Using and Programming the IBM PCjr^(R)

including 77 Ready-to-Run Programs

By Frederick Holtz

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FIRST EDITION

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Kitchen & classroom photographs courtesy of IBM.

Acknowledgments

Introduction

The IBM PCjr, long heralded, finally made its debut in late 1983. One of the most talked-about computers of all time, the PCjr has more than lived up to its expectations. This excellent machine is a home computer, but it's also a personal computer. And it can be upgraded to make it even more powerful. This book is designed to teach the beginner about the IBM PCjr and especially how to use its powerful BASIC language. For the experienced computer hobbyist, there is page after page of technical information about this machine. And for everyone, a super-big helping of programs that will put the PCjr through its many paces. Whether your interest lies in filekeeping, computer graphics, computer games, or straight text processing, you will find the information in these pages to help you over the rough spots and put you deeply into the world of personal computing.

While it is difficult to write a book aimed at persons whose experiences range from none at all to considerable, the two-part format of this book should make its content useful and informative to those at both high and low levels of expertise. Regardless of your experience with computers, when you finish this book, you will be well-informed about the present and future potential of what I have called the finest investment in the history of computers, the IBM PCjr.

Contents

PART 1

MEET THE IBM PCjr

The IBM PCjr is a unique computer in many ways. This uniqueness presents itself as an asset to the home and personal computer fields alike. Undoubtedly, this computer will be purchased by many individuals who are getting into computing for the first time. It will also be quite popular among those who are upgrading from a lower-level computer. Third, many IBM PCjrs will be purchased by relatively experienced computerists who already own an IBM Personal Computer or an IBM PC look-alike. They can use the portable IBM PCjr at home or in out-of-office environments where the IBM Personal Computer cannot be conveniently taken.

A versatile machine, yes. But the IBM PCjr is a relatively difficult machine to write about, at least in an introductory book, because I have a certain amount of difficulty ascertaining just who my audience is. It is customary to shoot for a point somewhere in the middle of this vast spread of possible readers. However, this often results in a book that is too high-level for the beginner, yet too low-level for the experienced. To circumvent this problem, I have elected to divide this book into two major sections. The chapters which make up Part 1 of this book are aimed primarily at the beginning computerist. They will also be of interest to the other two levels of readership, in that Chapter 1 in Part 1 contains a history of International Business Machines Corporation. Chapter 2 overviews the IBM PCjr.

Chapters 3 and 4 are tailored more to the person who has very limited experience in computer programming, or none whatsoever. These chapters provide detailed discussions in an easy-to-follow, building-block format. When you finish these two chapters, you are adequately prepared to begin doing wonders with the IBM PCjr. Those of you who have no experience with the IBM PCjr (Microsoft) BASIC language will also find these chapters to be most educational.

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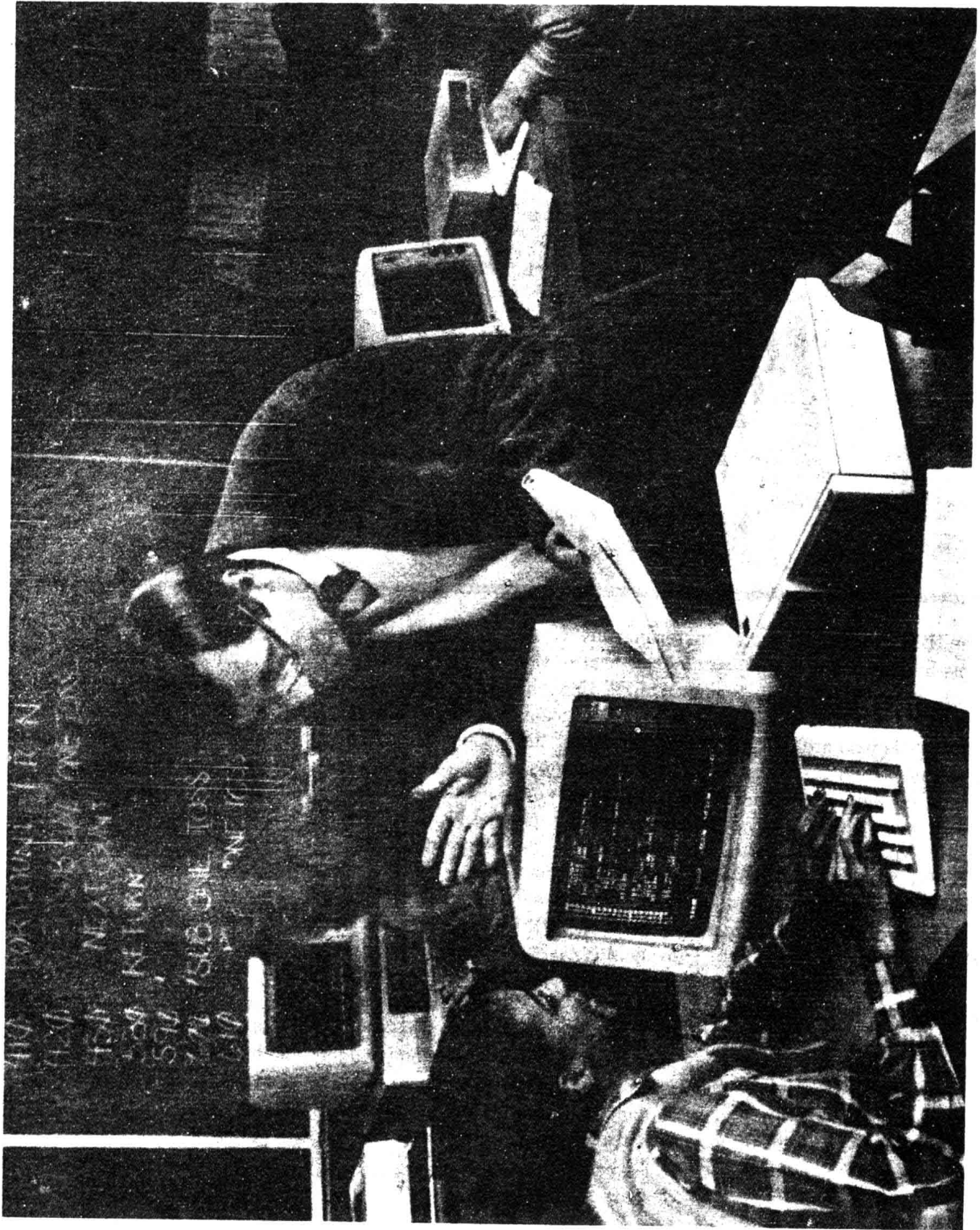
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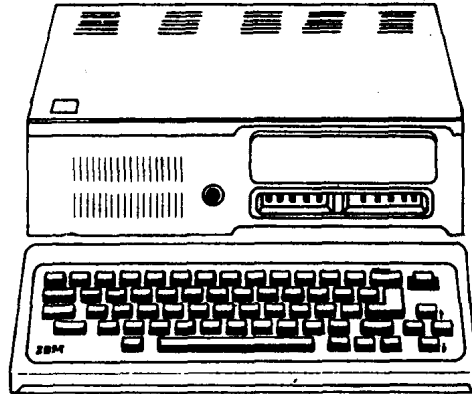
The Evolution of the PCjr

The IBM PCjr is here, approximately one year after news was leaked to the media of a new IBM computer for the home and personal market. This original leak referred to the possibility that IBM would enter the home computer field with a machine that would retail for less than $1,000. That story, which appeared in the *Wall Street Journal* in January, 1983, referred to the computer as the IBM Peanut. There was also a rumor that the Peanut would be followed later by a higher-level machine called the Popcorn.

IBM remained mysteriously mum about this computer, and even told dealers that there was no such animal. Though there was some feeling that the media had reacted too quickly to a loose arrangement of supposed "facts," if the release were absolutely fictitious, common sense would dictate that a retraction might be printed. This was not the case. IBM was content to let the computer-buying public, and, for that matter, the microcomputer industry wait, worry, and speculate. And all of these things were done.

The year 1983 was not a good year for many home computer manufacturers, which some might attribute to the expectation that, any day, IBM would announce the Peanut officially. Most of us assumed this machine would be available for the 1983 Christmas season. This was not to be. In early October, 1983, IBM announced their new computer—now named the IBM PCjr—to authorized IBM dealers. The machine was displayed, and, in early December, demonstrator units were sent out. Each dealer was allowed to order up to 20 units, supposedly for sale to customers in time for Christmas. This too was not to be. Dealers placed their orders in November, but in early December IBM cancelled these orders, stating that deliveries would not be made until the new year. All orders would have to be resubmitted.

During the second week of December, 1983, I interviewed several authorized IBM dealers across the United States. Most had a single IBM PCjr demonstrator, but most were relegating them to the back room because they did not feel secure

enough to pinpoint a delivery date and begin taking orders. Several of the dealers with whom I spoke were angry. One told me he would always think of IBM as "the Grinch who stole Christmas." Questioned further, the dealer alluded to the fact that many persons had put off buying a computer in order to check out the IBM PCjr. The October announcement that IBM did indeed have a new personal/ home computer brought sections of the microcomputer market to a standstill. IBM then failed to deliver as promised. Some buyers purchased other computers, but many decided to wait. To this dealer, this situation had a significant detrimental impact on computer sales.

The year 1983 will always be known as the "reining-in" of the home computer industry. Texas Instruments announced the termination of their very popular TI-99/4A home computer. This followed similar termination announcements for their yet-to-be-released TI-99/2A and their Compact series of microcomputers. Shortly before the TI-99/4A termination announcement, Texas Instruments had leaked news of a new, upgraded version, the TI-99/8. A few weeks later, word came down the grapevine that this project had been shelved.

The termination of the TI-99/4A came as a surprise to most of us, even though this announcement was not wholly unexpected. Texas Instruments had slashed the price of their only home computer to an almost-ridiculous $99, approximately $300 *below* the original retail price. This was done specifically to compete with the Commodore VIC-20 and the Commodore 64 computers, which were then (and still are) quite popular. The TI-99/4A market boomed. Units were sold by the hundreds of thousands. Unfortunately, however, Texas Instruments was not making money on these machines, since the units were selling at or below manufacturing costs. Texas Instruments had anticipated a booming market in TI-99/4A peripherals, such as expansion units, disk drives, printers, modems, and software. This was simply not to be. Though you could buy a TI-99/4A for under $100, a complete system with all peripherals and expansion modules could cost well over $1,500. To me (and apparently to many others), it didn't make good sense to couple a $400 or $500 disk drive unit to a $100 computer, nor to equip it with a $300 color monitor.

The result was a buy-up of the inexpensive computer units, but that was all. TI began losing money, literally by the truckloads, in their home computer division. It was a Catch-22 position: their peripherals were not selling, but it was not possible to jack the price of the computer back up, because other computers were now selling for less than $100. Today, a versatile home computer for under $100 is a rule rather than an exception.

Other home computer manufacturers were having difficulties as well. ATARI dropped their old 400 and 800 home computer models, to be replaced by the XL series. This unit came on the market at a price which one would reasonably expect, and which was then quickly cut as the price war began. Toy manufacturers such as Mattel offered home computers, also to lukewarm reception. Manufacturers found that they simply could not dump home computers on an increasingly sophisticated computer-buying public.

The buying public's memory has had much to do with the shake-out. They have learned that new offerings in electronics will be extremely expensive at first, but will grow much cheaper and better as the years pass. If you're now in your thirties or forties, you can probably remember purchasing your first electronic calculator, or (if you're a little younger) your first electronic watch. One can remember the mystique with which they were offered—a truly futuristic device that was tiny but powerful, and one that nearly everyone wanted. An electronic calculator or watch could cost upwards of $1,000, with the average price being $150-$200. Hundreds of thousands were sold, but compare those units to those available today, many for less than $15.

The same line of thinking applies to microcomputers. Less than two years ago, the public was accustomed to seeing personal micros selling for $1,000-$3,000, yet only a few years before they had been selling for twice that. As the price of higher-level personal computers became more reasonable, the medium prices ($500-$600) of

home computers did not look so attractive. Slashing prices temporarily stemmed the exodus from the home computer field—but not for long.

The IBM Peanut (now PCjr) may also have played a more important role than some suspect. Many persons undoubtedly put off buying a home computer, expecting that the IBM Peanut would be a high-level home computer reflecting in price the home computers already being offered. After all, the original release indicated only that the price would be under $1,000. This could mean $800, $500, or possibly even $200. No one knew for sure. Some may have thought, "Why buy a 'standard' make of home computer when if I wait for a little while, I can have an *IBM* home computer for a little more." Some may even have planned to wait six months after the Peanut came out, hopeful of an even better price. Many even thought the IBM Peanut would render all other home computers obsolete. Whether its announcement was a major contributor to the *fall* of the present home computer market is arguable, but that its announcement had a detrimental impact on an already faltering market is not.

IBM HISTORY

Why does IBM have such tremendous impact on the computer market as a whole? For example, though IBM had always been the acknowledged leader in large mainframe computer systems, it was only in August, 1981, that IBM announced its entry into the personal computer field with the IBM Personal computer. While IBM had been studying the market for quite some time, the program which produced the IBM PC had begun only thirteen months before the August 12, 1981, announcement. To say that IBM had taken the personal computer market by storm would be an understatement. But why does such a company have such influence in apparently any marketing area they choose to enter? To understand, one must know a bit about the history of IBM.

It begins in the late 1880's, when the value of tabulating machines was beginning to be established. The benchmark in the field occurred when machine compilation of the 1890 United States census cut the tabulation time from 7 to 3 years. Dr. Herman Hollerith, a statistician in the United States Census Office, devised a series of electrical machines to perform adding and counting operations on data stored on punched cards. In 1896, he formed the Tabulating Machine Company in Washington, D.C.

The first computing scale was patented in 1885 by Julius E. Pitrat of Gallipolis, Ohio. His patents were bought by Edward Canby and Orange O. Ozias, businessmen in Dayton, Ohio, who incorporated the Computing Scale Company in 1891. A mechanical time recorder was devised in 1888 by Willard Bundy, a jeweler in Auburn, New York. The next year, his brother Harlow organized the Bundy Manufacturing Company to produce time recorders. The company later relocated in Endicott, New York, as the International Time Recording Company.

In 1911, at the suggestion of merchant-banker Charles R. Flint, the International Time Recording Company, the Computing Scale Company, and the Tabulating Machine Company merged and incorporated in New York state as the Computing-Tabulating-Recording Company (C-T-R). It manufactured commercial scales, tabulating, and time-recording equipment. This was the beginning of what was to become IBM. The new company came under single management for the first time in 1914, when the company had 1,300 employees. In that year, the late Thomas J. Watson, Sr., left National Cash Register Company to join C-T-R as General Manager, soon becoming president. Finally, in 1924, the name International Business Machines Corporation (IBM) was adopted.

Early IBM products included a hand-operated gang punch, a non-printing tabulator, a keypunch, and a sorter. In 1928, punched cards doubled in data capacity, bringing about a popular new series of machines introduced in the early 1930s. These were full-scale accounting machines, as opposed to simple tabulators that could only add and subtract. During the Depression, IBM was one of the few companies to add salesmen, increase research allotments, and continue to produce products with no cutbacks whatsoever. In 1936, the company tackled

the job of providing machines and services for what has been called the "biggest accounting operation of all time"—the Social Security program.

In their computer operations (up until the introduction of the IBM PC in 1981) IBM and its products had little contact with or personal interest in the average consumer; their products and services were marketed to government and big business. Back in 1933, however, this changed when IBM entered the electric typewriter business. Even today, the average individual knows IBM best as the manufacturer of the IBM typewriter. In 1933, IBM purchased Electromatic Typewriters, Inc., a company with 36 employees. The first IBM electric typewriter appeared two years later.

During World War II, IBM produced the first general-purpose digital computer, called the Automatic Sequence Control Calculator (ASCC), after six years of developmental work with Professor Howard Aiken of Harvard University. This was an electromechanical computer that used relays and tape-controlled programming devices. The machine was presented to Harvard in 1944.

IBM jumped into the computer field. In 1948, the Selective Sequence Electronic Calculator (SSEC) was announced. Four years later, the IBM 701, IBM's first production computer, appeared. The capability of performing over 20,000 calculations per second may not sound like much compared to today's computers, which can perform millions of calculations per second, but one must remember that the IBM 701 was introduced over thirty years ago. Digital computers had just emerged from the prenatal stage, and the science of electronics was still in its infancy. Mechanics were depended upon more than electronics to get the job done. In the middle fifties, however, the field of electronics advanced rapidly, bringing about equally rapid advancement in the area of data processing machines and techniques. The following is a short chronology of IBM advancements.

1914. Mechanical keypunch, hand-operated gang punch, vertical sorter, and tabulator.

1919. Electric synchronized time clock system.

1920. Printer tabulator.

1924. Rotary card press.

1925. Horizontal sorting machine.

1928. 80-column punched card, subtracting-counting machine.

1931. 400-series alphabetical counting machine, 600-series calculating machine.

1933. Improved alphabetical counting machine.

1934. 405 alphabetical counting machine.

1935. IBM electrical typewriter.

1937. MODEL 77 calculator.

1941/45. Aircraft fire control instruments, director and prediction units for antiaircraft guns, the automatic sequence control calculator.

1948. First large-scale digital calculating machine, Selective Sequence Electronic Calculator, 604 calculating punch, IBM Model A typewriter.

1949. Model A executive electric typewriter with proportional spacing.

1950. Bombing/navigational systems, giant high-speed electronic calculators.

1951. Model A decimal tabulating typewriter.

1952. First production computer designed primarily for scientific calculations (IBM 701).

1953. IBM 702 computer, IBM 650 computer.

1954. IBM 704 and 705 computers succeeded the 701 and 702.

1955. Model 608 transistor calculator, high-speed printer, and Model 83 sorter.

1956. Model 305 RAMAC, Model 27 card proof punch, Model 28 printing card proof punch, electronic reading device for electronic typewriters, and an electronic input/output device to print automatically work done by computers.

1958. Model 7090 high-capacity computer, Model 7070 intermediate data processing system, Series 50 basic accounting machine, Model 632 electronic typing calculator (card output).

1959. Model 1401 data processing system, Model 1620 scientific computer, Model 357 data collection system, IBM 9090 reservation system, Model C standard and executive typewriters, and Model C Hektowriter.

1960. 7000 series solid-state computers re-

placed the 700 series vacuum tube machines, Model 410 computer, STRETCH computing systems. Executary dictation equipment, and Model 632 electronic typing calculator.

1961. IBM Selectric typewriter, Executary PBX dictation system, Model 1710 control system, Hypertape system, Model 1301 disk storage and Model 1403 high-speed printer.

1962. Model 1440 data processing system, Model 7094 computing system, Model 7010 data processing system, Model 7710 data communications unit, Model 1420 bank transmit system, Model 1062 teller terminal, Model 6400 accounting machine, and the Selectric Input/Output typewriter.

1963. Model 7094 II computer, Model 1460 electronic filing system, and Model 1240 banking system.

1964. IBM System/360 computer line, Model 1800 data acquisition and control system, graphic data processing system, and an experimental electronic laser positioning device.

1965. Model 44 medium-sized computer, Models 65 and 75 computer systems, Model 1130 desk-sized computer, Models 2740 and 2741 typewriter communications terminals, Model 2321 data cell drive, Model 224 Executary portable dictating unit, and Model 2361 computer memory.

1966. IBM Selectric Composer and magnetic tape Selectric Composer, Model 1287 optical reader, Model 9370 document reproducer, IBM 1500 system for computer-assisted instruction, IMPACT program series. Model 1080 data acquisition system, System/4 Pi aircraft and space computer.

1967. System/360 Model 25, Model D and Model D executive typewriters, Model 2680 CRT printer, QUICKTRAN 2 terminal system, Model 1259 magnetic character reader/sorter, Series/500 Magnetic Tape, binary synchronous communications.

1968. System/360 Model 85, Model 50 data inscriber, Model 2495 carriage reader, Model 265 and Model 2760 display units, Model 2285 display copier, and Model 1288 optical reader.

1969. IBM System/3 small business computer, System/360 Model 195 computer using monolithic integrated circuits, Model 2770 data communications system, and the IBM Mag Card Selectric typewriter.

1970. IBM System/370, Model 3330 disk file, Model 3803/3420 magnetic tape subsystem, Model 3211 printer, Model 129 card data recorder, electronic memory keypunch.

1971. Model 3270 information display system, Model 3410 magnetic tape subsystem, Model 3735 programmable buffered terminal, Model 3670 brokerage communication system, Model 2798 guidance display unit and model 2730 transaction validation terminal.

1972. Model 3705 communications controller, Model 2796 mobile terminal system, Model 3881 optical mark reader, Model 2922 programmable terminal, Model 3780 data communications terminal, Model 2984 cash issue terminal, Model 3886 optical character reader, and the Model 2991 blood cell processor.

1973. Model 3650 retail store system, Model 3660 supermarket system, Model 3600 and Model 3890 finance communications systems, Model 5275 direct numerical control station, Model 3704 communications controller, Model 3340 direct access storage facility, Model 3790 communications system.

1974. Bubble lattice storage, IBM Memory Typewriter, Model 3767 terminal, Model 3850 mass storage system.

1975. Model 3800 printing subsystem, Model 3760 dual key entry station, Model 5100 portable typewriter, and IBM System/32.

1976. Model 3838 array processor, Model 5937 industrial terminal, Model 6440 document printer, Series III copier/duplicators, and Word Processor/32.

1977. Model 3033 processor, Model 3031 and 3032 processors, and IBM System/34 computer.

1978. Model 8100 information system, Model 3033 multiprocessor complex, Model 5110 small business computer, System/38 general-purpose computer, Models 50 and 60 electronic typewriters.

1979. Model 4300 processor, Model 3279

color display terminal, Model 3287 color printer, IBM 3863, 3864, and 3865 modems, Model 5260 point-of-sale terminal, Model 75 electronic typewriter.

1980. Series/1 energy conservation system, IBM Series/1 computer, Model 3850 mass storage system, display writer system, NR-80 series nuclear magnetic resonance spectrometer, and educational courseware for personal computers.

1981. The IBM Personal Computer.

1982. The IBM PC-XT computer.

1983. IBM PCjr computer (Fig. 1-1).

This chronological listing of events is greatly abbreviated, but one can easily see the dominance that IBM has maintained through innovative developments. IBM's first entry into the consumer-oriented computer market came with the IBM PC in 1981. Many said IBM would fail, and that the company could not apply mainframe marketing techniques to the personal computer market. The first portion of this statement is totally incorrect; IBM certainly has not failed with its personal computer. (Today it is probably the most popular personal computer on the market.) The second statement is partially true, but IBM didn't use mainframe marketing techniques. The IBM Personal Computer was immediately made available to computer stores throughout the nation. ComputerLand stores are probably the most notable, but there are also a bevy of IBM franchised dealers who carry many other makes. IBM took the best of its mainframe marketing experience and modified it to sell the IBM PC.

IBM service has always been an important factor, whether for mainframes or office typewriters. IBM concentrated on service while their marketing program for the IBM PC was being developed, and most IBM franchised dealers are also IBM PC repair stations. To many, the IBM name is important because of the quality of their products.


Fig. 1-1. The IBM PCjr was introduced in 1983 (courtesy IBM).

Like IBM typewriters, IBM computers don't break down very often, and IBM repair is swift and efficient.

I have devoted quite a few pages to the IBM PC and its impact, because it is this forerunner of the IBM PCjr that makes the PCjr an especially valuable commodity. When the IBM PC was first introduced, there was very little software using the MS-DOS operating system for this new computer. This operating system, developed by Microsoft Inc., is fast becoming a universal operating system for microcomputers. The lack of IBM software when the machine was first introduced was quickly corrected. Nearly every major and minor software company in the United States began immediately rewriting programs for the IBM PC, and some companies concentrated on this machine exclusively. There is now a wide assortment of IBM PC look-alikes, and software for the IBM PC is very abundant. In fact there is more software being written for the IBM PC or MS-DOS operating system than for any other type of computer or operating system—which is remarkable for a machine that has been out only a few years. To say that it is advantageous to have an IBM-compatible machine is certainly a very accurate statement.

IBM PCjr: THE FACTS

If you have not yet purchased an IBM PCjr, this discussion will be especially relevant to you; if you already have one, some of what will be said in these pages will be obvious. However, much of this discussion will include the facts about the computer—along with my own personal views, some of which you may agree with and some which you may not.

The IBM Personal Computer, to my way of thinking, was not quite like any other personal computer that had been offered before. I think of it as the "missing link" between the personal computers that were popular shortly before its introduction and the larger minicomputers that were around at the same time. The PC was not a minicomputer, but it was far more than a personal computer (in the terminology of the day). Before actually seeing the

IBM PCjr, I predicted that this machine would be a bridge between the home computer and the personal computer, but I was not entirely accurate. The IBM PCjr cannot be classified as a true home computer, especially in its advanced configuration. It is, for all intents and purposes, the IBM Personal Computer that has been somewhat downgraded in its expansion capabilities.

Anyone who has experience with the IBM PC will have no problem programming the IBM PCjr. The PCjr uses Microsoft BASIC, which is also becoming a standard BASIC dialect in the microcomputer industry. Programs that will run on the IBM PC will also run on the IBM PCjr, with only a few exceptions. First of all, the minimum PCjr configuration includes the system unit with 64K memory; the maximum configuration (at present) may have 128K memory. Any program written in IBM PC BASIC that requires no more than 64K (or 128K for the advanced version) will run on the IBM PCjr. Naturally, I have not had the opportunity to test every program available, but I have yet to find one that would not run. The IBM PCjr will be discussed in more detail in the next chapter, so I won't go further with the use of description here. The point is that the IBM PCjr operates very much like the IBM PC, and much of the software available for the PC can also be used with PCjr.

In its minimum configuration, the PCjr will sell for around $669.00. This is for a machine that includes the built-in BASIC language (contained in ROM), cassette storage, 64K memory, and, of course, the processor board. This configuration is quite similar to what has been referred to as the "toy" configuration for the IBM PC. This computer is also available without disk drive and with a minimum amount of memory, and would use cassette tape for storage. Very few units have been purchased in this configuration, but IBM wanted to try for the largest possible segment of the computer buying public. The IBM PC was really meant to be used in a larger configuration.

The PCjr, on the other hand, was designed specifically to operate in the lower configuration, mode, but it is not as limited as the IBM PC would be. The Advanced BASIC language (BASICA)

available with the Disk Operating System package for the IBM PC is a powerful graphics tool that cannot be had without PC DOS, the IBM version of MS-DOS. However, the PCjr uses plug-in ROM modules to give this machine the same capability as the IBM PC BASICA, without having to use a disk operating system and disk drive. At a price of approximately $669.00, the minimum configuration PCjr can be thought of as an extremely advanced home computer. This assumes that a color television is used as the monitor, although the RGB color monitor or composite color monitor can be attached instead. Assuming that dealers will be giving discounts, one might be able to pick up a PCjr for about the price of an ATARI 800 home computer a few years ago.

In the second configuration, however, the IBM PCjr is a true personal computer. The maximum configuration contains 128K of memory, a single disk drive, a built-in modem, and a few other options. Such a computer system would certainly be equivalent in most ways to any Apple or Radio Shack product within the same general price range. The PCjr in its maximum configuration will sell for about $1265.00 (I think it would be difficult to pick up a similarly equipped Apple or TRS-80 Model III at a lower price.) The minimum configuration is limited to a 40-column display format, whereas the maximum configuration allows for a full 80-character display. The machine is very similar to an IBM PC with a single disk drive. The PCjr with disk drive will use PC DOS Version 2.1, which is also offered for the IBM PC. This computer could be classified as a very high-level home computer in one configuration, and as a moderately high-level personal computer in another.

Earlier in this chapter, I alluded to the questionable wisdom of coupling a $400 disk drive to a $100 home computer. However, the PCjr in its minimum configuration is very powerful for its cost, so here it makes good sense to upgrade when necessary to a full configuration. The IBM PCjr is probably the only computer that might be classified as a home computer that is adaptable, both from cost and capability standpoints, to the high-level personal computer field. It makes far more sense to me to spend the extra money for this high-level computer in its home configuration—especially if the purchase were made as an introduction to the microcomputer world—than to buy an under-$100 home computer with no reasonable upgrade capabilities. If you spend less than $100 for a home computer, it's usually easier to put it on a shelf and buy a personal computer once you've outgrown its capabilities, than to attempt an upgrade that may cost you 10 to 20 times the original price. Thus, we might say that it is the only home computer that can truly be expanded into what could be called a personal computer—and this expansion would cost only about half the price of the computer itself.

Its compatibility with the IBM PC and, more specifically with MS-DOS, makes it a very valuable training aid for those hobbyists who will go on to more complex computer operations involving personal computers. Most home computers prior to the IBM PCjr did not even allude to some of the higher-level graphic and text capabilities of true personal computers. Even in its minimum configuration, the IBM PCjr not only alludes to higher-level operations, but can perform many of them. I believe the choice of an IBM PCjr is an excellent one, especially for the beginning computerist who wants to be certain that his computer system will grow as his knowledge of computers grows. In some ways, it's like buying a small, highly efficient home surrounded by a lot of property. At first, the original setup will be adequate to take care of many needs and, as the need for more capability becomes apparent, there are excellent expansion possibilities.