This month Popular Computing investigates the TI-99/4A home computer. We start with a detailed description and evaluation of the hardware and finish up with TI software reviews by members of our staff.

What to call your computer? In the advertising world, the terminology usually runs something like this: the "personal computer" goes in the den, the "desktop" in the office, and the "color computer" in the kids' room. Texas Instruments, however, has carefully chosen the moniker "home computer" for the TI-99/4A, in a decision that goes beyond a mere marketing ploy.

The hardware and software designs for the TI-99/4A are aimed squarely at an at-home, family audience: the unit demands less sophistication or special training than other popular computers. The new offering is also less flexible and thus less attractive to more advanced computer buffs. TI hopes that the TI-99/4A will appeal to the mass market and is launching a major drive in favor

puters, however, the TI-99/4A stands out for the following reasons:
- more display colors than other units
- superior sound-generation capabilities
- unique educational software
- the TI speech-synthesizer option

Hardware

The TI-99/4A console is a sleek, compact package that contains the microprocessor, memory, keyboard, and connection jacks for video display and other options. External devices, such as the speech synthesizer, disk controller, and printer, are connected in an unusual way—rather than running cables from the console to each separate device, the external devices are

A deluxe home computer system including the TI-99/4A computer/keyboard, disk controller, disk drive, and RS-232C interface.

of general retail stores and mail-order firms, while downplaying sales through specialty computer outlets.

Actually a redesign of the TI-99/4, the new computer sports an improved, full-travel keyboard, expanded software title list, and a lower price. In capabilities, the TI-99/4A is comparable to the Atari 400, Commodore VIC-20, and Radio Shack Color Computer; all offer color, graphics, and sound, and use plug-in program cartridges. Among these low-cost com-

"docked" together into a long train-like structure which in turn docks into the right side of the console. While this simplifies connection of peripherals and minimizes the number of external wires and cables, it limits flexibility in arranging the system. It's also quite easy to jar the keyboard loose from its neighboring device, causing the system to shut down. (TI will soon introduce a method of avoiding this problem—a small cabinet into which all the pieces plug.)
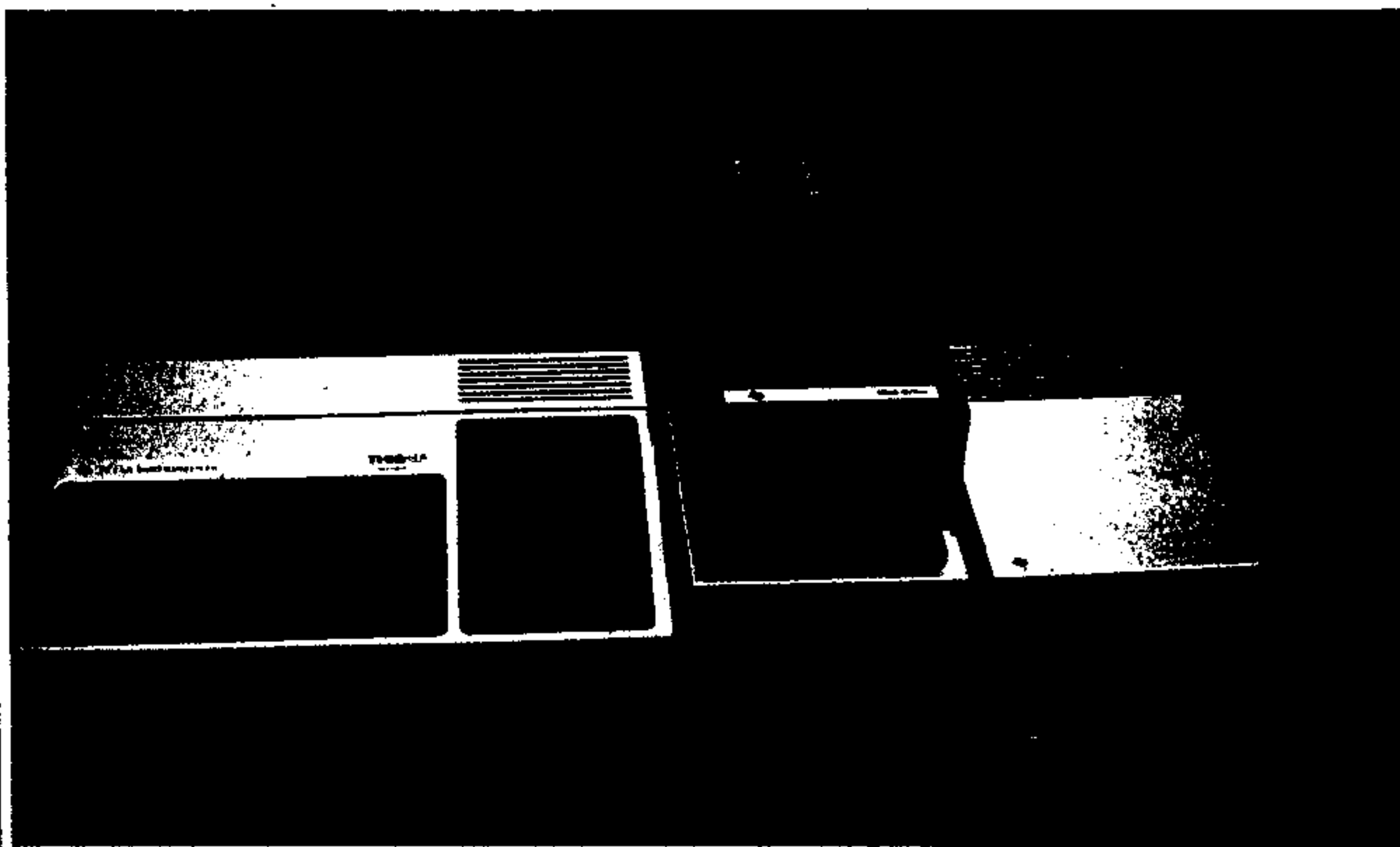
Inside the TI-99/4A. The computer's brain is the TMS 9900—the same 16-bit microprocessor used in many of TI's office computer systems (although minus some of the more advanced capabilities). The TI-99/4A also has a powerful video-display processor and sound-generator chips; both are microprocessors in their own right. These allow the computer to create impressive sights and sounds without tying up the central microprocessor's time. The unit includes 16K bytes of programmable memory (RAM) and 26K bytes of preprogrammed memory (ROM)—more than other computers in the under-$600 price range (the more ROM, the more built-in programming power).

Keyboard Console. The TI-99/4A keyboard has only 48 keys, fewer than most popular computers. Its key action, however, is typewriter quality and superior to the Atari 400 touch-sensitive key panel or the Radio Shack Color Computer's button-style keyboard.

Three special keys, Shift, Function, and Control, allow many of the ordinary keys to generate up to four distinct characters or commands. As a result, all the characters commonly used in computer programming, data processing, and communications, including uppercase and lowercase letters, symbols, punctuation, and control characters, can be used. TI provides templates and a template holder above the top row of keys to help users remember different key combinations available with various programs.

The function-key combinations provide some handy operations: editing and canceling lines, restarting or quitting programs, jumping back to the last display screen, repeating the previous operation, skipping to the next operation, or calling for "help."

TI's 48-key keyboard looks simple, and for many applications that's a virtue. It can be frustrating, however, in applications that require general text entry. Many characters are in awkward positions: for example, to generate the double quote mark you must press Function-P; for a question mark,

Function-I; to backspace, Function-S. Since there is only one Function key, it's time consuming to type in such characters, even when you've learned where they are.

The sparse keyboard also increases the likelihood of accidental entries. It's easy to press Function-equals when you mean Shift-equals. Shift-equals generates a plus sign; Function-equals erases your program and resets the computer—a rather devastating typo!

Display. The TI-99/4A can be connected to a color monitor (TI offers a 10-inch version) or to a television set using TI's television interface. The advantages of the monitor over a television set include sharper pictures,

generated through the display monitor's or television's built-in speaker. The unit can sustain three melodic voices, each spanning five octaves, plus a fourth special-effects voice that produces sounds ranging from a musical note to a pulsating noise. The computer is capable of generating realistic music as well as a variety of vivid sound effects for games, and, thanks to a built-in sound-generator chip, doesn't have to "stop everything" in order to be heard (unlike comparable computers). This feature makes the sound more useful for interactive games and educational programs and sets the TI-99/4A above most other "musical computers."

educators, and kids as the company that invented Speak & Spell—a teaching device with an amazingly humanlike voice and an excellent example of high technology moved into the mass marketplace. It's not surprising, then, that TI offers a powerful speech synthesizer for its home computer. Unlike other speech synthesizers for popular computers, TI's unit is capable of speaking with inflection (rising and falling tones) and variable pitch.

In many of TI's educational programs for children, the voice synthesizer becomes a helpful participant in the interaction between child and computer, and, as a $149 option, is possibly the best value in the system. (For further details, see the review of the TI speech Editor and Terminal Emulator II on page 70.)

Cassette System. The basic system includes a cassette interface that connects one or two cassette recorders for program and data storage. To speed I/O (input/output) operations, one cassette can be used for input and the other for output; to add reliability, both recorders can be used for output—creating two cassette copies of each data file. The system is easy to use because the screen automatically displays instructions for handling the recorders and cassettes before cassette operation begins.

It should be no surprise that TI, long known as the company that invented Speak & Spell, offers a powerful speech synthesizer for its home computer.

brighter colors, and cleaner sound. Either way, you get up to 24 lines of text per screen, each line containing up to 32 characters. Lowercase letters appear as small capitals, and uppercase characters as large capitals (few color computers display *true* lowercase).

The TI-99/4A can generate a multitude of graphics characters, each a combination of display dots in an 8 by 8 matrix. The graphics are not predefined; it's up to the user or the applications program to create the characters. The display resolution is 256 horizontal dots by 192 vertical dots, although the dots cannot be individually controlled using TI BASIC. TI application programs, however, take advantage of this high resolution to produce very impressive pictures and designs.

Sixteen colors are available for text and graphics and all can be used simultaneously on screen—a bonus when it comes to full-color compositions.

Sound. Sound for the TI-99/4A is

Plug-In Cartridges. Striving for an inroad to the mass market, TI has made a special effort to keep programs easy to run by creating plug-in cartridges. Each one contains up to 30K bytes of memory, most of it in preprogrammed ROM. Plugging in a cartridge automatically resets the computer and puts a menu, like the following, on the screen:

PRESS 1 FOR TI BASIC
2 FOR THE ATTACK

The application program in this example is The Attack, a popular game developed for Texas Instruments by the Milton Bradley toy company. Pressing 2 runs the program in the cartridge and program instructions take over from there. Many other computers require you to go through a complex multistep process to get a program running. For novice users and children especially, TI's plug-in-and-go method is far superior.

Speech Synthesizer. Texas Instruments is known to parents,

Disk System. For faster, more reliable storage, TI offers a floppy-disk system consisting of a disk controller and one to three drives. The disks are single density; each holds approximately 90,000 bytes, or characters, of information. The disk controller includes disk I/O software so that most of the disk storage is available for programs and data.

Thermal Printer. A thermal printer is available from TI for $399, a steep price considering that other manufacturers offer more versatile dot-matrix impact printers for about the same amount. Thermal printers, however, are fine for informal home use, and other printers can be used with the TI-99/4A with a $224.95 RS-232C interface.

Software

The TI-99/4A's system software—the code that controls the internal hardware in the computer—is reliable and powerful and best demonstrated by the superior graphics and sound achieved in many of the applications programs.

TI BASIC, provided in ROM, is an excellent choice for learning programming. The language has a powerful set of mathematical and text-handling functions and provides full access to the computer's color and sound capabilities. Two telling omissions from the usual BASIC repertoire are PEEK and POKE, commands that give direct access to the internal hardware, bypassing the BASIC interpreter and other system software. By omitting PEEK and POKE, TI prevents unintended operations—useful or otherwise. The decision to omit them may be consistent with TI's view of the mass market, but it reduces the machine's appeal for many popular-computer enthusiasts.

There are a few significant problems with TI BASIC. The language interpreter is sluggish, and whether listing a program on the screen or running a program, the lack of speed will probably be evident even to those with no computer experience. For *learning* BASIC, this lack of speed presents no real problem but for writing practical applications in BASIC, it can become a major annoyance. Fortunately, TI's plug-in cartridge programs are not written in TI BASIC, but in the TI-99/4A's native machine language, and they operate with impressive speed. Some of the programs distributed on disk are written in BASIC and are correspondingly slower.

Logo. The TI-99/4A becomes a different machine when running Logo, the computer language designed for children. (*Popular Computing* will devote a product review to Logo on the TI-99/4A in a future issue.) Logo is available as a plug-in cartridge for the TI-99/4A, although the memory expansion unit is also required. In the environment created by this language, the TI-99/4A shows up in its best light and the sparse keyboard becomes an asset. Because children are the primary users, the simplicity of plug-in cartridges is a plus, making the computer a *learning tool* rather than a data-processing device.

Other Applications Software. TI has developed more than 50 applications programs for the TI-99/4A and another 40 or so have been developed by independent suppliers. Most of the programs are designed for home use, ranging from personal finance to a large selection of games. TI's games are some of the most entertaining on the market, making full use of the 99/4A's sophisticated color graphics and sound-generating capabilities. Although some programs come on floppy disks, which require an additional investment of nearly $800 for a floppy-disk drive and controller, most TI software comes in "Command Modules" that are ready to plug in and run. TI was the first small-computer company to package software in this manner, and many others have since followed suit. (See page 66 for a sampling of TI programs.) One suggestion: when possible, always choose applications written in machine language rather than BASIC. They tend to make fuller use of the computer's capabilities.

Documentation. Instructions provided with the TI-99/4A system are well suited for the home audience. The BASIC language reference manual is well-designed and presents the information in an easy-to-understand way (although there's little technical information for advanced or merely curious programmers).

Manuals provided with plug-in cartridges are attractive—there's no need to refer to the large BASIC reference manual that comes with the system. The manuals provided with many of the disk-system programs, however, are obviously "budget productions," with typewritten text and few illustrations.

Who Should Buy the TI-99/4A?

If children had larger allowances, they would take the TI-99/4A home because of its fantastic games and ability to run Logo.

Those interested in word processing or serious BASIC programming would do well to look elsewhere—the TI-99/4A won't be the best buy simply because of the keyboard and the limitations of TI BASIC.

If, however, you're fascinated by speech synthesis, this computer should be high on your list of likely "buy" candidates. And for families who want an all-around "home-appliance" computer, the TI-99/4A might just fit the bill. □

At a Glance

Name: TI-99/4A home computer

Uses

Personal computing, homes, professional firms, schools

Manufacturer

Texas Instruments Inc.
POB 53
Lubbock, TX 79408
(800) 692-4279 in Texas
(800) 858-4565 all others

Standard Features

TMS 9900 16-bit microprocessor; 48-key, full-travel keyboard; video/audio output for color display— 24 lines of 32 characters, small and large capitals plus punctuation and symbols, programmable graphics characters, 16 colors, 256 by 192 graphics resolution; three simultaneous musical tones (five octaves) plus one special-effect noise; 16K bytes of programmable memory (expandable to 48K bytes); 26K bytes of preprogrammed ROM including TI BASIC

Base List Price

$525 (keyboard console)

Typical System Price

Television interface, thermal printer, speech synthesizer, one disk controller and drive—$1924.75

Popular Options and Accessories

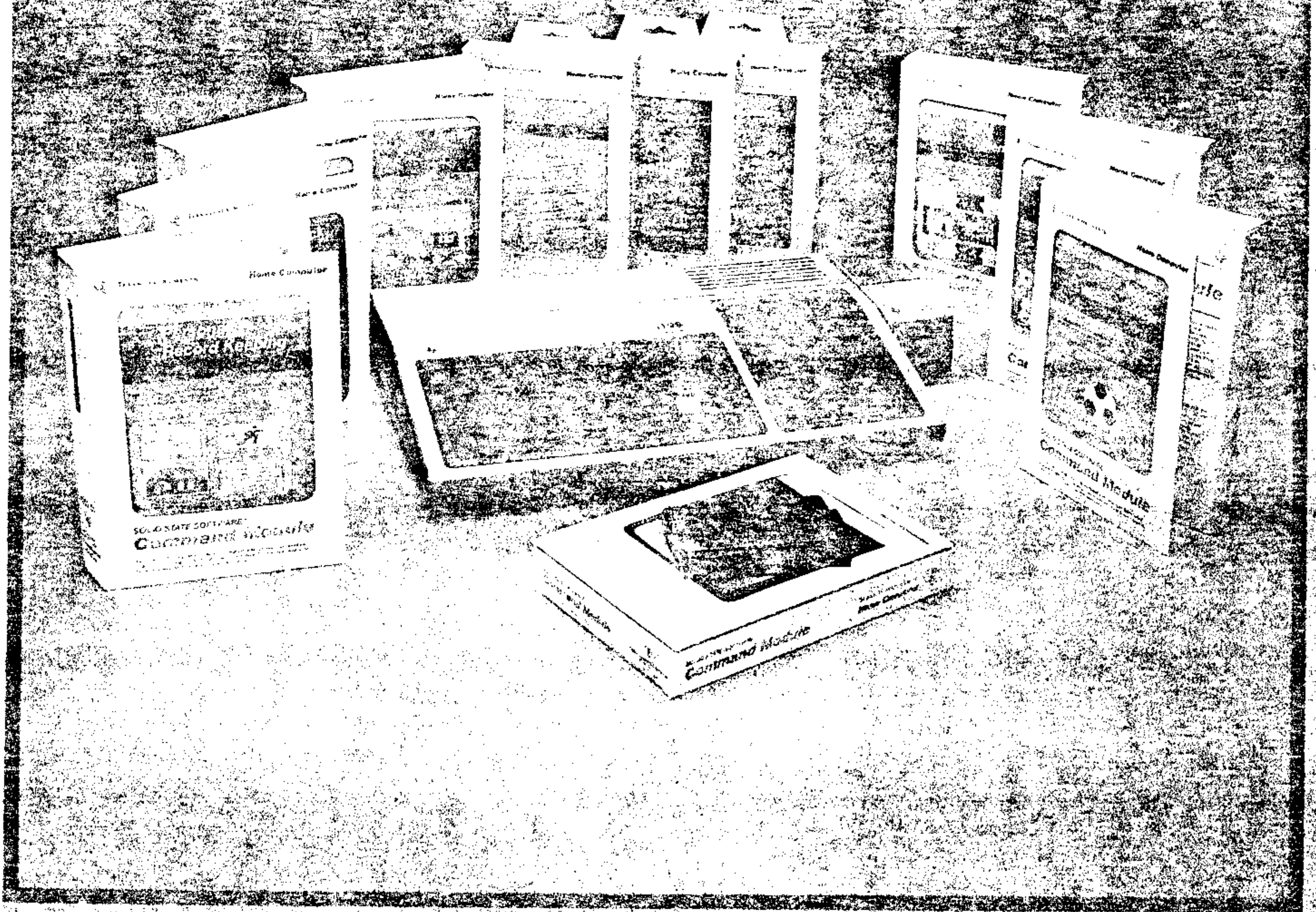|	
Television interface	$ 49.95
10-inch color monitor	399.95
Printer	399.95
Memory expansion (32K)	399.95
Speech synthesizer	149.95
Thermal printer	399.95
Disk-drive controller	299.95
Disk drive	499.95
RS-232C interface	224.95
Telephone interface (modem)	224.95
Wired remote controllers (2)	34.95

Other Languages Available

Extended BASIC, Logo, Pascal

The Texas Instruments plug-in cartridge system for the TI-99/4A home computer eliminates time-consuming booting up, loading, typing commands, and other assorted fidgeting needed to get most computer programs up and running. TI says that the programs, officially known as Solid-State Software Command Modules, are "snap-and-go." "Go where?" In search of an answer, Popular Computing staff members reviewed TI programs.

Personal Real Estate

The Personal Real Estate Command Module ($69.95) is a handy tool for individual investors, brokers, students, and others out to make a killing in the topsy-turvy real-estate market. Even those with a limited understanding of real-estate wheeling and dealing can use the program to define investments, evaluate loans, calculate rates of return, analyze cash flow and sales, determine lease potentials, and clarify, graph, and print depreciation schedules.

The manual that accompanies the Personal Real Estate program clearly defines such terms as "present values" (used in return rates for comparing certain values), and a definitive glossary of terms is included in each section. The appendix contains formulas used by the computer for many of the program calculations.

The best feature is the program's flexibility, which allows users to change information and repeat calculations. Projected outcomes for a series of different decisions can then be compared (Texas Instruments calls this the "what if" capability, and should you be inclined to forget the ups and downs of yesterday, calculations can be stored on disk or cassette.

With fast-paced market fluctuations and yo-yo interest rates, the Personal Real Estate Program is a must for serious entrepreneurs. – R.W.

Programming Aids I

Programming Aids I ($14.95) can help you discover how to use TI BASIC by presenting examples of programs and routines, thus eliminating tedious experimenting.

Catalog tells you what files are located on a disk. Without the catalog program, you'd have to drum up a disk-manager software cartridge to get the same information.

I/O Subroutines saves you the time and trouble of creating your own programs to display, input, and copy from the screen to the printer. The sub-

routines also provide several other handy functions but they're for beginners only – some are disappointingly slow for more experienced users.

Second Character Set illustrates use of the TI-99/4A's color capabilities to highlight text. This is a rather complicated feature, and the routine helps simplify its use.

Programming Aids I helps you avoid doing everything the hard way – the reason you bought the computer in the first place! – G.S.

Home Financial Decisions

Should you buy or lease that new Fiat you've got your eye on? Would you save money buying a house instead of renting? Can you really afford that trip to Mexico or should you sock your money away in a savings account for next year?

The Home Financial Decisions Command Module ($29.95) can help you find your way through all kinds of financial decisions by outlining your choices and considering variables. The program is divided into four areas – loans, residence, car, and savings – and further subdivided into specific situations.

The loan chapter of Home Financial Decisions deals with amounts you can afford to borrow, size of payments, number of monthly payments, down payments, and early payoffs. After answering a series of questions on annual percentage rates, compounded interest, and the like, the program delivers clear, concise answers in seconds and with no tedious pencil work on your part.

The residence section of the program can help you decide if you should rent or buy a home, remain in your current home or buy a new one, or refinance your mortgage. The savings section can help you figure out how to save for a major purchase, how long it will take you to reach your goal, and how much you'll need in an account for regular withdrawals (car payments, retirement, etc.) while the declining balance continues to draw interest.

I took my dilemma to the car chapter of the program. Could I really afford the monthly payments for a $25,000 De Lorean (sleek, stainless-steel body, and pure luxury) or should I stick to hoofing it around town for the sake of keeping food in the cupboard?

I chose the section titled "Buy A Car?" from the program menu and plugged in the following figures:

Purchase price for the new car	$25,000
Down payment	$5000
Number of monthly payments	36
Interest rate	18%

The computer told me I'd have to make payments of $723.05 for 35 months and a final payment of $722.95 to put the shiny beauty in my garage. Along the way, I'd pay $6,029.70 in interest. "Sure," I thought, "I can swing those monthly payments if I want to eat celery for the next three years." There had to be a better way.

What if I took out a loan over 48 months? To find out how this would affect the monthly payments, all I had to do was change the 36 after "Number of monthly payments" to 48 – the rest of the information was still conveniently plugged into the program.

In a split second, the computer informed me I'd be paying $587.50 per month if I stretched out the term of the loan. Great. Now I'd still be eating celery but at least I could afford to put gas in the De Lorean. Then my eye dropped down to the next line, where I discovered that the additional 12 payments would raise the total amount of interest on the car to $8200, a whopping $1170.30 increase.

"Ah well," I decided, "for the additional $1170.30 and the De Lorean, I'll give up the celery." Now all I have to do is convince the loan officer at the bank. It'll be a snap – I'll just invite her over to see the Home Financial Decisions program! – R.W.

Music Maker

Shower-stall crooners, Pied Pipers, and 8-year-old budding rock stars will love Texas Instruments' Music Maker

program ($14.95). Using two modes, the program lets everyone from concert pianists to those with no musical ability write tunes to their hearts' content.

In the Sound Graph mode, musicians can create music by drawing lines (representing tones) on the video screen. Want a high note? Push the cursor to the top of the screen. A low note? Drop the cursor down again.

In the Traditional Mode, notes are placed on a musical graph one measure at a time while Music Maker asks for time signatures, flats, and other musical notations. There's plenty of room for creative expansion as musical aptitude grows. Original ditties can be recorded on tape or disk, and hard copies of your latest hit can also be printed out. —H.C.

Weight Control and Nutrition

I was rather insulted when *Popular Computing* suggested I review Texas Instruments' Weight Control and Nutrition Program ($59.95). Granted, a few pounds had crept up and I was having trouble squeezing in between my desk and typewriter, but who needs a computer program to lose weight? I've done it hundreds of times.

The program began by asking me a few personal questions. I fudged a little on my weight but truthfully plugged in my age, desired weight, activity level, and more. There was a pause. The computer flashed a depressing statement; "You must consume no more than 1264 calories each day." I quickly flipped through the program manual only to find that caloric level translated into one bowl of spaghetti with garlic bread and a slice of vanilla cream pie for the entire day.

Not one to give up easily, I decided to check out a week's worth of menus just to see how the program would spread 1264 calories over three meals and a snack. The program started with Sunday breakfast, my favorite meal. Half a grapefruit, 8 ounces of skim milk, one pancake. I panicked.

Monday's dinner was liver, onions, and succotash. Tuesday's was chicken-cauliflower casserole. But I was determined to try the diet anyway.

The meals suggested by the program are nutritious, although they're not designed for those with special dietary requirements, and the recipes demand a chef willing to venture into the unknown. Fortunately the deviation from standard diet fare is pleasant.

All in all, the program is easy to follow and average weight loss is about two pounds a week. Diet data (how much weight is lost, new menus, etc.) is entered weekly and can be recorded on cassette or disk. Quick copies of recipes and menus can be printed (for the refrigerator door, of course!). —H.C.

Early Learning Fun, Addition and Subtraction II, and Multiplication I

Texas Instruments' educational software is superb, as these three packages demonstrate. All use the system's color, sound, music, and speech capabilities to their best advantage and are ideal ways to get kids started on the computer.

Early Learning Fun ($29.95) teaches and strengthens several skills: number, letter, and shape identification; counting from 1 to 9; alphabet and word associations ("A is for Ant"); and use of the computer keyboard.

Each of the four learning categories features several types of exercises. My kids were delighted with the graphics, sound, and musical reinforcement for correct answers. There's no "wrong" buzzer, which might discourage or frighten a young child—the computer just "beeps" instead of playing a song.

Very young children will probably need an adult handy to help them start the program and to become familiar with the keyboard, but after a few moments, they will likely take over.

Addition and Subtraction II and Multiplication I, developed for Texas Instruments by educational publisher

Scott, Foresman, and Company, were designed for elementary school ages, and are more sophisticated than Early Learning Fun. These programs adjust sequence and difficulty to the child's performance, use the speech synthesizer to offer verbal encouragement, and have time-out routines to help the child when his or her response is slow.

Multiplication I converts repetitive addition into single multiplication, demonstrates multiplication factors from 0 to 9, and advances from horizontal to vertical format multiplication.

Addition and Subtraction II covers counting from 0 to 18, advancing from horizontal to vertical format problems, and addition of three numbers.

At $29.95 for Early Learning Fun and $39.95 each for Addition and Subtraction II and Multiplication I, let's see now, that's ten, carry the one, nineteen, carry the one. . . .–G.S.

Speech Editor and Terminal Emulator II

Several TI program cartridges have a speech capability (assuming your computer's speech synthesizer unit is connected). While most of these programs use a fixed vocabulary to make the computer more interactive, Speech Editor and Terminal Emulator II are unique because they let you explore the capabilities of speech synthesis.

Speech Editor ($44.95) has a 400-word vocabulary; using the editor, you can type in any combination of these words to make larger words, phrases, and sentences. You can also experiment with pauses to make the speech more intelligible. By selecting TI BASIC with Speech Editor plugged in, you can even write your own programs taking advantage of the 400-word vocabulary. The major limitation is that, with a few exceptions, you cannot add inflection to the speech.

Terminal Emulator II ($49.95), primarily a telecommunications program, allows your TI-99/4A to communicate by telephone with database services or another computer, with the

addition of the RS-232C interface, telephone coupler, and speech synthesizer.

One of the program's most interesting features is text to speech: given ordinary English text, the computer applies rules of pronunciation to produce speech that is amazingly easy to understand. This system is far more versatile than the limited vocabulary method used in Speech Editor and other programs. By connecting the computer to The Source or Compuserve, you can *listen* to the news from AP, UPI, or other sources. Move over, Paul Harvey!

If you really want to explore the possibilities of speech synthesis, select TI BASIC with the TE II cartridge plugged in. (You don't need the RS-232C interface or the telephone coupler for this use.) Then you can write programs that control the speech synthesizer at the *allophone* level. (Allophones are the building blocks of speech. Combining allophones lets you generate English with any accent you choose.) You can even add inflection to the speech and select the voice pitch.–G.S.

Tax/Investment Record Keeping

Remember those shoeboxes overflowing with receipts, the desk drawers stuffed with bills, the basket that housed six years' worth of tax returns? You don't have to live with them anymore. Now there's the Tax/Investment Record Keeping program ($69.96) designed to clean up the paperwork generated by modern-day living.

The module features a "built-in" filing system that can be used as-is or adapted to special needs. Everything from double-entry bookkeeping and investment data to records of taxable and exempt expenses can be recorded, stored, and recalled at the push of a few keys. The program can also generate a variety of financial reports, locate and total specific transactions, compare income and expenses, assess capital gains and losses, and determine your net

worth. The accompanying manual presents clear examples and has an easy-to-understand demonstration that will help you use and modify the file system. Tax/Investment Record Keeping requires a Texas Instruments disk-memory system for information storage and a disk.–R.W.

Teach Yourself BASIC

Teach Yourself BASIC ($29.95) is a package of programs designed to teach the fundamentals of the TI BASIC language and programming concepts in general. Considering that it is written in BASIC, the programs are surprisingly effective and entertaining. The package has 10 programs covering everything from elementary concepts to advanced technology. Checkpoints are placed liberally throughout, and if your answers indicate a lack of understanding, the computer delivers further explanation on the topic at hand.

For many computer novices, Teach Yourself BASIC would be preferable to plowing through a book. The chief advantage is that it lets you use the computer *while* you're learning to program it.–G.S.

Yahtzee

In the cardboard version, players roll five dice and select what they'll keep, all aiming at getting high scores in some 13 categories (full house, straights, and so on). Each player gets three rolls and can choose to roll one or all of the dice on any given play.

Yahtzee isn't an exciting game to begin with and the problem with the computerized version is that it takes away all the action–which breaks the monotony of the original. The computer rolls the dice. The computer calculates the scores. You get to press the enter button. Big deal.

For $29.95 (the cost of the computer game) you could buy several traditional Yahtzee set-ups and have a much better time.–H.C.