IBM 4300 Series

MANAGEMENT SUMMARY

Since its introduction in January 1979, the 4300 Series has grown to include seven model groups. The 4300 Series initially consisted of two central processors, the 4331 and the 4341. In May 1980, IBM filled the conspicuously large performance gap between the two original processors by adding the 4331 Model Group 2. The new processor featured twice the processing power and up to four times the main memory capacity of the original 4331, which was designated the 4331 Model Group 1. In September 1980, IBM announced the 4341 Model Group 2, which provided increased processing power and up to twice the main memory capacity of the original 4341, now designated the 4341 Model Group 1.

In November 1981, four new processor models were introduced: the 4321, the 4331 Model Group 11, the 4341 Model Group 10, and the 4341 Model Group 11. The 4321 is a preconfigured workstation-oriented system. The 4331 Model Group 11 falls between the original 4331 Model Group 1, which has been withdrawn from marketing, and the 4331 Model Group 2 in capacity and performance. The 4341 Model Group 10, when introduced, provided an entry-level 4341 processor, while the 4341 Model Group 11 fit between the 4341 Model Group 1 and 4341 Model Group 2 in capacity and performance. IBM also doubled the maximum main memory capacity of the 4341 Model Group 2 processors.

In October, 1982, IBM announced two new 4341 models. The 4341 Model Group 9 is the latest entry-level 4341 processor which may be field-upgraded to the 4341 Model Group 10. The 4341 Model Group 12 is now the top-of-the-line 4341 processor featuring a faster processor cycle time than the 4341 Model Group 2.

The 4300 Series processors are versatile systems that offer full System/370 compatibility and impressive price/performance ratios. Moreover, incremental main memory is currently offered at only $10,000 per megabyte.

The IBM 4300 Series is a family of upward-compatible medium- to large-scale processors that can perform well as standalone systems, as distributed processing systems, or as nodes in a communications network.

MODELS: 4321, 4331 Model Groups 11 and 2, and 4341 Model Groups 9, 10, 1, 11, 2 and 12.
CONFIGURATION: Uniprocessor systems with 1 to 16 megabytes of main memory, 4K to 16K bytes of buffer storage, and up to 6 I/O channels.
COMPETITION: Burroughs B 3900, B 4900, B 5900 and B 6900, Honeywell DPS 8, IPL 4400 Series, Magnuson M80 Series, NCR 8500 Series, and Sperry Univac 90/60, 90/80, 1100/60, and System 80.
PRICE: Purchase prices for CPUs plus main memory range from $64,000 to $500,000.

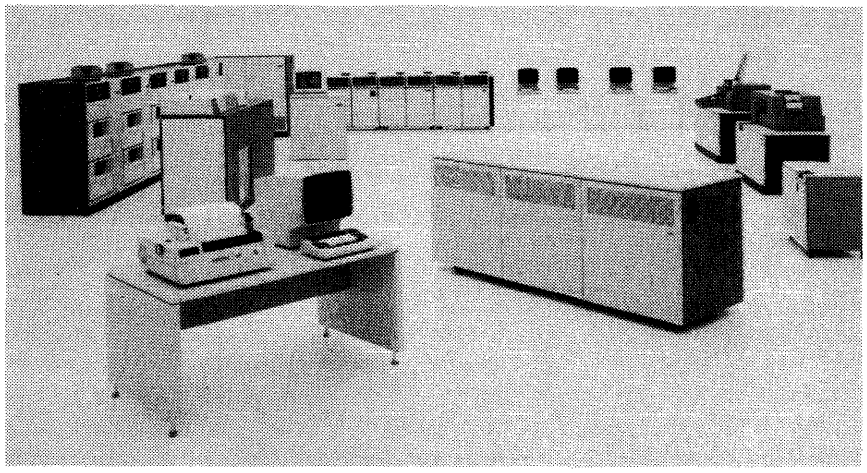
CHARACTERISTICS

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

MODELS: 4321; 4331 Model Group 11 (Models J11 and K11); 4331 Model Group 2 (Models J2, K2, KJ2, and L2); 4341 Model Group 9 (Models J9, K9, and L9); 4341 Model Group 10 (Models K10 and L10); 4341 Model Group 1 (Models K1 and L1); 4341 Model Group 11 (Models K11, L11, and M11); 4341 Model Group 2 (Models K2, L2, M2, N2, and P2); and 4341 Model Group 12 (Models K12, L12, M12, N12, and P12).

PREVIOUS MODELS: The 4331 Model Group 1 has been withdrawn from marketing.

DATE ANNOUNCED: See Table 1.



The 4341 processor provides 2 to 16 megabytes of main memory, 4K to 16K bytes of buffer storage, and up to 6 I/O channels. It can utilize virtually all of the System/370 communications and peripheral equipment, including the high-performance 3380 Direct Access Storage Device. The 4341 supports the MVS operating system as well as OS/VS1, and DOS/VSE.

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TABLE 1. CHARACTERISTICS OF THE 4300 SERIES PROCESSORS

	4321	4331 Model Group II	4331 Model Group 2	4341 Model Group 9
SYSTEM CHARACTERISTICS				
Date of introduction	November 1981	November 1981	May 1980	October 1982
Date of first delivery	March 1982	March 1982	4th quarter 1980	March 1983
Number of CPUs per system	1	1	1	1
Principal operating systems	SSX/VSE, VM/370 with CMS	DOS/VSE, VM/370, SSX/VSE	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, SSX/VSE	DOS/VSE (Adv.) SSX/VSE, OS/VS1 VM/370 MVS/SP, ACP/TPF
Purchase price of CPU with min. main storage capacity	$64,000	$82,420	$82,500	$81,000
Upgradable to	4331-2	4331-2	—	4341-10
MAIN STORAGE				
Storage type	MOS	MOS	MOS	MOS
Bytes fetched per cycle	4	4	4	—
Minimum capacity, bytes	1,048,576	1,048,576	1,048,576	1,048,576
Maximum capacity, bytes	1,048,576	4,194,304	4,194,304	4,194,304
Increment size, bytes	None	1,048,576	1,048,576	1,048,576 or 2,097,152
Error-correcting memory	Standard	Standard	Standard	Standard
BUFFER STORAGE				
Capacity, bytes	None	4,096	8,192	2,048
Cycle time, nanoseconds	—	200	200	—
Bytes fetched per cycle	—	4	4	—
CENTRAL PROCESSOR				
Cycle time, nanoseconds	300 to 1600	200 to 1600	200 to 1600	150 to 300
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370
System/370 mode options	ECPS:VM/370	Basic control, Extended Control, ECPS:VM/370	Basic Control, Extended Control, ECPS:VM/370	ECPS:VS1, ECPS:VM/370, ECPS:MVS
Instruction set	S/370 Universal	S/370 Universal	S/370 Universal	S/370 Universal
Reloadable control storage capacity, bytes	131,072	131,072	131,072	Not specified
Data path width, bytes	4	4	4	8
Direct Access Storage Compatibility	No	Yes	Optional	No
IBM 1401/1440/1460 Compatibility	No	No	Optional	No
I/O CHANNELS AND ADAPTERS				
No. of byte multiplexer channels	1	1	1	1 or 2
No. of block multiplexer channels	1	1	2	2, 4, or 5
No. of high-speed block multiplexer channels	0	0	1	0
Maximum total no. of channels	2	2	4	6
Maximum channel data rates bytes/second:				
Byte multiplexer (byte mode)	—	36,000	36,000	16,000 or 22,000
Byte multiplexer (burst mode)	—	500,000	500,000	1.0M or 2.0M
Block multiplexer	—	1.25M	1.25M	1.0M, 2.0M, or 3.0M
High-speed block multiplexer	—	—	1.86M	—
Integrated DASD Adapter (for 3310, 3370, and/or 3340/3344)	1 standard	1 standard	Optional (1 or 2)	No
Display/Printer Adapter	Standard	Standard	Standard	No
5424 Multi-Function Card Unit Adapter	No	Yes	Optional	No
8809 Magnetic Tape Unit Adapter	Standard	Standard	Optional	No
Integrated Communications Adapter	8 lines std.	8 lines std.	Optional (8 lines)	No
3704/3705 Communications Controllers	No	Optional	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370, 3375, or 3380)	No	No	Optional	Optional
Channel-to-Channel Adapter	No	No	No	Optional

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TABLE 1. CHARACTERISTICS OF THE 4300 SERIES PROCESSORS (Continued)

	4341 Model Group 10	4341 Model Group 1	4341 Model Group 11	4341 Model Group 2	4341 Model Group 12
SYSTEM CHARACTERISTICS					
Date of introduction	November 1981	January 1979	November 1981	September 1980	October 1982
Date of first delivery	March 1982	4th quarter 1979	March 1982	2nd quarter 1981	February 1983
Number of CPUs per system	1	1	1	1	1
Principal operating systems	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	SSX/VSE, DOS/VSE (Adv.) OS/VS1, VM/370 MVS/SP, ACP/TPF
Purchase price of CPU with min. main storage capacity	$150,000	$205,000	$240,000	$330,000	$360,000
Upgradable to	4341-11 or -12	4341-11 or -2 or -12	4341-12	4341-12	—
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Bytes fetched per cycle	8	8	8	8	—
Minimum capacity, bytes	2,097,152	2,097,152	2,097,152	2,097,152	2,097,152
Maximum capacity, bytes	4,194,304	4,194,304	8,388,608	16,777,216	16,777,216
Increment size, bytes	2,097,152	2,097,152	2,097,152 or 4,194,304	2,097,152 or 4,194,304	2,097,152 or 4,194,304
Error-correcting memory	Standard	Standard	Standard	Standard	Standard
BUFFER STORAGE					
Capacity, bytes	4,096	8,192	8,192	16,384	16,384
Cycle time, nanoseconds	Not specified	225	225	120	—
Bytes fetched per cycle	Not specified	8	8	16	—
CENTRAL PROCESSOR					
Cycle time, nanoseconds	150 to 300	150 to 300	120 to 240	120 to 240	115 to 230
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE System/370	ECPS:VSE, System/370	ECPS:VSE, System/370
System/370 mode options	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS
Instruction set	S/370 Universal	S/370 Universal	S/370 Universal	S/370 Universal	S/370 Universal
Reloadable control storage capacity, bytes	Not specified	Not specified	Not specified	Not specified	Not specified
Data path width, bytes	8	8	8	8	8
Direct Access Storage Compatibility	No	No	No	No	No
IBM 1401/1440/1460 Compatibility	No	No	No	No	No
I/O CHANNELS AND ADAPTERS					
No. of byte multiplexer channels	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
No. of block multiplexer channels	2, 4, or 5	2, 4, or 5	4 or 5	4 or 5	4 or 5
No. of high-speed block multiplexer channels	0	0	0	0	0
Maximum total no. of channels	6	6	6	6	6
Maximum channel data rates, bytes/second:					
Byte multiplexer (byte mode)	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000
Byte multiplexer (burst mode)	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M
Block multiplexer	1.0M, 2.0M, or 3.0M	1.0M, 2.0M, or 3.0M	2.0M or 3.0M	2.0M or 3.0M	2.0M or 3.0M
High-speed block multiplexer	—	—	—	—	—
Integrated DASD Adapter (for 3310, 3370, and/or 3340/3344)	No	No	No	No	No
Display/Printer Adapter	No	No	No	No	No
5424 Multi-Function Card Unit Adapter	No	No	No	No	No
8809 Magnetic Tape Unit Adapter	No	No	No	No	No
Integrated Communications Adapter	No	No	No	No	No
3704/3705 Communications Controllers	Optional	Optional	Optional	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370/3375, or 3380)	Optional	Optional	Optional	Optional	Optional
Channel-to-Channel Adapter	Optional	Optional	Optional	Optional	Optional

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PROCESSORS AND PERIPHERALS

The 4300 Series central processors can operate either in a System/370-compatible mode or in an extended control program (ECPS) mode. The latter mode takes full advantage of the extensive microcoding available in these machines to reduce operating system overhead and improve system throughput. The processors employ 64K-bit memory chips and logic chips that contain up to 704 circuits each.

All of the 4300 Series processors share these common features: the System/370 Universal Instruction Set, channels with virtual storage addressing, CE maintenance support functions including a support processor and remote support facility, store and fetch storage protection, byte-oriented operands, clock comparator and CPU timer, time-of-day clock, interval timer, PSW key handling, control registers, extended-precision floating point, machine check handling, and program event recording.

The 4321 is a purchase-only, entry-level processor with the same internal performance as the earlier 4331 Model Group 1. The 4321 is a preconfigured workstationoriented system that is designed for ease of installation and ease of use by non-EDP personnel. It can be used as a standalone system or in a remote computing environment. In October, 1982, IBM enhanced the 4321 to include one byte and one block multiplexer channel which are used to attach input/output devices to the system. The 4321 system consists of a processor with 1 megabyte of main memory, 128K bytes of control storage, a Display/Printer Adapter with 16 ports, a 3310 DASD Adapter for up to 16 drives, an 8809 Magnetic Tape Unit Adapter for up to 6 drives, and an integrated communications adapter that supports 3 BSC or SDLC communications lines. The 4321 can be field-upgraded to a 4331 Model Group 2.

The 4331 Model Group 11 falls between the 4321 and the 4331 Model Group 2 in capacity and performance. According to IBM, the 4331 Model Group 11 provides from 1.4 to 1.6 times the internal performance of a 4321 for commercial workloads and approximately 2.5 times the internal performance of a 4321 for scientific and engineering workloads. The 4331 Model Group 11 is equipped with 1, 2, or 4 megabytes of main memory, 128K bytes of reloadable control storage plus 12K bytes of read-only control storage, and 4K bytes of buffer storage. Many features that are optional on the 4331 Model Group 2 are standard on the Model Group 11, including 1 byte and 1 block multiplexer channel, a Display/Printer Adapter with 16 ports, a DASD Adapter for up to 4 strings of 3310, 3340/3344, or 3370 disk drives, an 8809 Magnetic Tape Unit Adapter for up to 6 drives, and an integrated communication adapter that supports 3 BSC or SDLC communications lines. The 4331 Model Group 11 can be field-upgraded to a 4331 Model Group 2. Installed 4331 Model Group 1 processors can be upgraded to a 4331 Model Group 11.

The 4331 Model Group 2 processor offers twice the performance of the 4321 and a little over one-half the performance of the 4341 Model Group 1. The 4331 Model Group 2 has an 8K-byte buffer storage unit and 1, 2, 3 or 4

DATE OF FIRST DELIVERY: See Table 1.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two consecutive bytes form a "halfword" of 16 bits, while 4 consecutive bytes form a 32-bit "word."

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

FLOATING-POINT OPERANDS: 1 word, consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 2 words, consisting of 56-bit fraction and 7-bit hexadecimal exponent, in "long" format; or 4 words in "extended precision" format.

INSTRUCTIONS: 2, 4, or 6 bytes in length, specifying 0, 1, or 2 memory addresses, respectively.

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

MAIN STORAGE

STORAGE TYPE: SAMOS (silicon and aluminum metal oxide semiconductor) process N-channel FET (field effect transistor). The SAMOS process relies on silicon or silicon compounds to enhance gate reliability and to control chip surface leakage. Memory is composed of 64K-bit chips, with four chips mounted on each ceramic substrate. Maximum density is achieved by stacking pairs of substrates to form 8chip modules.

CYCLE TIME: See Table 1.

CAPACITY: From 1,048,576 to 16,777,216 bytes. See Table 1 for capacities of specific models.

CHECKING: All data paths between the central processor and main storage are parity-checked by byte. When data is stored, an error-correcting code is substituted for the parity bits. (An 8-bit modified Hamming code is appended to each 8-byte "doubleword" of data.) When the data is retrieved, single-bit errors are detected and corrected automatically, and most multiple-bit errors are detected and signalled so that appropriate program action can be taken.

STORAGE PROTECTION: The Store and Fetch Protection features, which guard against inadvertent overwriting or unauthorized reading of data in specified blocks of storage, are standard in all models.

CENTRAL PROCESSORS

The 4300 Series processors are heavily microprogrammed processors that include these common features: LSI technology, one-level addressing facility, virtual storage capability by dynamic addressing, channels with virtual storage, System/370 Universal Instruction Set, CE maintenance support functions including support processor and remote support facility, store and fetch storage protection, byte-oriented operands, clock comparator and CPU timer, time of day clock, interval timer, reloadable control storage, PSW Key handling, control registers, extended precision floating point, machine check handling, and program event recording.

Microcode is loaded through the system diskette drive. The several diskettes supplied with the system contain field

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megabytes of main memory. The Model Group 2 can be equipped with the same integrated peripheral adapters as the Group 11 processor, plus an optional second DASD Adapter and greatly improved I/O channel capabilities. The maximum Model Group 2 channel complement consists of one byte multiplexer channel, two standard block multiplexer channels, and one high-speed block multiplexer channel. The latter channel can handle a data transfer rate of up to 1.86 million bytes per second, permitting the attachment of high-speed disk storage units via the 3880 Storage Control.

The 4341 Model Group 9 is an entry-level 4341 processor that provides an internal performance which is 70 percent of that of the Model Group 10 for commercial and scientific workloads involving equivalent memory and I/O configurations, according to IBM. The 4341 Model Group 9 is available with a 2K-byte buffer and 1,2 or 4 megabytes of main memory. It can be field-upgraded to a 4341 Model Grup 10.

The 4341 Model Group 10 provides approximately 0.85 times the performance of a 4341 Model Group 1 for typical commercial applications or 0.95 times the Model Group 1 for engineering and scientific applications. The 4341 Model Group 10 is available with a 4K-byte buffer and 2 or 4 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 11 or 12.

The 4341 Model Group 1 is available with 2 or 4 megabytes of main memory and an 8K-byte buffer. The internal performance of the 4341 Model Group 1 is up to 1.1 times an equivalently configured System/370 Model 158-3. The Model Group 1 can be field-upgraded to a 4341 Model Group 11, Model Group 2 or Model Group 12.

The 4341 Model Group 11 offers 1.25 times the internal performance of the 4341 Model Group 1. The Model Group 11 is available with an 8K-byte buffer and 2, 4, or 8 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 12.

The 4341 Model Group 2 is available with from 2 to 16 megabytes of main memory and 16K bytes of buffer storage. The internal performance of the Model Group 2 is from 1.6 to 1.8 times faster than the Model Group 1.

The top-of-the-line 4341 Model Group 12 is available with from 2 to 16 megabytes of main memory and 16K bytes of buffer storage. IBM states that the internal performance is up to 15 percent greater than the Model Group 2 for commercial workloads and up to 7 percent greater for scientific workloads.

None of the integrated peripheral adapters used on the 4331 processors is available for the 4341 processors. Instead, all peripheral and communications devices are connected via standard I/O channels and control units. Two block multiplexer channels and one byte multiplexer channel are standard on the 4341 Model Groups 9, 10 and 1. An Optional Channel Group adds either three more block multiplexer channels or two block multiplexer channels

engineering diagnostics, basic system features, and optional system features elected by the user. The system diskette facility also allows storage of failure data from the 4300 Series processors. This data can be subsequently analyzed by field engineering for maintenance purposes.

The no-charge 4341 Problem Analysis feature, which became available in January, 1983, allows the 4341 user to identify valid hardware problems as the cause of system interruptions. Screen-prompted instructions lead the user through the steps required to solve the problem. Using the Remote Support Facility, service information can be sent to and received from IBM Field Engineering. The Remote Operator Console Facility is used to run a subset of Problem Analysis from the user installation.

The 4341 features an eight-byte-wide data flow within the processor as well as an eight-byte-wide data flow between the processor, storage, and channels. Data flow within the 4321 and 4331 is four bytes wide.

There are two modes of operation available to the 4300 user. On the 4321 and 4331, the mode is selected at initial program load (IPL) time; on the 4341, at initial microcode load (IML) time. One of the two operating modes is the Extended Control Program Support (ECPS:VSE) mode, which utilizes the extensive microcoding facilities of the 4300 to reduce DOS/VSE or SSX/VSE overhead and improve system throughput. The other operating mode, 370 mode, has one option on the 4321, three options on the 4331, and three options on the 4341. On the 4321, the ECPS:VM/370 option provides improved system performance with VM/370. This option is recommended for operation in a CMS environment only. On the 4331, the Basic Control (BC) option provides for execution of System/360 programs, the Extended Control (EC) option provides for execution of programs that require dynamic address translation facilities, and the ECPS:VM/370 option provides improved system performance with VM/370. On the 4341, the ECPS/VS1 option improves processor performance with OS/VS1, the ECPS:VM/370 option provides improved system performance with VM/370, and the ECPS:MVS option allows the 4341 processor to be supported by MVS/SP-JES2 and -JES3. With the ECPS Expansion Feature, the 4341 Model Group 2 can support concurrent operation of ECPS:MVS and ECPS:VM/370.

With ECPS:VSE, a reduction of up to 20 percent of total CPU time has been measured by IBM when compared with the same version of DOS/VSE running in a typical DB/DC environment without ECPS:VSE. Likewise, with ECPS:VS1, a reduction of up to 7 percent of CPU busy time for the OS/VS1 supervisor has been measured by IBM when compared to the same version of OS/VS1 without ECPS:VS1. With ECPS:VM/370, a reduction of up to 84 percent of CPU busy time for the VM/370 control program has been measured by IBM when compared to the same version of VM/370 running without ECPS:VM/370.

Programs written to run on IBM 1401, 1440, or 1460 systems can be executed on the 4331 Model Group 2 using the IBM Systems 1401/1440/1460 Emulator program product and can achieve improved performance with a special feature on the processor. Another optional feature allows programs written for DOS, DOS/VS, or DOS/VSE and 2311/2314/2319 disk drives to be executed, with only JCL changes, using IBM 3310 Direct Access Storage.

SUPPORT PROCESSOR: A separately powered subsystem integrated within the processor housing and designed to automate and simplify failure diagnosis, the Support Processor provides failure monitoring, including environmental monitoring and recording capabilities for temperature fluctuations, power variances, and electrostatic discharges. Pro-

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TABLE 2. MASS STORAGE

Subsystems	3310 Disk	3330/3333 Disk	3340/3344 Disk
Cabinets per subsystem	1 to 32	1 to 32	1 to 32
Disk packs/HDAs per cabinet	1 or 2	1 or 2 removable	1 or 2 HDAs
Capacity, megabytes	129	100 or 200	70/280 per HDA
Tracks/segments per drive unit	—	7676, 15,352 or 30,704	8352 or 66,816
Average access time, milliseconds	27	30	25
Average rotational delay, milliseconds	9.6	16.7	10.1
Data transfer rate, bytes/second	1,031,000	806,000	885,000
Controller model	Integrated	3830-2 or 3880-1, -2, or -11	3830-2 or 3880-1, -2,
Comments		A 3333 can control up to three 3330 units	Fixed-head option available; 3344 attaches to 3340 Model A2

Subsystems	3350 Disk	3375 Disk	3380 Disk	3370 Disk
Cabinets per subsystem	1 to 32	1 to 32	1 to 16	1 to 32
Disk packs/HDAs per cabinet	2 HDAs	1 HDA	2 HDAs	2
Capacity, megabytes	317.5 per HDA	819.7	1260 per HDA	571.3
Tracks/segments per drive unit	33,300	—	—	—
Average access time, milliseconds	25	19	16	20
Average rotational delay, milliseconds	8.4	10.1	8.3	10.1
Data transfer rate, bytes/second	1,198,000	1,859,000	3,000,000	1,859,000,000
Controller model	3830-2 or 3880-1, -2, or -11	3880-1, -2, or -4	3880-2, -3, or -13	3880-1, -2, or -4
Comments	Fixed-head models available; Model A2 includes logic & power for up to three B2s or two B2s and one C2 unit	Model A1 includes logic & power for up to three B1s or two B1s and one D1 unit	Model A4 includes logic & power for up to three B4 units	Model A1 includes logic & power for up to three B1 units

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
3420:					
Model 3	7	556/800	NRZI	75	41,700/ 60,000
	9	800	NRZI	75	60,000
	9	1600	PE	75	120,000
Model 5	7	556/800	NRZI	125	69,500/ 100,000
	9	800	NRZI	125	100,000
	9	1600	PE	125	200,000
Model 7	7	556/800	NRZI	200	111,200/ 160,000
	9	800	NRZI	200	160,000
	9	1600	PE	200	320,000
Model 4	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
Model 6	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Model 8	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
3410/3411:*					
Model 1	7	200/556/ 800	NRZI	12.5	2500/6900/ 10,000
	9	800	NRZI	12.5	10,000
	9	1600	PE	12.5	20,000
Model 2	7	200/556/ 800	NRZI	25	500/13,900/ 20,000
	9	800	NRZI	25	20,000
	9	1600	PE	25	40,000
Model 3	7	200/556/ 800	NRZI	50	10,000/ 27,800/ 40,000
	9	800	NRZI	50	40,000
	9	1600	PE	50	80,000
3430	9	1600 or 6250	PE	50	80,000 or 312,500
8809	9	1600	PE	12.5 or 100*	20,000 or 160,000*

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
1403 Model N1	1100	132	10	6 or 8	3.5 to 18.75 wide, 22 long
1443 Model N1	240 lpm	120	10	6 or 8	4 to 16¾ wide continuous
3203 Model 5	1200	132	10	6 or 8	3.5 to 20.0 wide, 3.0 to 24.0 long

*Streaming Mode

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TABLE 3. INPUT/OUTPUT UNITS (Continued)

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
3211 Model 1	2000	132 std., add'l. 18 opt.	10	6 or 8	3.5 to 18.75 wide, 3.0 to 24.0 long
3230 Model 2	350 to 450 cps	100 to 132	10 to 13⅓	3,4,6 or 8	8½ to 11 wide continuous
3262:					
Model 1	650 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 ling
Model 5	650 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
Model 11	325 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
3268	340 cps	132	10 or 16.7	3,4,6 or 8	16 wide continouous
3287:					
Model 1 & 1C	80 cps	132	10	6 or 8	—
Model 2 & 2C	120 cps	132	10	6 or 8	—
3289	230 to 400 lpm	132	10	6 or 8	—
3880:					
Model 1	Up to 20,040	136,163, 204	10, 12, 15	6, 8, 12	6.5 to 14.75 wide,
Model 3	Up to 20,040	136, 163, 204	10,12, 15	6, 8, 12	3.5 to 11.0 long

Punched Card Equipment	Columns	Speed Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
1442 Card Read/ Punch	80	400 (read); 91-265 (punch)	1200	1300	Card image mode
2501 Card Reader	80	600 or 100	1200	1300	Card image mode
2520 Card Punch	80	300 or 500	1200	1300 (two)	Card image mode
2540	80	800 to 1,000 input 300 output	3,100	1,350 (five)	
3505 Card Reader	80	800 or 1200	3000	1750 (two)	51-col. read, optical mark read, 3525 adapter
5424	96	250 to 500	2,000 (two)	600 (four)	Card sorting possible with multiple-pass sorting technique

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TABLE 3. INPUT/OUTPUT UNITS (Continued)

MICR/OCR Reader/Sorters	Type Font	Speed, Documents/Min.	Number of Stackers	Document Size, Inches	Options
1255	MICR E13B	500 or 750	6 or 12	2.5 to 4.25 wide, 5.75 to 8.875 long	51-col. sort,dash symbol trans., self-checking numbers
1419	MICR E13B	1600	12	2.75 to 3.66 wide, 6.0 to 8.75 long	51-col. sort., endorser, batch numbering
3890	MICR E13B	1680 or 2400	6 to 36	2.75 to 4.17 wide, 4.85 to 8.75 long	Item numbering, endorsing, microfilming
1287	1428; OCR-A, OCR-C; hand-print numeric	100 to 665	3	2.25 to 5.91 wide, 3.0 to 9.0 long	Add'l. fonts, optical mark read, serial numbering
1288	OCR-A	Not specified	2	3.0 to 9.0 wide, 6.5 to 14.0 long	Expanded symbols, optical mark read, numeric handprinting
3881	Marks	100	2	3.0 to 9.0 wide, 3.0 to 12.0 long	BCD read, doc. counters, serial numbering
3886	OCR-A, OCR-B	96	2	3.0 to 9.0 wide, 3.0 to 12.0 long	Numeric handprinting, serial numbering

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and a second byte multiplexer channel. Five block multiplexer channels and one byte multiplexer channel are standard on the 4341 Model Groups 11, 2 and 12. One of the block multiplexer channels can be optionally selected as a byte multiplexer channel.

The 4300 Series processors support most of the System/370, 303X Series, and 308X Series peripheral devices. Five peripheral devices were introduced along with the 4300 Series computers: the 64.5-megabyte 3310 Direct Access Storage Device (4321 and 4331 only), the 571-megabyte 3370 Direct Access Storage Device, the 3880 Storage Control, the 650-lpm 3262 Line Printer (4321 and 4331 only), and the 1200-lpm 3203 Model 5 Printer. In 1980, IBM announced the 819-megabyte 3375 and 2.5-gigabyte 3380 Direct Access Storage Devices. The 3375 DASD can be used with the 4331 Model Group 2 and the 4341 processors. The 3380 DASD is available for use with the 4341 processors only.

All 4300 Series processors require a 3278 Model 2A Display Console or 3279 Model 2C Display Console as the operator console. Both consoles have a 1920character display and keyboard, for operation and maintenance. Up to three additional consoles or 3287 Printers (for a total of four devices) can be attached to the 4341 processors. The Display/Printer Adapter on the 4321 and 4331 processors can accommodate as many as 15 additional display units or printers.

SOFTWARE

Three operating systems are available for all 4331 and 4341 processors: DOS/VS Extended (DOS/VSE), OS/VS1 Release 7, and the Virtual Machine Facility 370 (VM/370) Release 6. In addition, SSX/VSE supports the 4321 and 4331 processors, and OS/VS2 (MVS) can be used with the 4341 processors.

DOS/VSE is said to be a major expansion of DOS/VS incorporating new functional and I/O support. Unfortunately, DOS/VSE provides only limited multiprogramming capabilities unless the user acquires the DOS/VSE Advanced Function product, an independently priced adjunct that allows the DOS/VSE user to employ up to 12 partitions and also makes it possible to incorporate many of the new program products available with the system.

IBM says the OS/VS1 Release 7 support is of particular importance in a distributed data processing environment, since it will generally provide a high level of compatibility with an MVS host system. As with DOS/VSE and VM/370, OS/VS1 Release 7 can run in ECPS mode with the ECPS:VS1 feature on either the 4331 or 4341 processor or in 370 mode.

With VM/370 Release 6, the 4300 user can operate in mixed-mode environments where CMS interactive computing is combined with a guest SCP (DOS/VSE or OS/VS1) on the 4300 processors.

cessor failures result in the generation of an eight-digit reference code logged on the system diskette and displayed on the console to alert the operator. The reference code contains information to guide the IBM customer engineer to the failing unit.

The Support Processor also provides support functions for the operator/support console and a remote data link for the Remote Support Facility (RSF) software. RSF is implemented via a customer-supplied telephone line to an IBM field technical support center. After customer authorization, initiation of the data link connection can be made only from the customer's location while the system is in maintenance mode and only by IBM customer engineering personnel who have proper sign-on authority. Additionally, all remote console screen activity can be observed on the customer's console display. The remote connection can be completely broken at any time by depression of a console key on the customer's display console.

CONTROL STORAGE: The 4300 Series processors utilize reloadable control storage (RCS) to hold the microcode which controls their operations. The RCS is composed of 18K-bit SAMOS-process N-channel FET chips.

On the 4321 and 4331 processors, 131,072 bytes of RCS are standard. The 4331 processors also include 12,288 bytes of read-only control storage. In addition to the RCS, some main memory is required for microcode storage and is therefore unavailable to the user. Approximately 168,000 bytes of main memory are required for microcode and system use on the 4321, and approximately 200,000 bytes are required on the 4331 Model Group 11. On the 4331 Model Group 2, at least 16,348 bytes of main memory are required for microcode storage. The total amount of microcode required is dependent upon the features installed and the functions performed.

On the 4341 processor, the microcode resides entirely in RCS but keeps dynamic tables in main memory, thereby reducing the amount of main memory available to the user by from 18K to 124K bytes, depending upon the configuration.

BUFFER STORAGE: Buffer storage is standard on all 4300 Series models except the 4321. Storage capacities range from 4096 to 16,348 bytes, depending on the model. (See Table 1 for the buffer capacities for the individual processors models.) The buffer storage is transparent to all programs and significantly reduces the effective main memory access time. On the 4331, the buffer storage is automatically replenished from main memory in 64-byte units; the 64-byte fetch cycle takes 2.6 microseconds, and the 64-byte store cycle takes 3.1 microseconds.

ADDRESSING: Three types of addresses are recognized: absolute, real, and logical. In all 4300 Series processors, a one-level addressing facility provides for improved virtual storage control by DOS/VSE (ECPS:VSE mode).

DYNAMIC ADDRESS TRANSLATION: This facility, which is standard in all models, is the mechanism that translates the virtual storage addresses contained in instructions into real main storage addresses as each instruction is executed. All models can address a virtual storage space of 16,777,216 bytes.

Translation between the virtual and real addresses is accomplished by a hardware-implemented table-lookup procedure that accesses tables in main storage which are created and maintained by the operating system. The translation process is speeded up by a group of high-speed registers (translation look-aside buffer) which hold recently referenced virtual storage addresses and their real storage equivalents.

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> SSX/VSE (Small Systems Executive/VSE) is the principal operating system for the 4321 processors. SSX/VSE is a pregenerated preconfigured subset of DOS/VSE that is designed for users with limited data processing skills. SSX/VSE supports batch or interactive applications on 4321 or 4331 processors operating in standalone or distributed environments.

MVS support is provided on the 4341 through the ECPS: MVS option, which includes new privileged instructions that enable the 4341 to utilize either MVS/SP-JES2 or MVS/SP-JES3. MVS Release 3.8 with Processor Support 2 provides the required basic SCP code. MVS/SP-JES2 and -JES3 are separately priced products that provide major extensions and enhancements to the MVS Base Control Program plus JES2 and JES3, respectively.

COMPETITIVE POSITION

The new 4341 Model Group 12 has a total main storage capacity of 16 megabytes of main memory which is the same as the previous top-of-the-line 4341 Model Group 2.

The 4300 Series is positioned just below the Burroughs B 6900 Series in regard to main storage capacity. The B 6900, in a multiprocessor configuration, can address up to 22.4 megabytes of memory.

The 4300 Series is positioned above the NCR 8500 Series which can access up to 8 megabytes of main memory. The 4300 Series is positoned slightly above the Burroughs 5925 which, in a multiprocessor configuration, has a total main stroage capacity of 15 megabytes.

ADVANTAGES AND RESTRICTIONS

The IBM 4300 user is given the opportunity to grow within the 4300 family of computer systems. Uniprocessor systems range from 1 to 16 megabytes of main memory which allows the user to buy only what he needs today, and provides the capability to upgrade later.

The 4300 Series offers the user the ability to function in a distributed processing environment. A communication network allows the user to link the central and remote sites. The advantage of using a distributed processing system is that it can offload processing activity and data from the central computer if it is more appropriate at remote locations.

The 4300 Series uses the S/370 architecture and software which makes it compatible with the 303X and the 308X. This is an advantage over the IBM 8100, in that the 8100 uses a unique operating system.

IBM's Communications Facility/Host licensed program allows the user to process and route transactions between the host 4300 system and Series/1 systems operating with the IBM Series/1 EDX Communications Facility.

Something to consider when installing the 4341 Model Group 12 is that DOS releases in System/370 mode will not >

> **INSTRUCTION REPERTOIRE: The 4300 Series processors employ the System/370 Universal Instruction Set. The instruction set includes complete 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.**

Also standard are some instructions that were optional on some models of the System/370. These include the dynamic address translation instructions of Load Read Address, Reset Reference Bit, Purge Translation Look-Aside Buffer, Store Then AND System Mask, and Store Then OR System Mask; the VTAM support instructions of Compare and Swap and Compare Double and Swap; the OS/VS support instructions of Insert PSW Key, Set PSW Key from Address, and Clear I/O; and the extended precision floating point instructions.

INSTRUCTION TIMES: Average execution times, in microseconds, for some representative instructions on the *IBM 4341 Model Group 1* processor are as follows:

Add (32-bit binary)	**0.600**
Multiply (32-bit binary)	**3.900**
Divide (32-bit binary)	**7.425**
Load (32-bit binary)	**0.375**
Store (32-bit binary)	**0.375**
Add (6-digit packed decimal)	**1.275**
Compare (6-digit packed decimal)	**1.275**
Add (short floating-point)	**1.472**
Multiply (short floating-point)	**4.350**
Divide (short floating-point)	**6.300**
Add (long floating-point)	**1.425**
Multiply (long floating-point)	**5.400**
Divide (long floating-point)	**10.950**

IBM has released the following processor performance comparisons:

- **The 4321, when operating in ECPS:VSE mode with 3310 direct-access storage, has a measured instruction execution rate averaging 0.91 times that of a System/370 Model 138 running under DOS/VS Release 3 with 3330 direct-access storage.**
- **The 4331 Model Group 2 has an internal speed approximately twice as fast as the 4321.**
- **The 4341 Model Group 1 has an instruction execution speed up to 1.1 times as fast as the System/370 Model 158-3.**

Furthermore, it is generally agreed that the instruction execution speed of the 4341 Model Group 1 is 3.4 to 4 times that of the 4321, or 1.7 to 2 times that of the 4331 Model Group 2. The 4341 Model Group 2 is 1.6 to 1.8 times faster than the 4341 Model Group 1.

INTERRUPTS: Classes of interrupts include I/O, external, program, supervisor call, machine check, and restart. Classes of interrupts are distinguished by the storage locations at which the old program status word (PSW) is stored and from which the new PSW is fetched.

ENGINEERING SCIENTIFIC ASSIST: This feature, which is standard on the 4341 Model Groups 9, 10, 11, 12, >

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operate on the 12- and 16-megabyte models except under VM/370. A VSE system can utilize up to but not including 16 megabytes of main memory when the VM linkage enhancements of VSE/AF are specified. Another consideration is that concurrent operation of the ECPS:MVS and ECPS;VM/370 requires the ECPS Expansion Feature (#1601).

USER REACTION

Datapro's 1983 survey of general-purpose computer users yielded responses from 557 IBM 4300 users who had a total of 659 processors installed. Of this total, 181 systems were 4331s and 478 systems were 4341s. The 4331 systems had been in use for an average of 33.7 months; the 4341 systems, for an average of 27.7 months.

The survey respondents represented a wide variety of industries, including manufacturing (155 responses), banking/finance (71 responses), retail/wholesale (69 responses), and education (45 responses).

The user's ratings are listed in the table below. Two separate weighted average columns are provided for the 4331 and 4341 systems, although the numbers of user responses for both systems have been combined:

	Excel.	Good	Fair	Poor	WA*	WA*
Ease of operation	164	335	35	5	3.13	3.26
Reliability of mainframe	455	88	7	2	3.78	3.82
Reliability of peripherals	238	271	36	5	3.40	3.32
Maintenance service:						
Responsiveness	245	272	33	3	3.45	3.34
Effectiveness	234	265	42	4	3.40	3.31
Technical support:						
Trouble-shooting	98	294	129	21	2.88	2.86
Education	62	296	146	27	2.66	2.77
Documentation	54	276	132	24	2.67	2.67
Manufacturers software:						
Operating system	122	353	54	15	3.08	3.06
Compiler & assemblers	143	377	26	1	3.26	3.19
Application programs	35	275	97	13	2.91	2.75
Ease of programming	70	365	84	7	2.96	2.94
Ease of conversion	94	313	86	14	2.91	2.99
Overall satisfaction	123	398	24	2	3.15	3.18

*Weighted Average on a scale of 4.0 for Excellent.

In May, we interviewed three of the survey respondents to gain additional insight into their experiences with the 4300 Series.

The first user interviewed represented an educational institution that had upgraded from an IBM 360 to the 4331. This user said that the conversion went very "smoothly"; however, "few operating system changes" were made at conversion time. He indicated that the system serves them "quite well". Future plans include running more application software on the system.

The second user interviewed was a maunfacturer that had converted from an IBM 370 to the 4331. They said that it

and 2, is designed to improve the performance of certain mathematical computations such as matrix inversion, decomposition, and multiplication. Engineering Scientific Assist consists of a new multiply-add instruction that reportedly reduces CPU busy time by 30 percent. The assist feature supports only long precision (64-bit) floating point numbers. It is supplied on a microcode diskette and installed as part of the IML process.

3838 ARRAY PROCESSOR: A special-purpose scientific processor available on 4341 systems only. The 3838 processes single-precision floating-point vector operations independently of the host CPU. Three models are available: the Model 1 with 256K bytes of bulk storage, the Model 2 with 512K bytes of bulk storage, and the Model 3 with 1024K bytes of bulk storage. The bulk storage provides independent data storage for up to seven concurrent users. The 3838 subsystem also includes an arithmetic processor with 16K bytes of control storage, a control processor, a data transfer controller, and a channel interface that attaches to a block multiplexer channel on the 4341 host.

SYSTEM CONSOLES: A 3278 Model 2A Display Console or a 3279 Model 2C Color Display Console is required with every 4300 Series processor. The 3278-2A and 3279-2C consoles consist of an anti-glare CRT display and a separately priced 75-key operator console keyboard with operator control panel. The CRT displays 1920 characters in 24 rows of 80 characters each. Both models have character sets of 96 characters. The 3279-2C displays console messages in four colors: white, red, blue, and green.

The 3278-2A or 3279-2C console allows the operator to manually control such functions as storage display and operation, address comparing, and normal versus instruction step processing. The console indicates to the operator both proper operations and malfunctions. For maintenance and service, the console can display and store the status of the processor complex and other valuable servicing information as well as initiating and monitoring diagnostic tools. An audible alarm is a standard feature sounded under program control for special conditions.

The 3278-2A or 3279-2C connects directly to a 4300 Series processor. On the 4321 and 4331, connection is via the standard Display/Printer Adapter, which permits connection of the required 3278-2A or 3279-2C plus up to 7 (or 15 with the optional Display/Printer Adapter Expansion) additional devices chosen from the following list: 3278 Display Station Model 2, 3287 Printer Models 1 (80 cps) and 2 (120 cps), 3287 Color Printer Model 1C (80 cps) and 2C (120 cps), 3289 Line Printer Model 4 (400 lpm), and 3262 Line Printer Models 1 (650 lpm) and 11 (325 lpm). These devices may be installed in any combination, except that the number of system printers (3262 Model 1 or 3289 Model 4) may not exceed two. On the 4341, up to three optional 32782A display consoles, 3279-2C display consoles, or 3287 printers can be added.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The *4321* processor includes one byte multiplexer channel and one block multiplexer channel which allow input/output devices to be attached to the system.

On the *4331 Model Group 11,* one block multiplexer channel and one byte multiplexer channel are standard. The block multiplexer channel has a data transfer rate of 1.25 million bytes per second. It provides 8 control unit positions and can be configured with up to 256 shared or nonshared subchannels that support a maximum of 256 devices. The

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was a "real good" changeover. They experienced a few "minor problems" with the operating software, but IBM solved them "very quickly". There was a problem with the power supply on the tape unit controller but it was attended to "promptly" by IBM field engineers. The manufacturing company representative said that they are "real pleased" with the system.

The third user interviewed was a retail/wholesale organization that had converted from an IBM 370 to the 4341. They said that the conversion process had gone "very, very smoothly". The operations manager said that it was one of the smoothest conversions he had ever seen with no "trouble" whatsoever. Recently they have had a few 3370 disk problems but the disk drives were "quickly" replaced by IBM. Overall, the user was "very happy" with the equipment.

The users' ratings and comments indicate that they are fairly well satisfied with the 4300 Series processors. Of the 557 respondents, 515 said they would recommend the 4300 Series to others, 10 said they would not, and 31 were undecided.□

block multiplexer channel on the 4331 Model Group 11 does not support 33XX series disk units.

The byte multiplexer channel attaches the 3203-5 Printer and System/370 byte multiplex devices to the 4331 Model Group 11. With this channel, the single-byte interleaved mode provides a speed of 36K bytes per second, and the burst mode provides a speed of up to 500K bytes per second. The byte multiplexer channel provides 8 control unit positions and up to 32 subchannels, 4 of which are shared subchannels supporting up to 16 devices each. The maximum number of subchannels is reduced by five with the Additional Line Group feature.

The *4331 Model Group 2* processor can have up to four integrated channels: one 5248 Byte Multiplexer Channel, one 1421 Block Multiplexer Channel, one 1422 Additional Block Multiplexer Channel, and one 1431 High-Speed Block Multiplexer Channel.

The 5248 Byte Multiplexer Channel operates at up to 36K bytes per second in single-byte mode and at up to 500K bytes per second in burst mode. The 5248 provides 8 control unit positions and up to 36 subchannels, 4 of which are shared subchannels with up to 16 devices each. The number of subchannels is reduced by one if the Communications Adapter is installed. In addition, each communications line reduces by one the number of subchannels available.

The 1421 and 1422 Block Multiplexer Channels can each accommodate a data transfer rate of up to 1.25 million bytes per second. The 1431 High-Speed Block Multiplexer Channel can handle a data transfer rate of up to 1.86 million bytes per second, permitting the attachment of high-speed peripheral devices such as the 3330/3333, 3340/3344, 3350, and 3370 via control units. If both the 1422 and the 1431 are installed on the same processor, the data transfer rate of the 1422 cannot exceed 600K bytes per second. Each of the block multiplexer channels for the 4331 Model Group 2 provides 8 control unit positions and can be configured with up to 128 nonshared subchannels and up to 16 shared subchannels, each with devices in multiples of 8. (The maximum number of devices is 128.) The high-speed block multiplexer channel and the second DASD Adapter are mutually exclusive.

In addition to the I/O channels described above, the 4331 processors can be equipped with integrated I/O adapters. A Display/Printer adapter, for attaching the required 3278-2A or 3279-2C Display Console and up to seven additional displays or printers, is standard on both the 4331 Model Group 11 and the 4331 Model Group 2. The following adapters are standard on the Model Group 11 and optional on the Model Group 2: the DASD Adapter (for 3310, 3370, or 3340/344 Direct Access Storage Devices), 8809 Adapter (for up to six 8809 Magnetic Tape Units), and Communications Adapter (for controlling up to eight communications lines). A 5424 Adapter (for a 96-column 5424 Multi-Function Card Unit) and a second DASD Adapter are also optional on the 4331 Model Group 2.

The *4341 Model Groups 9, 10 and Model Group 1* processors can have up to six I/O channels in two three-channel groups, one standard and the other optional. The standard group consists of one byte multiplexer channel and two block multiplexer channels. The standard byte multiplexer channel has a maximum data rate of 16K bytes per second in singlebyte mode, 64K bytes per second in 4-byte mode, and 1.0 million bytes per second in burst mode. Each of the two standard block multiplexer channels accommodates a maximum block transfer rate of 3.0 million bytes per second.

The Optional Channel Group (feature 1870) for the 4341 Model Groups 9, 10 and 1 consists of three additional block multiplexer channels. Two of the optional block multiplexer channels have a data rate of 2.0 million bytes per second each. The data rate of the third channel is 1.0 million bytes per second. One of the three channels can optionally be configured as a second byte multiplexer channel with a maximum data rate of 22K bytes per second in single-byte mode, 88K bytes per second in 4-byte mode, and 2.0 million bytes per second in burst mode.

The aggregate data rate of the two standard block multiplexer channels is six million bytes per second. The aggregate data rate of the five block multiplexer channels including the optional group is 11 million bytes per second. If one of the three optional channels is configured as a second byte multiplexer channel, the aggregate data rate of the remaining four block multiplexer channels is nine million bytes per second. All of the block multiplexer channels support the Data Streaming mode.

The *4341 Model Group 11 and Model Group 2* processors provide six channels as standard: one byte multiplexer channel and five block multiplexer channels. The transfer rate for the block multiplexer channels is 3.0 million bytes per second for channels 1 and 2, and 2.0 million bytes for channels 3, 4, and 5. One of the block multiplexer channels can be selected as a second byte multiplexer channel.

The aggregate data rate of the five block multiplexer channels is 12 million bytes per second. If one of the channels is configured as a byte multiplexer channel, the aggregate data rate of the remaining four channels is 10 million bytes per second.

The 4341 Model Group 12 processors also provide six channels as standard including one byte multiplexer channel and five block multiplexer channels. The transfer rate, however, is 3.0 million bytes per second for channels 1, 2 and 4, and 2.0 million bytes per second for channels 3 and 5. One of the block multiplexer channels may be selected as a second byte multiplexer channel.

The aggregate data rate of the five block multiplexer channels is 13 million bytes per second. If channel 5 is selected as a byte multiplexer channel, the aggregate data rate of the remaining four channels is 11 million bytes per second. If channel 4 is selected as a byte multiplexer channel, the

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aggregate data rate of the remaining four channels is 10 million bytes per second. All block multiplexer channels support the Data Streaming Mode.

The capability for the attachment and automatic I/O power sequencing of up to 24 separate control units is standard on the 4341. Optionally, 48 control units can be accommodated through the addition of the 1890 Channel Control Unit Positions Feature. No one channel may attach and powersequence more than eight control units.

A Channel-to-Channel Adapter (feature 1850) allows the interconnection of two channels, which may be on a 4341, System/360, or System/370. Only one of the interconnected processors needs to be equipped with this feature.

The 3088 Multisystem Channel Communication Unit is a standalone I/O Control Unit that provides channel-tochannel communication facilities for multiple IBM 303X, 308X, or 4341 processors. The 3088 provides the capability of interconnecting from four to eight processor channels. The channel interfaces can be configured with 32 or 64 contiguous unit addresses that provide the function of a Channel-to-Channel Adapter. From 126 to 252 logical Channel-to-Channel Adapter links are provided. The 3088 requires one control unit position on each processor channel to which it is attached. One unshared subchannel is required on each attached channel for each unit address.

SIMULTANEOUS OPERATIONS: Concurrently with computing, a 4331 or 4341 can control one high-speed I/O data transfer operation per block multiplexer channel and one low-speed I/O operation on each subchannel of a byte multiplexer channel. Alternatively, a byte multiplexer channel can operate in burst mode and handle a single higher-speed I/O operation.

CONFIGURATION RULES

In October, 1982, IBM enhanced the 4321 with additional features previously available on the 4331 Model Group 1. One DASD Adapter base is now standard. Supported devices include the 3310, 3340/3344 and 3370. One adapter for 8809 tape drives, supporting up to six drives, is standard. A Display/Printer adapter is standard with 16 ports for the attachment of the operator console, line printers, displays and printer terminals. Supported devices include 3278-2A and 3279-2C Operator Consoles, 3278-2 and 3279 Model S2A Display Stations, 3287 Printer Models 1, 2, 1C and 2C, 3262 Line Printer Models 1 and 11, 3289 Line Printer Model 4, 3268 Printer Model 2, and 3230 Printer Model 2.

The 4331 is a highly integrated system, with numerous peripheral adapters mounted in the processor cabinet, including those for 3310, 3370, and 3340 Direct-Access Storage Devices (up to 9,000 megabytes per adapter); 8809 Magnetic Tape Units; diskette drive; 5424 Multi-Function Card Unit; and communications adapter. Also available are byte and block multiplexer channels, as described under the "Input/Output Control" heading. The integrated Support Processor has a standard Display/Printer Adapter for up to 8 devices, with optional expansion to 16 devices. These devices include a 3278-2A Console, 3278-2 Displays, 3287 Printer Models 1, 2, 1C, and 2C, 3262 Printer Model 1, and 3289 Printer Model 4.

The 4341 is a more traditional mainframe, with only the Support Processor, the byte and block multiplexer channels, and the optional Channel-to-Channel Adapter feature integrated into the processor cabinet. Up to four 3278-2A Consoles, 3279-2C Consoles, or 3287 Printers, Models 1, 2, 1C, and 2C, can be attached to the Support Processor.

For information on channel configurability, see the Input/Output Control, Input/Output Units, Mass Storage and Communications Control sections of this report.

MASS STORAGE

For information on mass storage devices available on the 4300 Series, refer to Table 2.

INPUT/OUTPUT DEVICES

For information on magnetic tape units, impact printers, and card equipment supported on the 4300 Series, refer to Table 3.

4250 PRINTER: A high-resolution, non-impact printer with a printing density of 600 x 600 dots per square inch. The printing time for an 8.5" x 11" size page ranges from 1.5 to 2.5 minutes. The 4250 provides the capability of printing and merging text and graphics. The printer uses electro-erosion technology and produces a typeset quality camera-ready masterpage directly from the host computer system.

3814 SWITCHING MANAGEMENT SYSTEM: This facility is designed to aid in the management of complex EDP 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. As compared to the earlier IBM 2914 Model 1 Switching Unit, the 3814 provides increased capacity, extended functions, and improved reliability. The system is covered in greater detail in Report 70D9-491-20 in Volume 2.

TERMINALS: Numerous IBM display terminals, batch terminals, and typewriter terminals can be connected to a 4300 system in remote and/or local configurations. For details, please refer to Reports 70D1-491-45, 70D2-491-11, and 70D3-491-46 in the Peripherals section of DATAPRO 70 (Volume 2).

COMMUNICATIONS CONTROL

The principal communications control unit for the IBM 4321 and 4331 is the Integrated Communications Adapter, described below. The programmable 3704 and 3705 Communications Controllers, also described below, are the prime communications devices for the 4341 and can also serve as alternatives to the Communications Adapter when more than eight lines must be connected to a 4331. Loop Adapters are also available for the 4331. Other available communications control units for both the 4331 and the 4341 include the older 2701 Data Adapter Unit, which connects up to four lines, and the 3791 Controller, which serves as an intelligent base for local workstations of the 3790 Communication System.

4321 COMMUNICATIONS ADAPTER: A standard feature on the 4321, the Integrated Communications Adapter supports eight BSC or SDLC communications lines. Line speeds range from 1200 to 9600 bits per second. The SDLC protocol is supported by ACF/VTAME operating under SSX/VSE. Each communications line has one Line Attachment Base for clocked modems and one EIA/CCITT interface for external modems. The communications adapter provides the following functions: auto answer, autopoll operation, multipoint central station functions, multipoint tributary station functions for BSC only, EBCDIC Transparent mode for BSC only, and EBCDIC/ASCII code for BSC only.

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Certain parameters for each line can be configured from the operator console. These include selected stand-by, half-speed operation, NRZI mode in SDLC Mode, error index byte mode for BSC lines, ASCII code instead of EBCDIC code for BSC lines, and tributary station addresses for BSC lines. The following parameters can be configured at installation time and set by the IBM CE: BSC or SDLC protocol per line, duplex instead of half-duplex transmission, switched network facility instead of non-switched, new sync for multipoint primary station functions, and connect data set to line or data terminal ready procedure.

4331 COMMUNICATIONS ADAPTER: This feature is standard on the 4331 Model Group 11 and optional on the Model Group 2. It provides for the direct attachment of up to eight BSC, start/stop, or SDLC communications lines in any combination. (At any given time, the "any combination" may be two of the three available types.) The aggregate data rate capacity may not exceed 64,000 bits per second. For seven of the eight lines, the data rate per line may not exceed 9600 bps. The eighth line may be a BSC or SDLC highspeed line with data rate of up to 56,000 bps, operating concurrently with other lines provided that the data rate limitations are not exceeded. The adapter operates with start/stop and BSC lines in 2703 compatibility mode. SDLC is supported only by ACF/VTAME operating under DOS/VSE or by ACF/VTAME operating under VM/370 Release 6 with DOS/VSE running as a guest. The communications adapter provides auto answer, auto-poll operation, multipoint station functions, EBCDIC transparent mode for BSC only, and EBCDIC/ASCII code for BSC only.

The eight lines attached to the communications adapter may have these optional features in addition to the high-speed line feature (4720) already mentioned: up to eight line features without internal clock for attachment to external modems with (4695) or without (4696) clock (data circuit-terminating equipment); up to eight line features with integrated 1200-bps modems (nonswitched, 4781; switched with auto answer, 4782; nonswitched with switched network backup and manual answer, 4787; nonswitched with switched network backup and auto answer, 4788); up to eight line features with local attachments (4801); up to eight line features wth digital data service adapters (5650); and autocall unit interfaces for up to two of the installed lines (1020).

Certain configuration parameters for each line may be specified from the display console keyboard. These parameters include select stand-by, half-speed operation for synchronous lines only (for both clocked and nonclocked modems which have this capability), NRZI mode in SDLC mode, write interrupt (start/stop line), read interrupt (start/stop line), unit exception suppression (start/stop line), error index byte mode (BSC line), and ASCII code instead of EBCDIC (BSC line).

Certain configuration parameters can be selected at installation time and set by the IBM CE. These parameters include duplex instead of half-duplex connection (two-way alternate data flow transmission), switched network facility instead of nonswitched lines for external modems, new sync for BSC or SDLC in multipoint primary station function only, connect data set to line or data terminal ready procedure, and selection of WE202 or V.23 answer tone frequencies for 1200-bps integrated modems with automatic answering.

The 4331 Communications Adapter supports communications with virtually all of the current IBM terminals, systems, and communications controllers in one or more of the three transmission modes: SDLC, BSC, or start/stop.

4331 LOOP ADAPTERS: Provide the capability to attach certain terminals and control units to a 4331 Model Group 2, and Model Group 11, either directly or via a data link. Loop Adapter 1 (feature 4830) and Loop Adapter 2 (4831) provide for direct attachment. The Data Link Adapter (4840) provides remote attachment capabilities for 3843 Loop Control Units. Each Data Link Adapter can be used as a point-to-point or multipoint connection to attach up to four 3843 Loop Control Units.

The following devices can be connected to direct attached loops at 9600 bps or to data link attached loops at 2400, 4800, or 9600 bps: the 3640 Plant Data Communications Terminals, the 8775 Display Terminal Model 1 or 2, the 3287 Printer Model 11 or 12, and the 3274 Control Unit Model 51C and 3276 Control Unit Display Station Models 11 to 14, with their associated terminals (3278 Display Station, 3279 Color Display Station, 3262 Line Printer, 3287 Printer, and 3289 Printer). In addition, the 8775, 3287 Models 11 and 12, and the 3274 control unit and associated terminals can also be attached at 38,400 bps. Up to 80 terminals can be connected to a 4331 Model Group 2 via the Loop or Data Link Adapters.

Cable length for direct attached loops can be up to 1.25 miles (2000 meters) when operating at 38,400 bps or 2 miles (3200 meters) when operating at up to 9600 bps. Data link attached loops can be up to 2 cable miles in length. The 4331 supports one Loop Adapter 1, one Loop Adapter 2, and up to two Data Link Adapters. The loop and data link adapters are mutually exclusive with the 5424 Adapter.

3705 COMMUNICATIONS CONTROLLER: This programmable front-end network processor can be connected to either a byte or block multiplexer channel on a 4331 or 4341 processor.

The 3705 consists of a Basic Module and up to three Expansion Modules. The Basic Module houses the Central Control Unit and Control Panel. Also contained in these modules are the storage, Channel Adapters, Communications Scanners, Line Interface Bases, and Line Sets required to accommodate up to 352 communication lines. Configuration rules for the 3705 are quite complex. The maximum number of lines that can be connected is a function of the 3705 model, the line speeds and types, and the mode of operation. In the 2701/2/3 Emulation mode, a maximum of 255 lines can be controlled. Line speeds can range from 45.5 to 56,000 bits per second. In the Network Control Program (NCP) mode, data is transferred between the 3705 and the host computer via a single subchannel interface.

The 3705-II offers significant price/performance improvements over the original model, now designated the 3705-I. (The 3705-I is no longer available.) The 3705-II is available in 44 different models depending upon the number of frames and the storage capacity, which ranges from 32K to 512K bytes. Processor cycle time is 1.0 microseconds on Models E1-E8, F1-F8, G1-G8, and H1-H8, and 900 nanoseconds on Models J1-J4, K1-K4, and L1-L4. Other 3705-II features include a high-speed Communications Scanner, an upgraded Channel Adapter that transfers data in blocks of 32 characters, transmission speeds to 9600 bps in synchronous mode, a maximum transmission rate of 56,000 bps, and a Cycle Utilization Counter that accumulates statistical data to assist in measuring machine performance.

In March, 1981, IBM announced the entry-level 3705-80 series, which consists of Models 81, 82, and 83. The 3705-80 has 256K bytes of storage and supports 4, 10, or 16 communication lines. The 3705-80 can be used as a frontend communications processor or as a remote concentrator linked to a local 3705-II Controller.

When connected to a host IBM processor, a 3705 can use either the Network Control Program (NCP) or the 2701/2/3

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Emulation Program. NCP/VS, for virtual environments, includes all of the facilities of the original NCP and also has the partitioned Emulation Programming Extension (PEP) capability which permits operation in the NCP mode and Emulation mode concurrently.

The 3705 Controllers are supported under the VTAM and TCAM access methods. The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs), adds capabilities for multiple-processor environments. An X.25 NCP Packet Switching Interface is now available for use with ACF/NCP/VS. To utilize ACF/NCP/VS, the Advanced Communication Function for VTAM and TCAM is required. ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS, and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS, and user programs.

3704 COMMUNICATIONS CONTROLLER: The 3704 is a smaller version of the 3705 that can be connected to a byte multiplexer channel on either a 4331 or 4341 processor. The 3704 is available in only four models with a main memory capacity of 16K to 64K bytes. It can accommodate a maximum of 32 lines, just one-half the capacity of the basic 3705 configuration. The 3704 uses the same software as the 3705, thereby ensuring upward compatibility for economic expansion of a small network into a large one.

3725 COMMUNICATIONS CONTROLLER: In March, 1983, IBM announced the 3725 which consists of the Model 1 and the Model 2. The 3725 consists of a central control unit which operates under control of the Advanced Communications Function/Network Control Program, Emulator Program, or Partitioned Emulator Program. Main storage is available in 512K-, 786K-, or 1024K-byte sizes. It can be attached to either byte or block multiplexer or selector channels on the host processor. Up to six channel adapters are available with two adapters standard in the base frame and four can be added via the 3726 Expansion Unit. 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 allows for host-independent maintenance. Communication 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 3727 Operator Console provides an operator interface to the Maintenance and Operator Subsystem of the 3725.

Model 1 consists of the 3725 Communication Controller and the 3726 Communication Controller Expansion. Up to 256 duplex or half-duplex lines may be attached with Model 1. Model 2, however, allows for attachment of up to 24 duplex or half-duplex lines. Model 2 is field-upgradable to Model 1.

REMOTE OPERATOR CONSOLE FACILITY (ROCF): The ROCF, an extension of the 4300 Remote Support Facility, is designed to facilitate dial-up and initialization of a remote 4300 Series processor from a real or emulated 3275 Model 2 Display Station at the host site. A network can include a 4300 Series processor with ROCF installed and an IBM System/370, 303X, 308X, or 4300 Series host processor running either of two software products that provide 3275 emulation: the MVS/Operator Communications Control Facility (MVS/OCCF) or the VM/Pass-Through Facility Release 2. MVS/OCCF is designed to operate on any IBM host computer that supports MVS/SP Version 1, while the VM/Pass-Through Facility Release 2 requires the new VM/SP Release 2 program product. No software support is required if a real 3275 Model 2 Display Station is available at the host site or if both the host and the remote systems are 4331 processors. In the latter instance, 3275 emulation is performed by microcode in the host 4331.

The following 4300 system operations can be performed from the host site: initial microcode load (IML), initial program load (IPL), reset, restart, compare/trace, and alter/display. Power-on for the remote 4300 processor must be performed at the remote site. A password verification function is provided to help protect against unauthorized access to the remote 4300 system. ROCF supports bisynchronous communications at 1200 bits per second.

After a remote 4300 is initialized from the host, communications control should continue through the existing network facilities of the host processor. ROCF is not designed to perform interactive jobs. On a 4321 or 4331 system, ROCF suppresses the activities of all devices attached to the Display/Printer Adapter. When MVS/OCCF is used to initialize a remote 4341 MVS or DOS/VSE system, continued control can be provided by MVS/OCCF in conjunction with the Network Communications Control Facility. After a remote 4341 VM system has been initialized, continued control can be provided by the Programmable Operator Facility of VM/SP Release 2.

7770 AUDIO RESPONSE UNIT: Provides audio responses, in recorded human-voice form, to digital inquiries from pushbutton telephones or other inquiry-type terminals. Handles a maximum of 48 lines, any or all of which can be active simultaneously. Has a 32-word basic vocabulary, expandable in 16-word increments to a maximum of 128 words. Receives inquiry messages and forwards them to the processing unit, which processes each message and composes an appropriate reply. The 7770 then converts the reply into a sequence of English words which are read from its magnetic drum and transmitted to the inquirer.

SOFTWARE

COMPATIBILITY: Any program written for an IBM System/370 computer will operate on a 4300 Series processor in System/370 mode, provided that it is not timedependent; does not depend on system facilities such as storage size, I/O equipment, optional features, etc., being present when the facilities are not included in the configuration; does not depend on system facilities such as interruptions, operation codes, etc., being absent when the facilities are included in the 4300 Processor; and does not depend on results or functions which IBM specifies to be unpredictable or model-dependent.

Any program written for a System/360 will operate on a 4300 Series processor in System/370 mode, provided that it follows the above rules and does not depend on functions that differ between the System/360 and System/370.

Any program written for the IBM 4331 Processor in ECPS:VSE mode or System/370 mode will operate on the 4341 Processor provided it follows the above rules.

OPERATING SYSTEMS: The 4300 Series processors are supported by DOS/VSE (a significant expansion of DOS/VS), SSX/VSE (a subset of DOS/VSE), VM/370 Release 6, OS/VS1 Release 7, and OS/VS2 (MVS).

DOS/VSE: This extended disk-resident operating system provides enhancements over IBM's older DOS/VS in the specific areas of processor support, hardware features, device support, usability improvements, and serviceability.

DOS/VSE supports the System/370 mode and the ECPS:VSE Mode of the 4300 processors. When operating in ECPS:VSE Mode, DOS/VSE takes advantage of the 4300 processor's concept of relocating channels and page management. To support the hardware extensions to page

management, the DOS/VSE assembler has additional privileged instructions.

The basic DOS/VSE system provides the capability for multiprogramming of five concurrent job streams, which will typically include the VSE/POWER spooler, a real-time subsystem such as CICS/VS, one or two batch job streams, and an unscheduled work partition for jobs that require fast turnaround. The system's capabilities can be significantly expanded through the addition of the VSE/Advanced Functions program product.

The VSE/Advanced Functions (AF) Release 1 and 2 (5646XE8) add functions to DOS/VSE in the areas of performance, usability, and installation and maintenance. AF is required for most of the program products available with DOS/VSE. Release 1 of AF provides seven partitions for all SYSRES DASD types, support of the 3310/3370/3375 DASD with VM/370 on 4300 processors in System/370 mode, and an implicit link function for reducing the number of job control statements an application programmer needs to code for program compilation and testing. AF Release 2 provides all the functions of AF Release 1 plus DASD sharing across processors, support for up to 12 partitions and 208 user tasks, and extended label area support.

Device support within DOS/VSE includes the 5424 Multi-Function Card Unit, the 3287 Console Printers, 3289 Model 4 Line Printer, 3278 Model 2A Operator Console, 3279 Model 2C Color Display Console, the 8809 Magnetic Tape Unit, and the 3310/3370/3375 DASD units. In conjunction with the new DASDs, DOS/VSE provides support for ISAM via VSAM and the ISAM Interface Program. Support of the 3310 and 3370 is provided in the ECPS:VSE mode only, unless operation is under VM/370. Support for the 3310 and 3370 is enhanced by utilities provided with DOS/VSE; these include the Surface Analysis Utility and the VSE/Fast Copy Data Set Program. Changes in support for the 3800 Printing Subsystem include merging part of the 3800 ICR into DOS/VSE.

Unlike DOS/VS, where the interval timer is employed, DOS/VSE makes use of the time-of-day clock and the clock comparator. Job accounting times are calculated through the CPU timer. IBM claims these changes result in more accurate reporting without an effect on user interfaces.

DOS/VSE extends the use of alternate-path I/O from magnetic tape to DASD. If a DASD device is attached to a processor via two channels, DOS/VSE automatically switches to the second channel if the first one is busy. DOS/VSE also provides several improvements in user interfaces. These include simplified command syntax for IPL and JCL, reduction in the number of supervisor generation options, and a VOLUME JCL command for displaying DASD information. IBM has also added an Extent macro for DOS/VSE data management routines. This macro allocates extent information for all DASD types for DASD file protection.

The DOS/VSE supervisor has been enhanced in at least six specific areas. First, supervisor services for I/O operations have been improved by shortening the I/O interrupt path length. Second, the number of logical unit blocks has been increased; under DOS/VSE, up to 255 symbolic logical units per partition are available. Third, the use of job information blocks for file protection information has been eliminated. Fourth, a symbolic interface is provided to programs processing label information, such as OPEN and CLOSE routines. The interface provides a label area space that is dynamically managed to satisfy the individual requirements of each partition. This label area space is somewhat larger than in DOS/VS. Fifth, besides a channel command block, an I/O request block can be specified which contains a list of addresses (fixlist). By specifying the I/O area explicitly in the fixlist, the performance of the supervisor can be increased when running in ECPS:VSE mode. Finally, a system function now performs loading of modules into the SVA at IPL time without any user action. The user may add additional modules at any job control time.

The minimum main storage requirement for the DOS/VSE supervisor in System/370 mode is 112K bytes of which 24K bytes can be made pageable. In ECPS:VSE mode, the minimum requirement is 106K bytes, of which 26K bytes can be made pageable. (These minimum sizes can be reduced by approximately 18K bytes if part of the supervisor is made pageable at IPL time.)

SMALL SYSTEMS EXECUTIVE/VSE (SSX/VSE): A subset of DOS/VSE, SSX/VSE is a pregenerated, preconfigured operating system designed for use by personnel with limited data processing skills. SSX/VSE supports batch, interactive, and on-line applications on 4321 or 4331 processors operating in standalone or distributed environments. Only a stand-alone 4341 with local (channel attached) terminals can use SSX/VSE. Prompts and procedures are provided to aid in installation, operation, program development, and service related activities. According to IBM, a standalone SSX/VSE system can be installed in two hours or less.

SSX/VSE Release 2, which supercedes Release 1 and was made available in February, 1983, includes an option to define 16 megabytes of virtual storage and the option to increase the number of partitions to 12. Under VM/370, SSX/VSE Release 2 can be installed as a guest operating system on the 4331 and the 4341 with a minimum of two megabytes of main memory and with either 3310 or 3370 Direct Access Storage Devices present. While Release 1 supported only one terminal controller per SNA communications line, Release 2 will support up to 8 terminal controllers per line. Support for additional hardware devices such as the 3601/3602/4701 Finance Communications Systems and for additional program products such as Network Communications Control Facility are included in Release 2.

SSX/VSE consists of components that are unique to SSX/VSE and components that are based on DOS/VSE. SSX/VSE unique functions include: 1) system installation and initialization; 2) system administration and operation functions, including library maintenance support, program development support, data set management support, CICS/VS table maintenance, and system operation support such as job creation and submission and backup and recovery; 3) problem determination aid; 4) an application installation interface that aids in adapting applications programs to SSX/VSE; and 5) a network installation interface that allows the integration of SSX/VSE into an SNA cross domain environment.

Pregenerated DOS/VSE-based components include: basic system control; spooling and RJE networking based on VSE/POWER Version 2; on-line control based on CICS/DOS/VS; interactive control based on VSE/ICCF and IPF; terminal and network control based on ACF/VTAME; data management based on VSE/VSAM; utilities based on DOS/VS Sort/Merge, VSE/DITTO, and VSE/Fast Copy Data Set Program; operator support based on VSE/OCCF; and problem determination support based on VSE/IPCS.

The standard programming language is DOS/VS Cobol. Also available are SSX/VSE prompter-supported program products, which are DOS/VSE licensed programs that have been adapted to, and tested under, SSX/VSE. These prompter-supported program products include the SSX/VSE PL/1 Optimizing Compiler and Libraries, SSX/VSE

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PL/1 Transient Library, SSX/VSE RPG II, and DL/1 SSX/VSE. RPG II is supported for batch programming only.

The minimum hardware configuration required for the installation and operation of SSX/VSE consists of a 4321 or 4331 with one megabyte of main memory or a 4341 with 2 megabytes of main memory, one 3278 or 3279 System Console, one 3278 or 3279 locally attached display station, one 3262, 3289 Model 4, or 3211 Line Printer, one 8809, 3411, or 3420 Magnetic Tape Unit, either three 3310 or one 3370 Direct Access Storage Devices, and the associated integrated I/O adapters.

VM/370 RELEASE 6: Announced with the 4300 Series computers in January 1979, this release of IBM's Virtual Machine Facility/370 (VM/370) is an operating environment that manages a computer system's facilities in such a way that each of many users has at his or her disposal the functional equivalent of a dedicated computer system.

VM/370 Release 6 provides support for the 4331 and 4341 processors in System/370 mode, as well as for the channelattached 3203 Model 5 Printer. The 3800 Printing Subsystem can be supported as either a dedicated device or a VM/370 spooling device. Journaling and security enhancements optionally track unsuccessful LOG ON and all LINK attempts. Masking of LOG ON and LINK passwords can be forced as an installation option. A final enhancement provides a new CP command that allows messages to be sent to a virtual machine's storage.

ECPS:VM/370, an optional hardware assist feature for the 4300 Series processors, reduces the CPU time required to execute certain frequently used supervisor functions of VM/370 Release 6.

The *VM/Basic System Extensions, Release 2,* (5748-XX8), include major Conversational Monitor System (CMS) improvements such as an interactive "HELP" facility, file system enhancements, and the upgrade of CMS/DOS to DOS/VSE. Several Control Program enhancements are provided for improved system performance, and support is provided for the 3289 Model 4 Printer, the 8809 Magnetic Tape Unit, and the 3310 and 3370 Direct Access Storage Devices. In addition, the VM/System Extensions (5748XE1) provide a resource manager function, enhanced shadow page and shadow segment table management, and support of MVS/SE.

The *VM/System Product* (VM/SP), 5664-167, contains all of the functions currently available in Release 2 of both the VM/Basic System Extensions and VM/System Extensions program products, as well as the following previously announced capabilities: multiprocessor support, enhanced support for attached processors, a new CMS editor and EXEC interpreter, an enhanced CMS HELP facility, a CMS OS LOADER capability, full screen console support via an SIO interface, enhanced CP spooling, a single console image facility, an IPL command enhancement, a new interuser communication capability, and support for the 3278 Model 5 and 3279 display terminals. Other VM/SP enhancements include support for the 4331 Model Group 2 Processor and the 3375 and 3380 Direct Access Storage devices; enhanced DASD support; enhanced support for the 3270 Information Display System; new functions to enhance the integrity, security, and reliability of the VM/SP systems; enhanced SPTAPE command support; support for MVS/SP-JES2 and MVS/SP-JES3 as guest operating systems; CMS support of the LKED command for OS application program development; and an upgrade of CMS/DOS program execution support to the Release 2 levels of the VSE/Advanced Functions and VSE/VSAM.

The *VM/System Product Release 2,* announced in October 1981, includes all of the functions of Release 1, plus the following enhancements: programmable operator support, new CMS functions for the end user, new CMS productivity aids, DIAL command support for BSC 3270 users, a restructured CMS nucleus, removal of the CMS tokenization eight-byte restriction, starter system full screen support, enhanced HELP file installation, CMS/DOS upgrade to VSE/Advanced Functions, a command retrieve capability, an enhanced Query command, enhanced ASCII support, enhanced 3800 support, and a Trace Table recording facility.

OS/VS1 RELEASE 7: This release of IBM's OS/VS1 operating system provides support for the 4331 and 4341 processors in the System/370 mode, with the ECPS:VS1 hardware assist feature on the 4341 providing improved performance of certain frequently executed OS/VS1 supervisor functions through microcoding. Improvements to the OS/VS1 SCP include a new SYSOUT display command, concatenated procedure libraries, allocation deserialization, graphics console roll/delete, page supervisor preferred pages, non-zero memory VM/370 IPL, and enhanced automatic volume recognition. OS/VS1 has also been improved through message enhancements, list/search technique, RQE serviceability, and IOS short-term fix/longterm fix. Device support for the 3203 Model 5 Printer and the 3880 Storage Control is now a part of OS/VS1.

The *OS/VS1 Basic Programming Extensions* (5662-257) provide support for the 4331 and 4341 Model Group 2 processors, the 3262 Printer Model 1 and 11, and the 3375 Direct Access Storage unit. Additional enhancements include an improved dump facility, VM/VTAM Communications Network Applications support, and support for the Data Facility/Device Support program, which provides a new indexed volume table of contents (VTOC) for improved system performance.

OS/VS2 (MVS): In July 1980, IBM announced MVS support for the 4341 processors. A no-charge option, ECPS:MVS, provides new privileged instructions that enable the 4341 processor to utilize either of two VMS/System Products, MVS/SP-JES2 or MVS/SP-JES3. MVS Release 3.8 with Processor Support 2 provides the required basic SCP code. MVS/SP-JES2 and MVS/SPJES3 are separately priced products that provide major extensions and enhancements to the MVS Base Control Program plus JES2 and JES3, respectively. IBM has stated that the MVS/System Products will replace the earlier MVS/System Extensions product and serve as the base for future enhancements to MVS, JES2, and JES3. For 4341 Model Group 2 processors, ECPS:MVS has been enhanced to include cross memory services, the page fault assist function, and the ADD FRR (Functional Recovery Routine) instruction.

RMF (Resource Measurement Facility) support for the 4341 is provided by RMF Version 2 Release 3. The ECPS:MVS, ECPS:VM/370, and ECPS:VS1 options on the 4341 are mutually exclusive—except that a 4341 Model Group 2 equipped with the ECPS Expansion feature can operate concurrently in ECPS:MVS and ECPS:VM/370 modes.

For additional details on MVS, please refer to Report 70C491-02 (IBM 308X Series).

OTHER SOFTWARE FACILITIES: Enhancements to other IBM software products supplied with DOS/VSE, VM/370 Release 6, and OS/VS1 Release 7 are summarized below.

Some of the facilities available in conjunction with *DOS/VSE* and *DOS/VSE AF* include ACF/VTAME; VSE/

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POWER for spooling; Job Entry and File Transfer programs; the VSE/3270 Bisync Pass Through, which allows a 4300 processor to appear as a remotely attached BSC 3271 control unit to an IBM System/370, 303X, or another 4300 host computer; a DOS/VSE Remote Job Entry Workstation facility; the VSE/IPCS (Interactive Problem Control System) required to aid in problem determination by the regional support centers in the new IBM support plans; BTAM-ES (Extended Support); 1400 Emulation; and the ability for DOS/VSE to run together with VM/370 to provide CMS interactive facilities and virtual machine functions.

Additional data mangement facilities are also available with DOS/VSE. A newer version of DL/1 DOS/VS supports the 3310 and 3370/3375 disk devices, as well as supporting RPG II applications and running with the VSE/ICCF (Interactive Computing and Control Facility). Also available is a VSE/VSAM access method, a VSE/Fast Copy Data Set utility, VSE/DITTO, support for CICS/DOS/VS Release 1.4, the DB/DC Data Dictionary Release 3, and support for IBM's relational data management system, SQL/Data System.

To assist the DOS/VSE user in improving productivity, IBM offers the VSE/ICCF program product, mentioned above, which is the successor to the popular DOS/VS ETSS-II (Entry Time-Sharing System) field-developed product. DMS/CICS/VS (Development Management System) replaces the Display Management System program product available to DOS/VS users. VS/APL support has been extended to the 4300 Series computers, as has support for all standard and extended IBM programming language compilers, sort/merges and utilities available with DOS/VS.

In the System Installation Productivity Options/Extended (System IPO/E), the IPO concept has been extended to facilitate the installation, management, and use of the 4300 Series software products. IPO/E consists of a base set of integrated program products, pregenerated, preconfigured, and pretested with the latest service levels pre-applied, and ready to use in specific operating environments. IPO/E is provided for DOS/VSE, OS/VS1 Release 7, and VM/370 Release 6. Optional features, such as additional program products, can be integrated into the base IPO via an interactive prompter.

In addition to supporting DL/1 DOS/VS and VSE/VSAM, *VM/370 Release 6* supports VS/IFS (Interactive File Sharing), which allows multiple CMS users to share VSAM data sets; VM/Directory Maintenance, for management of the VM/370 directory; Display Management System/CMS; the Query-By-Example (QBE) interactive end-user query language; SPF/CMS (Structured Programming Facility/CMS); the DES (Display Editing System); high-level language support; and IPO/E. There is one IPO/E that supports a standalone and guest SCP environment, and a VM/DOS/VSE System IPO/E that supports DB/DC and DC environments.

Two of the communications-oriented enhancements available with *OS/VS1 Release 7* include: RES (Remote Entry Services) a component of OS/VS1 which allows jobs and commands to be submitted from remote terminals, with output returned; and HRNES (Host Remote Node Entry System), which allows an OS/VS1 system to be a remote job entry station to any MVS/JES2 or SVS/HASP system or to another OS/VS1 system. Operation is not dedicated; batch and on-line applications can be run concurrently.

ACF/VTAM and ACF/TCAM are both supported under Release 7, as is the NCCF (Network Communication Control Facility) and the Cryptographic Subsystem. OS/VS1 Release 7 will support IMS/VS Version 1.1.5, CICS/OS/VS Version 1.4, IMS and CICS Aids, the DL/1 Data Language, VSAM, and the DB/DC Data Dictionary. DMS/CICS/VS, CICS/VS, VSPC personal computing capabilities, and CADAM (Computer-Graphic Augmented Design and Manufacturing system) can be implemented under OS/VS1. The various compilers and utilities are also supported. The System IPO for OS/VS1 includes Release 7, IMS/VS, ACF/NCP/VS, ACF/VTAM, and CICS/VS.

OS/VS1 also supports the Direct Access Device Migration Aid, a tool that facilitates the migration of data and programs to the 3375 DASD, and the Data Facility/Data Set Services, a dump/restore program product that supports the 3375. (OS/VS1 does not support the 3380 DASD.)

Additional software facilities for *OS/VS2 (MVS)* include: Data Facility/Device Support, which provides an indexed VTOC for improved system perormance; Data Facility/Extended Functions, a functional replacement for VSAM master catalogs, VSAM user catalogs, and OS control volumes; Data Facility/Data Set Services, a dump/restore program that supports the 3375 and 3380 direct-access storage devices; the Direct Access Storage Device Migration Aid, which facilitates the migration of MVS data and programs to the 3375 and 3380; the Hierarchical Storage Manager, which manages 3330/3350/3375/3380 DASD devices, 3420 tape drives, and the 3850 Mass Storage System; and the MVS/Operator Communication Control Facility (MVS/OCCF), which allows one or more remote MVS systems to be operated from a host MVS system.

PRICING

POLICY: The 4321 is available for purchase or monthly rental only. IBM offers the 4331 and 4341 systems on a purchase, lease, or rental basis. The standard IBM lease or rental contract includes equipment maintenance and entitles the customer to unlimited usage each month. The purchase option accrual equals 40 percent of the monthly charge up to 50 percent of the purchase price.

The current Agreement for Lease or Rental of IBM Machines provides users with a single contract on which they can specify mixtures of rental and leased equipment, each with various terms. CPUs rented under the plan can be terminated or downgraded on 90 days' notice, and all other rented equipment can be terminated or downgraded on 30 days' notice. Base terms and extension terms are specified for each piece of equipment obtained through a leasing agreement. The basic lease term is two years, followed by one-year extension terms.

In October, 1982, IBM introduced a volume purchase discount plan for the 4300 Series. A discount of 6 percent is offered on the purchase of 5 to 9 4300 Series processors. For quantities of 10 or more, the discount is 9 percent.

MAINTENANCE: For purchased, leased, or rented systems, the IBM 4300 Series is under maintenance group D. The minimum period of maintenance service is 9 consecutive hours between 7:00 a.m. and 6:00 p.m. Monday through Friday. Charges for maintenance coverage outside this period are based upon the following percentages of the minimum monthly maintenance charge (MMC) added to the MMC:

IBM 4300 Series

	Consecutive hours				
	9*	12	16	20	24
Monday-Friday (until 8:00 a.m. Saturday)	10	12	14	16	18
Saturday (until 8:00 a.m. Sunday	4	5	7	8	9
Sunday (until 8:00 a.m. Monday)	4	7	9	11	12

*Outside of the hours 7:00 to 6:00 p.m.

For users without a maintenance contract, the 4300 Series is maintained under per-call class 3. Under this class, the per call charge during regular hours is $147 per hour, and during off hours the charge is $170 per hour.

SOFTWARE: IBM 4300 Series users receive the basic DOS/VSE, OS/VS1 Release 7, VM/370 Release 6, or OS/VS2 (MVS) system control programs at no additional cost. All other IBM software, including the DOS/VS Advanced Functions and the SSX/VSE operating system, is priced separately. In addition, basic monthly charges have been established for maintenance of the IBM system control programs and other licensed program products.

Charges for most software products are based on a continuous monthly charge. A one-time license fee is available for SSX/VSE. 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.

Local programming support is available on two levels. The Monthly Licensed Program Support Charge provides local support for a single licensed program. The Monthly Multiple Licensed Program Support Charge provides local support for multiple copies of a program. The multiple copies can be installed at more than one customer location, but the local support is performed at one designated location. Local program support for Class 1 SCPs is offered on the same two levels.

An alternative to contracted software maintenance is per-call service, charged to the applicable hourly rate. Program service/programming assistance costs $158 per hour during regular hours and $181 per hour at other times. The initial and prime interface for software problems and their solution is the IBM Support Center, described below.

SUPPORT CENTER: 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 he 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 resolved, the PSR (Program Support Representative) 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.

EQUIPMENT: The indicated prices for the following typical configurations include all the required control units and adapters, but do not include software.

TYPICAL 4321 SYSTEM: Includes a 4321 Processor with one megabyte of main memory, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with attached Model B2 (258 megabytes), two 8809 Magnetic Tape Units, a 650-lpm 3262 Model 1 Printer, and integrated tape and disk adapters. The monthly maintenance charge is $918.50 and the purchase price is $130,516.

TYPICAL 4331 GROUP 11 SYSTEM: Includes a 4331 Model K11 Processor with two megabytes of main memory and two I/O channels, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with attached Model B2 (258 megabytes), four 8809 Magnetic Tape Units, a 2520 Card Read Punch, two 650-lpm 3262 Model 1 Printers, and integrated tape and disk adapters. The monthly charge on a two-year lease is $9,145, the monthly maintenance charge is $1,973, and the purchase price is $244,072.

TYPICAL 4341 GROUP 9 SYSTEM: Includes a 4341 Model L9 Processor with four megabytes of main memory and three I/O channels, two 3278-2A Operator Consoles with keyboards, 3287 Model 1 Console Printer, two 3370 DASDs (1140 megabytes), a 3880 Model 1 Storage Control, six 3420 Model 3 Magnetic Tape Units (120KBS), a 3803 Model 1 Tape Control, a 2520 Card Read Punch, and a 1200-lpm 3203 Model 5 Printer. The monthly charge on a two-year lease is $14,289, the monthly maintenance charge is $2,283, and the purchase price is $367,340.

TYPICAL 4341 GROUP 12 SYSTEM: Includes a 4341 Model N12 Processor with 12 megabytes of main memory and 6 I/O channels, two 3278-2A Operator Consoles with keyboards, 3287 Model 2 Console Printer, a 3380 DASD Model A4 (2.5 billion bytes), a 3880 Model 2 Storage Control, eight 3420 Model 3 Magnetic Tape Units (120KBS), a 3803 Model 1 Tape Control, a 2520 Card Read Punch, and two 1200-lpm 3203 Model 5 Printers. The monthly charge on a two-year lease is $33,296, the monthly maintenance charge is $4,837.50, and the purchase price is $892,100.

IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES					
4321 J11	Processor with 1,048,576 bytes of main memory, one DASD Adapter, one 8809 Magnetic Tape Unit Adapter, one Display/Printer Adapter, one Communications Adapter, one Communications Adapter Base	$ 64,000	$281.50	$4,455	$ —
4331 J11	Processor with 1,048,576 bytes of main memory, 4K-byte buffer, one byte and one block multiplexer channel, one DASD Adapter, one 8809 Magnetic Tape Unit Adapter, one Display/Printer Adapter, one Communications Adapter Base	82,420	335.00	5,176	4,405
4331 K11	Same as 4331 J11, but with 2,097,152 bytes of main memory	92,420	361.00	5,734	4,880
4331 L11	Same as 4331 J11, but with 4,194,304 bytes of main memory	112,420	413.00	6,850	5,830
4331 J2	Processor with 1,048,576 bytes of main memory and 8K-byte buffer	82,500	327.00	6,275	5,340
4331 K2	Same as 4331 J2, but with 2,097,152 bytes of main memory	92,500	353.00	6,833	5,815
4331 KJ2	Same as 4331 J2, but with 3,145,738 bytes of main memory	102,500	379.00	7,391	6,290
4331 L2	Same as 4331 J2, but with 4,194,304 bytes of main memory	112,500	405.00	7,949	6,765
4341 J9	Processor with 1,048,576 bytes of main memory and 2K-byte buffer	81,000	388.00	6,345	5,400
4341 K9	Same as 4341 J9, but with 2,097,152 bytes of main memory	91,000	414.00	6,903	5,875
4341 L9	Same as 4341 J9, but with 4,194,304 bytes of main memory	111,000	466.00	8,019	6,825
4341 K10	Processor with 2,097,152 bytes of main memory and 4K-byte buffer	150,000	518.00	9,241	7,865
4341 L10	Same as 4341 K10, but with 4,194,304 bytes of main memory	170,000	570.00	10,446	8,890
4341 K1	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	205,000	541.00	10,505	8,940
4341 L1	Same as 4341 K1, but with 4,194,304 bytes of main memory	225,000	593.00	11,709	9,965
4341 K11	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	240,000	675.00	13,113	11,160
4341 L11	Same as 4341 K11, but with 4,194,304 bytes of main memory	260,000	727.00	14,323	12,190
4341 M11	Same as 4341 K11, but with 8,388,608 bytes of main memory	300,000	831.00	16,732	14,240
4341 K2	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	330,000	791.00	15,816	13,460
4341 L2	Same as 4341 K2, but with 4,194,304 bytes of main memory	350,000	843.00	17,026	14,490
4341 M2	Same as 4341 K2, but with 8,388,608 bytes of main memory	390,000	947.00	19,435	16,540
4341 N2	Same as 4341 K2, but with 12,582,912 bytes of main memory	430,000	1,050.00	21,843	18,590
4341 P2	Same as 4341 K2, but with 16,777,216 bytes of main memory	470,000	1,155.00	24,252	20,640
4341 K12	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	360,000	900.00	17,625	15,000
4341 L12	Same as 4341 K12, but with 4,194,304 bytes of main memory	380,000	952.00	18,741	15,950
4341 M12	Same as 4341 K12, but with 8,388,608 bytes of main memory	420,000	1,055.00	20,973	17,850
4341 N12	Same as 4341 K12, but with 12,582,912 bytes of main memory	460,000	1,160.00	23,205	19,750
4341 P12	Same as 4341 K12, but with 16,777,216 bytes of main memory	500,000	1,265.00	25,437	21,650
System upgrades:					
	4321 to 4331 J11	24,650	—	—	—
	4321 to 4331 K11	40,350	—	—	—
	4321 J11 to 4331 J2	40,000	—	—	—
	4321 J11 to 4331 K2	50,000	—	—	—
	4321 J11 to 4331 KJ2	60,000	—	—	—
	4321 J11 to 4331 L2	70,000	—	—	—
	4331 I1 to 4331 J11***	38,865	—	—	—
	4331 I1 to 4331 K11***	48,865	—	—	—
	4331 I1 to 4331 L11***	68,865	—	—	—
	4331 J1 to 4331 J11***	33,865	—	—	—
	4331 J1 to 4331 K11***	43,865	—	—	—
	4331 J1 to 4331 L11***	63,865	—	—	—
	4331 I1 to 4331 J1***	5,000	—	—	—
	4331 I1 to 4331 J2***	48,865	—	—	—

*Rental/lease prices include equipment maintenance.
***Requires Feature 1901.

IBM 4300 Series

EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES (Continued)				
4331 I1 to 4331 K2***	58,865	—	—	—
4331 I1 to 4331 KJ2***	68,865	—	—	—
4331 I1 to 4331 L2***	78,865	—	—	—
4331 J1 to 4331 J2***	43,865	—	—	—
4331 J1 to 4331 K2***	53,865	—	—	—
4331 J1 to 4331 KJ2***	63,865	—	—	—
4331 J1 to 4331 L2***	73,865	—	—	—
4331 J11 to 4331 K11	10,000	—	—	—
4331 J11 to 4331 K11	30,000	—	—	—
4331 J11 to 4331 J2	16,735	—	—	—
4331 J11 to 4331 K2	26,735	—	—	—
4331 J11 to 4331 KJ2	36,735	—	—	—
4331 J11 to 4331 L2	46,735	—	—	—
4331 K11 to 4331 K2	16,735	—	—	—
4331 K11 to 4331 KJ2	26,735	—	—	—
4331 K11 to 4331 L2	36,735	—	—	—
4331 K11 to 4331 L11	20,000	—	—	—
4331 L11 to 4331 L2	16,735	—	—	—
4331 J2 to 4331 K2	15,700	—	—	—
4331 J2 to 4331 KJ2	31,400	—	—	—
4331 J2 to 4331 L2	47,100	—	—	—
4331 K2 to 4331 KJ2	15,700	—	—	—
4331 K2 to 4331 L2	31,400	—	—	—
4331 KJ2 to 4331 L2	15,700	—	—	—
4341 J9 to 4341 K9	10,000	—	—	—
4341 J9 to 4341 L9	30,000	—	—	—
4341 J9 to 4341 K10	69,000	—	—	—
4341 J9 to 4341 L10	89,000	—	—	—
4341 K9 to 4341 L9	20,000	—	—	—
4341 K9 to 4341 K10	59,000	—	—	—
4341 K9 to 4341 L10	79,000	—	—	—
4341 K10 to 4341 L10**	20,000	—	—	—
4341 K10 to 4341 K11**	90,000	—	—	—
4341 K10 to 4341 L11**	110,000	—	—	—
4341 K10 to 4341 M11**	150,000	—	—	—
4341 L10 to 4341 L11**	90,000	—	—	—
4341 L10 to 4341 M11**	130,000	—	—	—
4341 K10 to 4341 K12**	210,000	—	—	—
4341 K10 to 4341 L12**	230,000	—	—	—
4341 K10 to 4341 M12**	270,000	—	—	—
4341 K10 to 4341 N12**	310,000	—	—	—
4341 K10 to 4341 P12***	350,000	—	—	—
4341 L10 to 4341 L12**	210,000	—	—	—
4341 L10 to 4341 M12**	250,000	—	—	—
4341 L10 to 4341 N12**	290,000	—	—	—
4341 L10 to 4341 P12**	330,000	—	—	—

*Rental/lease prices include equipment maintenance.
**Requires Feature 1870.
***Requires Feature 1901.

IBM 4300 Series

EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES (Continued)				
4341 K1 to L1**	20,000	—	—	—
4341 K1 to 4341 K11**	55,000	—	—	—
4341 K1 to 4341 L11**	75,000	—	—	—
4341 K1 to 4341 M11**	115,000	—	—	—
4341 L1 to 4341 L11**	55,000	—	—	—
4341 L1 to 4341 M11**	95,000	—	—	—
4341 K1 to 4341 K2**	125,000	—	—	—
4341 K1 to 4341 L2**	145,000	—	—	—
4341 K1 to 4341 M2**	185,000	—	—	—
4341 K1 to 4341 N2**	225,000	—	—	—
4341 K1 to 4341 P2**	265,000	—	—	—
4341 L1 to 4341 L2**	125,000	—	—	—
4341 L1 to 4341 M2**	165,000	—	—	—
4341 L1 to 4341 N2*	205,000	—	—	—
4341 L1 to 4341 P2**	245,000	—	—	—
4341 K1 to 4341 K12**	155,000	—	—	—
4341 K1 to 4341 L12**	175,000	—	—	—
4341 K1 to 4341 M12**	215,000	—	—	—
4341 K1 to 4341 N12**	255,000	—	—	—
4341 K1 to 4341 P12**	295,000	—	—	—
4341 L1 to 4341 L12**	155,000	—	—	—
4341 L1 to 4341 M12**	195,000	—	—	—
4341 L1 to 4341 N12**	235,000	—	—	—
4341 L1 to 4341 P12**	275,000	—	—	—
4341 K11 to 4341 L11	20,000	—	—	—
4341 K11 to 4341 M11	60,000	—	—	—
4341 L11 to 4341 M11	40,000	—	—	—
4341 K11 to 4341 K2	84,000	—	—	—
4341 K11 to 4341 L2	115,400	—	—	—
4341 K11 to 4341 K12	120,000	—	—	—
4341 K11 to 4341 L12	140,000	—	—	—
4341 K11 to 4341 M12	180,000	—	—	—
4341 K11 to 4341 N12	220,000	—	—	—
4341 K11 to 4341 P12	260,000	—	—	—
4341 L11 to 4341 L12	120,000	—	—	—
4341 L11 to 4341 M12	160,000	—	—	—
4341 L11 to 4341 N12	200,000	—	—	—
4341 L11 to 4341 P12	240,000	—	—	—
4341 M11 to 4341 M12	120,000	—	—	—
4341 M11 to 4341 N12	160,000	—	—	—
4341 M11 to 4341 P12	200,000	—	—	—
4341 K11 to 4341 M2	178,200	—	—	—
4341 K11 to 4341 N2	241, 000	—	—	—
4341 K11 to 4341 P2	303,800	—	—	—
4341 L11 to 4341 L2	84,000	—	—	—
4341 L11 to 4341 M2	146,800	—	—	—
4341 L11 to 4341 N2	209,600	—	—	—
4341 L11 to 4341 P2	272,400	—	—	—

*Rental/lease prices include equipment maintenance.
**Requires Feature 1870.

IBM 4300 Series

EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES (Continued)				
4341 M11 to 4341 M2	84,000	—	—	—
4341 M11 to 4341 N2	146,800	—	—	—
4341 M11 to 4341 P2	209,600	—	—	—
4341 K2 to 4341 L2	20,000	—	—	—
4341 K2 to 4341 M2	60,000	—	—	—
4341 K2 to 4341 N2	100,000	—	—	—
4341 K2 to 4341 P2	140,000	—	—	—
4341 L2 to 4341 M2	40,000	—	—	—
4341 L2 to 4341 N2	80,000	—	—	—
4341 L2 to 4341 P2	120,000	—	—	—
4341 M2 to 4341 N2	40,000	—	—	—
4341 M2 to 4341 P2	80,000	—	—	—
4341 N2 to 4341 P2	40,000	—	—	—
4341 K2 to 4341 K12	30,000	—	—	—
4341 K2 to 4341 L12	50,000	—	—	—
4341 K2 to 4341 M12	90,000	—	—	—
4341 K2 to 4341 N12	130,000	—	—	—
4341 K2 to 4341 P12	170,000	—	—	—
4341 L2 to 4341 L12	30,000	—	—	—
4341 L2 to 4341 M12	70,000	—	—	—
4341 L2 to 4341 N12	110,000	—	—	—
4341 L2 to 341 P12	150,000	—	—	—
4341 M2 to 4341 M12	30,000	—	—	—
4341 M2 to 4341 N12	70,000	—	—	—
4341 M2 to 4341 P12	110,000	—	—	—
4341 N2 to 4341 N12	30,000	—	—	—
4341 N2 to 4341 P12	70,000	—	—	—
4341 P2 to 4341 P12	30,000	—	—	—
4341 K12 to 4341 L12	20,000	—	—	—
4341 K12 to 4341 M12	60,000	—	—	—
4341 K12 to 4341 N12	100,000	—	—	—
4341 K12 to 4341 P12	140,000	—	—	—
4341 L12 to 4341 M12	40,000	—	—	—
4341 L12 to 4341 N12	80,000	—	—	—
4341 L12 to 4341 P12	120,000	—	—	—
4341 M12 to 4341 N12	40,000	—	—	—
4341 M12 to 4341 P12	80,000	—	—	—
4341 N12 to 4341 P12	40,000	—	—	—
PROCESSOR FEATURES & CHANNELS				
Many of the features listed below include microcode as well as hardware. Microcode is supplied on diskettes.				
Features for the 4321 and 4331:				
5655 X.21 Adapter, nonswitched	770	2.50	29	25
9201 3370 Direct Attachment (standard on 4321-J11)	NC	NC	NC	NC
9202 3310 Direct Attachment (standard on 4321-J11)	NC	NC	NC	NC
1001 Adapter Power Prerequisite for Communications Adapter	1,815	9.50	96	82
1002 Adapter Logic Prerequisite for 5424 Adapter	3,340	18.00	177	151

*Rental/lease prices include equipment maintenance.
NC—No Charge.

IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSOR FEATURES & CHANNELS (Continued)					
	1421 Block Multiplexer Channel (standard on 4331-11)	3,340	3.00	177	151
	1422 Block Multiplexer Channel, Additional	3,930	3.00	168	143
	1431 High-Speed Block Multiplexer Channel	4,760	3.50	275	235
	1901 Control Storage Expansion	3,865	51.50	206	176
	2001 Display/Printer Adapter Expansion	920	3.00	42	36
	3201 DASD Adapter; for 3310/3340/3370	2,730	5.00	146	124
	3202 DASD Adapter, Additional	2,730	5.00	139	118
	3401 Diskette Drive; reads IBM Type 1 Diskettes	2,665	27.50	141	120
	3898 External Signals; for external interrupt	225	2.00	12	10
Features for the 4321 and 4331:					
	3901 5424 Attachment	5,005	12.50	267	227
	3950 1401/1440/1460 Compatibility	NC	NC	NC	NC
	4910 8809 Mag Tape Unit Adapter	2,730	5.00	146	124
	5248 Byte Multiplexer Channel (standard on 4331-11)	2,665	3.00	141	120
	5531 Power Interface (standard on 4331-11)	1,670	2.50	88	75
	5532 Power Interface, Additional	830	2.50	43	37
	7851 3340/3344 Direct Attachment	NC	NC	NC	NC
	7901 Direct-Access Storage Compatibility; provides 2311/2314 emulation on 3310 or 3370 DASDs and 3330 emulation on 3370 DASDs	NC	NC	NC	NC
	8701 ECPS: VM/370	NC	NC	NC	NC
Features for the 4341:					
	1601 ECPS Expansion Feature (for 4341 Model Group 2 or Group 12 Processors only)	26,250	22.00	1,056	899
	1850 Channel-to-channel adapter	23,150	29.00	920	783
	1870 Optional channel group; three additional channels (for 4341 Group 1 and 10 Processors only)	17,790	6.00	707	602
	1890 Channel control unit positions, additional	2,755	10.00	109	93
	3088 Multisystem Channel Communication Unit:				
	Model 1; connects to 4 processors	95,000	120	—	—
	Model 1; connects to 8 processors	145,000	150	—	—
	3838 Array Processor:				
	Model 1; 256K bytes of bulk storage***	553,600	1,810.00	25,036	22,760
	Model 2; 512K bytes of bulk storage***	613,150	2,180.00	30,426	27,660
	Model 3; 1024K bytes of bulk storage	732,250	2,925.00	41,217	37,470
System Consoles:					
3278 2A	Display Console	2,505	18.50	118	101
3279 2C	Color Display Console	4,525	31.50	197	168
	4631 75-Key Operator Console Keyboard with channel-to-channel interface and operator control panel (for 4341)	1,085	5.50	48	41
	4632 Same as 4631 without channel-to-channel interface (for 4341)	1,010	5.50	47	40
	4633 Same as 4631 without operator control panel (for 4341)	524	5.00	21	18
	4634 Same as 4631 without channel-to-channel interface (for 4321 or 4331)	1,010	5.50	47	40
	6340 Security Keylock	35	—	—	—

*Rental/lease prices include equipment maintenance.
***Monthly charge on a 4-year lease.
NC—No Charge.

IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
MASS STORAGE					
3310	Disk Storage				
	Model A; 1 drive with controller; 64.5MB	10,710	80.50	507	432
	Model A2; drives with controller; 64.5MB each	11,570	135.00	840	716
	Model B1; drive; 64.5MB (for attachment to Model A2)	5,510	61.00	400	341
	Model B2; 2 drives; 64.5MB each (for attachment to Model A2)	10,120	117.00	733	625
3330	Disk Storage:				
	Model 1; 2 drives; 200MB	33,670	178.00	2,160	1,814
	Model 2; 1 drive; 100MB5	20,110	105.00	1,287	1,095
	Model 11; 2 drives; 400MB	47,920	178.00	3,085	2,591
3333	Disk Storage and Control (up to three 3330 modules can be attached):				
	Model 1; 2 drives; 200MB	42,200	199.00	2,691	2,290
	Model 11; 2 drives; 400MB	56,450	199.00	3,619	3,080
3336	Disk Pack, Model 1	775	—	—	—
3336	Disk Pack, Model 11	1,150	—	—	—
3340	Direct Access Storage Facility; 34.9 or 69.8MB per drive:				
	Model A2; Two drives plus control	8,600	116.00	1,633	1,390
	Model B1; One drive	4,730	62.00	918	781
	Model B2: Two drives	6,020	100.00	1,157	985
	4301 Fixed-Head Feature (for 3340 A2 or B2)	1,165	2.50	68	58
	4302 Fixed-Head Feature (for 3340 B1)	583	2.00	35	30
	6201 Rotational Positon Sensing (for 3340 B1)	467	1.50	28	24
	6202 Rotational Positon Sensing (for 3340 or A2 or B2)	590	1.50	36	31
	6148 Remote Switch Attachment	NC	NC	NC	NC
	8150 String Switch for 3340 A2	4,915	15.00	325	277
3344	Direct Access Storage; 279.6MB per drive:				
	Model B2; Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility	14,820	115.00	1,469	1,250
	Model B2F; Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility with 2MB fixed-head storage	19,460	161.00	1,921	1,635
3348	Data Module (for 3340 drives):				
	Model 35; 34.9MB	1,600	—	59	50
	Model 70; 69.8MB	2,200	—	82	70
	Model 70F; 69.8MB of which 502,080 are served by fixed heads	4,400	—	165	140
3350	Direct Access Storage; 317.5MB per drive:				
	Model A2; Dual Disk Drive	41,600	170.00	1,845	1,570
	Model A2F; Dual Disk Drive with 2MB fixed-head storage	51,910	221.00	2,291	1,950
	Model B2; Add-on Dual Disk Drive	32,940	128.00	1,469	1,250
	Model B2F; Add-on Dual Disk Drive for 2MB fixed-head storage per drive	43,250	179.00	1,921	1,635
	Model C2; Two-drive disk storage and associated control	43,030	179.00	1,921	1,635
	Model C2F; Two-drive disk storage and associated control	53,340	230.00	2,368	2,015
	1320 Primary Controller Adapter (permits selection of A2/AF controller as on-line controller via manual switch on the C2/C2F	286	1.50	14	12
	8150 String Switch for 3350 A2, A2F, C2, C2F	4,790	9.00	226	192
3830	Storage Control, Model 2; for 3330/3333, 3340/3344, or 3350 disk drives	8,120	125.00	2,465	2,071
	2150 Control Store Extension	1,880	11.50	569	478
	2151 Expanded Control Store; requires 2150	3,285	12.50	347	291
	6111 Register Expansion	109	3.50	33	28
	6148 Remote Switch Attachment	NC	NC	NC	NC
	6149 Remote Switch Attachment, Additional	NC	NC	NC	NC

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NC—No Charge.

IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
MASS STORAGE (Continued)					
	8170 Two-Channel Switch	2,290	12.50	239	201
	8171 Two-Channel Switch, Additional	2,290	12.50	239	201
3370	Direct Access Storage; 571.3MB per drive:				
	Model A1; Single Disk Drive	35,480	126.00	1,463	1,245
	Model B1; Add-on Single Disk Drive for attachment to Model A1	26,600	94.50	976	933
	8150 String Switch for 3370 A1	4,505	1.50	143	1,122
3375	Direct Access Storage; 819.7MB per drive:				
	Model A1; contains logic and power for up to three Model B1 units	38,040	130.00	1,463	1,245
	Model B1; connects to a 3375 Model A1	18,770	98.50	1,171	831
	Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	36,290	120.00	1,392	1,185
	4951 Model D1 Attachment for Model A1	2,590	6.00	89	76
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	3,795	1.50	157	134
3380	Direct Access Storage; 2.52 billion bytes per unit:				
	Model A4; connects to one 3880 storage director	86,310	285.00	3,161	2,690
	Model AA4; connects to one 3880 storage director	98,640	325.00	3,613	3,075
	Model B4; connects to a Model A unit	71,600	240.00	2,620	2,230
3880	Storage Control; includes two storage directors:				
	Model 1; each storage director can attach up to four 3330/3333, 3340 A2, 3350 A2/A2F, 3370 A1 ,or 3375 A1 or D1 in any combination	66,970	176.00	2,703	2,300
	Model 2; provides one storage director for 3330/3333, 3340/3344, 3350, 3370, or 3375 storage and one for 3380 storage	66,970	176.00	2,703	2,300
	Model 3; provides two storage directors for 3380 storage	66,970	176.00	2,703	2,300
	Model 4; provides one storage director which can attach up to four 3375 Model A1s	35,000	82.50	2,055	—
	Model 11; paging subsystem for 3350	251,520	676.00	7,145	6,080
	Model B13, includes two cache storage directors for 3380; 4 megabytes	179,950	576.00	6,821	5,805
	Model D13; same as B13, but with 8 megabytes	224,300	711.00	8,713	7,415
	6148 Remote Switch Attachment	NC	NC	NC	NC
	6149 Remote Switch Attachment, additional	NC	NC	NC	NC
	6150 Remote Switch Attachment for Eight-Channel Switch	NC	NC	NC	NC
	6550 Speed Matching Buffer for 3380	11,420	40.00	341	290
	8170 Two-Channel Switch Pair	8,140	11.00	241	205
	8171 Two-Channel Switch Pair, additional	21,720	38.50	647	551
	8172 Eight-Channel Switch	29,870	53.50	894	761
MASS STORAGE UPGRADES					
3344	B2 to 3344 B2F	7,440	—	—	—
3375	B1 to 3375 D1	7,520	—	—	—

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
MAGNETIC TAPE EQUIPMENT					
3410	Magnetic Tape Unit:				
	Model 1; 20,000 bytes/sec.	3,365	105	285	239
	Model 2; 40,000/20,000 bytes/sec.	4,365	116	378	318
	Model 3; 80,000/40,000 bytes/sec.	5,365	128	476	399
3411	Magnetic Tape Unit and Control:				
	Model 1; 20,00 bytes/sec.	7,910	162.00	633	532
	Model 2; 40,00/20,000 bytes/sec. (not in new production)	9,910	174.00	805	676
	Model 3; 80,000/40,000 bytes/sec. (not in new production)	11,910	184.00	978	822
	3211 Single Density Feature (for 3410 & 3411)	1,140	14.00	82	69
	3221 Dual Density Feature (for 3410 & 3411)	2,185	49.00	122	102
	7360 System/360/370 Attachment (required on 3411)	1,950	34.00	228	192
3420	Magnetic Tape Units:				
	Model 3; 120,00 bytes/sec. at 1600 bpi; 75 ips	14,910	193.00	567	476
	Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	19,170	193.00	793	666
	Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	19,990	211.00	764	642
	Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	22,390	211.00	917	770
	Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	22,400	253.00	905	760
	Model 8; 1,250 bytes/sec. at 6250 bpi; 200 ips	24,840	311.00	1,085	911
	6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,000	58.50	78	66
	6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,755	77.00	113	95
	6631 Single Density Feature (for Models 3, 5, and 7)	3,585	58.00	132	111
	3550 Dual Density Feature (for Models 3, 5, and 7)	4,630	89.50	160	134
	6407 7-Track Feature (for Models 3, 5, and 7)	3,585	78.00	123	103
3430	Magnetic Tape Subsystem				
	Model A1; Tape Unit and Control	33,400	235	1,905	—
	Model B1; Tape Unit Only	16,900	165	1,010	—
3803	Tape Controller:				
	Model 1; for 3420 Model 3, 5, and 7 drives	25,840	120.00	916	769
	Model 2; for 3420 Model 3 through 8 drives	34,430	165.00	1,330	1,117
	5310 9-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2)	3,850	1.50	129	108
	6320 7-track NRZI Feature (permits connection of 800-bpi drives to 3803-2; 5310 is prerequisite)	1,890	1.50	64	54
	Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives between up to four 3803 control units):				
	1792 For 2 Tape Controls	7,660	13.00	287	241
	1793 For 3 Tape Controls	9,775	20.50	372	312
	1794 For 4 Tape Controls	11,490	20.50	436	366
	3551 Dual Density Feature (for 3803-1)	2,870	3.50	105	88
	6148 Remote Switch Attachment	1,135	NC	42	35
	6408 7-Track Feature (for 3803-1)	2,870	3.50	105	88
	8100 Two-Channel Switch	5,745	6.50	214	180
8809	Magnetic Tape Unit:				
	Model 1A; first drive; operates in start/stop mode at 20,000 bytes/sec. or in streaming mode at 160,000 bytes/sec. (not in new production)	11,960	82.50	†680	431
	Model 2; second, fourth, or sixth drive; attaches to Model 1A or 3	10,610	74.50	†605	384
	Model 3; third or fifth drive; attaches to Model 2	11,960	82.50	†680	431

*Rental/lease prices include equipment maintenance.

†Effective September 1, 1983 at which time new user may not opt to lease.
NC—No Charge.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
DISKETTE EQUIPMENT					
3540	Diskette Input/Output Unit:				
	Model B1; one drive; 242.9KB	27,520	80.50	1,105	940
	Model B2; two drives	41,910	111.00	1,651	1,405
PUNCHED CARD EQUIPMENT					
1442	Card Read Punch (with control), Model N1; 400/91 cpm	24,040	332.00	1,075	—
2501	Card Reader (with control):				
	Model B1; 600 cpm	19,610	152.00	545	—
	Model B2; 1000 cpm	19,920	166.00	671	—
2520	Card Punch (with control):				
	Model B2; 500 cpm	47,340	638.00	1,700	—
	Model B3; 300 cpm	46,950	509.00	1,310	—
2821	Control Unit:				
	Model 1; one 2540 and one 1403 printer	43,850	118.00	1,675	1,407
	Model 5; for one 2540 and two 1403's	71,050	207.00	2,730	2,293
	Model 6; for one 2540 only	14,920	259.00	770	647
	8100 Two-Channel Switch	9,895	19.50	344	289
	8637 Universal Character Set Adapter	718	6.50	21	18
3505	Card Reader:				
	Model B1; 800 cpm	36,030	267.00	1,185	—
	Model B2; 1200 cpm	37,270	364.00	1,400	—
	5450 Optical Mark Read	10,130	99.00	349	—
	6555 Selective Stacker	2,845	14.00	89	—
	8103 3525 Punch Adapter	6,370	8.00	207	—
	8105 3525 Read/Punch Adapter	7,010	10.00	259	—
	8100 3525 Card Print Control	3,810	10.00	114	—
3525	Card Punch:				
	Model P1; 100 cpm	25,520	173.00	840	—
	Model P2; 200 cpm	26,520	234.00	1,065	—
	Model P3; 300 cpm	27,520	292.00	1,275	—
	1533 Card Read Feature	7,645	43.50	248	—
	1421 Basic Card Print	16,750	172.00	543	—
	5273 Multi-Line Card Print	1,365	50.00	146	—
	8339 Two-Line Card Print	874	7.50	23	—
5424	Multi-Function Card Unit, 96 col.:				
	Model A1; 60 cpm	8.950	312.00	610	—
	Model A2; 120 cpm	11,840	469.00	921	—
	6510 4331 Attachment	2,670	6.50	65	—
PRINTERS					
1403	Printer:				
	Model N1; 1100 lpm; 132 print positions	40,040	687.00	1,555	1,306
	1416 Interchangeable Train Cartridge (required for 1403 N1)	2,930	—	144	—
	4740 Interchangeable Train Cartridge Adapter (for 1403-2 or -7)	2,030	NC	99	83

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PRINTERS (Continued)					
	8640 Universal Character Set Feature (for 1403 N1)	447	4.00	14	12
	8641 Universal Character Set Feature (for 1403-2)	313	4.00	14	12
2821	Control Unit:				
	Model 1; one 2540 card unit and one 1403 printer	43,850	118.00	1,675	1,407
	Model 2; for one 1403	27,190	89.50	1,050	882
	Model 3; for two 1403s	54,270	183.00	2,095	1,760
	Model 5; for one 2540 and two 1403s	71,050	207.00	2,730	2,293
	3615 1100 lpm Printer Adapter (fro 2821; required for 1403 N1)	2,815	3.00	123	103
	7945 Third Printer Control (for 2821 Model 3 or 5)	22,560	15.50	878	738
	8100 Two-Channel Switch	9,895	19.50	344	289
	8637 Universal Character Set Adapter	718	6.50	21	18
3203	Printer, Model 5; 1200 lpm, 132 print positions	33,875	410.00	2,015	1,715
	1416 Interchangeable Train Cartridge (required)	2,930	—	144	—
3211	Printer; 200 lpm, 132 print positions	40,080	890.00	2,610	2,192
	3216 Interchangeable Train Cartridge	11,600	179.00	574	—
	5554 18 Additional Print Positions	2,150	15.50	81	68
3811	Control Unit for 3211 Printer	17,685	115.00	1,150	966
	5553 18 Additional Print Positions	789	5.00	27	23
3262	Line Printer:				
	Model 1; 650 lpm	15,040	180.000	595	506
	Model 5 (attachment to virtual storage processors)	17,000	180.00	823	700
	Model 11; 325 lpm	12,620	132.00	437	372
3268	Model 2	7,500	—	—	—
	5951 0.079-inch char. height	NC	NC	NC	NC
	5950 0.095-inch char. height	NC	NC	NC	NC
	5940 48-char. EBCDIC Set	186	—	—	—
	5944 64-char. EBCDIC Set	186	—	—	—
	5946 64-char. EBCDIC Set (optimized)	186	—	—	—
	5948 96-char. EBCDIC Set	186	—	—	—
	5961 128-char. text EBCDIC (Model 5 only)	—	—	—	—
	5980 48-char. International	—	—	—	—
	5988 96-char. International	—	—	—	—
3287	Serial Printer:				
	Model 1; 80 cps	5,365	37.50	257	219
	Model 2; 120 cps	5,720	46.50	314	267
	Model 1C; 4 colors; 80 cps	5,790	42.50	318	271
	Model 2C; 4 colors; 120 cps	6,145	51.50	374	318
	1120 APL/Text	183	0.50	6	5
	3610 Extended Character Set Adapter	477	3.00	20	17
	3880 Extended Print Buffer	220	0.50	7	6
	4110 Friction Feed Paper Handling	168	0.50	6	5

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PRINTERS (Continued)					
	8330 3271/3272 Attachment for Models 1 and 2	955	2.50	46	39
	8331 3274/3276 Attachment for Models 1 and 2	183	0.50	6	5
	8700 Variable-Width Forms Tractor	168	0.50	6	5
3289	Line Printer, Model 4; 230 to 400 lpm	13,140	161.00	868	739
	5821 48-chr. EBCDIC print belt	160	—	—	—
	5822 64-char. EBCDIC print belt	160	—	—	—
	5823 94-char. EBCDIC print belt	160	—	—	—
3800	Printing Subsystem; up to 20,040 lpm	373,150	938.00	10,693	9,100
	5401 Additional Character Generation Storage	4,475	26.50	114	97
	8170 Two-Channel Switch	9,790	20.50	305	260
	1490 Burster-Trimmer-Stacker	56,280	250.00	1,598	1,360
	7810 Tape to Print Subsystem Feature	12,030	46.50	424	361
4250	Non-impact printer, Model 1; 600 x 600 dots per square inch	21,000	155	1,205	—
OPTICAL AND MAGNETIC READERS					
1255	Magnetic Character Reader:				
	Model 1; 500 dpm, 6 stackers	41,040	375.00	1,405	—
	Model 2; 750 dpm, 6 stackers	46,970	601.00	1,720	—
	Model 3; 750 dpm, 12 stackers	63,960	791.00	2,265	—
	3215 Dash Symbol Transmission (for 1255 or 1419)	35	NC	56	—
	4380 51-Column Card Sorting (for 1255 or 1419)	661	NC	17	—
	4520 High-Order Zero and Bank Selection (for 1255 Model 3 only)	1,515	7.00	50	—
	7060 Self-Checking Numbers (for 1255)	2,465	3.50	82	—
	6360 System/360/370 Adapter (required on 1255)	22,910	55.00	793	—
1287	Optical Reader:				
	Model 1; reads documents only	108,450	1,650	4,580	—
	Model 3; reads documents only	163,550	2,370.00	7,080	—
	Model 5; reads handprinted digits from documents only	120,650	2,395.00	5,760	—
	3945 Farrington 7B Font	968	3.00	40	—
	4470 1428 and ANSCS OCR Font	968	3.00	40	—
	5300 NCR Optical Type Font	3,885	8.50	160	—
	5370 Numeric Handwriting	31,140	103.00	1,300	—
	5479 Optical Mark Reading	3,885	8.00	160	—
1288	Optical Page Reader	198,600	1,700.00	7,475	—
	3850 Expanded Symbol Set	2,710	5.00	113	—
	5370 Numeric Handwriting	46,710	103.00	1,635	—
	5479 Optical Mark Reading	4,575	8.00	160	—
	6550 Serial Numbering (for 1288 or 1287)	11,100	90.00	488	—
1419	Magnetic Character Reader; 1600 dpm	145,950	802.00	3,580	—
	7061 Self-Checking Number, Modulus 10	2,560	4.50	61	—
	7062 Self-Checking Number, Modulus 11	3,950	7.50	100	—
3881	Optical Mark Reader:				
	Model 1; for on-line use	62,420	258.00	2,344	1,995

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
OPTICAL AND MAGNETIC READERS (Continued)					
	Model 2; for off-line use with 3410 Model 1 Magnetic Tape Unit	56,860	205.00	2,127	1,810
	Model 3; on-line use with IBM Diskette Unit	72,800	245.00	2,585	2,200
	1471 BCD Read	2,600	3.50	92	78
	3450 Document Counters	1,030	4.00	29	25
	3550 Dual Density (for Model 2 only)	6,565	2.50	241	205
	3801 Expanded Storage	2,600	2.50	92	78
	6451 Serial Numbering	7,680	46.00	282	240
3886	Optical Character Reader:				
	Model 1; on-line	101,500	536.00	4,060	3,455
	Model 2; off-line	109,200	536.00	4,365	3,715
	3210 Additional Data Storage	1,020	1.00	38	32
	4520 Additional Hopper and Stacker Capacity	8,235	28.00	323	275
	4610 Additional Instruction Storage	5,120	12.00	201	171
	4720 Line Marking	5,680	12.00	219	186
	5340 Numbering/Marking Adapter	1,545	1.00	51	43
	5360 Numeric Handprinting	6,685	32.50	260	221
	6450 Serial Numbering	8,235	28.00	323	275
2890	Document Processor; Model A has 13K bytes, Model B has 29K bytes of memory:				
	Model A1; 6 pockets	280,350	400.00	7,473	6,360
	Model A2; 12 pockets	327,300	481.00	8,666	7,375
	Model A3; 18 pockets	374,250	559.00	9,858	8,390
	Model A4; 24 pockets	421,200	514.00	11,045	9,400
	Model A5; 30 pockets	468,150	714.00	12,244	10,420
	Model A6; 36 pockets	515,100	794.00	13,419	11,420
	Model B1; 6 pockets	328,400	488.00	9,306	7,920
	Model B2; 12 pockets	375,350	569.00	10,487	8,925
	Model B3; 18 pockets	422,300	645.00	11,680	9,940
	Model B4; 24 pockets	469,250	726.00	12,878	10,960
	Model B5; 30 pockets	516,200	803.00	14,053	11,960
	Model B6; 36 pockets	563,150	880.00	15,252	12,980
SYSTEM MANAGEMENT					
3814	Switching Management System (requires one Model A):				
	Model A1; Cotroller; 4x4 switch	47,480	124.00	2,138	1,710
	Model A2; Controller; 4x8 switch	60,420	161.00	2,719	2,175
	Model A3; Controller; 8x4 switch	64,740	158.00	2,919	2,335
	Model A4; Controller; two 4x4 switches	69,570	173.00	3,138	2,510
	Model B1; Remote Unit; 4x4 switch	39,710	84.00	1,788	1,430
	Model B2; Remote Unit; 4x8 switch	52,660	122.00	2,369	1,895
	Model B3; Remote Unit; 8x4 switch	56,970	118.00	2,569	2,055
	Model B4; Remote Unit; two 4x4 switches	61,800	133.00	2,781	2,225
	Model C1; Expansion Unit; 4x4 switch	37,980	81.00	1,706	1,365
	Model C2; Expansion Unit; 4x8 switch	50,930	119.00	2,288	1,830
	Model C3; Expansion Unit; 8x4 switch	55,240	115.00	2,488	1,990
	Model C4; Expansion Unit; two 4x4 switches	60,070	130.00	2,706	2,165
	3604 Keyboard/Display, Model 6, one required	1,745	12.50	—	83
	1520 Channel Expansion Internal—4 Control Unit Interfaces	1,550	1.00	70	56
	1521 Channel Expansion Internal—8 Control Unit Interfaces	3,100	1.00	138	110
	1530 Channel Expansion External	5,350	1.00	221	177
	1810 Control Unit Power Sequencing	518	1.00	21	17

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
SYSTEM MANAGEMENT (Continued)					
	6010 Remote Two-Channel Switch Control—Basic	5,180	17.00	231	185
	6011 Remote Two-Channel Switch Control—Additional	2,415	13.00	109	87
	6350 System Power Sequencing—Additional	207	—	8	6
DISPLAY AND DATA ENTRY TERMINALS					
A number of IBM terminals can be connected to a 4300 system in local or remote configurations. For details and prices please refer to Reports 70D1–491–45, 70D2–491–11, 70D3–491–46, and 70D4–491–43 in Volume 2 of DATAPRO 70.					
COMMUNICATIONS EQUIPMENT					
For the 4331 Model Group 2, 4331 Model Group 11, 4321 Model J11					
	1020 Autocall Unit Interface	330	3.50	15	13
	1601 Communications Adapter, base	2,330	3.00	123	105
	3701 EIA/CCITT Interface	330	3.50	15	13
	4695 Line Attachment Base; for clocked modems	330	2.00	15	13
	4696 Line Attachment Base; for non-clocked modems	390	2.00	19	16
	4720 High-Speed Modem Adapter	1,000	3.50	45	38
	4781 1200-bps Integrated Modem; non-switched	505	5.00	25	21
	4782 1200-bps Integrated Modem; switched, with auto-answer	650	5.00	34	29
	4787 1200-bps Integrated Modem; non-switched, with switch network backup and manual answer	690	5.00	35	30
	4788 1200-bps Integrated Modem; non-switched, with switch network backup and auto-answer	765	5.50	39	33
	4801 Local Attachment Interface	830	4.50	39	33
	5650 Digital Data Service Adapter	750	4.00	32	27
	3863 2400-bps Modem:				
	Model 1; non-switched	2,685	14.00	96	82
	Model 2; switched	2,935	16.50	103	88
	3864 4800-bps Modem:				
	Model 1; non-switched	4,410	22.00	166	141
	Model 2; switched	4,660	23.00	176	150
	3865 9600-bps Modem; non-switched	6,690	32.00	264	225
	4830 Loop Adapter 1; requires Adapter Power Prerequisite; cannot be installed with 5424 Adapter	8,065	48.50	524	446
	4831 Loop Adapter 2; requires 4830	1,630	25.00	98	83
	4840 Data Link Adapter; requires 4830	1,000	11.50	61	52
	3843 Loop Control Unit	5,625	28.00	195	166
7770	Audio Response Unit, Model 3 (up to 4 lines)	58,760	96.00	2,010	—
	4677 I/O Line Expander (up to 4 more lines)	8,575	30.00	294	—
	4679 I/O Line Panel (one required for each 8 lines beyond the first 8)	3,660	3.50	125	—
	4668 I/O Line Frame (required for over 16 lines)	9,790	4.00	336	—
	8721 16 Additional Vocabulary Words	4,890	4.00	166	—
3705-II	Communication Controller: For detailed pricing see Report 70C–491–06 (303X Series)				
3725	Communication Controller:				
	Model 1; up to six channel adpaters and from 512K to 1024K bytes of main storage capacity	75,000	213	3,260	—
	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	190	2,630	—
	1561 Channel Adapter	6,750	8	295	—
	4666 Internal Clock Control	1,500	2	65	—
	4771 LAB Type A	19,000	16	825	—

*Rental/lease prices include equipment maintenance.

IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
COMMUNICATIONS EQUIPMENT (Continued)					
	4772 LAB Type B	26,400	27	1,150	—
	4911 LIC Type 1	2,600	2	115	—
	4921 LIC Type 2	3,000	2	130	—
	4931 LIC Type 3	3,000	2	130	—
	4941 LIC Type 4A	2,600	2	115	—
	4942 LIC Type 4B	3,000	2	130	—
	7100 Storage Increment 256K	4,375	19	190	—
	8320 Two Proc Switch	4,000	3	175	—
3726	Communication Controller Expansion	32,000	40	1,390	—
3727	Operator Console	2,390	27	160	—

*Rental/lease prices include equipment maintenance.

SOFTWARE PRICES

		Monthly Charge			
		Basic License Charge	DSLO Charge	Monthly Licensed Program Support Charge	Monthly Multiple Licensed Program Support Charge
5666-265	SSX/VSE*	$1,150	$862	$105	$168
5666-274	SSX/VSE RPG II	114	86	7	11
5666-276	SSX/VSE PL/1 Optimizing Compiler and Library	281	211	50	80
5666-277	SSX/VSE PL/1 Transient Library	28	20	7	11
5666-275	DL/1 SSX/VSE	372	279	118	189
5668-981	X.25 Packet Switching Interface	190	112	36	58
5735-RC2	ACF/VTAM, OS/VS	322	241	50	80
	Networking Feature	773	579	127	203
5746-RC3	ACF/VTAM, DOS/VSE	134	100	50	80
	Networking Feature	254	190	127	203
5735-RC3	ACF/TCAM Version 2, OS/VS	615	461	83	132
	Networking Feature	1,035	776	88	141
5735-XX1	ACF/NCP/VS	180	135	32	51
5735-XX7	Network Terminal Option	146	109	11	18
5746-XE8	VSE/Advanced Functions, Releases 1 and 2	180	135	56	90
5746-RC7	Advanced Communications Function for VTAM Entry (ACF/VTAME)	131	98	71	113
5746-TS1	VSE/Interactive Computing and Control Facility	97	72	26	42
5746-XE3	VSE/POWER Releases 1 and 2	51	38	15	24
5666-273	VSE/POWER Version 2	300	225	22	35
5746-TC9	DOS/VSE Remote Job Entry Workstation	103	—	—	—
5746-AM5	VSE/3270 Bisync Pass Through	159	—	—	—
5746-AM2	VSE/VSAM Releases 1 and 22	55	41	22	35
	VSE/VSAM Space Management for SAM feature	32	24	7	11
5746-AM4	VSE/Fast Copy Data Set Program	417	—	—	—
5746-UT3	VSE/Data Interfile Transfer, Testing and Operations Utility (VSE/DITTO)	36	27	5	8
5746-XE7	VSE/Access Control—Logging and Reporting	48	36	21	34
5746-SA1	VSE/Interactive Problem Control System	31	23	6	10
5746-RC5	Basic Telecommunications Access Method Extended Support	32	24	7	11
5746-SU1	IBM Systems 1401/1440/1460 Emulator	133	99	5	8
5746-LM3	DOS FORTRAN IV Library Option I	38	28	7	11
5746-CB1	DOS/VS Cobol Compiler and Library	157	117	14	22
5746-LM4	DOS/VS Cobol Library	29	21	7	11

*One-time license charge of $20,000 (Basic License) or $15,000 (DSLO) is also available

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SOFTWARE PRICES

		Monthly Charge			
		Basic License Charge	DSLO Charge	Monthly Licensed Program Support Charge	Monthly Multiple Licensed Program Support Charge
5736-PL1	DOS PL/1 Optimizing Compiler	235	176	37	59
5736-LM4	DOS PL/1 Resident Library	55	41	7	11
5736-LM5	DOS PL/1 Transient Library	32	24	7	11
5736-PL3	DOS PL/1 Optimizing Compiler and Library	322	241	50	80
5746-RG1	DOS/VS RPG II	131	98	71	11
5746-SM2	DOS/VS Sort/Merge (Version 2)	128	90	13	21
5746-XX1	DL/1 DOS/VS (Version 1)	372	279	128	205
5748-XXJ	SQL/Data System	345	258	123	196
5748-XX8	VM/Basic System Extensions	136	102	39	62
5748-XE1	VM/System Extensions	1,345	1,005	173	277
5664-167	VM/System Product	330	247	59	94
5748-XP1	Remote Spooling Communications Subsystem (RSCS) Networking	84	63	33	53
5748-XXC	VM/Interactive File Sharing	40	25	12	19
5748-XXB	Display Management System/CMS	30	22	9	14
5748-XE4	VM/Directory Maintenance	98	73	27	43
5748-XT3	VM/CMS-3270 Display Support and Structured Programming Facility	419	—	—	—
5748-SA1	VM/Interactive Problem Control System Extension	41	30	6	10
5748-MS1	Interactive Productivity Facility	41	30	6	10
5748-RC1	VM/Pass-Through Facility	139	104	77	122
5746-XX3	CICS/VS/DOS	450	331	116	186
5740-XX1	CICS/OS/VS	1,425	589	116	186
5740-XC5	Development Management System/CICS/VS-OS	269	290	40	64
5746-XC4	Development Management System/CICS/VS-DOS	139	104	48	77
5740-XXF	DB/DC Data Dictionary for OS/VS	805	603	99	157
5746-XXC	DB/DC Data Directory for DOS/VS	366	274	78	124
5662-257	OS/VS1 Basic Programming Extension	189	141	41	66
5740-XYW	OS/VS1 Job Networking Facility	200	—	—	—
5740-XE1	MVS/System Extension	1,700	1,275	100	159
5740-XYS	MVS/SP-JES2 Release 1	1,700	1,375	85	136
	Release 2 or 3	1,715	1,285	175	280
5740-XYN	MVS/SP-JES3 Release 1	1,700	1,275	100	160
	Release 2 or 3	1,880	1,410	375	600
5665-288	MVS Operator Communication Control Facility	300	225	8	13
5740-XY4	RMF Version 2, Release 4	380	285	15	24
5740-XR8	JES2 NJE	693	519	84	134
5799-AZT	JES3 NJE	1,535	1,150	305	488
5740-XRB	MVS Hierarchical Storage Manager, Release 3	420	315	110	176
5748-FO3	VS Fortran Compiler and Library	212	159	17	27
5748-LM3	VS Fortran Library	63	47	7	11
5748-AP1	VS APL Release 4	305	228	39	62
5734-PL3	OS PL/1 Compiler and Library	339	254	50	80
5734-PL1	OS PL/1 Compiler	252	189	37	59
5734-LM4	OS PL/1 Resident Library	55	41	7	11
5734-LM5	OS PL/1 Transient Library	32	24	7	11
5740-SM1	OS/VS Sort/Merge Release 5	231	173	18	29
5740-CB1	OS/VS Cobol Compiler and Library	311	233	14	22
5740-LM1	OS/VS Cobol Library	101	75	7	11
5740-AM6	Data Facility/Device Support Release 1 (OS/VS1)	66	49	22	35
5740-UT3	Data Facility/Data Set Services Release 1 (OS/VS1 and MVS)	67	50	21	34
5740-XYQ	Data Facility/Extended Function (MVS)	103	77	50	80
5740-AM7	Data Facility/Device Support (MVS)	70	52	14	22
5668-002	Direct Access Storage Device Migration Aid Release 1 (OS/VS1 and MVS)	1,150	—	—	—

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SOFTWARE PRICES

	Monthly Program Support Charge	Monthly Multiple Program Support Charge
CHARGES FOR LOCAL PROGRAMMING SUPPORT		
For Class 1 SCP on 4321	$180	288
For Class 1 SCP on 4331 Model Group 11:		
Category A (DOS/VSE, OS/VS1 Release 7, VM/370 Release 6)	213	340
For Class 1 SCP on 4331 Model Group 2:		
Category A	258	412
For Class 1 SCP on 4341 Model Group 10:		
Category A	459	734
Category B (all SCP's in Category A, MVS Release 3.8, MVS corequisite SCP's)	646	1,030
For Class 1 SCP on 4341 Model Group 11:		
Category A	529	846
Category B	1,130	1,220
For Class 1 SCP on 4341 Model Group 2:		
Category A	902	974
Category B	1,290	1,390
For Class 1 SCP on 4341 Model Group 9:		
Category A	432	465
Category B	776	836
For Class 1 SCP on 4341 Model Group 12		
Category A	984	1,060
Category B	1,400	1,510 ■