

# Hewlett-Packard System 35

## MANAGEMENT SUMMARY

The ranks of desk-top computers have been increased by two with the entrance of Hewlett-Packard's System 35 models—the 9835A and the 9835B. The System 35 (9835) is part of the HP 9800 Series, which also includes the 9815, 9825, and System 45 (9845), and is a replacement for the previous 9830.

HP's desk-top minis are currently performing computations on inventory control, sales analysis, accounts receivable, structural engineering, statistical analysis, matrix math, and other jobs in many diversified fields. HP-supplied software packages are available to handle these and a number of other applications. The advantage of software packages, of course, is that the programming work has already been done, and the system can be operational without delay.

However, not all applications are covered by available packaged programs, and this is where the System 35's programmability becomes important. BASIC is the programming language chosen by Hewlett-Packard for its desk-top computers. There are several reasons why this would appear to have been a wise decision:

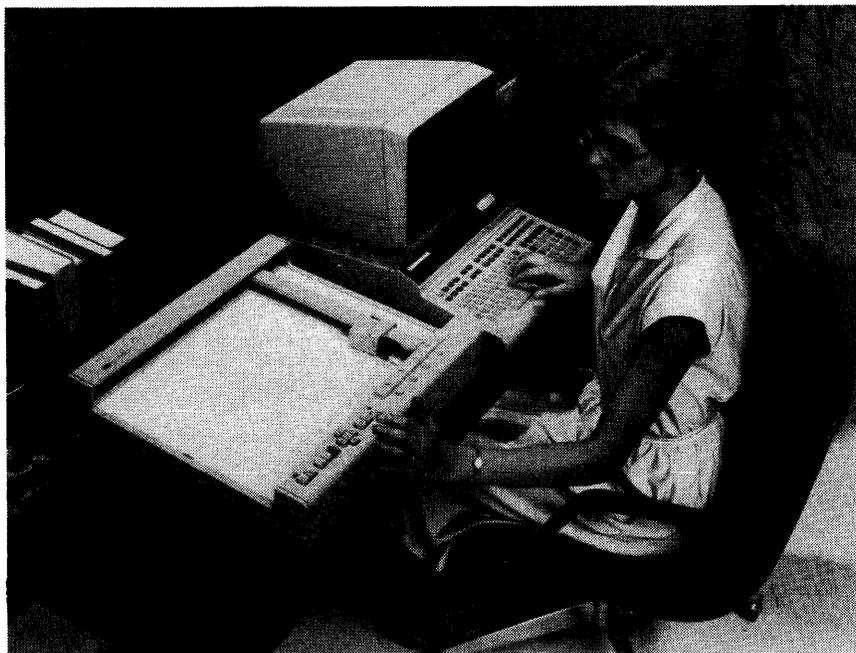
- BASIC is English-oriented. Most commands look like their English counterparts; GO TO means "go to" or "branch." Other familiar phrases are used, along with common arithmetic and algebraic statements and symbols that are easily recognized.
- BASIC is a widely-used, standard computer language; users don't have to rely only on Hewlett-Packard's ➤

Hewlett-Packard's System 35 desk-top computers are offered in two models: the 9835A includes a CRT which displays 25 lines of 80 characters each; the 9835B includes a single-line, 32-character, LED display. A built-in tape cartridge drive is standard equipment on both models, and a built-in 16-character thermal printer is one of the available options. Basic memory is 64K bytes, expandable to 256K bytes. System 35 prices start at \$8,700.

## CHARACTERISTICS

**MANUFACTURER:** Hewlett-Packard, Desktop Computer Division, 3404 E. Harmony Road, Fort Collins, Colorado 80525. Telephone (303) 226-3800.

Hewlett-Packard has six computer product divisions, including the General Systems Division (GSD), the Data Systems Division (DSD), and the Desktop Computer Division (DCD). GSD manufactures and markets the HP 250 and HP 300 Series general-purpose computer systems, the HP 2026 Data Entry and Communications systems, and the HP 3000 Series I, II, III, and 33. DSD produces and markets the HP 1000 Series minicomputers along with disk drives, the HP 21MX minicomputers, and measurement control and computational systems. The Desktop Computer Division is responsible for the HP 9800 Series, including the Systems 35 and 45 as well as the 9825, 9815, and 97S. DCD also markets peripherals for use with the 9800 Series, both HP and non-HP products. Other computer product divisions manufacture interactive CRT terminals, line printers, magnetic tape drives, hard-copy terminals, data collection devices, and disk drives. Another division, the Computer Service Division, performs maintenance on HP computers. ➤



The Hewlett-Packard System 35 is shown with the optional 9872A digital plotter, one of the peripherals available for use with HP's desk-top computer. The 9872A features four program-selectable pens, addressable moves as small as 0.025 mm, and 38 built-in instructions.

## Hewlett-Packard System 35

▷ program library, as there are many other sources for BASIC software packages and algorithms. BASIC language versions may vary slightly from source to source, but conversion will be much less difficult and time-consuming than reprogramming from scratch.

- The HP System 35 BASIC language interpreter is implemented in read-only memory (ROM), or firmware. This firmware implementation of the programming language saves the user approximately 112K bytes of read/write memory that would otherwise be used for storage of the BASIC interpreter. With the interpreter permanently available in ROM, it is also not necessary to load it each time it is needed.

The "industry compatibility" of BASIC becomes very important if the user outgrows a System 35 (or other) computer. A move to a larger Hewlett-Packard system or to another BASIC minicomputer will be comparatively simple; many programs can be salvaged and will run, with slight modifications, on the new system without having to be completely rewritten.

Hewlett-Packard also offers two optional plug-in ROM modules that make assembly language available to the System 35 user. The Assembly Execution ROM makes it possible to run previously-written assembly language programs, and the Assembly Development and Execution ROM allows the user to write *and* run programs using assembly language.

Two models of the System 35 are available: the 9835A has a 2000-character CRT, and the 9835B has a 32-character, LED, single-line display. A 16-character-per-line thermal printer is optional for both models. Standard equipment includes 64K bytes of read/write memory, a built-in tape cartridge drive with a capacity of 217K bytes per cartridge, and an alphanumeric keyboard with twelve user-definable special-function keys. A German, French, Spanish, or Katakana character set is offered at no increase in price as a factory-installed option in lieu of the standard ASCII keyboard.

The 12 special-function keys can be used to represent and access 24 (using a shift key) single- or multiple-line functions, programs, or text (where text can be used as a typing aid). By defining keys equivalent to words and phrases, users can save time and possibly errors by not having to rekey routines each time they are needed. Keyboard overlays are available to define the specific use for keys in individual applications.

The System 35 user has a wide selection of peripheral devices from which to choose, making it possible to customize a system to his unique specifications. Users can include a card reader, any of three printers, a digitizer, a plotter or a plotter/printer, a paper tape reader and a paper tape punch, a disk drive, and others. Special-purpose input/output interface cards make an even wider variety of peripherals usable on the System 35. Three interface cards can be inserted into slots in the ▷

▷ The company is also one of the foremost manufacturers of sophisticated laboratory test equipment and specialized process control instrumentation. In addition to conventional laboratory equipment such as signal generators, oscilloscopes, and voltmeters, HP also manufactures more exotic instruments such as gas chromatographs, digital thermometers, network analyzers, and spectrum analyzers. Related products include both digital and analog graphic recorders, analytic instrumentation systems, and medical electronic instrumentation systems. Other Hewlett-Packard divisions manufacture hand-held and desk-top calculators, both programmable and nonprogrammable.

Hewlett-Packard products are sold by 135 sales offices and serviced by 160 offices in 37 countries and are manufactured in facilities in the U.S., United Kingdom, Germany, France, Japan, and Malaysia. The company employs about 40,000 persons worldwide, with about 14,100 worldwide involved in computational products.

MODELS: HP 9835A and HP 9835B.

DATE ANNOUNCED: September 1978.

DATE OF FIRST DELIVERY: January 1979.

NUMBER DELIVERED TO DATE: Not available.

### DATA FORMATS

BASIC UNIT: 16-bit (2-byte) word.

INSTRUCTIONS: The System 35 is usually programmed by the entry of BASIC language statements. Actual machine-language instructions are firmware components of read-only memory (ROM) and are not alterable by the user. Optionally, an assembly language ROM can be used to program directly in assembly language statements.

INTERNAL CODE: ASCII.

### MAIN STORAGE

TYPE: MOS/LSI integrated circuits.

CYCLE TIME: Not available.

CAPACITY: 64K bytes (32K 16-bit words) of system read/write memory, expandable to 256K bytes; 16K bytes of ROM, expandable to 128K bytes.

### CENTRAL PROCESSOR

Read-only memory is utilized to store the operating system, and plug-in modules of ROM chips can be added to supply increased language and system flexibility.

Provision is made for the addition of up to 16 ROM chips. Five are currently available: Mass Storage, General I/O, Plotter Graphics, Assembly Execution, and Assembly Development and Execution.

CONTROL STORAGE: The operating system resides in 112K bytes of permanent ROM. Up to 128K bytes of additional ROM is available in plug-in modules.

REGISTERS: Conventional minicomputer rules on registers do not apply. Systems software assigns portions of memory to serve as registers as needed. This function is completely transparent to the programmer.

INDIRECT ADDRESSING: Available with assembly and BASIC languages; accomplished by subscripts.

INSTRUCTION REPERTOIRE: The System 35 utilizes an HP-enhanced version of BASIC. The BASIC interpreter ▷

## Hewlett-Packard System 35

### PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION & SPEED	MANUFACTURER
<b>INTEGRAL WITH PROCESSOR</b>		
Cartridge drive CRT (9835A)	217K-byte capacity, 1,440 bytes per second	HP HP
Display (9835B)	Display/keyboard (console), 2000 characters (25 lines by 80 characters), 128 ASCII character set (French, Spanish, German, or Katakana character sets optional), adjustable brightness, inverse video, blinking, underline	HP
Printer (optional)	Single line, 32 characters, ASCII character set, 5 x 7 dot matrix, light-emitting diodes, alphanumeric Thermal, 16 character positions, 5 x 7 dot matrix, 190 lpm	HP
<b>MAGNETIC TAPE EQUIPMENT</b>		
9875A	Cartridge; single or double drive, 225K-byte capacity, 1,500 bytes per second	HP
<b>PRINTERS</b>		
9876A	Thermal line printer; graphics capability, ASCII character set, 80 positions, 480 lpm	HP
9871A	Serial printer; 96-character interchangeable disk, 132 positions, bidirectional, 30 cps	HP
<b>CARD EQUIPMENT</b>		
9869A	Reader; 40- or 80-column cards, punched or marked cards, 450-card hopper, 300 cpm	HP
<b>PAPER TAPE EQUIPMENT</b>		
9883A 9884A	Reader; 8-level, 1-inch paper/Mylar/plastic tape, 500 cps Punch; 5-, 6-, 7-, or 8-level; paper/Mylar/plastic tape, 75 cps	HP HP & Facit
<b>PLOTTERS</b>		
9872A	Digital plotter; 11 x 15.75 inches, four program-selectable pens, multicolor, 14 inches per second	HP
7245A	Plotter/printer; 7.4 x 11 inches, 10.1 inches per second, long-axis plotting to 16.4 feet	HP
<b>DIGITIZER</b>		
9874A	Tiltable glass platen, 15-character LED display, 16K bytes of read-only memory, rear projection of graphic images	HP

➤ rear of the mainframe, and as many as 14 peripheral devices can be attached by adding the I/O expander option.

Another important option allows the user to augment BASIC's capabilities by adding ROM chips. Five such ROM's are now available: an Input/Output ROM provides an extension to BASIC for exchanging data and control information with external devices; a Mass Storage ROM provides for communication with flexible disk drives and tape drives; a Plotter ROM provides the statements necessary to create graphic images on plotters; and the two previously-mentioned modules make it possible to use assembly language with a System 35. It is expected that Hewlett-Packard will make other ROM's available in the future.

Hewlett-Packard has a wide variety of application packages for both scientific and business needs. All software is available on an unbundled basis from HP and includes the necessary reference manuals. There is also a BASIC Users' Club which serves as another source for additional programs. ➤

➤ is in 112K bytes of ROM and includes over 150 functions and statements. Plug-in ROM modules are available to further enhance the BASIC facility or to program in assembly language.

**INSTRUCTION TIMINGS:** The following are representative timings only and are approximate (all examples use full 12-digit floating-point data):

Add	0.29 millisecond
Subtract	0.35
Multiply	1.00
Divide	3.10

**INTERRUPTS:** Available in software and optional interface cards.

**PHYSICAL SPECIFICATIONS:** The 9835A (with CRT) is 14.8 inches high, 15.1 inches wide, 19.5 inches deep and weighs 49 pounds. The 9835B (without CRT) is 5.1 inches high, 15.1 inches wide, 19.5 inches deep and weighs 26 pounds. Power is selectable by rear panel switches at 110, 120, 220, or 240 VAC with a tolerance of +5% and -10%, and frequency is from 48 to 66 Hertz. Operating temperatures can range from 41 to 104 degrees F.

#### CONFIGURATION RULES

Three I/O slots in the rear of the System 35 accept input/output interface cards. Capability for attaching up to 14 peripheral devices can be obtained by using the 9878A I/O Expander. ➤

## Hewlett-Packard System 35

### ➤ USER REACTION

Datapro interviewed eight System 35 users, selected at random from a list supplied by the vendor, during September 1979. Among the users were a county government agency, a power company, several scientific laboratories, and several federal government agencies.

All systems in use were Model 9835A's, and all had been purchased outright from HP, except one that was on a five-year lease. One user had three System 35's, and the others had one each.

The systems were being used by all eight users for scientific/engineering computing, plus other applications including real-time control, instrumentation control, data base management, and data communications. All users were using HP's enhanced version of BASIC, and three users also had the optional assembler ROM.

Only two systems had more memory than the basic 64K bytes; one had 128K bytes and the other 256K bytes. Two users were using on-line disk storage, and two were using printers.

The results of the survey are summarized below:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	3	0	0	3.6
Reliability of mainframe	5	3	0	0	3.6
Reliability of peripherals	3	3	0	1	3.1
Maintenance service:					
Responsiveness	4	2	0	0	3.7
Effectiveness	4	2	0	0	3.7
Technical support	3	3	0	0	3.5
Manufacturer's software:					
Operating system	4	4	0	0	3.5
Compilers and assemblers	4	3	0	0	3.6
Applications programs	2	3	1	0	3.2
Ease of programming	3	5	0	0	3.4
Ease of conversion	3	2	0	0	3.6
Overall satisfaction	5	3	0	0	3.6

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

Even more than the results above indicate, the comments expressed by these users showed a high level of satisfaction with the System 35 and Hewlett-Packard's support.

One user called his System 35 "an exceptionally strong little system—lots faster than I had expected and also easier to work with than I had expected." Another said that the system "will do everything I originally desired and more," while another felt that "HP's enhanced BASIC is very powerful with lots of FORTRAN features." The only negative comments expressed came from two users who voiced dissatisfaction with what they called inadequate documentation. One said it is "a real challenge to figure out how to control the peripherals from reading the manuals."

The general impression received from all eight interviews was one of great satisfaction overall with both the product and Hewlett-Packard. □

➤ The System 35 is configured with 16K bytes of ROM, expandable to a total of 128K bytes through the use of optional plug-in ROM chips which individually fit into any one of four drawers located on the front of the mainframe.

The Model 9835A has a CRT which displays 25 lines of 80 characters each on its 12-inch screen, while the Model 9835B has a 32-character, LED, single-line display. As a factory-installed option on either model, the standard ASCII character set can be replaced by any one of the following at no increase in price: a German, French, Spanish, or Katakana character set. Both models include a tape cartridge drive built into the mainframe. Each tape cartridge has a 217K-byte capacity.

### MASS STORAGE

**9885M/S FLEXIBLE DISK DRIVE:** Provides 0.5 megabytes of disk storage on a single-platter flexible disk drive. The 9885M (master) includes a built-in controller, which handles data storage for the master and up to three additional slave drives (9885S), offering a total on-line capacity of up to two megabytes. The 9885S has no controller and must be connected to a 9885M. The required interface card and cable is included with the 9885M. There is a maximum of 65 user-available tracks per diskette, 30 records per track, and 256 bytes per record. The total storage available to the user is 499,200 bytes per diskette. The average rotational delay is 83.3 milliseconds (360 rpm); average access time (head positioning) is 267 milliseconds; and data transfer rate is 23,000 bytes per second. The Mass Storage ROM, which is required, uses about 1000 bytes of read/write memory for data buffer, bootstrap area, pointers, and status words. A write verify feature ensures that the information recorded on diskette storage exactly matches the source information from the System 35's memory.

### INPUT/OUTPUT UNITS

See the Peripherals/Terminals Table.

### COMMUNICATIONS CONTROL

The 98036A Interface provides bit serial communications between the System 35 and asynchronous EIA RS-232C devices such as data terminals and modems. Data rates available are 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, and 9600 bits per second and are set by an externally accessible rotary switch. Under program control, the switch-selected data rate can be reduced to one half of its set value. Allowable data formats include 5, 6, 7, or 8 bits per character with 1, 1.5, or 2 stop bits and odd, even, or no parity. The physical interface can be either EIA RS-232C or 20 mA current loop. Receive-only capability for a 60 mA current loop is also possible.

The I/O ROM is required for buffered input operations and extended RS-232C control/status capability. Transmitter and receiver sections of the 98036A have separate one-character buffers whose status can be interrogated by the System 35. This interface can be programmed to interrupt when the input buffer is full or when the output buffer is empty.

### SOFTWARE

**OPERATING SYSTEM:** All executive and input/output operations are controlled by firmware-implemented software. The system executive and BASIC interpreter reside in 112K bytes of ROM.

**PROGRAMMING LANGUAGES:** Hewlett-Packard's enhanced version of BASIC is included with both the Model 9835A and the Model 9835B; it resides with the system executive in 112K bytes of ROM. The interpreter thus

## Hewlett-Packard System 35

► does not have to be loaded into memory each time the user needs it, and, since it resides in read-only memory, it does not interfere with that portion of read/write memory allotted for user programs.

Optional ROM chips or modules can be inserted into four drawers on the mainframe, enhancing the system by providing additional capability. Three such ROM's are currently available:

- **Input/Output ROM**—Provides an extension to the BASIC language for exchanging data and control information with external devices. Exchange of data can be performed automatically in one of four modes: asynchronous handshake, vectored interrupt, fast handshake, or DMA (direct memory access). Additional statements provide for extensive bit manipulation and full control of the HP Interface Bus.
- **Mass Storage ROM**—Provides drivers to communicate with the 9885M Flexible Disk Drive. The BASIC language commands for this storage device are resident in the System 35.
- **Plotter ROM**—Provides the statements necessary to create graphic images on the 9872A and 7245A plotters.

Two additional ROM's provide the System 35's with assembly language programming. The Assembly Development ROM gives the user the capability to write and debug assembly language subprograms, and the Execution ROM allows the user to load, run, and store programs developed with the Development ROM. The Execution ROM also contains a number of utilities (assembly language sub-routines) which give the user access to such selected main system capabilities as basic arithmetic operations for full precision numbers, conversions between number types, stor-

age and retrieval of variables (both string and numeric), mass memory read and write record, and rudimentary printing. There is also a utility to establish an assembled subprogram as an interrupt service routine. Hewlett-Packard recommends that assembly language on the System 35 should be used only to optimize the efficiency and speed of computation-intensive routines, specialized I/O operations, and fast interrupt response, not in an effort to exceed the programming limitations of BASIC. The Execution ROM uses 224 bytes of read/write memory, and the Development ROM uses 320 bytes.

**APPLICATIONS SOFTWARE:** Specialized applications program sets are available in a number of statistical and mathematical areas. The sets include Utility Library, Basic Statistics and Data Manipulation, Regression Analysis, Statistical Graphics, Nonlinear Regression, and Numerical Analysis. A brief description of each program set is included with the pricing information at the end of this report. A translator is also offered to convert programs written in HPL language (for the 9825 A/S) to System 35's BASIC. Additional programs are available through HP's BASIC Users' Club. All Hewlett-Packard software for System 35 is available on an unbundled basis.

### PRICING

**POLICY:** Hewlett-Packard offers System 35 for purchase or on a rental or lease arrangement with terms ranging from three months to seven years. Specific rental and leasing information is available on request from local Hewlett-Packard sales offices.

**SUPPORT:** All HP 35 systems are covered under a 90-day parts and labor warranty. Maintenance, training, and other services are available on an individual-contract basis.

### EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.*</u>
<b>SYSTEMS</b>			
9835A	System 35A; includes CRT and ASCII character set	\$9,900	\$41
9835B	System 35B; includes single-line display and ASCII character set	8,700	36
<b>FACTORY-INSTALLED OPTIONS</b>			
Opt. 201	128K bytes total read/write memory	3,200	4
Opt. 202	192K bytes total read/write memory	6,080	8
Opt. 203	256K bytes total read/write memory	8,640	12
Opt. 500	Built-in 16-character thermal printer	500	3
Opt. 810	French character set (instead of ASCII)	NC	NC
Opt. 820	Spanish character set (instead of ASCII)	NC	NC
Opt. 830	German character set (instead of ASCII)	NC	NC
Opt. 840	Katakana character set (instead of ASCII)	NC	NC
<b>FIELD-INSTALLED OPTIONS</b>			
98322F	64K bytes additional read/write memory	3,200	4
98350F	16-character thermal printer for 9835A	500	3
98351F	16-character thermal printer for 9835B	500	3
<b>PLUG-IN READ-ONLY MEMORY (ROM)</b>			
98331A	Mass Storage ROM	500	1
98332A	General I/O ROM	750	1
98337A	Plotter Graphics ROM	500	1
98338A	Assembly Execution ROM	500	1
98339A	Assembly Development and Execution ROM	2,000	1
<b>MASS STORAGE</b>			
9875A	Cartridge tape unit (HP-IB)	2,600	7
9885M-035	Flexible disk drive, master (requires 98331A ROM); includes interface card and cable	3,750	28
9885S-035	Flexible disk drive, slave	2,500	18

\*Basic monthly maintenance charge for Zone 1 (0 to 100 miles).

## Hewlett-Packard System 35

### EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.*</u>
<b>PERIPHERALS</b>			
9876A-035	Thermal line printer, 80 character positions; includes interface card and cable	3,750	18
9871A-035	Serial impact printer; includes interface card and cable	3,800	28
9871A-001	Serial impact printer (HP-IB)	3,600	26
9872A-035	Plotter (HP-IB; requires 98337A ROM)	4,200	24
7245A-035	Printer/Plotter (HP-IB; requires 98337A ROM)	4,600	27
9874A-035	Digitizer (HP-IB)	6,200	26
9869A-035	Card Reader; includes interface card and cable	4,275	21
9883A-035	Paper tape reader; includes interface card and cable	2,710	14
9884A-035	Paper tape punch; includes interface card and cable	3,280	31
9878A-035	I/O expander; includes interface card and cable	1,200	5
<b>PERIPHERAL INTERFACE CARDS</b>			
98032A-385	Interface card for 9885M Flexible disk drive (normally included with 9885M)	400	2
98034A-335	HP-IB interface; for 9875A Cartridge tape unit, 9871A Printer, 9872A Plotter, 9874 Digitizer	400	2
98032A-366	Interface card for 9876A Thermal line printer (normally included with 9876A)	400	2
98032A-371	Interface card for 9871A-001 Serial printer	400	2
98032A-381	Interface card for 9881A Line printer	400	2
98032A-369	Interface card for 9869A Card reader	400	2
98032A-383	Interface card for 9883A Paper tape reader	400	2
98032A-384	Interface card for 9884A Paper tape punch	400	2
98040-335	Interface card for user supplied incremental plotter	600	2
98032A-340	6940 Multiprogrammer	520	2
98032A-335	16-bit parallel interface	400	2
98033A-335	BCD interface	400	2
98036A-335	RS-232C bit serial interface	600	3
98035A-035	Real time clock	600	3

\*Basic monthly maintenance charge for Zone 1 (0 to 100 miles).

### SOFTWARE PRICES

		<u>Purchase Price</u>
09835-10000	Utility Library; contains sections for sorting, numerical analysis, information management, finance, and statistics; each section consists of several related programs and/or subroutines	\$300
09835-15000	Basic Statistics and Data Manipulation; contains summary statistics as well as routines for entering, editing, naming, recoding, sorting, storing, transforming, and listing data for statistical analysis by other programs	200
09835-15010	Regression Analysis; performs multiple linear regression; variable selection methods using stepwise, forward, backward, or manual procedures; and polynomial regression analysis	500
09835-15020	Statistical Graphics; gives a choice of nine plotting routines for the 9872A four-color plotter; time series plot, histogram, probability plot, scattergram, semi-log plot, log-log plot, xyz plot, and Andrews plot	500
09835-15040	Nonlinear Regression; provides routines to determine the best-fitting curve for a set of data. Models may be any combination of algebraic or Boolean expressions involving one or more independent variables and up to 10 parameters	500
09835-10250	Numerical Analysis; contains seven main sections: rootfinders, numerical integration, O.D.E. solvers, Eigen analysis, interpolation, general functions, and Fourier analysis	500
09835-10030	9825 HPL to System 35 BASIC Translator; provides aid in transferring programs written in HPL language for the 9825A Desk-Top Computer to BASIC language programs for the System 35 Desk-Top Computer. The package translates 85-90% of HPL statements into BASIC; it also provides a means of reading 9825 cartridges in the System 35	500