoring and control functions for all 3090 models. Users must upgrade from a 3092 Controller Model 1 to a Model 2 when moving up from a model 200E or 300E to a model 400E or 600E, respectively. 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.

## IBM 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.
3420:					
Model 3	7	556/800	NRZI	75	41,700/60,000
	9	800	NRZI	75	60,000
	9	1600	PE	75	120,000
Model 5	7	556/800	NRZI	125	69,500/100,000
	9	800	NRZI	125	100,000
	9	1600	PE	125	200,000
Model 7	7	556/800	NRZI	200	111,200/160,000
	9	800	NRZI	200	160,000
	9	1600	PE	200	320,000
Model 4	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
Model 6	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Model 8	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
3422		1600/ 6250		125	200,000 780,000
3430	9	1600	PE	50	80,000
	9	6250	GCR	50	312,500
3480					
Model B22	18	38,000 (bytes)	—	79	3,000,000
Model B11	18	38,000 (bytes)	—	79	1,500,000
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
3262:					
Model 3	252-650 lpm	132	10	6 or 8	3½ to 16 wide, 6 to 14 long
Model 5	252-650 lpm	132	10	6 or 8	3½ to 16 wide, 6 to 14 long
Model 13	125-325 lpm	132	10	6 or 8	3½ to 16 wide, 6 to 14 long
3800:					
Model 3	215 ppm	136, 163, 204	10, 12, 15	6, 8, 10, 12	6½ to 14¾ wide, 3½ to 11 long
Model 6	134 ppm	136, 163, 204	10, 12, 15	6, 8, 10, 12	6½ to 14¾ wide, 3½ to 11 long
3820	20 ppm	—	10, 12 other	—	7 to 8½ wide, 10½ to 14 long
4245 Model 12 & D12	1,200 lpm (48 char. set)	132	10	6 or 8	3½ to 22 wide, 3 to 24 long
4245 Model 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	—

➤ environments more portable; it could also encourage hardware downsizing. With SAA, it may be cheaper for certain users to move mainframe applications down to smaller IBM or IBM-compatible systems.

Price/performance is an additional factor that has dogged the 3090 since its introduction; there is a perceived lack of product differentiation between the IBM 308X Series and the 3090. The IBM 308X Series continues to be popular even as a used machine since many users still don't perceive a big enough price/performance difference between

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

While one 3092 processor element remains active, the other processor acts as a backup processor. It also continues to monitor the active processor and stands ready should

## IBM 3090 Series

TABLE 4. TERMINALS

MODEL	316X	8775	3179	3180	3191
<b>DISPLAY PARAMETERS</b>					
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
<b>KEYBOARD PARAMETERS</b>					
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
<b>OTHER FEATURES</b>					
Buffer capacity	—	—	—	—	—
Tilt/swivel	Standard	—	Standard	Standard	Standard
Graphics capability	—	—	—	—	—
<b>TERMINAL INTERFACE</b>					
	RS-232, RS-422A	3725 Communications Controller	3174, 3274 Controllers	3174, 3274, 3276 Controllers	3174, 3274 Controllers

➤ the 308X models and the 3090s to make the jump to the newer (but more expensive) product line. IBM could end the old debate over product differentiation with the introduction of the anticipated 3090 F models and a major revision to the MVS operating system. According to information supplied through IDC, the new F models will support a new I/O subsystem featuring a channel speed of 6 megabytes per second, greater storage capacity, and a 25 to 30 percent performance boost. IDC also expects IBM to introduce a new five-way 3090 processor.

Besides product marketing problems, IBM continues to face pricing pressures from its plug-compatible rivals, Amdahl and NAS. Both vendors, now shipping all their top-end 3090-compatible models, are at the high point of their respective product cycles. Amdahl, a vendor that had a particular good year during 1987, brought out "E" models of its own a year ago to keep in step with IBM. Amdahl's good fortune is reflected in recent financial results—it reported 1987 third-quarter profits of \$36.8 million compared to 1986 third-quarter profits of \$7.1 million. Amdahl attributed the results to strong demand for its 5890 mainframes.

NAS responded to the 3090E announcements with accelerated delivery dates of its three-way and four-way Alliance Series processors and the expansion of channel capacity and memory. NAS also introduced a 6 megabyte-per-second channel speed. Amdahl and IBM both currently offer 4.5 megabyte-per-second speeds, although both vendors will probably increase these channel rates in the near future.

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

IBM decided to pursue the technical computing market after determining that the potential customer base was too ➤

➤ the active processor fail. In most cases, if the active processor fails, a switchover to the backup processor occurs.

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

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

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

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

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

When errors cannot be corrected automatically, users can begin problem analysis procedures from the system console index frame. If the problem was caused by a power malfunction, the first of a set of power status problem analysis frames is displayed. If the problem lies elsewhere, the first of a second set of problem analysis frames is displayed. ➤

## IBM 3090 Series

TABLE 4. TERMINALS (Continued)

MODEL	3192-G, -C	3192-D	3193	3278	3279
<b>DISPLAY PARAMETERS</b>					
Max. chars./screen	1,920 or 2,560	1,920, 2,560, 3,440, 3,564	3,840	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	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	—	—
Total colors/no. simult. displayed	7 colors	None	Monochrome	None	4 to 7 colors
<b>KEYBOARD PARAMETERS</b>					
Style	Typewriter	Typewriter; modifiable	Typewriter; modifiable	Data entry or typewriter	Typewriter
Character/code set	—	—	—	94	—
Detachable	Yes	Yes	Yes	Yes	Yes
Program function keys	24	24	—	12	12
<b>OTHER FEATURES</b>					
Buffer capacity	—	—	—	—	—
Tilt/swivel	Standard	Standard	—	No	Standard
Graphics capability	Standard (3192 G models)	—	—	—	Standard (S3G model)
<b>TERMINAL INTERFACE</b>					
	3174, 3274 Controllers	3174, 3274 Controllers	3174, 3274 Controllers	3274, 3276 Controllers	3274, 3276 Controllers

▷ large to ignore. According to IBM, about 20 percent of the computing market, constituting 3 percent of the work force, is now involved in technical computing. By IBM estimates, this segment of the market is growing twice as fast as the other 80 percent. In 1985, after a long absence, IBM reentered the technical computing market with the introduction of its Vector Facility (VF), a frame that can be attached to each processor of a 3090 mainframe complex. IBM has installed more than 250 VFs since introducing the facility. NAS, Amdahl, and Honeywell (in alliance with NEC of Japan) are selling Japanese systems. As a potentially lucrative mainframe market, engineering/scientific computing appears promising, but at the moment much of the business at the high end is going to Cray Research Inc., a firm that has become synonymous with supercomputing. In 1987, IBM launched an effort to increase its presence here with a more aggressive sales and marketing effort by calling on engineering/scientific customers outside the traditional IBM customer base.

In the peripherals area, IBM hopes its new triple-density 3380 DASDs and a new 3990 controller will stop market share erosion in the competitive high-end storage market. IBM's double-density DASDs did not sell as well as IBM had hoped. The company was also losing market share to vendors selling plug-compatible versions of IBM devices. Shortly after IBM's September 1987 announcement of the new DASDs, NAS announced its own triple-density DASDs. Memorex and StorageTek responded with price reductions and enhancements to their existing models.

#### ADVANTAGES AND RESTRICTIONS

Ever since IBM began delivering 3090 models, company representatives have been put on the defensive. Industry analysts have contended that there seems to be little price/performance difference between a new 3090 and the previous 308X Series. For quite a few users, a 308X still looks like a better buy than a new 3090.

To dispel these perceptions, IBM has been reemphasizing the differences between the two product lines. Many of

▶ 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 it's determined that 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 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 3180 Display Station Model 145 is used as either a system or maintenance console. The 3090 Models 120E, 150E, 180E, 200E, and 300E require a system console for interaction with the processor complex and the two 3092 processor elements and a service support console. The Model 400E and Model 600E require two system consoles and a system support console. The service support console must be placed within 33 feet of the 3092 controller, while the system display can be placed 4,921 feet from the 3092.

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

## IBM 3090 Series

▷ these differences were unveiled well into the 3090 product cycle. By the end of the marketing cycle, IBM insists, 3090s will look a lot different from 308Xs. Most technology improvements have occurred at an evolutionary pace. Some of these improvements include faster CPU cycle times, denser memory chips, expanded storage, the Vector Facility attachment, faster data transfer rates, and double- and triple-density DASDs. Additionally, users can now configure up to six processors in a single complex and maintain a single image of the operating system. The seven models ranging from single-processor complexes up to the six-way Model 600E provide users with a 10-fold performance improvement.

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

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

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

To take full advantage of the expanded storage concept, users who haven't done so already will have to migrate to the System/370 Extended Architecture operating system. Extended architecture offers such enhancements as storage constraint relief through 31-bit addressing; the dynamic channel subsystem; and a number of reliability, availability, and serviceability features. ▷

▶ **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 3090 Series

➤ The Vector Facility seems a clear indication that commercial mainframes of the future will be incorporating specialized architectures to carry out specialized tasks, such as compute-intensive engineering/scientific applications, side by side with commercial applications. Users can add a Vector Facility to each processor of a 3090 mainframe, making it possible to introduce vector capabilities at a reasonable price. Vector capabilities were not available for the 308X mainframe generation.

In the operating system area, IBM introduced a new version of the popular VM operating system, VM/XA SP, a release that lets users take advantage of IBM's 31-bit extended architecture environment. VM users who were formally limited to 16 megabytes of virtual storage can now make use of 2 gigabytes of virtual storage. The improvement will help the system support more users and bigger application programs. This is especially beneficial to VM/CMS users who were limited to 24-bit addressing under the previous VM/XA SF release.

VM/XA SP also lets users run four preferred guests simultaneously. This option lets users run different IBM environments on one machine and perhaps eliminates the need for additional processors.

To make its systems software more affordable to small and medium-size system users, IBM has begun to implement a four-level software pricing structure. Software now falls under four graduated pricing categories ranging from Processor Group 40 at the high end, Processor Group 30 and Processor Group 20 in the middle, to Processor Group 10 at the low end. All 3090 machines except the entry-level Model 120E are Group 40 machines. The Model 120E is a Group 30 machine. The Group 30 designation makes software less expensive for Model 120E users migrating to their first 3090 system, but the eventual move to a larger 3090 system could prove to be painful. When 120E users migrate to a Model 150E machine 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.

In the hardware pricing area, IBM is also notorious for pricing key components separately. When making price comparisons between the new 3090 Series and competing systems, users should be aware of what the 3090 Series includes and what additional hardware is required. The Model 200E, for instance, includes the central processors, 64 megabytes of main memory, two 64-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 3180 Model 145 Display Stations, and the 3864 Model 2 Modem—all required components.

### USER REACTION

The 1987 Datapro survey of general-purpose mainframes yielded responses from 85 IBM 3090 users. (The enhanced

- • 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 mode, 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 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 which 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. IBM offers the Vector Facility. The feature, which can be added to any processor within a 3090 complex, adds a vector extension to the basic IBM System/370 and 370 Extended Architecture systems. The Vector Facility is suited to such applications as structural design, reservoir modeling, fluid dynamics, and load flow. The Vector Facility is a field-installable option that is implemented in both hardware and software.

The facility can be installed on the Models 120E, 150E, and 180E and on each processor of a dyadic Model 200E, a three-way Model 300E, a four-way Model 400E, and a six-way Model 600E. It is supported by MVS/XA and VM/SP High Performance Option. The Vector Facility feature adds 171 new instructions and 16 vector registers,

## IBM 3090 Series

▷ 3090 "E" models were announced and delivered well after the survey was done, and so could not be rated.) Of the 85, 37 said they installed a 3090 Model 200 dual processor, 13 installed a Model 150 single processor, 9 installed a Model 180 single processor, and 8 installed a Model 400 four-way processor. The rest of the respondents did not specify a particular 3090 model.

At the time the survey was taken, these various 3090s had been installed an average of 14.66 months. Of those surveyed, 36.47 percent said they purchased the machines from IBM, 48.24 percent leased the hardware from a third party, and 10.59 percent leased the hardware from IBM. While the sites surveyed represented a variety of industries, banking/finance/securities and manufacturing clearly dominated. Sixteen respondents said they were involved with banking/finance/securities industries and fifteen said they were manufacturing concerns. Other industries mentioned less frequently were health care/medical (nine sites); government, insurance, utilities, and retail/wholesale (six sites each); education and chemical petroleum (five sites each); transportation (four sites); and service bureaus (two sites). The primary application areas are consistent with overall large-system survey results. As usual, accounting/billing was rated as the top application area at 72.94 percent. Runner-ups included payroll/personnel (58.82 percent); purchasing (43.53 percent); and order processing/inventory control (38.82 percent). Other applications listed by percentage size included sales/distribution (24.71 percent); education/scheduling/administration (20.00 percent); engineering/scientific (18.82 percent); banking/check processing/loans/savings (17.65 percent); and health care/medical, insurance, and manufacturing (each 16.47 percent). Other applications such as math and statistics, petroleum and fuel analysis, construction, and process control were cited less frequently.

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

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

▶ each containing 128 32-bit elements. Other features include binary, 32-bit, and 64-bit floating-point operands, using contiguous, noncontiguous, and random addressing.

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

**PHYSICAL SPECIFICATIONS:** A basic Model 200E configured with 64 megabytes of main memory and 32 channels will typically require 37.4 kVAs when operating at 400 Hz. This same configuration has a typical heat output to air of 12.1 Btu per hour. A fully configured Model 200E featuring 64 megabytes of main memory, 128 megabytes of expanded storage, and 48 channels requires 44.1 kVAs. This same configuration has a typical heat output to air of 13.2 Btu per hour. A basic Model 400E configured with 128 megabytes of main memory and 64 channels will typically require 40.0 kVA. This same configuration has a typical heat output of 10.6 Btu.

### CONFIGURATION RULES

A minimum 120E configuration includes the central processor complex, a 3092 Model 3 Processor Controller, a 3097 Model 1 or 2 Power and Coolant Distribution Unit, and a 3089 Model 3 Power Unit (or equivalent source of 400 Hz power). Other required hardware includes one 3370 Model A2 DASD, two IBM 3180 Model 145 display stations, and an IBM 3864 Model 2 Modem equipped with Automatic Calling (#5801).

The 3090 Model 150E Processor complex consists of a single central processor, a 3092 Model 1, a 3097 Model 1 or 2, a 3089 Model 3, two 3370 Model A2 DASDs each with string switch (#8150), two 3180 Model 145s, and a 3864 Modem Model 2 equipped with Automatic Calling (#5801).

The 3090 Model 180E Processor Complex consists of a single central processor, a 3092 Model 1, a 3097 Model 1 or 2, a 3089 Model 3 (or two 3089s if processor complex is configured with 192 megabytes or 256 megabytes of expanded storage in addition to a Vector Facility), two 3370 Model A2 DASDs each with string switch (#8150), two 3180 Model 145s, and a 3864 Modem Model 2 equipped with Automatic Calling (#5801).

The 3090 Model 200E Processor Complex consists of two central processors, a 3092 Model 1, and a 3097 Model 1 or 2. It also requires two 3089 Model 3s or other appropriate 400 Hz power source, two IBM 3370 Model A2 DASDs with string switch (#8150), two IBM 3180 Model 145s, and an IBM 3864 Modem Model 2 equipped with Automatic Calling (#5801).

The 3090 Model 300E Processor Complex consists of three central processors, a 3092 Model 1, a 3097 Model 1 or 2, two 3089 Model 3 or equivalent power source, two 3370 Model A2 DASDs each with string switch (#8150), two 3180 Model 145s, and a 3864 Modem Model 2 equipped with Automatic Calling (#5801).

The Model 400E Processor Complex consists of four central processors, a 3092 Model 2, and two 3097 Units Model 1 or 2. It also requires four 3089 Model 3s, or other appropriate 400 Hz power source, two 3370 Model A2s with string

## IBM 3090 Series

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

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

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

\*Weighted Average on a scale of 4.0 for Excellent.

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

➤ switch (#8150), three 3180 Model 145s, and two 3864 Modem Model 2s, each equipped with Automatic Calling (#5801).

The Model 600E Processor Complex consists of six central processors, a 3092 Model 2, two 3097 Model 1 or 2, four 3089 Model 3s or equivalent 400 Hz power source, two 3370 Model A2 DASDs with string switch (#8150), three 3180 Model 145s, and 3864 Modem Model 2 equipped with Automatic Calling (#5801).

### INPUT/OUTPUT CONTROL

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

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

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

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

For user sites that must locate peripherals some distance away from a 3090 processor and channel subsystem, IBM offers the IBM 3044 fiber optic channel extender link. The product allows peripherals to be placed up to 6,600 feet (2 kilometers) away from IBM processors. According to IBM, remote printer displays and other low-to-medium speed peripherals using the fiber optic link can run at speeds almost matching the speeds of devices locally connected to a central processor.

### MASS STORAGE

IBM disk storage devices are covered in Table 2.

### INPUT/OUTPUT UNITS

IBM tape drives and printers are covered in Table 3.

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

### TERMINALS

IBM terminals are covered in Table 4.

### COMMUNICATIONS CONTROL

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

## IBM 3090 Series

► supports the 3720 and 3725 Communications Processors and their predecessor, the 3705.

The 3725 *Communication Controller Models 1 and 2* consist of a central control unit that operates under control of the Advanced Communications Function/Network Control Program (ACF/NCP), Emulator Program, or Partitioned Emulator Program. Main storage ranges from 512 kilobytes to 3 megabytes, which can be added in 256-kilobyte increments. It can be attached to either byte or block multiplexer or selector channels on the host processor. Up to six channel adapters are available. The Model 1 can have up to six channel adapters in a single frame and the Model 2 can have up to four channel adapters. With the optional two-processor switch feature, connection can be made to a maximum of eight processors, six of which can operate concurrently. The Maintenance and Operator Subsystem (MOSS) supplies host-independent maintenance. The 3727 Operator Console provides an operator interface to the MOSS. Communications scanners and line interfaces are provided by a transmission subsystem. The scanners are microprocessor based and can control eight Line Interface Couplers with up to 32 lines.

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

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

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

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

Similar to the 3725, the 3720 uses MOSS facilities which 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 the System/370 or 370-XA mode can run on a 3090 using MVS/SP or VM/SP provided the program: 1) is not time dependent; 2) is not dependent on system facilities and peripherals that may be present or absent from a 3090 configuration; 3) does not depend on results or functions as defined in the

System/370 Principles of Operation as being unpredictable, model dependent, or deviations; 4) does not depend (in 370-XA mode) on the contents of instruction parameter fields B and C on interception of the SIE; and 5) does not depend (in S/370 mode) on the presence of the 2-kilobyte page size or the presence of storage protection keys associated with 2-kilobyte blocks of storage.

**MULTIPLE VIRTUAL STORAGE (MVS)** is IBM's large-scale operating system, designed to handle multiprocessor configurations. MVS provides a virtual I/O (VIO) paging mechanism for temporary data sets and private virtual storage for up to 16 million bytes for individual Time Sharing Option users. Workload Management Routines monitor the use of processing resources and allocate resources to jobs or time-sharing users. MVS also provides Resource-Use Routines, a set of algorithms that monitor the use of system resources and recommend scheduling changes to optimize the utilization of system resources. Deadline scheduling under Job Entry Subsystem (JES) 3 dynamically alters the scheduling priority of jobs in order to meet completion deadlines. Other MVS facilities include a network job processing capability that permits the transmission of program input and output between compatible JES3 installations and recovery capabilities for multiprocessor 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). The availability of MVS/SE is made possible 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 (TLB), improved system availability through storage protection, and improved system resource utilization.

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

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

MVS/SP-JES2/3 Version 1 Release 3.5 supports IBM 3090 Series processors in System/370 mode, simplifies global resource serialization processing, and provides standalone dump support for the 3480 Magnetic Tape Subsystem ►

## IBM 3090 Series

► in full-function mode. This release does not support the expanded storage option available on 3090 processors.

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

*MVS/System Product Version 2:* MVS/SP Version 2 must be installed in conjunction with the Data Facility Product. The two programs are known collectively as MVS/Extended Architecture (MVS/XA) and are designed to support the System/370 Extended Architecture. The Data Facility Product provides data management, device support, program library management, and utility functions. MVS/XA also requires Assembler H Version 2, a functional replacement for OS Assembler H Release 5, and SMP Release 4.

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

MVS/SP-JES2/3 Version 2 Release 1.3 supports the 3090 Processor Complex in System/370 Extended Architecture (370-XA) mode. The release supports the expanded storage option for the 3090 processor and also provides for RAS enhancements.

Multiple Virtual Storage/System Product 2.1.3 Vector Facility Enhancement supports the Vector Facility. The software product lets systems using the Vector Facility recognize a vector user and assigns the vector job to the central processor set up for vector processing. The software release features vector affinity, System Management Facilities, enhanced operator commands, and serviceability enhancements. Operating under MVS/XA, vector affinity automatically allows users to run on the central processor that has the Vector Facility. System Management Facilities provides accounting information detailing Vector Facility usage and affinity. New operator commands let operators display systems using the Vector Facility and bring the processor equipped with the Vector Facility on- or off-line. The Vector Facility can be brought off-line independent of the central processor. Additionally, the Interactive Problem Control System and standalone dump have been enhanced. Checkpoint restart supports the Vector Facility.

MVS/SP-JES2/3 Version 2 Release 1.5 provides virtual storage constraint relief through MVS-XA exploitation and expanded trace facilities. Additionally, the release provides two new JES3 user exits, improved usability for job networking, and greater flexibility in coding initialization statements.

MVS/SP-JES3 Version 2 Release 1.7 provides support for the Model 400E in System/370 Extended Architecture mode and also provides reconfiguration support. Reconfiguration support involves those functions involved in processor side partitioning and expanded storage. A side consists of the channel paths, processors, expanded storage elements, real storage elements, and vector facilities that can support a single operating system.

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, and other features.

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

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

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

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

VM/SP High Performance Option Release 4.2 Support for Vector Facility contains all the functions of VM/SP HPO Releases 3.6 and 4. VM/SP HPO Release 4 supports the execution of vector applications while also supporting VS Fortran Version 2 on CMS, Assembler H, the Engineering ►

## IBM 3090 Series

► and Scientific Subroutine Library, additional control program commands, and applications that use the Vector Facility. Such applications do not require special setups and programming.

VM/SP High Performance Option Release 5 is offered as an adjunct to VM/SP Release 5 and provides additional features. The product is designed to support large CMS-based interactive environments and facilitates the running of MVS/370 production systems under VM. The product merges VM/SP Release 5 and VM/SP HPO Release 5 functions and supports up to 9,900 SPOOL files per user, exceeding the previous limitation of 9,900 SPOOL files per system.

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

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

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

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

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

VM/XA Systems Facility Release 2 Additional Enhancements extends VM/XA support to the 3090 processor systems announced on January 26, 1987, including Models

300E and 600E. The product also provides support for IBM 3380 Models AE4 and BE4 and 3880 Models 11, 13, 21, and 23 Control Units; the IBM 5080 Graphics System; the IBM 3480 Magnetic Tape Subsystem; the IBM 3890 Document Processor; the IBM 3720 Communications Controller; and 3090 Expanded Storage. The product also supports a "Vary Channel Path" command, which lets operators make a channel path logically available or unavailable to one or more real devices.

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

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

*VM/XA System Product (SP) Release 1* supersedes all releases of VM/XA SF and provides a migration path for VM/XA SF users. Enhancements include an interactive environment capable of supporting large numbers of users. It also supports a bimodal CMS which operates in either System/370 mode with 24-bit addressing or 370-XA mode with 24- or 31-bit addressing. Additionally, program interfaces have been defined to allow the development of applications which 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 which are supported by VM/XA as V=R preferred virtual machines are supported as V=F guests. The feature will be available by third quarter-1988.

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

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

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

## IBM 3090 Series

► **INTERACTIVE EXECUTIVE/370 (IX/370)** is IBM's implementation of the UNIX System V operating system. Designed for the VM/SP environment, IX/370 runs as a guest under VM/SP Release 3.0 or later. IX/370 includes the following functions based on UNIX System V: support for IBM and other full-duplex ASCII terminals, the Bourne shell command language, a hierarchical file system, a text processing and document preparation facility, the ability to control and track document and source code changes, and the ability to copy files to other UNIX systems. In addition, IBM has added the following extensions to UNIX: virtual memory support, multiple IX/370 system support, file system enhancements that allow data block sizes of 4096 bytes, extended file and logical record locking, and a full-screen editor with windowing.

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

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

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

XRF, a major IMS addition, is an MVS/XA and SNA enhancement designed to increase the availability of IMS/VS Version 2 DB/DC transaction processing. XRF is now included in IMS/VS Version 2 and in MVS/SP Version 2 Release 1.3 with the Availability Enhancement. XRF uses additional hardware and software to create an alternate IMS/VS Version 2 subsystem and keeps the alternate subsystem synchronized with the active subsystem. Whenever service to end users is disrupted, the alternate IMS/VS subsystem takes over the workload of the active system. XRF thus reduces the time that end users are prevented from accessing the system.

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

The basic batch-oriented version of IMS (IMS/VS-DB) can be augmented with data communications capabilities to produce a transaction-driven system. This is achieved by

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

As an alternative to IMS/VS-DC, a DB/DC system can be put together using CICS. CICS generally provides similar functional capabilities with lower overhead in some environments. CICS was designed for relatively short program modules of about 2 kilobytes to 6 kilobytes, while the IMS/VS-DC is better suited to 20-kilobyte or larger modules.

Database 2 (DB2) is IBM's relational data base product that runs under either MVS/XA or MVS/370. It's designed to coexist 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.

*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 multi-user 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

## IBM 3090 Series

▶ 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 may make use of these file structures include *DB/DC Data Dictionary* and *Query Management Facility (QMF)*.

DB/DC Data Dictionary provides a central source of information describing files, data bases, programs, and user-defined resources and how they all interrelate. The Data Dictionary can help enforce naming conventions and establish a central control point, particularly within organizations that permit remote locations to develop and run their own data and programs. The application can be particularly beneficial to organizations planning to convert to a DL/1 data base system, according to IBM. The dictionary simplifies the entry of DL/1 data base definition and declaration for Cobol, PL/1, and Assembler language programs.

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

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

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 which supports a variety of terminals and supports most applications under MVS/370 and MVS/XA.

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

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

CICS/OS/VS also gives the user the ability to share network resources with other VTAM communications application programs. The system provides for more terminal I/O

overlap by using VTAM's read-ahead capabilities and by providing a direct interface between the application program and the terminal control program. CICS/OS/VS Version 1 Release 6 allows command-level application programs assembled with Assembler H Version 2 to use 31-bit addressing. Up to 1 gigabyte virtual storage requests are supported.

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

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

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

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

## IBM 3090 Series

► Transaction Processing Facility (TPF) supports realtime transaction processing applications using a centralized data base. TPF performs work, main storage, program, and data management functions. TPF Version 2 Release 3 can be channel attached to an IBM 3725 Communication Controller running Network Control Program Version 4 Releases 1 and 2. TPF supports up to 64,000 resources via SNA extended network addressing. This addressing provides selection of the resources from a maximum of 255 subareas, each having 32,000 resources, up to a maximum of 64,000 resources in a TPF network. TPF Version 2 Release 4, based on System/370 Extended Architecture, replaces Release 3. Release 4 supports processors running in extended architecture modes. In addition, the release supports 3990 storage controllers, 3380 DASD, and tightly coupled extended architecture. The tightly coupled facility creates a multiprocessing environment within a multiprocessor system that runs with a single copy of TPF, permitting shared system data and resources. Extended Architecture/I/O support extends current support from 16 physical channels to as many physical channels as are available on the user's IBM processors running XA.

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

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

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

In addition to SAA plans, IBM currently offers many tools to help programmers, end users, and various "knowledge workers" develop and maintain applications. IBM packages for the MVS/SP and MVS/XA environments include Application Prototype Environment (APE), the Screen Definition Facility/Customer Information Control System (SDF/CICS), Cross System Product Set (CSPS), Cross System Product/Application Development (CSP/AD), Cross System Product/Application Execution (CSP/AE),

Interactive Instructional Authoring System (IIAS), Interactive System Productivity Facility (ISPF), Interactive System Productivity Facility/Program Development Facility (ISPF/PDF), IMS Application Development Facility II, Query Management Facility (QMF), Time Sharing Option (TSO), TSO Extensions (TSO/E), and Conversational Monitor System, (CMS).

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

ISPF/PDF Version 2.1.2 for MVS is used to create and maintain both source programs and text data. ISPF/PDF provides interfaces to many system facilities through user-friendly menus. Version 2.1.2 uses 31-bit addressing mode and supports the Kanji language. Both ISPF and ISPF/PDF provide virtual storage constraint relief and allow growth of ISPF and ISPF/PDF by using the extended address space of MVS/XA.

Facilities available for VM/SP and VM/XA environments include APE, CSP/AD, CSP/AE, Cross System Product/Query (CSP/Q), 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 data bases from machine-readable formats. It runs under DOS/VSE and MVS/XA.

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

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

*DisplayWrite/370* provides word processing functions for professional end users. It includes a full-screen text editor/formatter that provides basic and advanced text functions for creating and revising documents. Document printing is ►

## IBM 3090 Series

► 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 eigensystems. Release 2 more than doubles the number of routines available with Release 1.

### PRICING AND SUPPORT

**POLICY:** IBM 3090 machines are offered for purchase or rental. During the first six months following installation, 20 percent of the monthly rental charges may 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 four defined groups (10, 20, 30, and 40) allow for a four-tier processing structure for each applicable product. The 3090 Model 120E is a Processor Group 30 machine. The six other 3090 models are

Processor Group 40 machines. Users with Processor Group 40 machines pay the highest onetime fees for software. Users who upgrade to larger model groups will have to pay an upgrade charge for the software.

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

The centralized IBM Support Center provides 24-hour, 7-day customer access by telephone (an 800 number is provided). It utilizes the Software Support Facility data base, which incorporates every problem encountered and resolved (or unresolved) by the central support group. The 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 150E Processor Complex; 32 megabytes of main memory, 16 integrated channels	\$1,250,000
One 3092 Processor Controller Model 1	200,000
One 3097-1 Power and Coolant Distribution Unit	121,000
One 3089 Model 3 Power Unit	38,000
Two 3370 Model A2 Direct Access Storage Devices (DASDs)	70,960
Two 3180 Model 145 Display Stations	4,790
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 3480 A22 Tape Cartridge Control Units	130,860
Four B22 Cartridge Tape Units	172,480
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer; (20,040 lpm)	330,750
<b>TOTAL PURCHASE PRICE:</b>	<b>\$4,359,260</b> ►

**IBM 3090 Series**

► **MEDIUM CONFIGURATION:**

3090 Model 200 Processor Complex; 64 megabytes of main memory, 32 integrated channels	\$4,100,000
128 megabytes of expanded storage	695,000
One 3092 Model 1 Processor Controller	200,000
One 3097-1 Power and Coolant Distribution Unit	121,000
Two 3089 Model 3 Power Units	76,000
Two 3370 Model A2 DASDs	70,960
Two 3180 Model 145 Display Stations	4,790
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)	73,600
Fourteen 3422 Model B01 Tape Units (125 ips)	250,600
One 3005 Two-Channel Switch (2 by 16)	3,250
Two 3480 A22 Tape Cartridge Control Units	130,860
Four B22 Cartridge Tape Units	172,480
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer; (20,040 lpm)	330,750
<b>TOTAL PURCHASE PRICE:</b>	<b>\$8,269,710</b>

**LARGE CONFIGURATION:**

3090 Model 600E Processor Complex; 128 megabytes shared central storage, 64 integrated channels	\$10,344,000
64 megabytes of additional central storage; A side	540,000
64 megabytes of additional central storage; B side	540,000

512 megabytes of expanded storage; A side	2,435,000
512 megabytes of expanded storage; B side (1 gigabytes of expanded storage total)	2,435,000
First additional channel group; 8 channels, A side	130,000
Second additional channel group; 8 channels, A side	130,000
Third additional channel group; 16 channels, A side	260,000
First additional channel group; 8 channels, B side	130,000
Second additional channel group; 8 channels, B side	130,000
Third additional channel group; 16 channels, B side	260,000
One 3092 Processor Controller Model 2	235,000
Two 3097-1 Power and Coolant Distribution Units	242,000
Four 3089 Model 3 Power Units	152,000
Two 3370 Model A2 DASDs	70,960
Three 3180 Model 145 Display Stations	7,185
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)	73,600
Fourteen 3422 Model B01 Tape Units (125 ips)	250,600
One 3005 Two-Channel Switch (2 by 16)	3,250
Two 3480 A22 Tape Cartridge Control Units	130,860
Four B22 Cartridge Tape Units	172,480
Three 4248 Model 2 printers (4,000 lpm)	225,000
One 3800 Model 3 laser printer; (20,040 lpm)	330,750
<b>TOTAL PURCHASE PRICE:</b>	<b>\$21,861,195</b>

**EQUIPMENT PRICES**

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>PROCESSORS &amp; FEATURES</b>					
Model 120E	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-3, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3180 System Consoles, and 3864-2 Automatic Calling Unit	715,000	1,600	59,580	—
Model 150E	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3180-145 System Consoles, and 3864-2 Automatic Calling Unit	1,250,000	2,400	108,350	—

## IBM 3090 Series

PROCESSORS & FEATURES (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
Model 180E	Processor Complex consists of CPU, 32MB of central storage, 64KB of buffer memory, and 16 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, 3089-3 Power Unit, two 3180-145 System Consoles, and 3864-2 Automatic Calling Unit	2,200,000	2,870	183,350	—
Model 200E	Processor Complex; consists of two CPUs, 64MB of main memory, 64KB buffer per CPU, and 32 integrated channels; requires 3092-1 Processor Controller, 3097-1 or -2 Power/Coolant Distribution Unit, two 3089-3 Power Units, two 3180-145 System Consoles, and 3864-2 Automatic Call Unit	4,100,000	5,900	414,000	—
Model 300E	Processor Complex; consist of three CPUs, 64KB buffer per CPU, 64MB of main memory, 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 3180 Model 145 System Consoles, and 3864-2 Modem	5,600,000	8,600	479,170	—
Model 400E	Processor Complex; consists of four CPUs, 128MB of main memory, 64KB buffer per CPU, and 64 integrated channels; requires 3092-2 Processor Controller, two 3097-1 or -2 Power/Coolant Dist. Units, four 3089-3 Power Units, three 3180-145 System Consoles, and two 3864-2 Automatic Call Units	7,819,000	11,910	786,900	—
Model 600E	Processor Complex; consists of six CPUs, 64KB buffer per CPU, 128MB of main memory, 64 integrated channels; requires 3092 Model 2 Processor Controller, two 3097 Model 1 or 2 Power/Coolant Distribution Units, four 3089 Model 3 Power Units, three 3180 Model 145 System Consoles, and two 3864-2s	10,344,000	17,000	912,000	—
<b>Required 3090 Hardware</b>					
3092-1	Processor Controller; required for 150E, 180E, 200E, and 300E	200,000	1,125	18,000	—
3092-2	Processor Controller; required for 400E and 600E	235,000	1,295	21,140	—
3092-3	Processor Controller; required for Model 120E	120,000	650	10,000	—
—	Upgrade from 3092 Model 1 to 3092 Model 2	35,000	—	—	—
—	Upgrade from 3092 Model 3 to 3092 Model 1	80,000	—	—	—
3097-1	Power and Coolant Distribution Unit for 3090 Models 120E, 150E, 180E, 200E, 300E, 400E, or 600E	121,000	220	10,880	—
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; required for 3090 Models 120E, 200E, 300E, 400E, or 600E	111,000	200	9,250	—
—	3097 Model 2-to-Model 1 Upgrade	10,000	—	—	—
4650	I/O Power Sequence Control for the 3090 Models 120E, 150E, 180E, 200E, or 400E	8,000	50	720	—
3089-3	Power Unit; 3090 Model 150E requires one 3089 Model 3, Model 180E configured with more than 192 or 256 megabytes of expanded storage and a Vector Facility requires two, Model 200E requires two, Model 400E requires four, Model 300E requires two, and Model 600E requires four	38,000	90	3,415	—
3180-145	Console Display Station; two required for the 3090 Models 120E, 150E, 180E, 200E, and 300E, and three for the Models 400E and 600E	2,395	300	—	—
5801	Automatic Call Unit for the 3864-2 Modem	1,090	192	—	—
<b>Expansion Frames</b>					
7330	Expansion Frame for Models 120E, 150E, and 180E; requires 1545	45,000	50	4,050	—
7330	Expansion Frame for Models 120E and 200E; requires 3854 or 1545	45,000	50	4,050	—
7330	Expansion Frame for Model 400E on A side; requires 3854 or 1545	45,000	50	4,050	—
7331	Expansion Frame for Model 400E on B side; requires 3856 or 1546	45,000	50	4,050	—
<b>Channel Groups: Models 120E and 150E</b>					
3848	Eight additional channels	130,000	145	10,830	—
<b>Channel Groups: Model 180E</b>					
3848	First additional channel group; eight channels	130,000	145	10,830	—
3849	Second additional channel group, eight channels; requires 3848	130,000	145	10,830	—

NA—Not applicable.  
A dash (—) also means not applicable.  
NC—No charge.  
\*Includes equipment maintenance.  
\*\*Four-year lease.

## IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>Channel Groups: Model 200E</b>					
3850	First additional channel group; eight channels	130,000	145	11,690	—
3851	Second additional channel group; eight channels.	130,000	145	11,690	—
3854	Third additional channel group, 16 channels; requires 7330	260,000	290	23,380	—
<b>Channel Groups: Model 300E</b>					
3850	First additional channel group; eight channels	130,000	145	11,690	—
3851	Second additional channel group; eight channels	130,000	145	11,690	—
3854	Third additional channel group; 16 channels	260,000	290	3,854	—
<b>Channel Groups: Model 400E</b>					
	—A side:				
3850	First additional channel group	130,000	145	11,690	—
3851	Second additional channel group	130,000	145	11,690	—
3854	Third additional channel group; requires 7330	260,000	290	23,380	—
	—B side:				
3852	First additional channel group	130,000	145	11,690	—
3853	Second additional channel group	130,000	145	11,690	—
3856	Third additional channel group; requires 7331	260,000	290	23,380	—
<b>Channel Groups: Model 600E</b>					
	—A side:				
3850	First additional channel group	130,000	145	11,690	—
3851	Second additional channel group	130,000	145	11,690	—
3854	Third additional channel group	260,000	290	23,380	—
	—B side:				
3852	First additional channel group	130,000	145	11,690	—
3853	Second additional channel group	130,000	145	11,690	—
3856	Third additional channel group	260,000	290	23,380	—
<b>Additional Central Storage</b>					
	Model 150E or Model 180E:				
4064	Additional 32 megabytes	270,000	250	22,500	—
	Model 200E:				
4128	Additional 64 megabytes	540,000	500	45,000	—
	Model 300E:				
4128	Additional 64 megabytes	540,000	500	45,000	—
	Model 400E:				
4128	Additional 64 megabytes for A side	540,000	500	45,000	—
4228	Additional 64 megabytes for B side	540,000	500	45,000	—
	Model 600E:				
4128	Additional 64 megabytes for A side	540,000	500	45,000	—
4228	Additional 64 megabytes for B side	540,000	500	45,000	—
<b>Expanded Storage: Models 120E and 150E</b>					
5064	First 64 megabytes	405,000	500	42,740	—
5128	First 128 megabytes	695,000	900	74,700	—
6128	Expansion from 64 megabytes to 128 megabytes; requires 5064	290,000	400	31,940	—
<b>Expanded Storage: Model 180E</b>					
5064	First 64 megabytes	405,000	500	42,740	—
5128	First 128 megabytes	695,000	900	74,700	—
5192	First 192 megabytes	985,000	1,300	98,740	—
5256	First 256 megabytes	1,275,000	1,700	128,320	—
6128	Expansion from 64 megabytes to 128 megabytes; requires 5064	290,000	400	31,940	—
6192	Expansion from 64 megabytes to 192 megabytes; requires 5064	580,000	800	59,160	—
6256	Expansion from 64 megabytes to 256 megabytes; requires 5064	870,000	1,200	88,740	—
6193	Expansion from 128 megabytes to 192 megabytes; requires 5128 or 6128	290,000	400	29,580	—
6257	Expansion from 128 megabytes to 256 megabytes; requires 5128 or 6128	580,000	800	59,180	—
6258	Expansion from 192 megabytes to 256 megabytes; requires 5192, 6192, or 6193	290,000	400	29,580	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>Expanded Storage: Model 200E</b>					
5024	1024 megabytes	4,755,000			
5064	First 64 megabytes	405,000	500	42,740	—
5128	First 128 megabytes	695,000	900	74,700	—
5192	First 192 megabytes	985,000	1,300	98,740	—
5256	First 256 megabytes	1,275,000	1,700	128,320	—
5512	First 512 megabytes	2,435,000	3,300	266,460	—
6028	Expansion from 512 megabytes to 1024 megabytes	2,320,000			
6128	Expansion from 64 megabytes to 128 megabytes	290,000	400	31,940	—
6192	Expansion from 64 megabytes to 192 megabytes	580,000	800	59,160	—
6256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	88,740	—
6512	Expansion from 64 megabytes to 512 megabytes	2,030,000	2,800	223,580	—
6193	Expansion from 128 megabytes to 192 megabytes	290,000	400	29,580	—
6257	Expansion from 128 megabytes to 256 megabytes	580,000	800	59,160	—
6513	Expansion from 128 megabytes to 512 megabytes	1,740,000	2,400	191,640	—
6258	Expansion from 192 megabytes to 256 megabytes	290,000	400	29,580	—
6514	Expansion from 192 megabytes to 512 megabytes	1,450,000	2,000	159,700	—
6515	Expansion from 256 megabytes to 512 megabytes	1,160,000	1,600	127,760	—
<b>Expanded Storage: Model 300E</b>					
5024	1024 megabytes	4,755,000			
5064	First 64 megabytes	405,000	500	42,740	—
5128	First 128 megabytes	695,000	900	74,700	—
5192	First 192 megabytes	985,000	1,300	98,740	—
5256	First 256 megabytes	1,275,000	1,700	128,320	—
5512	First 512 megabytes	2,435,000	3,300	266,460	—
6028	Expansion from 512 megabytes to 1024 megabytes	2,320,000			
6128	Expansion from 64 megabytes to 128 megabytes	290,000	400	31,940	—
6192	Expansion from 64 megabytes to 192 megabytes	580,000	800	59,160	—
6256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	88,740	—
6512	Expansion from 64 megabytes to 512 megabytes	2,030,000	2,800	223,580	—
6193	Expansion from 128 megabytes to 192 megabytes	290,000	400	29,580	—
6257	Expansion from 128 megabytes to 256 megabytes	580,000	800	59,160	—
6513	Expansion from 128 megabytes to 512 megabytes	1,740,000	2,400	191,640	—
6258	Expansion from 192 megabytes to 256 megabytes	290,000	400	29,580	—
6514	Expansion from 192 megabytes to 512 megabytes	1,450,000	2,000	159,700	—
6515	Expansion from 256 megabytes to 512 megabytes	1,160,000	1,600	127,760	—
<b>Expanded Storage: Model 400E</b>					
—A side:					
5024	1024 megabytes	4,755,000			
5064	First 64 megabytes	405,000	500	42,740	—
5128	First 128 megabytes	695,000	900	74,700	—
5192	First 192 megabytes	985,000	1,300	98,740	—
5256	First 256 megabytes	1,275,000	1,700	128,320	—
5512	First 512 megabytes	2,435,000	3,300	266,460	—
6028	Expansion from 512 megabytes to 1024 megabytes	2,320,000			
6128	Expansion from 64 megabytes to 128 megabytes	290,000	400	31,940	—
6192	Expansion from 64 megabytes to 192 megabytes	580,000	800	59,160	—
6256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	88,740	—
6512	Expansion from 64 megabytes to 512 megabytes	2,030,000	2,800	223,580	—
6193	Expansion from 128 megabytes to 192 megabytes	290,000	400	29,580	—
6257	Expansion from 128 megabytes to 256 megabytes	580,000	800	59,160	—
6513	Expansion from 128 megabytes to 512 megabytes	1,740,000	2,400	191,640	—
6258	Expansion from 192 megabytes to 256 megabytes	290,000	400	29,580	—
6514	Expansion from 192 megabytes to 512 megabytes	1,450,000	2,000	159,700	—
6515	Expansion from 256 megabytes to 512 megabytes	1,160,000	1,600	127,760	—
—B Side:					
7024	1024 megabytes	4,755,000			
7064	First 64 megabytes	405,000	500	42,740	—
7128	First 128 megabytes	695,000	900	74,700	—
7192	First 192 megabytes	985,000	1,300	98,740	—
7256	First 256 megabytes	1,275,000	1,700	128,320	—
7512	First 512 megabytes	2,435,000	3,300	266,460	—
8028	Expansion from 512 megabytes to 1024 megabytes	2,320,000			
8128	Expansion from 64 megabytes to 128 megabytes	290,000	400	31,940	—
8192	Expansion from 64 megabytes to 192 megabytes	580,000	800	59,160	—
8256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	88,740	—
8512	Expansion from 64 megabytes to 512 megabytes	2,030,000	2,800	223,580	—
8193	Expansion from 128 megabytes to 192 megabytes	290,000	400	29,580	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

## IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>EXPANDED STORAGE: Model 400E (Continued)</b>					
8257	Expansion from 128 megabytes to 256 megabytes	580,000	800	59,180	—
8513	Expansion from 128 megabytes to 512 megabytes	1,740,000	2,400	191,640	—
8258	Expansion from 192 megabytes to 256 megabytes	290,000	400	29,580	—
8514	Expansion from 192 megabytes to 512 megabytes	1,450,000	2,000	159,700	—
8515	Expansion from 256 megabytes to 512 megabytes	1,160,000	1,600	127,760	—
<b>Expanded Storage: Model 600E</b>					
5024	1024 megabytes	4,755,000			
	—A side:				
5064	First 64 megabytes	405,000	500	42,740	—
5128	First 128 megabytes	695,000	900	74,700	—
5192	First 192 megabytes	985,000	1,300	98,740	—
5256	First 256 megabytes	1,275,000	1,700	128,320	—
5512	First 512 megabytes	2,435,000	3,300	266,460	—
6028	Expansion from 512 megabytes to 1024 megabytes	2,320,000			
6128	Expansion from 64 megabytes to 128 megabytes	290,000	400	31,940	—
6192	Expansion from 64 megabytes to 192 megabytes	580,000	800	59,160	—
6256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	88,740	—
6512	Expansion from 64 megabytes to 512 megabytes	2,030,000	2,800	223,580	—
6193	Expansion from 128 megabytes to 192 megabytes	290,000	400	29,580	—
6257	Expansion from 128 megabytes to 256 megabytes	580,000	800	59,160	—
6513	Expansion from 128 megabytes to 512 megabytes	1,740,000	2,400	191,640	—
6258	Expansion from 192 megabytes to 256 megabytes	290,000	400	29,580	—
6514	Expansion from 192 megabytes to 512 megabytes	1,450,000	2,000	159,700	—
6515	Expansion from 256 megabytes to 512 megabytes	1,160,000	1,600	127,760	—
	—B side:				
7024	1024 megabytes	4,755,000			
7064	First 64 megabytes	405,000	500	42,740	—
7128	First 128 megabytes	695,000	900	74,700	—
7192	First 192 megabytes	985,000	1,300	98,740	—
7256	First 256 megabytes	1,275,000	1,700	128,320	—
7512	First 512 megabytes	2,435,000	3,300	266,460	—
8028	Expansion from 512 megabytes to 1024 megabytes	2,320,000			
8128	Expansion from 64 megabytes to 128 megabytes	290,000	400	31,940	—
8192	Expansion from 64 megabytes to 192 megabytes	580,000	800	59,160	—
8256	Expansion from 64 megabytes to 256 megabytes	870,000	1,200	88,740	—
8512	Expansion from 64 megabytes to 512 megabytes	2,030,000	2,800	223,580	—
8193	Expansion from 128 megabytes to 192 megabytes	290,000	400	29,580	—
8257	Expansion from 128 megabytes to 256 megabytes	580,000	800	59,180	—
8513	Expansion from 128 megabytes to 512 megabytes	1,740,000	2,400	191,640	—
8258	Expansion from 192 megabytes to 256 megabytes	290,000	400	29,580	—
8514	Expansion from 192 megabytes to 512 megabytes	1,450,000	2,000	159,700	—
8515	Expansion from 256 megabytes to 512 megabytes	1,160,000	1,600	127,760	—
<b>VECTOR FACILITY</b>					
	—For Models 120E, 150E, and 180E:				
1545	Vector Facility; requires 7330	325,000	300	29,240	—
	—For Model 200E:				
1545	First Vector Facility; requires 7330	325,000	300	29,240	—
1550	Second Vector Facility	230,000	175	20,700	—
	—For Model 300E:				
1545	First Vector Facility	325,000	300	29,240	—
1550	Second Vector Facility	230,000	175	20,700	—
1555	Third Vector Facility	230,000	175	20,700	—
	—For Model 400E:				
1545	First Vector Facility on A side; requires 7330	325,000	300	29,240	—
1550	Second Vector Facility on A side	230,000	175	20,700	—
1546	First Vector Facility on B side; requires 7331	325,000	300	29,240	—
1551	Second Vector Facility on B side	230,000	175	20,700	—
	—For Model 600E:				
1545	First Vector Facility for A side	325,000	300	29,240	—
1550	Second Vector Facility for A side	230,000	175	20,700	—
1555	Third Vector Facility for A side	230,000	175	20,700	—
1546	First Vector Facility for B side	325,000	300	29,240	—
1551	Second Vector Facility for B side	230,000	175	20,700	—
1556	Third Vector Facility for B side	230,000	175	20,700	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

## IBM 3090 Series

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>SYSTEM UPGRADES</b>				
3090 Model 120E to Model 150E	535,000	—	—	—
3090 Model 150 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 150E to Model 180E	950,000	—	—	—
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 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 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 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	—	—	—
<b>MASS STORAGE</b>				
3370 Direct Access Storage:				
Model A1; Single Disk Drive; 571.3MB	35,480	173.00	1,851	1,575
Model B1; Add-on Single Disk Drive for attachment to Model A1	26,600	129.00	1,387	1,180
Model A2; 729.8MB; contains logic and power for up to three Model B2 units	35,480	134.00	2,190	—
Model B2; connects to a 3370 Model A2	26,600	101.00	1,640	—
8150 String Switch for 3370 A1	3,830	1.50	181	154
3375 Direct Access Storage; 819.7MB per drive:				
Model A1; contains logic and power for up to three Model B1 units	24,730	144.00	1,851	1,575
Model B1; connects to a 3375 Model A1	18,700	109.00	1,486	1,265
Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	23,590	133.00	1,763	1,500
4951 Model D1 Attachment for Model A1	2,590	6.00	112	95
4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
8150 String Switch Feature for 3375 A1	3,795	1.50	199	169
3375 Model B1 to D1 Upgrade	7,520	—	—	—
3380 Direct Access Storage:				
Model AD4; 2.52 billion bytes of storage	82,000	295.00	4,730	—
Model BD4; Direct Access Storage; connects to a Model AD4 or AE4	59,000	215.00	3,440	—
Model AE4; 5.04 million bytes per unit	113,000	295.00	7,030	—
Model BE4; connects to a Model AE4 or AD4 unit	90,000	215.00	5,735	—
3380 AD4 Conversion to AE4	40,000	—	—	—
3380 BD4 Conversion to BE4	40,000	—	—	—
Model AJ4; 2.52 billion bytes of storage	82,000	225.00	4,325	—
Model BJ4; 2.52 billion bytes of storage	59,000	165.00	3,115	—
Model AK4; 7.56 billion bytes of storage	128,000	225.00	6,625	—
Model BK4; 7.56 billion bytes of storage	105,000	165.00	5,415	—
Model CJ2; 1.26 billion bytes of storage	70,000	230.00	3,730	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

## IBM 3090 Series

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>3880 Storage Control Unit</b>				
Model 001 Storage Control Unit	51,000	176.00	4,124	3,510
Model 003 Storage Control Unit	51,000	82.50	1,370	1,165
Model D23 Storage Control Unit; 8 megabytes of memory	110,000	575.00	2,940	—
Model E23 Storage Control Unit; 16 megabytes of memory	146,000	600.00	3,900	—
Model G23 Storage Control Unit; 32 megabytes of memory	218,000	650.00	5,825	—
Model H23 Storage Control Unit; 48 megabytes of memory	290,000	700.00	7,750	—
Model J23 Storage Control Unit; 64 megabytes of memory	362,000	750.00	9,675	—
Model E21 Storage Control Unit; 16 megabytes of memory	146,000	600.00	3,900	—
Model G21 Storage Control Unit; 32 megabytes of memory	218,000	650.00	5,825	—
Model H21 Storage Control Unit; 48 megabytes of memory	290,000	700.00	7,750	—
Model J21 Storage Control Unit; 64 megabytes of memory	362,000	750.00	9,675	—
<b>3880 Controller Model Upgrades</b>				
Model 001 to Model E21	95,000	—	—	—
Model 001 to Model G21	167,000	—	—	—
Model 001 to Model H21	239,000	—	—	—
Model 001 to Model J21	311,000	—	—	—
Model 003 to Model D23	59,000	—	—	—
Model 003 to Model E23	95,000	—	—	—
Model 003 to Model G23	167,000	—	—	—
Model 003 to Model H23	239,000	—	—	—
Model 003 to Model J23	311,000	—	—	—
Model B13 to Model D23	59,000	—	—	—
Model B13 to Model E23	95,000	—	—	—
Model B13 to Model G23	167,000	—	—	—
Model B13 to Model H23	239,000	—	—	—
Model B13 to Model J23	311,000	—	—	—
Model D11 to Model E21	95,000	—	—	—
Model D11 to Model G21	167,000	—	—	—
Model D11 to Model H21	239,000	—	—	—
Model D11 to Model J21	311,000	—	—	—
Model D13 to Model D23	59,000	—	—	—
Model D13 to Model E23	95,000	—	—	—
Model D13 to Model G23	167,000	—	—	—
Model D13 to Model H23	239,000	—	—	—
Model D13 to Model J23	311,000	—	—	—
3880 Features:				
3005; 3880 Model 003 Support Feature for 3380 AJ4/AK4	5,000	—	5,000	—
3010; 3880 Model D23 Support Feature for 3380 AK4	5,000	—	5,000	—
6140; For 3880 Models D21/D23 4.5MB/Second Transfer Support Feature	3,000	—	80	—
9431; 3880 Attachment Feature	NC	NC	NC	NC
9432; 3990 Attachment Feature (2-path)	NC	NC	NC	NC
9433; 3990 Attachment Feature (4-path)	NC	NC	NC	NC
6550; Speed Matching Buffer for 3380	8,250	40.00	220	187
6560; Speed Matching Buffer	9,710	40.00	260	221
8170; Two-Channel Switch Pair	5,290	40.00	140	119
8171; Two-Channel Switch Pair, Additional	14,120	38.50	380	323
8172; Eight-Channel Switch	19,420	53.50	520	443
<b>3990 Storage Control Unit</b>				
Model 001; Storage Control Unit; 2-path	60,000	185.00	3,185	—
Model 002; Storage Control Unit; 4-path	110,000	370.00	5,870	—
Model G03; Storage Control Unit; 4-path, 32 megabytes of memory	200,000	800.00	10,800	—
Model J03; Storage Control Unit; 4-path, 64 megabytes of memory	312,000	875.00	16,475	—
Model L03; Storage Control Unit; 4-path, 128 megabytes of memory	536,000	1,025.00	27,825	—
Model Q03; Storage Control Unit; 4-path, 256 megabytes of memory	984,000	1,325.00	50,525	—
<b>3990 Controller Model Upgrades</b>				
Model 001 to Model 002	50,000	—	—	—
Model 001 to Model G03	170,000	—	—	—
Model 001 to Model J03	282,000	—	—	—
Model 001 to Model L03	506,000	—	—	—
Model 001 to Model Q03	954,000	—	—	—
Model 002 to Model G03	120,000	—	—	—
Model 002 to Model J03	232,000	—	—	—
Model 002 to Model L03	456,000	—	—	—
Model 002 to Model Q03	904,000	—	—	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

IBM 3090 Series

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)	
<b>3990 Controller Model Upgrades (Continued)</b>					
Model G03 to Model J03	112,000	—	—	—	
Model G03 to Model L03	336,000	—	—	—	
Model G03 to Model Q03	784,000	—	—	—	
Model J03 to Model L03	224,000	—	—	—	
Model J03 to Model Q03	672,000	—	—	—	
Model L03 to Model Q03	448,000	—	—	—	
8172; Four-Channel Switch; Additional	18,000	40	940	—	
6149; Remote Switch Attachment (3880/3990)	NC	NC	NC	NC	
6150; Remote Switch Attachment; Additional (3880/3990)	NC	NC	NC	NC	
7149; Local Remote Switch Attachment	NC	NC	NC	NC	
7150; Local Remote Switch Attachment; Additional	NC	NC	NC	NC	
<b>MAGNETIC TAPE EQUIPMENT</b>					
<b>3420</b>	Magnetic Tape Units:				
	Model 3; 120,000 bytes/sec. at 1600 bpi; 75 ips	11,930	248.00	768	645
	Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	15,340	248.00	1,075	903
	Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	16,000	272.00	1,035	869
	Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	17,920	272.00	1,235	1,037
	Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	17,920	326.00	1,225	1,029
	Model 8; 1250 bytes/sec. at 6250 bpi; 200 ips	19,880	401.00	1,465	1,231
	6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	1,600	74.00	103	87
	6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,205	99.00	151	127
	6631 Single Density Feature (for Models 3, 5, and 7)	2,870	74.00	177	149
	3550 Dual Density Feature (for Models 3, 5, and 7)	3,705	124.00	231	194
	6407 7-Track Feature (for Models 3, 5, and 7)	2,870	107.00	177	149
<b>3803</b>	Tape Controller:				
	Model 1; for 3420 Model 3, 5, and 7 drives	20,680	158.00	1,335	1,121
	Model 2; for 3420 Model 3 through 8 drives	27,550	218.00	1,945	1,634
	5310 9-Track NRZI Feature (permits connection of 800 bpi drives to 3803-2)	3,080	2.00	186	156
	6320 7-Track NRZI Feature (permits connection of 800 bpi drives to 3803-2; 5310 is prerequisite)	1,515	2.00	92	77
	Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives between up to four 3803 control units):				
	1792 For 2 Tape Controls	6,130	15.00	388	326
	1793 For 3 Tape Controls	7,820	25.00	504	423
	1794 For 4 Tape Controls	9,195	25.00	590	496
	3551 Dual Density Feature (for 3803-1)	2,300	3.50	139	117
	6148 Remote Switch Attachment	910	—	55	46
	6408 7-Track Feature (for 3803-1)	2,300	3.50	139	117
	8100 Two-Channel Switch	4,600	6.50	288	242
<b>3422</b>	Magnetic Tape Subsystem				
	Model A1 Control Unit	36,800	440.00	2,460	—
	Model B1 Magnetic Tape Unit	17,900	181.00	1,165	—
	3005 Two Channel Switch	3,250	4.00	183	—
	3010 Two-Control Unit Switch, primary	7,350	20.00	425	—
	3015 Two-Control Unit Switch, secondary	5,250	20.00	310	—
	3020 Data Streaming	1,575	35.00	122	—
<b>3430</b>	Magnetic Tape Subsystem				
	Model A1; Tape Unit and Control	33,400	251.00	2,575	—
	Model B1; Tape Unit Only	16,900	176.00	1,365	—
<b>4991</b>	Multi-drive Attachment				
		600	5.00	46	—
<b>3480</b>	Model A11 Tape Controller				
	Model B11 Tape Unit	49,080	355.00	2,810	—
	Model A22 Tape Controller	38,810	220.00	2,160	—
	Model B22 Magnetic Tape Unit	65,430	423.00	4,605	—
		43,120	264.00	3,015	—
	1511 Channel Attachment, First	5,785	21.00	357	—
	1512 Channel Attachment, Second	5,785	21.00	357	—
	1513 Channel Attachment, Third	5,785	21.00	357	—
	2511 Automatic Cartridge Loader	8,900	40.00	485	—
	3211 A11/A22 Control Unit Coupler	4,045	—	—	—

NA—Not applicable.  
A dash (—) also means not applicable.  
NC—No charge.  
\*Includes equipment maintenance.  
\*\*Four-year lease.

## IBM 3090 Series

## MAGNETIC TAPE EQUIPMENT (Continued)

3480 Upgrades:  
Model A11 to Model A22; 3201 required for conversion to Model A22  
Model B11 to Model B22

Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
14,000	—	—	—
11,000	—	—	—

## PRINTERS

3262	Model 3; band printer; 252 to 650 lpm	15,040	202.50	806	686
	Model 5; band printer; 252 to 650 lpm	17,000	202.50	1,117	951
	Model 13; band printer; 325 lpm	12,620	148.00	592	504
	5450 OCR Feature	3,990	42.00	149	127
	1090 Audible Alarm	201	—	6	5
3268	Model 2	7,500	76.00	498	424
	Model 2C	8,990	102.00	677	—
3800	Model 3; high-speed laser printer; prints up to 215 pages per minute (ppm)	330,750	776.00	16,520	—
	Model 6; high-speed laser printer; prints up to 134 ppm	175,000	—	—	—
	1010 Accumulator	21,250	138.00	1,060	—
	1021 Accumulator Expansion	5,445	42.00	270	—
	1490 Burster-Trimmed-Stacker	52,500	372.00	2,630	2,020
	5401 127 Writable Character Generator Storage Positions (Additional)	4,695	29.00	174	135
	5410 Raster Pattern Storage (Additional)	8,655	8.00	431	—
	7810 Tape-to-Printing Subsystem Feature (Model 1)	12,630	57.00	699	537
	8170 Two-Channel Switch (Model 1)	10,270	23.00	469	363
	8180 Two-Channel Switch (Model 3)	10,270	23.00	469	—
3820	Model 1; Page Printer; laser-based machine prints up to 20 pages per minute	31,185	356.00	1,845	—
	3005 Pattern Storage Memory, 256KB	1,050	10.00	67	—
	3010 Pattern Storage Memory, 512KB	1,700	23.00	112	—
	3020 Pattern Storage Memory, 1024KB	3,000	46.00	202	—
	3025 Pattern Storage Memory, 2048KB	6,000	92.00	404	—
	3030 Pattern Storage Memory, 3072KB	9,000	138.00	607	—
	3040 EIA Interface Cable 12m	125	—	—	—
	3045 EIA Interface Cable 6m	90	—	—	—
	3050 EIA Interface Attachment	500	11.00	37	—
	3055 S/370 Channel Interface Attachment	2,600	46.00	180	—
	3065 Pattern Storage Memory, 4096KB	12,000	184.00	809	—
4245	Model 12/D12 Band printers; 1,200 lpm. Model 12 attaches to IBM byte, block, or selector channels. The Model D12 attaches via 3274 or 4700 controllers.	31,000	250.00	2,050	—
	Model 20/D20 Band printers; 2,000 lpm. Model 20 attaches to IBM byte, block, or selector channels. The Model D20 attaches via 3274 or 4700 controllers.	35,000	400.00	2,340	—
	4245 Upgrades: Model 12/D12/T12 to Model 20/D20/T20	10,000	—	—	—
4248	Model 2; Variable-speed band printer; 2,200, 3,200, and 4,000 lpm	75,000	800.00	6,205	—
	3751 36 additional print positions; plant installed	10,000	110.00	615	—
	3753 36 additional print positions; field installed	15,000	110.00	615	—

## 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	12,950	264.00	—	—
	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	9,950	240.00	—	—
	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		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	11,450	300.00	—	—
	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				

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

### IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>Cluster Controllers: (Continued)</b>					
	Model 81R Small Cluster Control Unit with RS-232-C Remote Link Attachment; supports up to eight terminals; for SNA or X.25 networks	3,500	168.00	—	—
	Model 82R Small Cluster Control Unit with X.21 Remote Link Attachment; supports up to eight terminals; for SNA or X.25 networks	3,500	168.00	—	—
1011	Storage Expansion; 512 kilobytes	1,300	40.00	—	—
1012	Storage Expansion; 1 megabytes	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 21A; local, SNA mode	14,220	77.00	1,038	883
	Model 21B; local, 3272 mode	14,200	80.00	1,038	883
	Model 21C; remote; requires 3701	9,990	59.00	727	619
	Model 21D; local, 3272 mode	14,220	85.00	1,038	883
	Model 31A; local, SNA mode	16,650	97.00	1,216	1,035
	Model 31C; remote; requires 3701	12,420	79.00	907	772
	Model 31D; local, 3272 mode	16,650	105.00	1,216	1,035
	Model 41A; local, SNA mode	18,230	62.00	1,281	1,090
	Model 41C; remote; requires 3701	13,840	43.00	973	828
	Model 41D; local, 3272 mode	18,230	62.00	1,281	1,090
	Model 51C; remote; requires 3701	4,885	40.00	334	284
	Model 61C; remote; requires 3701	7,600	29.00	513	437
1550	CCITT V.35 Interface	525	1.50	25	22
1800	Extended Function Storage, D2 CSE	2,430	20.00	166	141
1801	Control Storage Expansion	790	4.00	59	50
3101	Internal Disk Drive Enhancement	1,620	15.00	117	100
3622	Extended Function Storage, Ty C1	950	8.50	97	83
3623	Extended Function Storage, Ty C2	1,265	10.50	127	108
3625	Extended Function Storage, Ty C3	950	8.50	97	83
3627	Extended Function Storage, Ty D1	950	8.50	97	83
3631	Extended Function Storage, Ty D3	820	7.00	59	50
3650	Extended Function Storage, Ty C1	1,640	15.00	117	100
3660	Extended Function Storage, DS	1,550	2.00	100	85
3680	Encrypt/Decrypt; -1C, 3274 -21C, -31C, -41C, -51C, and -61C only	1,780	2.00	99	84
3701	External Modem Interface; requires 6302 or 6303	337	3.00	18	16
5101	Internal Disk Drive Enhancement	1,530	14.00	109	93
5550	Power Expansion	341	1.50	18	16
5650	Dataphone Digital Service; point-to-point; -21C, -31C, -41C, -51C, and -61C only	840	1.50	41	36
5651	Dataphone Digital Service; multipoint; -21C, -31C, or -51C only	840	1.50	41	36
5655	X.21 Adapter; nonswitched networks; -41C or -61C only	800	1.50	38	33
5656	X.21 Adapter; switched networks; -41C or -61C only	800	2.00	47	40
	Terminal Adapters (for Models -21X, -31X, and -51C only)—				
6901	Type A1; devices 9 through 16	918	2.00	60	51
6902	Type A2; devices 17 through 24	918	2.00	60	51
6903	Type A3; devices 25 through 32	918	2.00	60	51
7801	Type B; requires 5550	986	4.00	71	60
7802	Type B1; devices 1 through 4	986	4.00	71	60
7803	Type B2; devices 5 through 8	831	2.50	60	51
7804	Type B3; devices 9 through 12	831	2.50	60	51
7805	Type B4; devices 13 through 16	831	2.50	60	51
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	67	57
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.

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

## IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>ASCII Display Stations</b>					
Model 316X Display Stations:					
3161	Model 1 ASCII Display Station; 1,920 characters, emulates 3101-881; emulates additional non-IBM models through added features	695	35.00	—	—
8001	Additional Read Command	15	—	—	—
8501	Extended Emulation, including ADDS Viewpoint, Hazeltine 1500, TeleVideo 910, and Lear Siegler ADM-3A and ADM-5	35	—	—	—
8901	Five TeleVideo Emulation, includes 910, 912, 920, 925, and 925E	35	—	—	—
3162	Model 110 Microcoded Display; full keyboard, green, RS-232-C interface	610	35.00	—	—
	Model 120 Microcoded Display; full keyboard, green, RS-232-C and RS-422-A interfaces	724	35.00	—	—
	Model 210 Microcoded Display; full keyboard, amber, RS-232-C interface	645	35.00	—	—
	Model 220 Microcoded Display; full keyboard, amber, RS-232-C and RS-422-A interfaces	724	35.00	—	—
	Model 310 Microcoded Display; short keyboard, green, RS-232-C interface	645	35.00	—	—
	Model 320 Microcoded Display; short keyboard, green, RS-232-C and RS-422-A interfaces	724	35.00	—	—
	Model 410 Microcoded Display; short keyboard, amber, RS-232-C interface	645	35.00	—	—
	Model 420 Microcoded Display; short keyboard, amber, RS-232-C and RS-422-A interfaces	724	35.00	—	—
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	45.00	—	—
860	ALA Display; displays diacritic characters in separate position	976	45.00	—	—
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 3564 characters	2,095	95.00	—	—
	Model 120 Display with 4 user selectable screen formats; up to 3564 characters	2,095	95.00	—	—
	Model 130 APL Display with 4 user selectable screen formats; up to 3564 characters	2,095	95.00	—	—
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 CDO Display with 122-key typewriter keyboard; 1,920 or 2,560 characters; 7 colors; 3-year warranty	2,045	85.00	—	—
	Model CEO Display with 102-key enhanced keyboard; 1,920 or 2,560 characters; 7 colors; 3-year warranty	2,045	85.00	—	—
	Model CFO Display with 104-key typewriter keyboard; 1,920 or 2,560 characters; 3-year warranty				
	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	—	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

## IBM 3090 Series

ASCII Display Stations (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
	Model DFO Display with 104-key typewriter keyboard; 1,920, 2,560, 3,440, or 3,564 characters; 7 colors; 3-year warranty	1,895	60.00	—	—
	Model G10 Color Graphics Display with 122-key typewriter keyboard; 1,920 or 2,560 characters, 8 colors	2,795	110.00	—	—
	Model G20 Color Graphics Display with 122-key/APL typewriter keyboard; 89 colors; 2,560 characters	2,795	110.00	—	—
	Model G30 Color Graphics Display with 104-key enhanced keyboard; 1,920 or 2,560 characters; 8 colors	2,795	110.00	—	—
	Model G40 Color Graphics Display with 104-key/APL enhanced keyboard; 2,560 characters; 8 colors	2,795	110.00	—	—
	Model GDO Color Graphics Display with 122-key typewriter keyboard; 2,560 characters; 8 colors; 3-year warranty	2,995	110.00	—	—
	Model GEO Color Graphics Display with 122-key/APL typewriter keyboard; 1,920 or 2,560 characters; 8 colors; 3-year warranty	2,995	110.00	—	—
	Model GFO Color Graphics Display with 104-key enhanced keyboard; 1,920 or 2,560 characters; 8 colors	2,995	110.00	—	—
	Model GGO Color Graphics Display with 104-key/APL typewriter keyboard; 1,920 or 2,560 characters, 8 colors; 3-year warranty	2,995	110.00	—	—
3193	Advanced Monochrome Displays for 3270 Subsystems; attaches to 3174, 3274, 8 partitions, 2 logical terminals, combines characters and images; 880 x 1200 dots				
	Model 10 Display with 122-key keyboard; 3,840 characters; 100 pels	2,495	75.00	—	—
	Model 10 Display with 102-key enhanced keyboard; 3,840 characters; 100 pels	2,495	75.00	—	—
3194	Color Display for 3270 Subsystems; attaches to 3174, or 3274				
	Model 10 Display with 122-key keyboard; 1,920 characters; 7 colors	2,895	—	—	—
	Model 20 Display with 102-key keyboard; 1,920 characters; 7 colors	2,895	—	—	—
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 1; 960-character display; for BSC transmissions	5,380	36.00	348	296
	Model 2; 1,920-character display; for BSC transmissions	5,535	37.00	356	303
	Model 3; 2,560-character display; for BSC transmissions	5,680	38.00	361	307
	Model 4; 3,440-character display; for BSC transmissions	5,830	39.00	377	321
	Model 11; 960-character display; for SNA/SDLC transmissions	5,380	32.00	348	296
	Model 12; 1,920-character display; for SNA/SDLC transmissions	5,535	33.00	356	303
	Model 13; 2,560-character display; for SNA/SDLC transmissions	5,680	34.00	361	307
	Model 14; 3,440-character display; for SNA/SDLC transmissions	5,830	34.00	377	321
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

NA—Not applicable.  
A dash (—) also means not applicable.  
NC—No charge.  
\*Includes equipment maintenance.  
\*\*Four-year lease.

## IBM 3090 Series

ASCII Display Stations (Continued)		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
5650	DDS Adapter for point-to-point operations	840	1.50	41	36
5651	DDS Adapter; multipoint operation	840	1.50	41	36
5655	X.21 Adapter; for nonswitched networks	800	1.50	38	33
5656	X.21 Adapter; for switched networks	884	2.00	47	40
6302	Communications Adapter without clock	365	2.00	15	13
6315	SDLC/BSC Switch	682	3.00	36	31
6360	Light Pen	548	0.50	24	20
3278	Model 1; 960 char.	1,484	10.00	115	98
	Model 2; 1,920 char.	1,572	10.00	119	102
	Model 3; 2,560 char.	1,716	10.50	146	124
	Model 4; 3,440 char.	1,804	11.50	149	127
	Model 5; 3,564 char.	2,060	13.00	175	149
3610	Extended Character Set Adapter	—	—	17	15
3620	Character Set Extension	464	2.50	30	26
4621	Keyboard; 75-key EBCDIC Ty	334	2.00	22	19
4622	Keyboard; 75-key EBCDIC De	334	3.00	22	19
4623	Keyboard; 75-key EBCDIC De/Kp	334	3.00	22	19
4624	Keyboard; 75-key ASCII Ty	334	2.00	22	19
4626	Keyboard; 87-key EBCDIC Typ/APL	455	2.50	27	24
4627	Keyboard; 87-key EBCDIC Ty	455	2.50	27	24
4628	Keyboard; 87-key ASCII Ty	455	2.50	27	24
4629	Keyboard; 87-key EBCDIC Typ/Text	455	2.50	27	24
3620	Character Set Extension	464	2.50	30	26
6360	Selector Light Pen	394	0.50	24	20
4999	Magnetic Reader Control	273	3.50	17	15
3279	Model S2A; base color; 1,920 char.	2,190	19.00	201	171
	Model S2B; extended color; 1,920 char.	2,415	19.00	204	174
	Model S3G; extended color; 2,560 char.	3,115	25.00	310	264
	Model 2X; base/extended color; 1,920 char.	2,190	19.00	206	176
	Model 3X; base/extended color; 2,560 char.	2,235	19.00	227	193
3850	Extended Function (Model 2X or 3X)	210	2.00	15	13
4621	75-key EBCDIC Typewriter	417	1.50	22	19
4622	75-key EBCDIC Data Entry	417	2.50	22	19
4623	75-key EBCDIC Data Entry, keypunch layout	417	2.50	22	19
4624	75-key ASCII Typewriter	417	1.50	22	19
4626	87-key EBCDIC Typewriter/Text; 3278 only	569	2.00	27	24
4627	87-key EBCDIC Typewriter; 3278/3274 only	569	2.00	27	24
4628	87-key ASCII Typewriter; 3278/3274 only	569	2.00	27	24
4629	87-key EBCDIC Typewriter/Text; 3278 only	569	2.00	27	24
4640	87-key EBCDIC Typewriter Overlay	569	2.00	27	24
4651	87-key EBCDIC Attribute Select Typewriter	569	2.00	27	24
4652	87-key EBCDIC Attribute Select Typewriter/APL	569	2.00	27	24
3290	Information Panel Display For 3270 Subsystems; plasma panel technology				
	Model 220 Slim Profile Display; 9,920 characters; data/typewriter keyboards; multiple screens/windows, optional 5300 large character format	6,500	288.00	—	—
	Model 230 Slim Profile Display; 9,920 characters; modifiable data/typewriter keyboard with integrated numeric pad; similar to 3179; 3180; multiple screens/windows, optional 5300 large character format	6,500	288.00	—	—
	Model T30 TEMPEST Specification Display; similar to 230, but not modifiable	9,300	360.00	—	—
8775	Display Terminal with control logic for standalone remote operation; highly compatible with 3270 cluster datastreams				
	Model 11 Display; 960, 1,920, or 2,560 characters in 9 x 16 format	3,070	27.00	147	125
	Model 12 Display; 3,440 characters in 9 x 12 format as well as 960, 1,920, or 2,560 characters in 9 x 16 format	3,450	27.00	165	140
1009	Setup Keylock	63	—	63	—
1090	Audible Alarm	93	—	2	2
1488	Business Machine Clock	234	1.50	6	5
3623	Extended Feature Storage; needed for 3624, 3626, 5110, or IDIF	848	4.00	44	35
3701	External Modem Interface	374	3.50	17	15
3905	Feature Adapter; provides logic to perform 3624, 3626, or IDPF	424	2.00	17	15
4621	75-key EBCDIC Typewriter keyboard	417	2.00	21	18
4622	75-key EBCDIC Data Entry keyboard	417	3.00	21	18
4623	75-key EBCDIC Data Entry keyboard; keypunch layout	417	3.00	21	18
4626	87-key EBCDIC Typewriter/APL keyboard	569	2.50	26	23

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

## IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>ASCII Display Stations (Continued)</b>					
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	207.00	3,350	**2,680
A3	Controller Unit (8 x 4)	64,740	203.00	3,595	**2,875
A4	Controller Unit (two 4 x 4s)	69,570	223.00	3,875	**3,095
B1	Remote Unit (4 x 4)	39,710	107.00	2,205	**1,765
B2	Remote Unit (4 x 8)	52,660	157.00	2,920	**2,335
B3	Remote Unit (8 x 4)	56,970	151.00	3,165	**2,530
B4	Remote Unit (two 4 x 4s)	61,800	171.00	3,435	**2,745
C1	Expansion Unit (4 x 4)	37,980	104.00	2,105	**1,680
C2	Expansion Unit (4 x 8)	50,930	152.00	2,820	**2,255
C3	Expansion Unit (8 x 4)	55,240	147.00	3,065	**2,450
C4	Expansion Unit (two 4 x 4s)	60,070	168.00	3,340	**2,670

#### Additional Hardware and Options

Upgrades	Model A1 to A4, Model B1 to B4, or Model C1 to C4	22,090	—	—	—
3178-C20	Display Station	1,095	—	—	—
3278-2	Display Station	1,572	10.00	119	102
3287-1	Hard Copy Printer	4,830	41.00	348	296
3287-2	Hard Copy Printer	5,150	52.00	426	362
1410	Expanded Storage Unit	4,800	23.00	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	16.00	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	21.00	284	**226
6011	Additional Remote Two-Channel Switch Control	2,415	15.00	133	**106
6012	Second Additional Remote Two-Channel Switch Control	2,415	15.00	133	**106
6013	Third Additional Remote Two-Channel Switch Control	2,415	15.00	133	**106

### CHANNEL EXTENSION

3044-C01	Fiber-Optic Channel Extender Link; channel unit	8,500	27.00	—	—
3044-D01	Fiber-Optic Channel Extender Link; downstream unit	8,500	27.00	—	—

NA—Not applicable.

A dash (—) also means not applicable.

NC—No charge.

\*Includes equipment maintenance.

\*\*Four-year lease.

IBM 3090 Series

		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly Charge (2-Year Lease)* (\$)
<b>COMMUNICATIONS EQUIPMENT</b>					
3720	Communications Controller:				
	Model 1 Communications Controller; local base	36,500	175.00	2,605	
	Model 2 Communications Controller; remote base	26,000	142.00	1,855	
	Model 11 Communications Controller	42,500	178.00	3,035	
	Model 12 Communications Controller	33,000	146.00	2,285	
3725	Communications Controller:				
	Model 1; up to six channel adapters and from 512K to 1024K bytes of main storage capacity	75,000	232.00	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	208.00	3,330	—
	1561 Channel Adapter	6,750	8.50	399	—
	4666 Internal Clock Control	1,500	2.00	85	—
	4771 Line Attachment Base Type A	19,000	17.00	1,115	—
	4772 Line Attachment Base Type B	26,400	30.00	1,560	—
	4911 Line Interface Coupler Type 1	2,600	2.00	155	—
	4921 Line Interface Coupler Type 2	3,000	2.00	174	—
	4931 Line Interface Coupler Type 3	3,000	2.00	174	—
	4941 Line Interface Coupler Type 4A	2,600	2.00	155	—
	4942 Line Interface Coupler Type 4B	3,000	2.00	174	—
	7100 Storage Increment 256K	4,375	20.00	257	—
	8320 Two Processor Switch	4,000	3.00	237	—
3726	Communications Controller Expansion	32,000	43.00	1,880	—
3727	Operator Console	2,390	28.00	215	—

SOFTWARE PRICES

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
<b>Operating Systems</b>					
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 1; available March 1988; Multiple Preferred Guest component will be available third quarter 1988				
	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	—

NA—Not applicable.

A dash (—) also means not applicable.

IBM 3090 Series

Operating Systems (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5664-173	VM/SP HPO High Performance Option Releases 3.2 through 5.0 and up; optional on 4381, but really needed if VM/SP is to fully utilize 4381 characteristics	5,325	1,775	NA	136
	Graduated Charge: Processor Group 20	5,325	1,775	57,665	136
	Graduated Charge: Processor Group 30	5,325	1,775	92,265	136
	Graduated Charge: Processor Group 40	5,325	1,775	92,265	136
5667-126	IX/370 Interactive Executive Version 1 Release 1.3 requires VM/SP Release 3.0 or up				
	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; CSTVs 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
<b>Utilities, Installation Management, Performance Analysis</b>					
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				
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

NA—Not applicable.  
A dash (—) also means not applicable.

## IBM 3090 Series

Utilities, Installation Management, Performance Analysis (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
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	4,500	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
5668-006	Downstream Load Utility/8775; for VSE, VS1, MVS/370, MVS/XA				
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	—	NA
5740-SM1	DF SORT Data Facility Sort; for MVS/370, MVS/XA, VS1				
5740-XT9	OPC Installation Management/Operations Planning and Control; for MVS/370, MVS/XA, VS1				
	Graduated Charge: Processor Group 20	NA	247	NA	19
	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				
5796-PNA	VM/RTM Real Time Monitor; for VM/SP				
	Graduated Charge: Processor Group 20	NA	406	NA	17
	Graduated Charge: Processor Group 30	NA	50	700	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 Realtime 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
<b>Languages and Language-Specific Programming Aids</b>					
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

NA—Not applicable.

A dash (—) also means not applicable.

IBM 3090 Series

Languages and Language-Specific Programming Aids (Continued)

	Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5668-805 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	—	37
5668-903 Fortran IAD Interactive Debug Release 2; for VM/IS, VM/SP, VM/XA, MVS/370, MVS/XA				
Graduated Charge: Processor Group 20	1,920	320	7,835	26
Graduated Charge: Processor Group 30	1,920	320	11,195	26
Graduated Charge: Processor Group 40	1,920	320	17,915	26
5668-940 Cobol II (VS) Library only Version 1 Release 2; for MVS/370, MVS/XA, VS1, VM/SP, VM/XA				
Graduated Charge: Processor Group 20	2,550	425	10,410	53
Graduated Charge: Processor Group 30	2,550	425	14,870	53
Graduated Charge: Processor Group 40	2,550	425	23,795	53
5668-958 Cobol II (VS) Compiler and Library Version 1 Release 2; for MVS/370, VS1, MVS/XA, VM/SP, VM/XA				
Graduated Charge: Processor Group 20	6,420	1,070	26,210	53
Graduated Charge: Processor Group 30	6,420	1,070	37,445	53
Graduated Charge: Processor Group 40	6,420	1,070	59,915	53
5668-962 Assembler H Version 2 Release 1; for VM/SP, VM/XA, VS1, MVS/370, MVS/XA, TPF2	465	155	NA	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

NA—Not applicable.

A dash (—) also means not applicable.

## IBM 3090 Series

Languages and Language-Specific Programming Aids (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5734-LM5	PL/1 Transient Library Only Release 5.1; for VM/SP, VM/XA, MVS/370, VS1, MVS/XA	NA	37	775	7
	Graduated Charge: Processor Group 20	NA	37	1,110	7
	Graduated Charge: Processor Group 30	NA	37	1,775	7
5734-PL1	PL/1 Optimizing Compiler and Libraries, R.5.1; for VM/SP, VM/XA, MVS/370, VS1, MVS/XA	NA	296	6,215	39
	Graduated Charge: Processor Group 20	NA	296	8,880	39
	Graduated Charge: Processor Group 30	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	NA	398	8,355	53
	Graduated Charge: Processor Group 20	NA	398	11,940	53
	Graduated Charge: Processor Group 30	NA	398	19,100	53
5740-CB1	Cobol (VS) Compiler and Library; for MVS/370, MVS/XA, VS1, VM/SP	NA	365	7,665	15
	Graduated Charge: Processor Group 20	NA	365	10,950	15
	Graduated Charge: Processor Group 30	NA	365	17,520	15
5740-LM1	Cobol (VS) Library Only; for MVS/370, MVS/XA, VS1, VM/SP	NA	118	2,475	7
	Graduated Charge: Processor Group 20	NA	118	3,540	7
	Graduated Charge: Processor Group 30	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	NA	184	3,860	15
	Graduated Charge: Processor Group 20	NA	184	5,520	15
	Graduated Charge: Processor Group 30	NA	184	8,830	15
5746-LM4	Cobol (DOS/VS) Library Only; for VSE, VM/SP	NA	33	690	7
	Graduated Charge: Processor Group 20	NA	33	990	7
	Graduated Charge: Processor Group 30	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	747	249	5,660	18
	Graduated Charge: Processor Group 20	747	249	8,090	18
	Graduated Charge: Processor Group 30	747	249	12,945	18
5785-ABH	Prolog Programming In Logic; for VM/SP	NA	NA	8,000	NA
	Graduated Charge: Processor Group 20	NA	NA	8,000	NA
	Graduated Charge: Processor Group 30	NA	NA	—	NA
5785-ABJ	Cobol/CICS/VS to COBOL II Command Level Conversion Aid; for MVS/370, MVS/XA	NA	350	7,000	NA
	Graduated Charge: Processor Group 20	NA	350	7,000	NA
	Graduated Charge: Processor Group 30	NA	350	—	NA
5796-PNQ	Pascal/VS Release 2.2; for VM/IS, VM/SP, MVS/370, VS1	NA	247	4,410	NA
	Graduated Charge: Processor Group 20	NA	247	6,300	NA
	Graduated Charge: Processor Group 30	NA	247	6,300	NA
5796-PWC	INTELLECT for MVS/VSAM; for MVS/370, MVS/XA	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 20	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 30	NA	3,050	—	NA
5796-PWE	INTELLECT for VM-VSAM; for VM/SP	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 20	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 30	NA	3,050	—	NA
5796-PWJ	General CICS/VS ADA	NA	NA	12,100	NA
	Graduated Charge: Processor Group 20	NA	NA	12,100	NA
	Graduated Charge: Processor Group 30	NA	NA	—	NA
5796-PYH	INTELLECT for VM-SQL/DS; for VM/SP	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 20	NA	3,050	57,000	NA
	Graduated Charge: Processor Group 30	NA	3,050	—	NA
5798-DFH	Fortran Utilities Version 2.2.; for VM/IS, VM/SP, VM/XA	NA	NA	1,100	NA
	Graduated Charge: Processor Group 20	NA	NA	1,575	NA
	Graduated Charge: Processor Group 30	NA	NA	1,575	NA
5798-DQZ	LISP/VM List Processing; for VM/SP	NA	325	7,150	NA
	Graduated Charge: Processor Group 20	NA	325	7,150	NA
	Graduated Charge: Processor Group 30	NA	325	—	NA

NA—Not applicable.

A dash (—) also means not applicable.

IBM 3090 Series

Languages and Language-Specific Programming Aids (Continued)

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
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
5798-RWP	Expert System Consultation Environment/VM; for VM/SP				
	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
5798-RWQ	Expert System Development Environment/VM; for VM/SP				
	Graduated Charge: Processor Group 20	NA	1,750	35,000	NA
	Graduated Charge: Processor Group 30	NA	1,750	35,000	NA
	Graduated Charge: Processor Group 40	NA	1,750	—	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
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	1,315	NA	214
5740-UT3	DFDSS Data Facility/Data Set Services Version 1 Release 2.0; for MVS/370, MVS/XA, VS1	NA	88	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

NA—Not applicable.  
A dash (—) also means not applicable.

## IBM 3090 Series

Data Base Management and File Handling (Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
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	16
5748-XXJ	SQL/DS Structured Query Language/Data System Release 3.5; for VM/SP,				
	Graduated Charge: Processor Group 20	NA	464	9,740	144
	Graduated Charge: Processor Group 30	NA	464	13,920	144
	Graduated Charge: Processor Group 40	NA	464	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
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
<b>Data Communications, Time Sharing, Transaction Processing, Terminal Control</b>					
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	320	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	NA	44
5664-298	PC Bond: PC Connectivity to VM, Release 2.0; for VM/IS, VM/SP				
	Graduated Charge: Processor Group 20	NA	107	2,000	NA
	Graduated Charge: Processor Group 30	NA	107	NA	NA
	Graduated Charge: Processor Group 40	NA	107	—	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

NA—Not applicable.

A dash (—) also means not applicable.

IBM 3090 Series

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

		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5665-279	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
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	455	NA	66
5665-321	NPDA Network Problem Determination Application Version 3 Release 2; for MVS/XA (31-bit)	2,040	340	NA	30
5665-333	NPM NetView Performance Monitor; for MVS/370, MVS/XA	3,210	615	NA	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				
	Graduated Charge: Processor Group 20	NA	695	2,085	148
	Graduated Charge: Processor Group 30	NA	695	2,085	148
	Graduated Charge: Processor Group 40	NA	695	—	148
5668-915	DSX Distributed System Executive Version 3 Release 2.0; for MVS/370, MVS/XA, VSE	2,700	1,035	NA	88
5668-920	NPDA Network Problem Determination Application Version 3 Release 2.0; for MVS/370, MVS/XA	1,650	264	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	—	90

NA—Not applicable.

A dash (—) also means not applicable.

## IBM 3090 Series

Data Communications, Time Sharing, Transaction Processing, Terminal Control Continued)		Initial Basic License Charge (\$)	Monthly Basic* License Charge (\$)	Graduated Onetime Charge (\$)	Licensed Program Support Charge (\$)
5668-947	NCCF Network Comm. Control Facility Version 2 Release 2.0; for MVS/370, MVS/XA	2,250	375	NA	55
5668-948	BTS Batch Terminal Simulator; for MVS/370, MVS/XA, VS1	1,030	394	NA	28
5668-951	NSI Non-SNA Interconnect Release 4.0; for MVS/370, MVS/XA, VS1	1,605	465	NA	40
5668-963	NRF Network Routing Facility Release 2; for VS1, MVS/370, MVS/XA	3,525	1,175	NA	248
5668-971	NLDM Network Logical Data Manager Release 3.0; for MVS/370, MVS/XA	1,305	207	NA	24
5668-981	NPSI NCP X.25 Packet Switching Interface, Release 4.3; for MVS/370, MVS/XA, VS1, VSE	770	269	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	874	NA	91
5735-XX7	NTO Network Terminal Option Release 3.0; for MVS/370, MVS/XA, VM/SP, VSE, VS1	660	206	NA	12
5735-XXB	EP Emulation Program Release 4.0; for VSE, MVS/370, VS1, VM/IS, VM/SP, MVS/XA	1,365	256	NA	40
5740-XX1	CICS/OS/VS Customer Information Control, Release 7.0; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	5,730	1,910	62,075	160
	Graduated Charge: Processor Group 30	5,730	1,910	62,075	160
	Graduated Charge: Processor Group 40	5,730	1,910	99,320	160
5740-XYF	SDF/CICS Screen Definition Release 3.0; for MVS/370, MVS/XA	NA	349	7,675	50
5748-RC1	PVS VM Pass-Through Facility Release 3; for VM/IS, VM/SP, VM/XA				
	Graduated Charge: Processor Group 20	NA	185	3,000	90
	Graduated Charge: Processor Group 30	NA	185	3,000	90
	Graduated Charge: Processor Group 40	NA	185	3,000	90
5748-XP1	RSCS Networking Version 1 Release 3; for VM/SP, VM/XA	NA	111	NA	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
<b>Departmental/Office System</b>					
5664-176	PROFS Professional Office System Version 1 Release 2.3; for VM/SP				
	Graduated Charge: Processor Group 20	5,000	895	22,000	NA
	Graduated Charge: Processor Group 30	5,000	895	22,000	NA
	Graduated Charge: Processor Group 40	5,000	895	—	NA
5664-370	DisplayWrite/370 Version 1 Release 1.1; for VM/SP				
	Graduated Charge: Processor Group 20	NA	665	9,800	42
	Graduated Charge: Processor Group 30	NA	665	14,000	42
	Graduated Charge: Processor Group 40	NA	665	14,000	42
5665-290	DISOSS Distributed Office Support System Version 3 Release 4; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	4,570	1,630	52,705	223
	Graduated Charge: Processor Group 30	4,570	1,630	52,705	223
	Graduated Charge: Processor Group 40	4,570	1,630	84,330	223
5665-330	Personal Services/370 Release 2; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	2,400	800	28,400	132
	Graduated Charge: Processor Group 30	2,400	800	28,400	132
	Graduated Charge: Processor Group 40	2,400	800	45,440	132
5665-346	Personal Services/TSO; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	1,200	36,000	NA
	Graduated Charge: Processor Group 30	NA	1,200	36,000	NA
	Graduated Charge: Processor Group 40	NA	1,200	57,600	NA
5665-382	DisplayWrite/370 Version 1 Release 1.1; for MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	NA	665	14,000	42
	Graduated Charge: Processor Group 30	NA	665	14,000	42
	Graduated Charge: Processor Group 40	NA	665	14,000	42
5748-XXE	DLF Document Library Facility; for VS1, MVS/370, MVS/XA	480	160	NA	NA
5748-XX9	DCF Document Composition Facility (SCRIPT/VS) Release 3.1; for VM/SP, VM/XA, VSE, MVS/370, MVS/XA				
	Graduated Charge: Processor Group 20	972	324	7,370	NA
	Graduated Charge: Processor Group 30	972	324	10,530	NA
	Graduated Charge: Processor Group 40	972	324	16,845	NA

NA—Not applicable.

A dash (—) also means not applicable. ■