IBM System/32

MANAGEMENT SUMMARY

The System/32 has enjoyed great success during the first three years of its life, and IBM has continued to enhance the product line with new models and improved software capabilities. Industry estimates already put the number of installed System/32's at well over 10,000.

Following the announcement of the System/32 in January 1975, it was no longer merely "nice" or "clever" for a small business data processing system to be disk-based, oriented toward CRT data entry, and available at a rental price of around $1,000 a month (or the equivalent purchase price of about $40,000)—it was virtually mandatory. During the period following the introduction of the IBM System/32, the industry has been inundated with small business systems from major computer manufacturers, from numerous minicomputer makers, and from system builders who put together packages of hardware and software for specialized markets, Competition in this marketplace has become so intense that the $1,000 rental and $40,000 purchase prices have been lowered by a number of vendors, including IBM.

One of the initial advantages the competition had over the System/32 was larger disk capacity. This permitted larger files, longer job queues, and the capability to accommodate multiple simultaneous users. In January 1976, IBM offered a partial response with new models of the System/32 that provide an increased disk capacity—although removable-cartridge disk units still remain the province of the independents. The System/32's disk capacity was increased from a maximum of 9.1 megabytes to 13.7 megabytes, still implemented in the form of a nonremovable disk unit. Diskette I/O capability is a standard feature of the System/32, but the diskette's comparatively low storage capacity and data transfer rate ➢

IBM's highly successful entry-level business computer system is now available in a choice of 32 models ranging in price from $33,560 to $50,410. The basic package includes 16K bytes of main memory, a non-removable moving-head disk drive, a diskette drive, a serial matrix or line printer, and a keyboard and display unit. Unbundled software includes three programming languages, numerous program products for specialized functions, and a variety of modularized industry application programs (IAP's).

CHARACTERISTICS

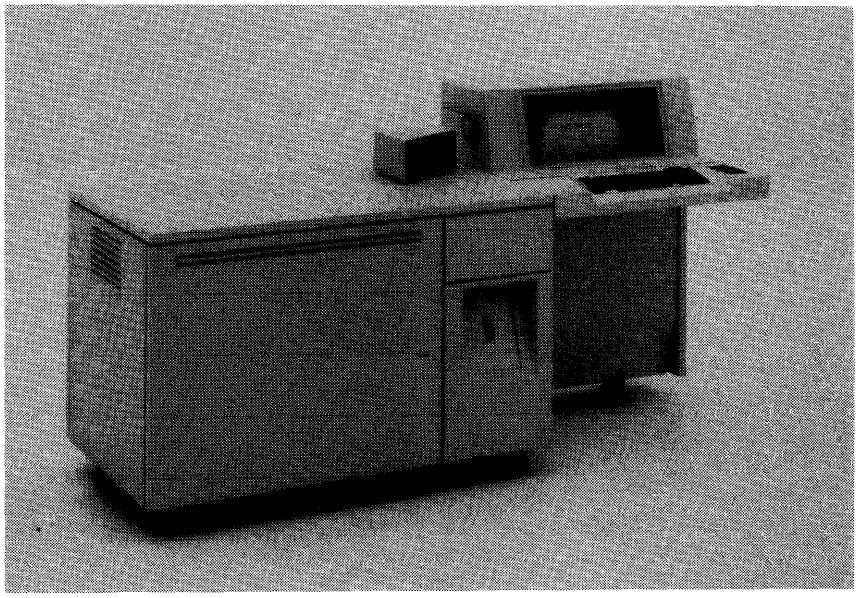
MANUFACTURER: International Business Machines Corporation, General Systems Division, 875 Johnson Ferry Road N.E., Atlanta, Georgia 30342. Telephone (404) 231-3000.

MODEL: System/32.

DATE ANNOUNCED: Submodels A12, A13, A22, A23, B12, B13, B22, B23, B32, and B33—January 1975; Submodels A14, A24, B14, B24, and B34—January 1976; Submodels A01, A02, A03, A04, A11, A21, B11, B21, and B31—November 1976; Submodels A31, A32, A33, A34, C41, C42, C43, and C44—September 1976.

DATE OF FIRST DELIVERY: Submodels B12, B22, and B32—February 1975; Submodels A12, A13, A22, and A23—May 1975; Submodels A14, A24, B14, B24, and B34—March 1976; Submodels A01, A02, A03, A04, A11, A21, B11, B21, and B31—November 1976; Submodels A31, A32, A33, A34, C41, C42, C43, and C44—May 1977.

NUMBER INSTALLED TO DATE: Over 10,500 as of April 1977; production through April 1978 is estimated to be an additional 8,000 units. ➢



The highly integrated System/32 is a compact unit in a desk-sized cabinet. The appearance varies slightly from model to model, depending on the printer configured. The user has a choice of serial printers rated at 40, 80, or 120 cps and line printers rated at 50, 100, 155, or 285 lpm. Fixed-disk capacity can be 3.2, 5.0, 9.1, or 13.7 megabytes.

IBM System/32

mean that it is properly considered an input/output medium rather than a mass storage facility.

The absence of removable-cartridge disk storage has two important ramifications. First, the system's file storage capacity is effectively limited to the amount of information that can be stored on-line. Secondly, disk dumps to create back-up files for efficient restart procedures in case of catastrophe are not available to the user.

The amount of disk storage available—3.2, 5.0, 9.1, or 13.7 megabytes—is quite adequate for many small businesses. However, it precludes the system from doing double duty by loading a separate set of files (i.e., disk cartridges) for processing other applications. Most small businesses are probably not geared to doing this anyway, but it does impose a limitation on the system's ability to grow.

The ability to create a backup file has long been recognized as a valuable technique to protect a data processing center in case of major system failure or other catastrophe. But the technique has frequently not been practiced, particularly in small installations where the incremental cost in additional equipment and processor time would form a substantial portion of the total monthly system costs. As a result, back-up files are often regarded as unaffordable luxuries. They shouldn't be. At 256K bytes per diskette, dumping a full 13.7-megabyte disk to diskettes would fill up more than 50 diskettes. While practical for retaining transaction data, the diskettes do not really provide a satisfactory back-up for the internal disk.

The other half of IBM's January 1976 announcement included 80- and 96-column card I/O for the System/32. This does not mean that IBM is having second thoughts about "cardless" systems, because a parallel announcement introduced IBM's first new data collection system in many years. The 5230 Data Collection System is intended for use in an office or factory environment to collect data such as time, attendance, work flow, etc. The output from the 5230 can be to diskettes, 80- or 96-column cards, or a data communications link. A new applications program allows the System/32 to process data collected by a 5230 system.

In June 1976, IBM introduced nine new System/32 models, several new peripheral devices, and a host of software releases covering new application areas. These products included a smaller-capacity, 3.2-megabyte disk drive; a slower, 40-cps unidirectional serial printer; a stand-alone ink jet document printer; a magnetic card reader/recorder; software that permits the System/32 to be used as a word processing system; and several new Industry Application Programs (IAP's).

In September 1976, IBM added eight more models to the System/32 product line, including four models offering

DATA FORMATS

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

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

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

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

In the one-address format, the Q-byte may contain an immediate operand, a mask, a branch condition, or a mode selection. In the two-address format, the Q-byte designates the address length or contains a fixed hexadecimal value. In a command machine instruction, the Q-byte contains a device address and function specification, a jump condition, or a transfer function.

The operation code of all System/32 instructions is divided into three fields composed of either two or four bits. Bits zero and one specify operand one main storage addressing activity for the instruction; bits two and three function similarly for operand two. Bits four through seven define the type of operation to be performed.

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

MAIN STORAGE

TYPE: MOSFET (metal oxide semiconductor field effect transistor) integrated circuits.

CYCLE TIME: 600 nanoseconds per 1-byte access.

CAPACITY: 16,384 bytes standard in all models; expandable to 24,576 or 32,768 bytes through installation of one or two 8K Additional Storage modules.

CHECKING: A parity bit with each byte, generated during writing and checked during reading.

STORAGE PROTECTION: None.

RESERVED STORAGE: 2K bytes are reserved for SCP (System Control Programming) functions in all models; the remainder of main storage is available for user programming.

CENTRAL PROCESSOR

The System/32 central processing unit is a microprocessor that uses bipolar logic circuits and is physically located on a swing-open gate in the lower left front portion of the cabinet.

The CPU is identical in all submodels. The submodels all have certain integral peripheral units built into the processor housing. These include a printing unit, a keyboard, a single-platter removable disk unit, a diskette unit, and a CRT display. The differences among the various submodels center on the capacity of the nonremovable disk unit and the type and speed of the printer.

The System/32 processor can operate in burst, interrupt, or process modes. The burst mode provides a dedicated data path between main storage and disk. Interrupt mode occurs at the end of most I/O operations, while the processor is

IBM System/32

120-cps serial printers and four offering 285-lpm line printers. This announcement also added IBM's 1255 Magnetic Character Reader to the list of System/32 peripheral equipment—an important consideration for customers in the banking industry.

Designed and marketed by IBM's General Systems Division, the System/32 can be rented for a little more than $700 per month and is aimed at the vast number of potential first-time computer users. IBM defines the typical System/32 prospect as a business with sales in the range of $1 million to $10 million and up to 250 employees. IBM has predicted that the System/32 will be the biggest-selling computer ever announced—and that the system's impressive capabilities and modest price tag, coupled with its IBM nameplate and its sales record to date, make it difficult to refute that prediction.

The System/32 can be programmed to perform either interactive or batch-mode data processing. Data can be entered either through the on-line operator keyboard or via diskettes prepared on an off-line 3740 Data Entry System. Optional communications adapters enable the System/32 to operate as a remote terminal or as a satellite processor within a communications network including larger IBM computers.

The System/32 is packaged in a compact, desk-sized cabinet that includes all the components of the basic system—the central processing unit, memory, keyboard, CRT display, printer, disk storage unit, and diskette drive. It requires no special flooring, air conditioning, or power supplies, and can be plugged into a 208/230-volt electrical outlet right in the office. Since the computer is no longer sheltered in a computer-room environment, security from unauthorized access is provided by an optional keylock for turning on the system.

Thirty-two models of the System/32 are now available; they are distinguished by their various printing capabilities and disk storage capacities. The basic System/32 consists of a central processing unit with 16K bytes of metal oxide semiconductor (MOS) main memory, 3.2 million bytes of nonremovable disk storage, a printer, keyboard console, CRT display screen, and single diskette I/O drive. Main memory for all central processor models can be increased to a maximum of 32K bytes, in 8K increments.

The System/32 customer can select a unidirectional serial printer with a print speed of 40 cps, a bidirectional serial printer with a print speed of 40, 80, or 120 characters per second, or one of four 132-position line printers with a speed of 50, 100, 155, or 285 lines per minute. The serial printers can be used to produce output on ledger cards or other individual forms similar to those processed by typewriters. At present, however, the System/32 lacks the split platens, single-form feed chutes, magnetic-stripe readers, and other flexible forms-handling facilities offered by many of the competitive small accounting computers. Only one printer can be used in a System/32 configuration.

executing the interrupt routine. At other times when the machine is in operation, it is in the process mode.

CONTROL STORAGE: The microprograms that control the processor's operations are stored in 4K 16-bit words of MOSFET writable control storage.

REGISTERS: Index Registers 1 and 2 (XR1 and XR2) are each two bytes long and are used to hold a base address for base-displacement addressing. The Instruction Address register (IAR) is a two-byte register whose purpose is to hold the address of the first byte of the next sequential instruction. The Address Recall Register (AAR) functions to hold the return address whenever a program branches to a subroutine following a test and branch or branch on condition instruction. The ARR is two bytes long.

ADDRESSING: The System/32 has two 16-bit index registers. The contents of either register can be added to a one-byte address (or "displacement") contained in an instruction, permitting base-plus-displacement addressing of any higher storage location within 256 bytes of the base address contained in the register. Two-byte direct addresses may also be used.

INSTRUCTION REPERTOIRE: The System/32 has a repertoire of 158 basic operation codes used for functions, including addition and subtraction of unpacked (1 digit per byte) decimal operands, but no multiply or divide. Also included are an edit instruction and addition, subtraction, and comparison of logical characters. Eleven operation codes are used for input/output processing. Aside from I/O instructions, there are six arithmetic, 11 data handling, one no-operation, one supervisor call, four logical, one branch, one transfer, and one jump instruction.

There are about 300 instructions implemented on the System/32, built around the 158 operation codes presently being utilized. Included in this large instruction set is the scientific set, required if the user implements FORTRAN IV.

INSTRUCTION TIMINGS: The following average times, in microseconds, assume the use of direct (2-byte) operand addresses.

Decimal add (5 digits)	150.8
Decimal subtract (5 digits):	150.8
Binary (logical) add (5 bytes):	72.0
Binary (logical) subtract (5 bytes):	71.4
Move (5 bytes):	42.6
Compare (5 bytes):	56.2
Load or store register (2 bytes):	19.8 to 25.2
Add to register (2 bytes):	26.2 to 38.2
Jump or condition:	26.2 to 28.8

INTERRUPTS: At the end of most I/O operations, the microprocessor issues a signal that the operation has ended and causes the program to branch to a special interrupt handler routine. Interrupts for the disk drive and printer are handled entirely by the hardware, while programs must be provided to handle the keyboard, BSCA, and SDLC interrupts.

PHYSICAL SPECIFICATIONS: The 5320 System Unit, a single desk-size cabinet that houses all components of the System/32, is 70 inches wide, 27 inches deep, and 38 inches high. It weighs 640 pounds.

Power requirements are 208 or 230 VAC ±10 percent, 60 Hertz ±0.5 Hertz in the U.S.; 100, 110, 123.5, 200, 220, or 235 VAC ±10 percent, 50 Hertz ±0.5 in Europe; and 100 or 200 VAC ±10 percent, 60 Hertz ±0.5 Hertz in Japan. The system power requirement is 1.0 KVA, and the permissible operating environment is from 60° to 100° F. and from 8% to 80%

IBM System/32

Nonremovable disk storage is provided in a capacity of either 3.2 million, 5 million, or 13.7 million bytes. Off-line and back-up storage for additional data is provided by IBM diskettes (or "floppy disks"), which are priced at $8 each and have a capacity of up to 246,272 bytes of data in the standard System/32 format or 303,104 bytes in a special "extended" format. The diskette also serves as one of the principal vehicles for data entry, and has a capacity of 242,944 bytes when data is recorded off-line using an IBM 3740 Data Entry System. Magnetic tape capabilities, however, are noticeably absent from the System/32 product line.

The central processor utilizes bipolar logic and features an 8K-byte MOSFET writable control storage unit to contain the microcode that controls the operation of the system. Data is represented in 8-bit bytes in EBCDIC format. IBM specifies that the average internal (micro-level) machine instruction time is 1 microsecond. Program instruction execution times, hence, are considerably slower than those of the System/3, with a decimal add of 5 digits requiring approximately 150 microseconds on a System/32 as compared to approximately 24 microseconds on a System/3 central processor. Other noteworthy performance parameters of the System/32 include the ability to overlap input/output processing with internal processing (except for diskette operations), a transfer rate of 889,000 bytes per second between the disk file and main memory, and a 600-nanosecond main memory cycle time.

A System/32 can be equipped with only one communication line at present, enabling it to handle half-duplex data transmission in either the binary synchronous (BSC) mode or IBM's new Synchronous Data Link Control (SDLC) protocol. In the binary synchronous mode, it can communicate with another System/32, a System/3, a System/7, a System/360, a System/370, a 5320 Model 2 Data Collection System, a 3747 Data Converter, a 3741 Model 2 Data Station, or a 3741 Model 4 Programmable Work Station. The SDLC line discipline is a fundamental component of IBM's System Network Architecture for future communications products. Thus, System/32 users can expect to be compatible with the present and future IBM communications offerings. SDLC on the System/32 enables it to perform as a remote workstation to larger System/370 computers operating under the DOS/VS, OS/VS1, or OS/VS2 operating system.

An enhancement that allows a System/32 to appear as an IBM 3770 Data Communications System and to operate with IBM's CICS/VS communications monitor or IMS/VS data base management system on a System/370 was announced in June 1975.

The System/32 incorporates design concepts and components that are aimed at providing a high degree of reliability. In contrast to the other computers in its product line, IBM claims that the System/32 requires no regular preventive maintenance. Diagnostics supplied with the system are executed each time the system is initialized and can isolate most central processor mal-

relative humidity. Hence, air conditioning is not required for the system except in extreme operating environments, but IBM recommends normal office air conditioning for operator comfort. The system dissipates between 2000 BTU's (Model A) and 2750 BTU's (Model C) of heat per hour. Service area and general machine requirements indicate the need for a floor area of 10.3 feet by 7.2 feet.

INPUT/OUTPUT CONTROL

SIMULTANEOUS OPERATIONS: All System/32 input and output operations are overlapped with each other and with internal processing, except for diskette reading and writing.

CONFIGURATION RULES

Every System/32 is a "packaged" configuration consisting of a single desk-size cabinet that houses the central processing unit, main storage, fixed-disk storage unit, diskette drive, serial or line printer, keyboard console, and display screen. The 32 current models of the System/32 are distinguished by their printing capabilities and disk storage capacities, as shown in the following matrix:

	Disk Storage, megabytes			
Printer	3.2	5.0	9.1	13.7
40 cps, unidirectional	A01	A02	A03	A04
40 cps, bidirectional	A11	A12	A13	A14
80 cps, bidirectional	A21	A22	A23	A24
120 cps, bidirectional	A31	A32	A33	A34
50 lpm	B11	B12	B13	B14
100 lpm	B21	B22	B23	B24
155 lpm	B31	B32	B33	B34
285 lpm	C41	C42	C43	C44

All models have a basic main storage capacity of 16K bytes, which can be expanded to 24K or 32K bytes, and all models can be equipped for data communications by installing either the SDLC or BSCA feature, as described under COMMUNICATIONS CONTROL. Changes from one model to another can be made in the field. Only one input/output unit of each type can be used in a System/32.

MASS STORAGE

DISK STORAGE: A disk unit containing either 3,210,240, 5,053,440, 9,169,920, or 13,777,920 bytes of nonremovable disk storage is an integral component of every System/32. The disk unit consists of either 104, 164, or 298 cylinders of 2 tracks each or 299 cylinders of 3 tracks each. Each track, in turn, contains 60 sectors of 256 bytes each.

All data is recorded on one side of a single fixed disk that is served by two read/write heads mounted on a pivoting access arm. The disk is mounted vertically on the lower left part of the System/32 cabinet, behind the CPU logic and main memory.

The disk rotational speed is 2964 rpm, yielding a nominal data transfer rate of 889,000 bytes per second and an average rotational delay (latency) of 10.1 milliseconds. Head positioning times for the four models, in milliseconds, are as follows:

	Average	Minimum	Maximum
3.2-megabyte unit:	50.4	13	121
5.0-megabyte unit:	70	13	180
9.1-megabyte unit:	72.5	14.2	166.9
13.7-megabyte unit:	72.5	14.2	166.9

INPUT/OUTPUT UNITS

DISKETTE DRIVE: A single drive unit that reads and writes data on flexible diskettes is an integral component of every

IBM System/32

functions to an easily replaceable circuit board. The System/32 disk file incorporates a new arm movement technique designed to prolong its operation. The entire disk file is packaged in an airtight module to eliminate errors or malfunctions resulting from dust; in the event of a disk failure, the entire module can be removed and replaced by a new one with a minimum of time and effort. System/32 customers who rent the equipment have access to 24-hours-per-day, 7-days-per-week on-call maintenance service from IBM. Customers who purchase the system receive 5-days-per-week, 9-hours-per-day maintenance service under the Minimum Monthly Maintenance Charge, or they can elect round-the-clock service for an additional charge.

With the System/32 announcement, IBM also unveiled a Term Availability Plan (TAP) that offers a saving of approximately 9% in first-year monthly rental charges to customers who select a three-year lease contract. The three-year lease represents a departure in IBM pricing policy in that IBM reserves the right to increase the monthly charges by up to 5% during both the second and third years of the lease term.

IBM claims the System/32 is so easy to use that it can be operated by clerical personnel with a minimum of training and will not require the service of a programming staff. To make that possible, IBM is supplying separately priced Industry Application Programs that contain all the coding necessary to get a user installation up and running, plus operator run books and training materials to aid the operator in understanding the functions of each application package. Fourteen such packages are currently available, aimed at users in a multitude of distributor industries, schools, hospitals, manufacturers and fabricators, medical group practices, small accounting firms, and membership organizations and associations. The IAP's include routines to perform billing, order entry, invoicing, accounts receivable, and payroll, plus additional functions such as inventory control, job costing, membership mailing lists, etc., that are unique to each industry area. Many of the IAP's are modular, allowing combinations of modules from various IAP's to be used together. All of the currently available IAP's can be used on a System/32 configuration with 16K to 24K bytes of main memory.

The flurry of IBM announcements in June 1976 included a letter-writing IAP, a Word Processor/32 program product, several new peripherals mentioned earlier (including the magnetic card reader/recorder and stand-alone ink jet printer), and options that allow upper and lower case printing/display and half-space printing. These announcements, when combined with an enhanced System Control Program (SCP), provide the capability to automatically generate, revise, and format documents. Input can be provided from the keyboard or via prerecorded magnetic cards or diskettes.

While it would seem difficult to justify a System/32 for use only as a word processing system, the package should

System/32. The IBM diskette (or "floppy disk") is a small, flexible, reusable magnetic disk that is permanently enclosed in a protective jacket about eight inches square and a fraction of an inch thick. The data capacity of each diskette is 242,944 bytes (1898 records of 128 bytes each) when used to exchange data between a System/32 and a 3740 Data Entry System or other IBM equipment. Diskettes to be used exclusively with a System/32 can contain up to 246,272 bytes of data in the standard format (128-byte sectors) or 303,104 bytes in "extended" format (512-byte sectors).

Data is read from or written on a diskette at a nominal speed of 31,250 bytes per second. Diskette records can be read at the rate of up to 3400 128-byte records per minute and written and verified at up to 1800 128-byte records per minute.

KEYBOARD: The System/32 keyboard is used by the operator to enter data and control the system's functions. It consists of a standard typewriter keygroup, a 10-key numeric keygroup arranged in adding-machine fashion, and a group of function keys. In addition, the typewriter keys in the top row are dual-defined, providing a total of 24 command keys for controlling program functions.

A small operator panel, located at the right of the keyboard, contains the power on/off switch; LOAD, START, and STOP keys; and indicator lights that signify Keyboard Ready, Processor Check, Thermal Check, and Power Check conditions. The power on/off switch can be replaced by an optional key-operated switch that protects against unauthorized use of the system.

A dual-case keyboard and display is available as an option on all B and C models. This feature provides upper and lower case characters and additional graphics, as well as redefining the character/graphic arrangement of the System/32 keyboard. The ASCII keyboard character set and the integral line printer with 6 or 8 lines per inch spacing are mutually exclusive with this feature.

DISPLAY: A small CRT display screen, located just to the left of the keyboard and printer, is an integral component of every System/32. It can display up to 240 characters of information in 6 lines of 40 characters each. The display is used to provide operator guidance, input verification, and auxiliary output under program control. The System/32 will normally be programmed to display all data entered via the keyboard so that the operator can verify its accuracy before the system acts upon it.

SERIAL PRINTER: A serial matrix printer is an integral component of every System/32 Model A. Four different serial printers are currently available: a unidirectional model rated at 40 characters per second, and three bidirectional models rated at 40, 80, and 120 characters per second. Matrix characters are formed by 8 wires arranged in a vertical array, with each wire printing dots in up to 4 of 7 possible horizontal positions. The character set consists of 64 ASCII or EBCDIC symbols, and there are 132 print positions, spaced 10 to the inch. Vertical spacing is 6 lines per inch. A variable-width forms tractor feeds continuous forms ranging from 3½ to 14⅞ inches in width. Forms with up to 6 parts and a maximum thickness of 0.018 inch can be handled. Ledger cards and other precut forms can be processed singly in typewriter fashion.

LINE PRINTER: A horizontal-belt line printer is an integral component of every System/32 Model B or C. The rated printing speed, in lines per minute, depends upon the specific model and character set chosen, as follows:

	Character Set		
	48	64	96
Models B11, B12, B13, B14	50	50	50
Models B21, B22, B23, B24	100	100	80

IBM System/32

sell well as a combination data and word processing system. The overall capabilities of the System/32 for word processing are comparable with those of most other CRT-based intelligent units. One of IBM's significant advantages is its ability to read and write batches of magnetic cards in a format compatible with that of the IBM Magnetic Card Selectric Typewriters.

Operating system support for the System/32 is supplied by a small, 2K-byte System Control Program (SCP) plus a separately priced utility program product that includes a Sort Utility, a Data File Utility, and a Source Entry Utility. The SCP and Sort utility capabilities are similar to those for the System/3 Model 6. For those users who wish to write their own programs, RPG II, the first and by far the most widely used of the three programming languages now available for the System/32, also provides processing capabilities similar to those of the System/3 Model 6 version, including the Auto Report and RPG II Telecommunications Feature. The other available languages are an assembler with macro capabilities and a FORTRAN IV compiler, announced in May 1976 and January 1977, respectively. Both these languages offer the potential user greater programming latitude and expanded application possibilities. The System/32 SCP was significantly enhanced with the January 1977 announcement of SCP Version 6, which added capabilities such as scientific macros, job stream support, and improved data management and library techniques.

In designing the System/32, IBM borrowed substantially from the System 3 Model 6, its earlier offering in the small "office computer" sweepstakes. The data representations and instruction repertoires of the two systems are quite similar, and several of the System/32 software products, as mentioned above, are adaptations of the products originally supplied for the System/3 Model 6. IBM, however, also took account of many of the limitations of the Model 6 and developed an improved package that is available for a considerably lower price. System/32 performance enhancements include the following:

- Data entry on the System/3 Model 6 is performed one character at a time through the keyboard, or via the relatively slow optional Data Recorder. On the System/32 IBM has incorporated a diskette drive that can be used to read data from IBM diskettes at a rate of 3400 128-byte records per minute.

- The System/32 features a selection of line printing speeds ranging from 50 to 285 lines per minute, a considerable improvement over the 70-lpm maximum provided by the serial printer in the System/3 Model 6.

- System/3 Model 6 commercial users who write their programs in RPG II are required to learn a fairly complicated system control language called the Operation Control Language (OCL) to provide the instructions needed for program execution. Basically the same OCL is used on the System/32, but it is supplied to the user in cataloged procedures accom-

	Character Set		
	48	64	96
Models B31, B32, B33, B34	155	120	80
Models C41, C42, C43, C44	285	225	160

Characters are formed by means of an interchangeable metal print belt with an engraved type font in one of several character sets: 48-character EBCDIC, 48-character FORTRAN, 64-character EBCDIC, 64-character ASCII, or 96-character dual-case modified Courier or Artisan. There are 132 print positions, spaced 10 to the inch. Vertical spacing is 6 lines per inch. A variable-width forms tractor feeds continuous forms ranging from 3½ to 14⅞ inches in width. Forms with up to 6 parts and a maximum thickness of 0.020 inch can be handled. The use of card stock is not recommended.

Feature 4530 provides half-line vertical spacing on B and C models, allowing subscripting and superscripting with the Artisan and modified Courier print belts. This feature cannot be installed on machines with eight lines per inch vertical spacing or the data recorder attachment.

INK JET PRINTER: The 46/40 Document Printer is a stand-alone ink jet printer with its own microprocessor and integrated magnetic card reader/recorder capable of accepting a stack of up to 200 cards prepared on IBM magnetic card typewriters. Formatting and playback printout tasks are performed by the 46/40 while the magnetic card typewriters are used for input keying and initial text editing.

Characters are formed by droplets of ink, directed to the paper at the rate of 117,000 per second. Actual printing speed varies with the pitch selected (all three are standard on the 46/40)—77 characters per second for the 10-pitch and 92 characters per second for 12-pitch and proportional spacing.

The 46/40 has two paper drawers that hold up to 600 sheets each and an envelope hopper that holds up to 500 envelopes. Paper dimensions can vary from a document 7 by 7.5 inches to one measuring 8.5 by 14 inches. Letters and envelopes are printed in the same sequence, one immediately following the other, to facilitate envelope stuffing procedures.

A communications option is available for transmission of data recorded on magnetic cards to a host computer or another 46/40. Incoming data can be either printed or recorded onto black magnetic cards in both attended and unattended modes. Transmission speeds range from 600 to 2400 bits per second.

3740 DATA ENTRY SYSTEM: This key-to-diskette system can be used off-line to record data on diskettes for entry into a System/32 via its integral diskette drive. Alternatively, a 3741 Model 2 or Model 4 can communicate directly with a System/32 equipped with the Binary Synchronous Communications Adapter (BSCA).

The basic components of a 3740 Data Entry System are the 3741 Data Station, 3741 Programmable Work Station, and 3742 Dual Data Station. The 3741 Model 1 and 2 Data Stations are alike except that Model 2 includes a binary synchronous communications interface. The 3741 Model 3 and 4 Programmable Work Stations are like the 3741 Models 1 and 2, respectively, with the addition of user programming capability. All models can be equipped with a 40-character-per-second 3713 Printer or a 155-line-per-minute 3717 Printer.

Every 3741 Data Station or Programmable Work Station includes a microprocessor, a CRT unit for data, control, and status display, and a diskette drive; a second drive can be added. The 3742 Dual Data Station provides two operator

IBM System/32

panying the application programs and can be invoked through simple operator commands. (Users who write their own programs in RPG II, however, must still cope with the OCL.)

- When it was initially introduced, the Model 6 had little in the way of supporting application software to ease the way into data processing for first-time computer users. In contrast, Industry Application Programs for 14 targeted industry sectors, several of which are derivatives of IBM Field Developed Programs and Installed User Programs for the System/3, play an important role in the System/32 product line. These packages have varying facilities for customizing the programs through user questionnaires, but the Application Customer Service and Application Programming Service introduced by IBM to aid System/3 users in developing their own programs for "bread and butter" business applications are not currently offered to System/32 users. System/32 customers receive their IBM-supplied software in the form of object code, thus relieving them of the task of compiling and debugging the programs.

Although the System/32 obviously isn't meant by IBM to be a replacement for the more costly System/3, the high degree of compatibility between the two systems should make conversions fairly easy. System/3 programs written in RPG II must be modified to account for new System/32 input/output devices and recompiled on a System/32. System/3 card and tape data files can be converted at an IBM data center and returned to the customer in System/32-acceptable format on diskettes.

A System/3 Model 8, 12, or 15 will be an appropriate choice for many customers who outgrow their System/32 configurations, and conversions from a System/32 to a System/3 are performed in the same straightforward manner described above. For either conversion, data files can be transmitted to the data entry over a binary synchronous communications line, and IBM states that such conversions can be performed within the regular 75 hours of test time allotted to each System/32 customer.

An even more likely growth path for most System/32 users became available in April 1977 when IBM unveiled the System/34 (Report 70C-491-27), a greatly improved small business computer that represents the likely successor to the System/32 line. As compared to the S 32, the System/34 offers nearly eight times the internal processing speed, twice the main memory and disk storage capacity, and the ability to attach up to seven additional independent multiprogramming workstations to the basic system. The RPG II programming language for the System/34 is source-compatible with System 32 RPG II. Thus, System/32 users who upgrade to a System/34 can retain their Industry Applications Programs and their own RPG II programs by recompiling them.

The most significant difference between the System 32 and the System/34 is the number of users each can

stations that have independent diskette drives but share the CRT unit and microprocessor.

All models of the 3741 and 3742 provide facilities for recording manually keyed data on diskettes and for verifying previously keyed data. Each diskette can hold up to 1,898 data records, and the records can vary from 1 to 128 characters in length.

Report 70D-491-41 provides a detailed description of the 3740 Data Entry System.

129 MODEL 2 CARD DATA RECORDER: This 80-column keypunch/verifier provides on-line reading of up to 50 cards per minute and punching or punching and printing at the rate of 12 to 50 cards per minute, depending upon the number of columns punched. A 3741/5320 Attachment Feature (# 8201) is required on the 129-2 for on-line connection to the System/32. The card input speed can be increased to a maximum of 80 cpm by adding RPQ #Z04771. A detailed description of the 129 Card Data Recorder can be found in Report 70D-491-21.

5496 MODEL 1 DATA RECORDER: This 96-column keypunch/verifier provides on-line reading, punching, and printing at speeds of up to 21 cards per minute. A 2772/3741/5320 Attachment Feature is required on the 5496-1 for on-line connection to the System/32. A detailed description of the 5496 Data Recorder can be found in Report 70D-491-22.

1255 MAGNETIC CHARACTER READER: Reads and sorts MICR-encoded documents from 5.75 to 8.875 inches in length, 2.5 to 4.25 inches in width, and 0.003 to 0.007 inch in thickness. Three models are available. Model 1 reads up to 500 six-inch documents per minute, while Models 2 and 3 read up to 750 six-inch documents per minute. Models 1 and 2 have six horizontal stackers arranged in a single vertical bay and require one and one-half sort passes for each digit position. Model 3 has twelve horizontal stackers in two vertical bays. The optional Self-Checking Number, 51-Column Card Sorting, and Dash Symbol Transmission features are available for all three models. Model 3 can be equipped with the High-Order Zero and Blank Selection feature, which reduces off-line sorting times. One 1255 can be connected to a System/32 via an 1100 MICR Reader/Sorter attachment on the processing unit and a 6303 System/32 adapter on the 1255 itself. All three models can be used for off-line sorting.

5321 MAGNETIC CARD UNIT: Provides magnetic card input and output for the System/32. The 5231 reads 50-track cards recorded with 102 characters per track at a maximum rate of 20 seconds per card and records at a maximum rate of 30 seconds per card. Cards recorded on a 5231 unit can be read by IBM Mag Card Selectric and Mag Card II typewriters and by the 46/40 Document Printer. The 5321 input hopper can accommodate up to 50 cards, and the output hopper holds up to 60 cards. Attachment to the System/32 is via a 4900 Mag Card Unit Attachment. The 5321 cannot be used on any 5320 "A" models, nor can it be employed on any 5320 "B" or "C" model to which a 1255 MICR Reader or a 5496 Data Recorder is already attached.

5230 DATA COLLECTION SYSTEM: This system is composed of 5234 Time Entry Stations and 5235 Data Entry Stations connected to a 5231 Controller. Time Entry Stations can read punched-hole or magnetic badges. Data Entry Stations can read 80- or 96-column cards and/or hole and magnetic badges. The 5234 also has the facility for keyed numeric entry of up to three 8-digit fields. The 5231 Controller can handle up to 15 time and/or data entry stations in any combination and is nonprogrammable. The 5231 Model 1 provides 96-column punched card output,

IBM System/32

support. While the S/32 is rigidly restricted to serving one user at a time, the S/34 can handle up to eight independently functioning users plus an output spooling task operating as a system utility in a background mode. Although much of the early emphasis has been on the multi-user interactive capabilities of the system, IBM has carefully pointed out that the S/34 can also function well as a batch system. One of the eight concurrent jobs on the system can be a batch-mode job.

The System/34 appears to be the first in a series of upward-compatible low-end computer products that already partially overlap both the System/32 and the System/3 performance ranges and in all likelihood will eventually replace some or all models in those families. Or, at least, the System/34-style architecture seems destined to become dominant.

Although the System/34 clearly outdistances the System/32 in price/performance comparisons, the System/32 has, at least for the time being, retained a viable position at the low end of the IBM small business computer line, due mainly to the fact that there are several S/32 models priced below the minimum S/34 system. In addition, IBM has made the rental charges for System/32's more attractive than those for the System/34. In view of the strong current trend toward multi-user small business computers, however, a prospective user would be unwise to install a System/32 without first taking a hard look at IBM's own System/34 and at some of the competitive multi-user systems.

USER REACTION

Detailed below are the responses to Datapro's annual computer user survey that were received from 36 System/32 users during August 1977. The total number of systems accounted for by all these users was 93. Seven of the 36 users accounted for a total of 64 of the installed systems; there were 3 users with 2 systems each, 1 with 3, 1 with 4, 1 with 16, and 1 with 35. Of the 93 installed systems, 57 had the minimum 16K bytes of memory, 28 had 24K bytes, 2 had 32K bytes, and the remainder were unspecified.

As expected, RPG II was the overwhelming choice as the programming language, although FORTRAN was specified as a second language in two single-system installations. Surprisingly, only five of the users had purchased Industry Application Programs from IBM. Two of these five users were also committed to in-house programming in RPG II. Business applications predominated, with only two users indicating non-business uses as primary. Applications involving data communications had been implemented on four systems (two users).

The time in use varied from 2 to 28 months, and the average for all users was 15.7 months. Of the 36 users, only 4 had purchased their systems, while the remaining 32 were renting from IBM. Three of these 4 were single-system installations, while the fourth user had purchased 35 systems.

while the 5231 Model 3 provides 80-column punched card output. The 5231 Model 2 provides diskette output and the facility for transmission over a switched or nonswtiched point-to-point BSCA communications line at 600, 1200, 2000 or 2400 bps.

COMMUNICATIONS CONTROL

6301 SYNCHRONOUS DATA LINK CONTROL (SDLC) COMMUNICATIONS: This optional feature, in conjunction with stored-program control, enables a System/32 to communicate with a System/370 Model 115, 125, 135, 145, 155-II, 158, 158MP, 165-II, 168, or 168MP computer via an appropriately equipped 3704 or 3705 Communications Controller. The System/370 must be operating under DOS/VS, OS/VS1, or OS/VS2 VTAM, and the 3704/3705 under NCP/VS.

The SDLC feature enables the System/32 to communicate in half-duplex mode at a speed of up to 7200 bps on a single non-switched point-to-point or multipoint line, or at up to 4800 bps on a switched point-to-point line. This feature will operate in half-duplex mode over switched network (dial) facilities and non-switched or equivalent private communications lines which may be duplex or half-duplex facilities. The System/32 operates as an SDLC secondary station and can share a communications line with other IBM SDLC terminals using the same transmission rate. Data transmission or reception is overlapped with System/32 processing and/or I/O operations other than diskette reading or writing.

Only one SDLC feature can be installed on a System/32, and the SDLC and BSCA features are mutually exclusive. A prerequisite is either one of the IBM integrated modems or the EIA Interface, as described below.

2074 BINARY SYNCHRONOUS COMMUNICATIONS ADAPTER (BSCA): This optional feature, in conjunction with stored-program control, enables a System/32 to function as a processor/terminal communicating with any of the following IBM devices on a switched, nonswitched, or private communications line:

- Another System/32 equipped with the BSCA.
- A 6640 Document Printer equipped with the BSC/EBCDIC feature and 3700/3701 or 5501 or 5508 or 5510 Communications feature.
- An IBM Office System 6/430, 6/440, or 6/450 equipped with the features listed for the 6640 above.
- An IBM Mag Card II typewriter.
- A System/3, System/7, or System/360 Model 20 computer equipped with a BSCA.
- A System/360 or System/370 computer via an Integrated Communications Adapter, 2701 Data Adapter Unit, or 3704 or 3705 Communications Controller equipped for binary synchronous communications.
- A 3741 Model 2 Data Station or 3741 Model 4 Programmable Work Station.
- A 3747 Data Converter.
- A 5230 Model 2 Data Collection System.

The BSCA feature enables the System/32 to communicate in half-duplex mode at a speed of up to 7200 bps on a single non-switched point-to-point or multipoint line, or at up to 4800 bps on a switched point-to-point line. The transmission code may be ASCII, EBCDIC, or EBCDIC Text Transparency, as selected at program compilation time. Data

IBM System/32

Based upon the survey results, the most widely used System/32 models appear to be the AX3 and BX3, where X stands for 1, 2, or 3. This is corroborated by the average installed disk capacity of 10.7 megabytes.

Tabulated below are the users' ratings, with the weighted average ratings from Datapro's 1976 survey also shown for comparative purposes.

	Excellent	Good	Fair	Poor	1977 WA*	1976 WA*
Ease of operation	19	15	0	0	3.6	3.8
Reliability of mainframe	27	8	0	0	3.8	3.9
Reliability of peripherals	14	11	0	0	3.6	3.6
Maintenance service:						
Responsiveness	22	12	1	0	3.6	3.6
Effectiveness	18	15	1	0	3.5	3.7
Technical support	10	17	6	1	3.1	3.0
Manufacturer's software:						
Operating system	11	19	3	0	3.3	3.6
Compilers and assemblers	13	17	5	0	3.2	3.2
Applications programs	4	13	5	3	2.7	2.9
Ease of programming	13	17	3	0	3.3	3.6
Ease of conversion	6	15	3	0	3.1	2.5
Overall satisfaction	14	17	3	0	3.3	3.4

*Weighted Average on a scale of 4.0 for Excellent.

As mentioned previously, the IAP's supplied by IBM were not especially popular with the users who had purchased them, nor were they frequently elected for purchase. The reason in most cases: cost versus value. The users in this sample pointed out by their actions and opinions that if they had to spend money on software, they would rather purchase the RPG II compiler and write the necessary applications programs themselves.

The tabulated results show plainly that the System/3 users were well satisfied with their systems. Even though the 1977 weighted average user ratings were lower than the 1976 figures in seven categories, there was a high degree of consistency in the users' opinions of virtually all aspects of the hardware, software, and support. The users collectively assigned weighted average ratings of 3.0 or better in 11 of the 12 categories. In view of this kind of user satisfaction, it is easy to understand why the System/32 has been a winner for IBM and a pacesetter for the industry.□

transmission or reception is overlapped with System/32 processing and/or I/O operations other than diskette reading or writing.

On a multipoint line, the System/32 operates as a tributary station. No support is provided for the System/32 to operate as a control station on a multipoint line; therefore, communication with other devices which do not provide control station capability must be done on a point-to-point line only.

Like the SDLC, the BSCA will operate in half-duplex mode over dial (switched network) facilities, and in half-duplex mode over non-switched or equivalent private communication lines which may be duplex or half-duplex facilities.

The BSC devices at all termination or drop points of a data link to which the System/32 is connected must use the same transmission rate, code, and clocking source (modem or business machine). When used on a multipoint line, the System/32 operates as a BSC tributary station; it is not supported for operation as a control station. Therefore, communications with other BSC devices which do not have control station capability must be accomplished via a non-switched point-to-point line.

Only one BSCA feature can be installed on a System/32, and the BSCA and SDLC features are mutually exclusive. A prerequisite is either one of the IBM integrated modems or the EIA Interface, as described below. Neither the SDLC nor BSCA can operate within the same program as card I/O, the 5321 Mag Card Unit, the 1255 Magnetic Character Reader, or the diskette drive.

INTEGRATED MODEMS: IBM offers a choice of five integrated modems for use with a System/32 equipped with either the SDLC or BSCA feature. Their characteristics can be summarized as follows:

#5500—1200 bps, non-switched.
#5501—1200 bps, switched network with Auto Answer.
#5600—2400 bps, non-switched point-to-point.
#5602—2400 bps, non-switched multipoint tributary.
#5610—2400 bps, switched network with Auto Answer.

Only one integrated modem can be installed in a System/32, and the Processing Unit Expansion feature is required when any one of the three 2400 bps modems is chosen.

SWITCHED NETWORK BACKUP (SNBU) FEATURE: Available with (7952) or without (7951) an Auto Answer capability, SNBU provides for backup attachment of the System/32 to the public switched network when one of the 2400 bps integrated modems (#5600 or #5602) is used on a non-switched line as the prime communications link. SNBU can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1, and OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2. One SNBU can be installed on a System/32. SNBU with auto-answer is mutually exclusive with SNBU and SDLC. This feature requires the 2074 BSCA, a 5600 or 5602 Integrated Modem, and a 5733 Processing Unit Expansion feature.

EIA INTERFACE: This feature can be chosen as an alternative to the IBM integrated modems for use with a System/32 equipped with either the SDLC or BSCA feature. It provides a cable and interface that meet the EIA RS-232C specifications and permit the attachment of an external modem supplied by IBM or another vendor. If the modem does not provide its own clocking, the Internal Clock feature, which provides a clocking speed of 600 or 1200 bps, is also required. IBM modems that can be connected to the EIA Interface include the 3872 Model 1 (2400/1200 bps), 3974 Model 1 (4800/2400 bps), and 3875 Model 1 (7200/3600 bps).

SOFTWARE

OPERATING SYSTEM: The System/32 System Control Program (SCP) includes a supervisor that occupies 2K bytes of main memory and provides the basic facilities that permit selective loading of programs from the disk, control all input/output operations, provide a program roll-out/roll-in capability, and provide support for data communications transmission.

Communications between the user and the SCP is provided through an Operation Control Language (OCL). These statements provide the system with information on how a job should be executed, such as the names of files to be processed, where the files are located, and what program to load. Normally, the collection of OCL statements required to direct the execution of a job is stored in procedures in disk storage and can be invoked by entering simple commands through the operator keyboard. Procedures are also supplied for execution of the utility programs that accompany the System Control Program and for the Indus-

IBM System/32

try Application Programs available to System/32 users. New procedures can be developed for user-written applications programs and specialized operations. The System/32 OCL has the capability to prompt the operator to supply required parameters or to specify default values for missing OCL parameters, as well as a logical IF statement that initiates execution of jobs based on conditions tested by the OCL.

Control of all I/O operations is provided by SCP data management routines. Support is provided for the CRT display, the keyboard (including the capability to recognize and interpret special function and command keys), the printer, and the disk unit. The diskette is supported by a Load/Dump utility only. Disk files can be organized in sequential, indexed sequential, or direct fashion.

A roll-out/roll-in capability is provided to suspend processing programs in order to allow an inquiry to be made into the file. The executing program is rolled out to disk storage, the inquiry program is executed, and the interrupted processing program is then returned (rolled in) to main memory to resume processing.

The SCP maintains a system history area on the disk that contains a log of recently executed OCL statements and system activities. The contents of the history area may be displayed on the operator console and printed if desired to provide a record of system processing activity.

The overlay linkage editor facility converts relocatable object modules, produced by the Basic Assembler, into a unified and executable program. Overlay structures may be created automatically or as designated by the user.

The current levels of SCP (Versions 5 and 6) include these enhancements: automatic generation, revision, and formatting of documents; input via keyboard, prerecorded magnetic cards, or diskettes; scientific macros; job stream support; and improved data management and library techniques.

Device support provided for the 1255 MICR Reader by the System/32 SCP (Version 6) is in the form of a subroutine similar to that provided on System/3 Models 12 and 15. Included in the services provided are data management and device control. The subroutine can be used with user-written RPG II or Basic Assembler programs. File access on the System/32 may be sequential, direct, indexed sequential, or linked direct (LDAM).

LANGUAGES: System/32 users currently can avail themselves of three languages: Basic Assembler, RPG II, and FORTRAN IV.

System/32 Basic Assembler Language and Macro Processor Program Product (5725-AS1) supports all features of the System/32 and includes mnemonic operation codes, symbolic referencing of storage addresses, automatic storage assignment, address displacement calculation, operand field expressions, source identification sequence fields, cross-reference listings, and error checking with diagnostic messages.

Macro capability is provided for the following SCP facilities: disk functions, printer operations, keyboard and display screen access, and binary synchronous communications. The macros provide no capability that is not available in RPG II and the system utilities.

RPG II (Report Program Generator; 5725-RG1) allows the programmer, using up to six different preprinted coding forms, to prepare a set of specifications that describe the form of the input data, the calculations to be performed, and the format of the desired output. RPG II for the System/32 offers essentially the same features as the System/3 Model 6 RPG II, with variations in the data management facilities for the support of System/32 input/output devices. For example, the SET/KEY display support feature provided with the System/3 Model 6 has been replaced by an operator prompting function that can display messages stored in a program or in the system library. In addition, the System/32 RPG II Interactive Data Entry (IDE) function permits the console to be used as an interactive data entry device. Data can be entered through the system keyboard, displayed for reference on the display screen, and routed to an executing RPG II program for processing. The program provides operator prompting on the CRT display. A program can be assigned one IDE file, which can accommodate various types of records from 4 to 160 characters in length. The IDE program is automatically generated by RPG II when CONSOLE is specified as the Device on the File Description Sheet.

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

The RPG II Telecommunications Feature facilitates the transmission and reception of binary synchronous data over voice-grade or high-speed communications lines. The programmer fills out an RPG II Telecommunications Specification Sheet, which specifies the functions to be performed. (See "Communications Software" for further details.)

IBM System/32 FORTRAN IV (5725-F01) contains the features defined in ANSI standard X3.10-1966 and the language extensions supported by IBM 1130 Basic FORTRAN IV and IBM System/3 FORTRAN IV.

IBM extensions to FORTRAN IV include the following: list-directed input/output for card devices, printer, display screen, keyboard, and sequential disk files; debug statements (DEBUG, AT, TRACE ON, TRACE OFF) that trace program flow and check validity of subscripts; an IMPLICIT statement that enables the user to specify the type (including length) of all variables, arrays, and user-supplied functions whose names begin with a particular letter; a GENERIC statement that enables the user to specify a single generic name for a FORTRAN-supplied function that has several subprograms, one of which is automatically selected, depending on argument type; interprogram communication statements (INVOKE, GLOBAL, and PROGRAM), that allow FORTRAN main programs to be loaded successively into main storage and executed; relational operation symbols (EQ., NE., GT., LT., GE., LE.), which may be used in the relational expression of a logical IF statement to execute or skip an associated statement depending on whether the expression is true or false, respectively; and names of up to six characters for variables, arrays, functions, and subroutines.

The IBM System/32 FORTRAN IV library contains intrinsic functions for absolute value maximum difference and minimum difference, truncation, modulo arithmetic, type conversion (integer to real or real to integer), transfer of sign, positive difference, precision increase and decrease.

The library also contains external mathematical functions for natural and common (base 10) logarithms, exponentia-

IBM System/32

tion, square root, arctangent, sine and cosine, and hyperbolic tangent. Finally, the library contains service subprograms that test, record, and alter simulated sense lights; dump selected areas of main storage (with or without termination of program execution; test for exponent overflow or underflow, divide-check exception, or library function error; test operator-controlled switches; test for an inquiry request; and terminate execution.

System/32 FORTRAN IV provides a commercial orientation through the use of subroutines that decode input records after they are read; edit output to meet special formatting requirements, such as for invoices, checks, and commercial documents; perform variable-length decimal arithmetic; perform common tasks, such as field comparison and data movement; set and test bits; shift array data; and perform input/output for card devices, keyboard, display screen, and printer. These subroutines have the same calling sequences and function as their counterparts on the IBM 1130 and System/3.

UTILITIES: Programs supplied with the SCP assist the user in preparing and maintaining his disk files. The programs provided include Disk Initialization, Alternate Track Assignment, Alternate Track Rebuild, File and Volume Display, and File Delete. In addition, a set of routines is provided to permit copying of data, programs, and procedures from the diskette to the disk file and to transfer such information from the disk file to the diskette to provide back-up files and off-line storage. The entire system library, selected files, or portions of files can be transferred to diskette files. In order to provide sufficient contiguous storage space for creation of new files, the operator can invoke the COMPRESS OCL procedure to reorganize the contents of the disk file in a contiguous area next to the systems library. The SAVE procedure allows one file or all files to be transferred to diskette with a specified retention period. Files can also be added to existing files saved previously on diskette. Both single- and multiple-volume diskette files can be created. The DELETE procedure permits files to be removed from disk storage to create space for new members.

System/32 Utilities Program Product (5725-UTI): In addition to the file management utilities supplied with the SCP control program, IBM offers a System/32 Utilities Program Product that provides basic data base management capabilities. This separately priced program product consists of three programs: Data File Utility (DFU), Sort, and Source Entry Utility (SEU). The Sort program is similar in function to the System/3 sort, while the DFU and SEU programs are newly written for the System/32.

The Data File Utility (DFU) program provides the following data base management functions: data file creation and maintenance, data file inquiry, and data file list. All three functions utilize catalogued RPG II File Description and Input Specifications so that the operator need enter only the name of the file and the name of the catalogued RPG II specifications. The utility prompts the operator to enter additional information required to tailor the program to the user's processing requirements.

The Data File Creation and Maintenance function of DFU operates only on indexed sequential files and provides facilities for creating and updating user data files. The program prompts the operator by displaying the field name for the data to be entered on the display console. When updating is being performed, the data currently in the field is displayed to assist the operator. Other features include automatic duplication of fields, control totals, generated record keys, and modulus 10 and 11 self-check digits for verifying entered data.

The Data File Inquiry function of DFU allows inquiries into indexed sequential files. Retrievals are performed by record key, and a function key can be used to roll forward or backward in key sequence through the file. Selected records can be printed with page and column headings.

The Data File List function of DFU provides a report-writing capability for listing and summarizing selected information from indexed or sequential files. Selection of records is based on record types defined in the RPG II input specifications for the file, and the file can be sorted in either ascending or descending order prior to printing, using up to five fields as sort fields. Records may also be selected for printing based upon a comparison of a user-supplied constant or another data field. This selection precedes the sorting function if sorting is specified. Data can be retrieved from a second file based on the use of a field in the records being listed as a key; the retrieved record from the second file is considered as an extension to the original record being listed. A total of 40 fields can be processed per record. Output reports include page and column headings, edited data fields, up to six fields calculated by the use of one of the arithmetic operators and up to four fields or constants, and selected column totals with up to five levels of subtotals.

The System/32 Sort Utility provides basically the same functions as the System/3 sort. Disk files can be sorted in ascending or descending sequence. The Sort program accepts files organized in sequntial, indexed, or direct order. It can select records based on a comparison of the contents of a field with a constant or another field or a tag sort in which only the control field and a record address are retrieved. A summary sort groups records with similar control fields and summarizes designated numeric fields into a single summary record. The Sort program automatically allocates disk space for a work file and can handle indexed, direct, and sequential file organizations.

The Source Entry Utility (SEU) program can be used to create and maintain user-written OCL procedures, RPG II source code statements, and Sort source code statements. The SEU is accompanied by Sort, RPG II, and Auto Report format descriptions to aid the user in entering source statements correctly. Functions include the capability to move statements within source or procedure members in new members, to insert up to 99 new statements into an already-existing member, and to delete selected statements. A function key can be used to roll backward or forward through the code to locate a selected statement. A record being entered or updated is displayed on the operator display screen as the data is entered. Optional functions available with SEU are the capability to perform syntax diagnosis on RPG II and Auto Report source statements as they are entered and the capability to resequence statements in a source-code member.

System/32 File Conversion Utility (5725-UT2): This utility accepts input from and provides output to a 5321 Mag Card Unit or fixed disk. If fixed disk is employed, file access may be either sequential, direct, indexed sequential, or LDAM (linked direct access method). Conversion functions provided by the utility include numeric fields to packed, unpacked, or signed binary; lower case EBCDIC to upper case; and monocase EBCDIC characters to lower case or to proper noun. The utility also can combine a primary mag card, LDAM, or System/32 file with a secondary input file to produce a merged output file and access variable-length fields separated by field separator characters.

COMMUNICATIONS SOFTWARE: Communications software for the System/32 consists of the RPG II Telecommunications Feature, which provides support for transmission and reception of binary synchronous data over voice-grade or high-speed communications lines, and the two utilities described in this section.

IBM System/32

The RPG II Telecommunications Feature permits a System/32 to operate in any of the following communications modes: receive only, transmit only, receive with conversational reply, or alternate transmit only, receive with conversational reply, or alternate transmit and receive file. The feature permits a System/32 executing programs written in RPG II to function as a terminal in one of three types of networks: point-to-point switched, point-to-point nonswitched, or multipoint. The System/32 Binary Synchronous Communications support also includes a system utility that permits communications characteristics, such as the line type, line speed, terminal address, and number of error retries, to be specified at program execution time.

Employing the Telecommunications Feature, a System/32 can communicate with another System/32 with RPG II; a System/3 with ML/MP, CCP, or RPG II; a System 7 with MSP/7; a System/360 or 370 with BTAM, TCAM/NCP, CICS/DOS, or CICS/OS; a System/370 with VTAM/NCP, CICS/VS, or IMS/VS; a System/360 Model 20 with BSCA IOCS; a 3741 Model 2 or 4; a 3747; or a 5231 Model 2 in receive mode only and supported as a 3741 Model 2 or 4.

The System/32 SNA/SDLC Batch Work Station System Utility sends and receives batch data between a System/32 and a System/370 operating under the Virtual Telecommunications Access Method (VTAM), the Network Control Program (NCP/VS), and DOS/VS POWER VS, CICS/DOS/VS, OS/VS1 Remote Entry Service (RES), OS/VS2 Job Entry Subsystem 2 (JES 2), CICS/OS/VS, or IMS/VS. The utility program operates with SDLC protocol and enables System/32 computers to perform as remote workstations to System/370 Models 115 through 168 that are equipped with 3704 or 3705 Communications Controllers operating under NCP/VS. In addition, the System/32 can act as a 3770 Data Communications System and operate with the CICS/VS communications monitor or the IMS/VS data base management system.

This utility program permits the System/32 to transmit jobs to a System/370 computer and receive output from the central system upon completion of the job. In addition, the System/32 can receive multiple jobs, including control language and data, from a System/370 computer for execution at the local site. The batch workstation utility also includes provisions for compressing blanks and duplicate characters to ensure more efficient data transmission and to expand compressed data transmitted from the central system. A minimum of 7 buffers, each 256 bytes in size, is provided.

Programming systems support is under DOS/VS, OS/VS1, OS/VS2, or any of these operating systems under VM/370. Data security and privacy features for a remote workstation on a 370 under VTAM, NCP, POWER/VS, RES, JES2, CICS/VS, or IMS/VS are applicable to this utility. The utility will run on a System/32 with 16K bytes of memory and BSCA under the Systems Control Program 5725-SCI; the diskette drive is not supported.

System/32 Multi-Leaving Remote Work Station System Utility (MRJE/WS) permits a System/32 to function as an RJE workstation for submission of jobs to a System/370 under control of HASP II version 3.1 or 4, ASP version 2.6 or 3.1, OS/VS1 RES, OS/VS2 JES2 or JES3, or VM/370 with the Remote Spooling Communications subsystem.

Under control of the System/32 SCP and utilizing the BSCA, this utility communicates with a 370 over a point-to-point switched or nonswitched communication line. The keyboard/display acts as the workstation console, and nonremovable disk storage simulates card I/O operation.

Any size record is accepted as input and formatted into 80-character segments for transmission to the 370, where reformatting is the user's responsibility. Any workstation print output may be stored on a temporary disk file and printed later using the supplied print utility. The EBCDIC text transparency capability of BSCA is supported. Details of security and configuration requirements are the same as those listed above the SNA/SDLC Batch Work Station System Utility.

DATA COLLECTION SUPPORT PRODUCT FOR 5230 SYSTEM: This program product accommodates 80- or 96-column card, diskette, and/or BSC teleprocessing inputs. Its function is to edit, verify, format, and consolidate data from an IBM 5230 Data Collection System. The data, once processed, is transferred to payroll, inventory management, production status, and costing master files. These master files are used in the IBM Manufacturing Management Accounting System in such areas as product costing, inventory, requirements planning, capacity planning, and production control. The system will operate on any model of the System/32 and requires the utilities program product for operation.

WORD/PROCESSOR/32: This program product (5725-XX1) utilizes the 5321 Mag Card Unit and enhancements to the System/32 to provide word processing capabilities. Word processing functions for automatic generation, revision, and formatting of documents can be entered from the System/32 console/keyboard or via prerecorded magnetic cards or diskettes. Documents are generated on the system printer, with options available for upper and lower case printing, and half-spacing for producing right-justified text. System/32's in use for data processing can utilize existing data files for document creation. Production statistics are an automatic by-product of this program product. This product requires a 16K-byte System/32 with 5 megabytes of disk storage and a 50-lpm line printer.

SYSTEM/32 LETTER WRITING APPLICATION: Designed for the user who needs to print large volumes of personalized letters, this program product (5725-XX2) provides upper and lower case printing and allows automatic insertion of name, address, salutation, title, and limited phrases within the body of the letter. Files can be generated through the System/32 keyboard or entered via diskettes prepared on an IBM 3740 Data Entry System.

Any 16K System/32 with a line printer can utilize this program product. It is written in RPG II and became available in June 1976.

SYSTEM/32 JOB ANALYSIS SYSTEM (JAS/32): This program product, employing the critical path method, helps management to plan, schedule, and control project-oriented work. JAS/32, through its nine standard reports, shows the critical path activities and their paths, related to cost, resources, and duration. Data entering the system may be free- or fixed-form. The system has a capacity to handle up to 10 subsets (groups of jobs or tasks) connecting to form a network of up to 14,000 activities or work items, 10 subnets per master file, 32 calendars, 4 types of time relationships between work items, 3 types of schedule dates, and 9 levels of milestones.

JAS/32 is written in System/32 Assembler language and executes under control of SCP Version 6 or above. The Source Entry Utility is required for execution of JAS/32.

SYSTEM/32 SUBROUTINE LIBRARY—MATHEMATICS (SL-MATH): These subroutines assist in matrix and numerical mathematics including array operations, linear equations, roots of functions, differentiation, interpolation, and approximation. Three linear programming optimization subroutines handle standard linear problems using the dual revised simplex method, the bounded variable revised simplex method, and a capacitated, minimal-cost network flow problem.

IBM System/32

SL-Math is written in FORTRAN IV and is a subset of SL-Math for the 1130 and 1800. The subroutines require a 16K- to 24K-byte System/32 operating under SCP version 6 or above. The System/32 must include at least 3.2 megabytes of disk storage and a control storage increment (feature 1500).

SYSTEM/32 STATISTICAL SYSTEM: This program product enables the user to perform stepwise linear regression analysis, factor analysis, analysis of variance, and polynomial curve fitting. Stepwise linear regression allows up to 25 variables and up to 499 observations. Deletion and entry of variables, up to 10 factors, and up to 499 observations. Eigenvalues are produced using the QR algorithm. Orthogonal and oblique reference frames are possible. Analysis of variance allows up to 4 factors, up to 9 levels per factor, and up to 499 observations. Component sums of squares can be pooled so that specific designs may be analyzed. Polynomial curve fitting allows up to 124 data points to be used and up to a tenth-degree polynomial to be specified. Polynomials are available for unequal point spacing, and are re-enterable for evaluation at a specific set of points. The program allows derivatives to be obtained. A scaling option is included.

The System/32 Statistical System runs under SCP Version 6 or above and is written in FORTRAN IV. The product requires a 16K-byte System/32 with control storage increment (Feature 1500) and 3.2 megabytes of disk storage.

SYSTEM/32 SHIPPING CONTROL FOR SUPPLIERS TO THE AUTOMOTIVE INDUSTRY: This program product (5725-M44) is an operator-oriented, batch or interactive system for original replacement market manufacturers and suppliers of automotive equipment. The system provides computerized solutions for many problems associated with the planning, controlling, and reporting of shipping dock transactions. Requirements for both release orders and discrete quantity orders are met by the generation of a variety of planning reports, shipping documentation, and completed transaction reports. An IBM System/32 Model A12 is the minimum system required to run this product.

SYSTEM/32 RELEASE CONTROL FOR SUPPLIERS TO THE AUTOMOTIVE INDUSTRY: This program product (5725-M45) is designed to operate in conjunction with 5725-M44 or as a stand-alone product. The application is operator-oriented and designed to maintain accurate release information which may be used to improve management planning of shipments, fabrication activities, and material acquisitions. The product will run on a System/32 Model A12 or above.

INDUSTRY APPLICATION PROGRAMS (IAP's)

The current System/32 software complement includes 14 Industry Application Programs that provide routines to perform the data processing functions required by small businesses in the selected industry areas. Each IAP package also includes detailed operator instructions and the OCL procedures required for execution of the programs. All IAP's are written by RPG II and are distributed on IBM-owned diskettes. Various techniques are provided for tailoring the programs to satisfy specialized user requirements.

SYSTEM/32 MEMBERSHIP AND MAILING LIST SYSTEM (5725-K11): These programs provide the capability to establish interrelated data files to handle membership dues, accounting, publication accounting, information exchange, and event participation accounting. The programs prepare invoices for membership dues and for publications, maintain lists for chapter memberships, product dynamic listings of the membership base for analysis, and handle receipts of dues and publication payments. Membership identification cards, 3 x 5 information cards, and membership rosters can be produced. User-defined membership codes of up to 11 characters can be used. Dues and special charges can be calculated by an individual rate per member, by class of membership, or by a set rate for all members. Mailing functions include label preparation and mailing lists based on user-specified criteria, circulation and postal zone summary reports, and agency distribution of publications. In addition, a record of individual participation in association-sponsored events can be accumulated, and a statistical summary of membership participation maintained. The ANALYZE command permits interrogation of the data base to produce selective membership mailings, dynamic membership lists, and statistical profiles of the organization membership.

If only membership dues administration and mailing functions are desired, a minimum System/32 configuration can accommodate approximately 13,000 to 15,000 members. Interactive file maintenance facilities include automatic updating of all files with one transaction, periodic updating by member class to maintain membership codes, special charges and dues, and individual updating of selected records. The Membership and Mailing List System was released in April 1975 and requires the System/32 Systems Control Program and the Utilities Program Product.

SYSTEM/32 CONSTRUCTION MANAGEMENT ACCOUNTING SYSTEM (CMAS): This industry application package consists of the following four programs: Job Costing (5725-M61), Accounts Payable (5725-M62), Payroll (5725-M63), and General Ledger (5725-M64). These programs provide a wide variety of accounting and management reports for single- or multi-company organizations. Reports produced by the Payroll program, in addition to paychecks and employee earnings statements, include payroll registers containing totals of employee hours worked and data on deductions and gross and net pay, a labor cost report for each job, and reports on workmen's compensation and insurance and union contributions. Job Cost Analysis produces reports on actual cost of materials, labor, subcontracting activities, and overhead compared to estimated costs. The system also provides a selection of financial management reports associated with general ledger accounting. Facilities for tailoring the programs permit the system to accommodate company growth. Use of the Construction Management Accounting System requires the System/32 System Control Program and the Utilities Program Product. CMAS became available in February 1975.

SYSTEM/32 HOSPITAL FINANCIAL MANAGEMENT SYSTEM (HFMS): This system is designed to handle the information processing needs of small hospitals with capacities ranging from 50 to 150 beds. Four programs are included in the package: Patient Billing (5725-H11), Accounts Receivable (5725-H12), Payroll (5725-H13), and General Ledger/Accounts Payable (5725-H14). The programs produce daily census reports on patient statistics, admissions and outpatient visits, and accounts receivable transactions.

The Patient Billing system automatically generates reports on room charges and provides daily general ledger revenue summaries for input to the General Ledger/Accounts Payable programs. The General Ledger/Accounts Payable system is based on the standard American Hospital Association chart of accounts and can be tailored to fit user charts of accounts with up to seven-digit account codes. The system provides monthly financial reports, general ledger trial balances, and accounts payable functions.

The Accounts Receivable program permits daily posting, reporting, and control of all accounts receivable transactions, and can accept keyed entry of data on new accounts or automatic entry of new accounts from the Patient Billing

IBM System/32

program. The Payroll program handles hourly or salaried employees on a biweekly payroll period. The system can accommodate up to ten rates and voluntary deductions per employee and one non-federal tax routine. Other reports include accrued benefits, personnel status, labor distribution, and automatic preparation of input to the General Ledger/Accounts Payable system.

The Hospital Financial Management System requires the System/32 System Control Program and the Utilities Program Product. The complete package became available in April 1975.

SYSTEM/32 MANUFACTURING MANAGEMENT ACCOUNTING SYSTEM (MMAS): Nine programs are included in this IAP: Production Status and Costing (5725-M31), Payroll (5725-M32), Accounts Payable (5725-M33), Accounts Receivable (5725-M34), Inventory Management (5725-M35), Product Definition and Costing (5725-M36), General Ledger (5725-M37), Sales Analysis (5725-M38), and Order Entry and Invoicing (5725-M39). All programs in the system became available by late December 1975. MMAS is aimed at those industries in the manufacture and fabrication of both ferrous and non-ferrous metals, and in the manufacture of machinery, household and office furniture, and related products. The system is written in RPG II and runs on a 16K System/32 under System Control Program 5725-SC1 Version 2. The Data File and Source Entry Utilities are required.

Production Status and Costing provides analysis reports for production and accounting departments, such as job status, work list, and exception reporting for quantity or cost variances from projections. Transactions are accepted through interfaces with the Payroll, Inventory Management, and Accounts Payable programs.

Payroll provides for hourly, salaried or executive employees on a weekly, biweekly, semi-monthly, or monthly basis and accounts for regular, overtime, premium, vacation, and sick pay. Transactions may be passed for use in General Ledger applications. After payroll register and checks are produced, the system can give the user reports on labor and job distribution, miscellaneous and union deductions, year- and quarter-to-date earnings, workmen's compensation worksheet, and W-2 and 941A reports.

Accounts Payable provides either accrual or cash basis for open payables and cash disbursements. Chief among the reports provided are a purchase journal which provides an audit trail for cost transactions, an open payables report indicating payment by date, vendor, or invoice, a cash requirement report for checking invoice selection for payment, a cash disbursement register which acts as a check register, and a vendor analysis report for information on business volumes and discounts lost. Both the cash disbursements journal and the purchase journal pass auditing information to the General Ledger Application.

Accounts Receivable can accept transactions directly or from the Order Entry and Invoicing application, and provides for open item and balance forward customers. A multi-option aged trial balance is provided, along with a facility for delinquency notices.

Inventory Management provides a transaction entry/edit/posting function for a perpetual inventory, as well as interfaces to Order Entry and Invoicing, Sales Analysis, Production Definition and Costing, and Production Status and Costing.

The Production Definition and Costing programs provide a means for organization of bills of material and calculation of product costs. Reports can be produced on costed bills of material, potential cost changes and variances, and where-used lists.

The General Ledger programs accept transactions directly or from the Accounts Payable and Payroll applications. The application uses audit registers and a financial statement worksheet for balance verification prior to closing. The major closing output is an income statement and balance sheet, whose format is user-controlled. The user can also control the chart of accounts if desired. Up to 10 companies can be supported with direct transaction input.

The Sales Analysis programs utilize input from Order Entry and Invoicing, Accounts Receivable, and/or Inventory Management. Reports provide multiple comparative analyses of profit and sales by item, customer, or salesman and a daily or monthly recap for each salesman. Reports may optionally be printed in detail or summary form.

Order Entry and Invoicing programs provide input into Inventory Management, Accounts Receivable, and Sales Analysis. This application handles editing as well as preparation of an invoice register and price lists. Pricing may be at retail price, discount from a list price, an operator-entered price, or a customer-negotiated contract price. Order and back-order status are provided by due date.

A System Tailoring Procedure is usable in all nine application areas. This procedure allows the user, through the use of a questionnaire, to select optional functions and/or programs and to tailor file sizes to his requirements. Rerunning the procedure can change the selected options and file sizes.

SYSTEM/32 DISTRIBUTION FINANCIAL ACCOUNTING SYSTEM (DFAS): Includes General Ledger (5725-D61), Accounts Payable (5725-D62), and Payroll (5725-D63) applications. General Ledger permits either a 12-month or 13-period fiscal year and provides an income statement and balance sheet as standard reports. The Accounts Payable application provides a purchase journal, a cash disbursements journal, an open payables report, a cash requirements report, and a vendor analysis report. In addition, check-writing and reconciliation are also provided. The Payroll application is an hourly/salary/executive payroll that handles regular, overtime, premium, vacation, and sick pay. It can be run weekly, bi-weekly, semi-monthly, and monthly.

These application packages are written in RPG II and run under the System Control Program 5725-SC1. The System/32 Utilities and a minimum 16K processor are required.

SYSTEM/32 CLIENT ACCOUNTING AND FINANCIAL REPORTING SYSTEM (CAFRS): This IAP (5725-C21) is designed for certified public accounts, bookkeepers, or small accounting firms as an aid in solving the problems of client accounting. Data can be entered through the keyboard or by a cassette created on a 3740 Data Entry System. Standard types of accounting reports such as journals, ledger, trial balance, and financial statements can be generated. Other supporting analyses and lists, as well as additional comparison reports, are also available to the user.

This IAP requires a minimum 16K System/32 and the System/32 Utilities. CAFRS is written in RPG II and has been available since November 1976.

MEDICAL GROUP MANAGEMENT SYSTEM: This IAP (5725-H15) provides a balance-forward accounts receivable system for a medical group of from 3 to 15 doctors. Patients are billed on a monthly basis, and third parties (insurance companies) can be billed as required. Options exist to provide a detailed appointment list showing patient

Rev. 1/79

appointment information and patient charge slips, and a practice analysis system that provides statistical reports for each doctor on a calendar year basis.

SYSTEM/32 MANAGEMENT SYSTEM FOR LAW FIRMS: This IAP (5725-F52) is designed to aid law firms in effectively controlling their time and disbursement accounting, billing, and accounts receivable. The Billing Information Memo and other reports such as Unbilled Time and Disbursements, Matter Billing Summary, and Aged Accounts can be printed weekly, monthly, or on demand to provide the necessary information to make the necessary billing decisions.

This IAP runs on a minimum System/32 and became available in January 1977.

DISTRIBUTORS MANAGEMENT ACCOUNTING SYSTEM (DMAS): This IAP consists of separately priced modules including Billing (5725-D41), Accounts Receivable (5725-D43), Inventory Control (5725-D45), and Sales Analysis (5725-D47). DMAS is generalized and designed for numerous types of businesses in the distribution industry. Payroll, Accounts Payable, and General Ledger modules may be added from DFAS (5725-D6X). DMAS will run on either a 16K- or 24K-byte System/32. Performance improvements in the larger-memory versions of each system come from the reduction of overlays, incorporation of larger blocking factors, and use of dual I/O areas.

Functions performed by the Billing system include order entry and editing, production of slot-sequenced picking documents for warehouse operations or case labels, customer invoices, an audit trail of daily billing activities, and a daily summary of each salesperson's activity. Other information provided by the Billing program includes the provision of multiple pricing options, special allowance notations, suggested retail prices, and automatic substitutions and special offers. The Billing program accumulates accounts receivable information that is later available to the Sales Analysis, Inventory Control, and Accounts Receivable programs for further analysis and evaluation.

The Inventory Control programs maintain perpetual inventory and "on-order" status for each item in inventory. A weekly buyer's report provides data on sales by item and inventory demand and movement. Reports on inventory activities, including inventory turns, profitability, and stockouts, can be prepared on a weekly or monthly basis or on demand.

The Sales Analysis programs produce reports on the sales activities and performance of individual items, sales personnel, and customer activities. Either detailed or summary reports can be selected.

The Accounts Receivable program uses data accumulated by the Billing program to produce weekly and monthly statements and aging reports. The programs handle both open-item and balance-forward customer accounts and print a copy of the aged trial balance on demand. Delinquent notices are automatically prepared for monthly delinquent accounts.

The Billing, Inventory Control, Accounts Receivable, and Sales Analysis programs are tailored to individual customer requirements through the use of a questionnaire that permits the user to select optional functions and reports and to tailor file volumes and data field sizes. The Distributors Management Accounting System requires the System/32 System Control Program (Version 5 or above) and the Utilities Program Product for execution. DMAS is written in RPG II.

SYSTEM/32 LUMBER DEALERS MANAGEMENT ACCOUNTING SYSTEM (LDMAS): This IAP is composed of a Billing module (5725-D4F), an Accounts Receivable module (5725-D4B), an Inventory Control module (5725-D4D), and a Sales Analysis module (5725-D49). The user may elect to purchase any or all modules. The Billing application prepares estimates and can handle selection of six different prices per item, dependent on customer code; these prices are in addition to the list price. The application also handles price conversion, with computations for square-foot, lineal-foot, and board-foot items in addition to multiple sales tax calculations. The Inventory Control Application provides both last and average cost figures for inventory valuation as well as inventory distribution by value. The Accounts Receivable application permits the user to change a customer from open item to balance forward or the reverse at the end of the month or accounting period. The Sales Analysis application produces daily and monthly reports by customer, as well as four-way reporting of profit margins. Facilities are built in to modify data file sizes and user-maintained constants.

This IAP requires a System/32 with either 16K or 24K bytes of memory, 5 megabytes of disk storage, and a printer with 132 positions. The system is written in RPG II and runs under the System Control Program, 5725-SC1 (Version 5 or above). The System/32 Utilities are also required. An LDMAS user may elect to purchase the DFAS Payroll, Accounts Payable, and General Ledger modules.

SYSTEM/32 FOOD DISTRIBUTORS MANAGEMENT ACCOUNTING SYSTEM (FDMAS): Like LDMAS, FDMAS is composed of a Billing module (5725-D6A), an Accounts Receivable module (5725-D66), an Inventory Control module (5725-D68), and a Sales Analysis module (5725-D6C). The Billing module features an open orders file in customer or item order that allows either case labels or a packing list in warehouse (slot) sequence. For billing purposes, variable pricing methods are available, including contract pricing, six classes of customer class pricing, cost plus pricing, catchweight pricing, broken case pricing with surcharge, special charges and allowances, case label charges, and cash and trade discounts. The Accounts Receivable module offers balance forward or open item selectable by account with late charges on monthly statements. As one of the features of this module, a summary or detail aged trial balance can be produced monthly or on demand. Up to four aging periods can be specified for the trial balance. The Inventory Control module supplies last cost and burden cost, full maintenance of broken case quantities, and warehouse location by slot. The Sales Analysis module provides sales and profitability figures by salesman, customer, item, and item class. The number and type of reports generated from this module are dependent in large part on the installation of the other modules in this application.

All programs in FDMAS are written in RPG II and can coreside with the Accounts Payable, Payroll, and General Ledger modules of DFAS. Both 16K- and 24K-byte versions of FDMAS are available. Version 5 or above of the System/32 SCP is required, as is the System/32 Utilities program product.

SYSTEM/32 STUDENT ADMINISTRATION SYSTEM: This application consists of three interrelated programs written in RPG II, available for separate purchase. The Student Records module (5725-E31) is a prerequisite for the other modules and generates student profiles, class rosters, course curriculum lists, instructor lists, and instructor/room schedules.

The Student Accounting module (5725-E32) manages and reports attendance data on a daily basis, including absences unresolved from prior days. This module also contains programs that analyze report marks and prepare report cards. The Student Scheduling module (5725-E33) provides scheduling for up to four terms in a school year and up

IBM System/32

to 24 periods in a day. Module options include student free time requests and instructor selection. Scheduling for the next year and rescheduling remaining terms of the current year are other features.

The Student Administration System requires a 24K-byte System/32 with a 5-megabyte disk storage capacity. The system is written in RPG II and requires the Utilities program product.

SYSTEM/32 MOTOR FREIGHT ACCOUNTING SYSTEM (MFAS): This application (5725-T21) offers small and medium-sized general freight and specialty carriers a package of programs to help analyze and refine numerous revenue accounting functions. These include such business operations as freight bill entry and daily reports, accounts receivable, interline payments, owner operator accounting, and shipment analysis. MFAS prints statements for direct customer billing, freight payment plans, transport clearing houses, inbound and outbound terminal summaries, and undelivered freight reports. MFAS operates under SCP on a 24K-byte System/32. The application is written in RPG II and requires the Utilities program product.

SYSTEM/32 FINANCIAL INSTITUTIONS CUSTOMER ACCOUNTING SYSTEM: This IAP consists of four modules: Customer Information File (5725-F11), System Demand Deposit Accounting (5725-F12), System Savings Accounting (5725-F13), and Installment Loan Accounting (5725-F14). The system makes it possible for small commercial banks with 5 to 25 million dollars in deposits to handle savings and checking account information now processed by correspondent banks, other data services, or manual means.

The Customer Information File module provides the bank with a central source of information about its customers and their associated accounts, retrievable by customer name or specific account number. This module provides a customer services report, a customer profile, and mailing labels for selected groups of customers.

The Demand Deposit Accounting module processes checking account deposits and withdrawals and offers the optional functions of overdraft banking, automatic funds transfer, and combined statements showing savings account balances. Monetary transactions can be entered with the IBM 1255 Magnetic Character Reader and posted against the current, available, or collected balance.

The Savings Accounting module processes deposits and withdrawals from regular savings accounts and time deposit open accounts. The module offers up to eight different plans at one time for calculating, compounding, and crediting interest. Annual interest is reported to the customer on 1099 forms.

The Installment Loan Accounting module processes add-on, discount, and simple interest loans employing both monthly and quarterly payment schedules. The same loan may have different accrual and refund methods and early payoff including interest and insurance refunds.

This application requires either a 24K- or 32K-byte System/32 operating under SCP Version 6 or above with System Utilities installed.

PRICING

POLICY: IBM offers the System/32 on a purchase or rental basis. Two rental policies are available, the standard Monthly Availability Charge (MAC) and the System/32 Term Availability Plan (TAP).

The TAP has a contract duration of 36 months and has a first-year monthly charge that is approximately 9 percent lower than the Monthly Availability Charge (MAC). The TAP provides lease and purchase price protection for a period of one year and accrual of up to 50% of the purchase price of the equipment at the end of three years. IBM reserves the right, on 60 days' notice, to increase the TAP monthly charge and/or purchase price by up to 5% during the second year of the lease, and by another 5% during the third year. The customer can elect to extend the TAP contract for any number of one-year periods and for one period of less than a year. Equipment acquired under the TAP may be field-upgraded, although modifications that result in a model downgrade will incur a termination charge. IBM offers a discount of 10 percent to qualified educational institutions.

SOFTWARE: System/32 users receive the basic System Control Program at no additional cost. All other IBM software, including RPG II, Basic Assembler, FORTRAN IV, the 5320 Program Support Product, and the Industry Application Program, is separately priced. The IAP's are supplied on IBM-owned diskettes, include documentation, operator manuals, and instructional materials, and are maintained by IBM.

EQUIPMENT: The following systems illustrate the limits of non-communications-oriented System/32 configuration possibilities. No software is included in the indicated prices.

MINIMUM SYSTEM: Consists of 5320 Model A01 System Unit, including 16K bytes of main storage, 3.2 million bytes of disk storage, diskette drive, 40-cps unidirectional serial printer, keyboard, and display. Monthly rental, $785 (1-year lease) or $714 (TAP). Purchase price, $33,560.

EXPANDED SYSTEM: Consists of 5320 Model B33 System Unit with 32K bytes of main storage, 9.1 million bytes of disk storage, diskette drive, 155-lpm line printer, keyboard, and display. Monthly rental, $1,382 (1-year lease) or $1,256 (TAP). Purchase price, $44,166.

LARGE SYSTEM: Consists of 5320 Model C44 System Unit with 32K bytes of main storage, 13.7 megabytes of disk storage, diskette drive, 285-lpm line printer, keyboard, display, 129-2 data recorder, BSCA, and 3741-2 data station. Monthly rental, $2,287 (1-year lease). Purchase price, $70,356.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (TAP, 1st year)*
BASIC SYSTEM					
5320	System Unit (includes CPU, 16K bytes of main storage, fixed-disk storage unit, diskette drive, printer, keyboard, and display)				
Model A01	40 cps unidirectional printer, 3.2 MB disk storage	$33,560	$160.00	$ 785	$ 714
Model A02	40 cps unidirectional printer, 5.0 MB disk storage	34,160	160.00	866	787
Model A03	40 cps unidirectional printer, 9.1 MB disk storage	37,280	170.00	967	879
Model A04	40 cps unidirectional printer, 13.7 MB disk storage	39,280	180.00	1,031	937

IBM System/32

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (TAP, 1st year)*
BASIC SYSTEM (Cont'd.)					
Model A11	40 cps bidirectional printer, 3.2 MB disk storage	33,810	165.00	880	800
Model A12	40 cps bidirectional printer, 5.0 MB disk storage	34,410	165.00	963	875
Model A13	40 cps bidirectional printer, 9.1 MB disk storage	37,530	175.00	1,062	965
Model A14	40 cps bidirectional printer, 13.7 MB disk storage	39,530	185.00	1,128	1,025
Model A21	80 cps bidirectional printer, 3.2 MB disk storage	34,020	170.00	929	845
Model A22	80 cps bidirectional printer, 5.0 MB disk storage	34,620	170.00	1,012	920
Model A23	80 cps bidirectional printer, 9.1 MB disk storage	37,740	185.00	1,111	1,010
Model A24	80 cps bidirectional printer, 13.7 MB disk storage	39,740	190.00	1,177	1,070
Model A31	120-cps bidirectional printer, 3.2 MB disk storage	34,230	175.00	979	890
Model A32	120-cps bidirectional printer, 5.0 MB disk storage	34,830	175.00	1,062	965
Model A33	120-cps bidirectional printer, 9.1 MB disk storage	37,950	185.00	1,161	1,055
Model A34	120-cps bidirectional printer, 13.7 MB disk storage	39,950	195.00	1,227	1,115
Model B11	50 lpm line printer, 3.2 MB disk storage	38,380	185.00	1,001	910
Model B12	50 lpm line printer, 5.0 MB disk storage	38,980	185.00	1,084	985
Model B13	50 lpm line printer, 9.1 MB disk storage	42,100	195.00	1,183	1,075
Model B14	50 lpm line printer, 13.7 MB disk storage	44,100	205.00	1,249	1,135
Model B21	100 lpm line printer, 3.2 MB disk storage	38,480	195.00	1,078	980
Model B22	100 lpm line printer, 5.0 MB disk storage	39,080	195.00	1,161	1,055
Model B23	100 lpm line printer, 9.1 MB disk storage	42,200	205.00	1,260	1,145
Model B24	100 lpm line printer, 13.7 MB disk storage	44,200	215.00	1,326	1,205
Model B31	155 lpm line printer, 3.2 MB disk storage	38,690	205.00	1,155	1,050
Model B32	155 lpm line printer, 5.0 MB disk storage	39,290	205.00	1,238	1,125
Model B33	155 lpm line printer, 9.1 MB disk storage	42,410	215.00	1,337	1,215
Model B34	155 lpm line printer, 13.7 MB disk storage	44,410	225.00	1,403	1,275
Model C41	285-lpm line printer, 3.2 MB disk storage	44,690	230.00	1,348	1,225
Model C42	285-lpm line printer, 5.0 MB disk storage	45,290	230.00	1,431	1,300
Model C43	285-lpm line printer, 9.1 MB disk storage	48,410	240.00	1,530	1,390
Model C44	285-lpm line printer, 13.7 MB disk storage	50,410	250.00	1,596	1,450
1005	Additional main storage; 8192 bytes (maximum of 2)	878	2.50	42	38
1100	MICR reader/sorter attachment	8,775	25.00	260	236
1500	Control storage increment for FORTRAN IV	878	2.50	42	38
3200	Data recorder attachment	2,525	6.00	78	71
3400	Upper/lower case keyboard/display (B Models only)	1,000	1.00	29	26
4530	Half-line vertical space printing (B Models only)	600	0.50	15	14
4655	Keylock	72**	—	72**	72**
4900	Mag card unit attachment (B and C Models only)	2,800	4.00	77	70
5552	48-character FORTRAN print belt (B & C models only)	170	—	—	—
5910	64-character EBCDIC print belt	170	—	—	—
5911	48-character EBCDIC print belt	170	—	—	—
5912	64-character ASCII print belt	170	—	—	—
5913	96-character modified Courier print belt	170	—	—	—
5914	96-character Artisan print belt	170	—	—	—
PUNCHED CARD EQUIPMENT					
129-2	Data recorder; 80-column alphanumeric reader/print/punch; no verification	4,090	55.00	179	—
1020	Accumulate feature	583	3.00	24	—
1025	Accumulate program feature	146	1.50	5	—
3610	Expansion feature	389	—	10	—
3950	Variable length feed	964	7.70	30	—
6065	Reading board extension	16	—	—	—
8201	3741/5320 attachment	1,770	9.00	73	—
5496-1	Data Recorder; 96-column alphanumeric reader/printer/punch	4,450	59.50	203	—
7061	Self-checking number modulus 10 feature	527	1.00	36	—
7062	Self-checking number modulus 11 feature	527	1.00	36	—
7850	2772/3741/5320 attachment	1,290	16.50	55	—
MAGNETIC CARD EQUIPMENT					
5321	Mag card reader/recorder	10,200	55.00	255	217
PRINTERS					
46/40	Ink jet document printer; 77/92 cps (stand-alone device)	29,000	135.00	760	670
—	Communications option	5,400	—	135	120

IBM System/32

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (TAP, 1st year)*
MICR EQUIPMENT					
1255-1	MICR reader/sorter; 5 sort pockets, 1 reject stacker; 500 dpm	35,460	251.00	904	—
1255-2	MICR reader/sorter; 5 sort pockets, 1 reject stacker; 750 dpm	40,590	400.00	1,100	—
1255-3	MICR reader/sorter; 10 sort pockets, 2 select/reject stackers; 750 dpm	55,260	527.00	1,450	—
4380	51-column card sorting feature	661	—	16	—
4520	High-order zero & blank selection feature	1,315	500	33	—
6303	5320 attachment	5,335	4.00	135	—
7060	Self-checking number/improved recognition feature	2,135	2.50	54	—
TERMINALS					
3741-2	Data Station	5,655	54.00	234	199
3741-4	Programmable Work Station	7,680	70.00	348	296
1350	Application Control Language Translator for Model 4	1,090	1,050	46	39
1680	Expanded Communications feature (expanded buffer, transmit select fields and records, receive data and insert constants, and unattended print mode)	855	2.00	34	29
3200	Data Recorder Attachment feature	1,715	6.00	75	68
3892	Expansion feature for printer or disk	335	3.00	12	10
4002	Feature Group A; includes verify, production statistics, field totals, self-checking number, and disk initialization capability	503	1.00	19	16
4655	Keylock feature	36	—	—	—
4975	Additional 4K bytes of storage	439	5.00	23	19
5450	Operator ID Card Reader feature	468	3.00	19	16
5500	1200-bps Integrated Modem, non-switched	660	3.50	20	18
5501	1200-bps Integrated Modem, switched with auto answer	880	5.50	28	25
5901	Alphanumeric keyboard with numeric key arrangement similar to adding machine	132	0.50	5	4
6123	Record Insert feature	164	0.50	6	5
6677	Second Disk Drive	1,560	2.50	62	53
7705	Synchronous Clock feature	164	0.50	6	5
7850	Terminal Identification feature	335	0.50	12	10
8111	Matrix Printer Attachment feature	164	1.00	6	5
8121	Expansion feature for 3715 Printer or disk	855	6.50	34	29
8123	Expansion feature for 3717 Printer or disk	616	1.50	22	19
COMMUNICATIONS FEATURES					
2074	Binary synchronous communications adapter	3,600	10.00	103	94
3701	EIA interface	420	4.50	12	11
4703	Internal clock	210	0.50	6	6
5500	1200 bps integrated modem, non-switched	660	5.00	20	18
5501	1200 bps integrated modem, switched with auto answer	880	7.00	28	25
5600	2400 bps integrated modem, non-switched point-to-point	2,240	11.50	75	68
5602	2400 bps integrated modem, non-switched multipoint tributary	2,490	13.00	81	74
5610	2400 bps integrated modem, switched with auto answer	2,550	14.00	83	75
5733	Processing unit expansion (prerequisite for 5600, 5602, and 5610)	320	0.50	8	8
6301	Synchronous data link control (SDLC) communications	4,400	15.00	127	115
7951	Switched network backup	357	3.50	11	10
7952	Switched network backup with auto answer	535	5.00	17	15

* Rental prices include equipment maintenance.
**Single use charge.

SOFTWARE PRICES

	Initial Charge	Monthly License Charge
PROGRAM PRODUCTS		
System/32 RPG II	—	$ 27
System/32 Utilities Program (Data File Utility, SORT, and Source Entry Utility)	—	15
IBM 5230 Data Collection System Support for System/32	$500	26
Word Processor/32	—	125
System/32 FORTRAN IV	—	75
System/32 File Conversion Utility	—	40
System/32 Letter Writing Application	—	35
System/32 Shipping Control for Suppliers to the Automotive Industry	—	52
System/32 Release Control for Suppliers to the Automotive Industry	—	57
System/32 Job Analysis System	—	57
System/32 Subroutine Library—Mathematics	—	50
System/32 Statistical System	—	50
System/32 Basic Assembler Language and Macro Processor	—	75

IBM System/32

SOFTWARE PRICES

	Initial Charge	Monthly License Charge
INDUSTRY APPLICATION PROGRAMS		
System/32 Membership and Mailing List System	—	107
System/32 Construction Management Accounting System:		
Job Costing	—	33
Accounts Payable	—	42
Payroll	—	57
General Ledger	—	33
System/32 Hospital Financial Management System:		
Patient Billing	—	32
Accounts Receivable	—	27
Payroll	—	53
General Ledger/Accounts Payable	—	42
System/32 Manufacturing Management Accounting System:		
Product Definition & Costing	—	36
Inventory Management	—	36
Payroll	—	36
Production Status & Costing	—	36
Order Entry & Invoicing	—	43
Sales Analysis	—	36
Accounts Receivable	—	29
Accounts Payable	—	28
General Ledger	—	28
System/32 Distribution Financial Accounting System:		
General Ledger	—	28
Accounts Payable	—	28
Payroll	—	36
System/32 Client Accounting and Financial Reporting System	—	95
Medical Group Management System	—	90
System/32 Management System for Law Firms	—	183
System/32 Distributors Management Accounting System		
Billing	—	49
Inventory Control	—	48
Accounts Receivable	—	33
Sales Analysis	—	43
System/32 Lumber Dealers Management Accounting System		
Billing	—	49
Inventory Control	—	48
Accounts Receivable	—	33
Sales Analysis	—	43
System/32 Food Distributors Management Accounting System		
Billing	—	49
Inventory Control	—	43
Accounts Receivable	—	33
Sales Analysis	—	43
System/32 Student Administration System		
Student Records	—	65
Student Accounting	—	72
Student Scheduling	—	86
System/32 Motor Freight Accounting System		145
System/32 Financial Institutions Customer Accounting System		
Customer Information File	—	88
Demand Deposit Accounting	—	79
Savings Accounting	—	78
Installment Loan Accounting	—	90