Beginning with PRODOS 8 & 16

with examples of using a hard disk

by

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Beginning with PRODOS 8 & 16

Forward

When Joseph Gleason called me in early February and asked me to write a book on PRODOS, I was quite surprised. The task was one which I had become accustomed after working as an instructional designer—developing instruction that improves an individual's productivity. Steve Ross and I then began to lay the plans for a book designed to help the inexperienced as well as the experienced user become proficient with the PRODOS operating system.

We would like to thank Jacqueline O'Dell and Bill Schultz, two of our doctoral students, for their critiques and editorial comments during the development of the book. We also want to acknowledge Joseph Gleason and his staff at Quality Computers for their assistance and suggestions. And last, I would like to thank Dave Madison of Opus 2 in Memphis for his encouragement, assistance, and support.

In the course of this book we have mentioned several software packages to provide examples of how to organize your hard disk. Many of these titles are fictitious (e.g., SLAM.DUNK) and thus will not be found in any store, advertisement, or software library (to our knowledge). Other packages are real and do exist (e.g., AppleWorks). Please do not assume that the mere

mention of a particular package indicates an endorsement on our part.

This book was designed to be 100% compatible with Quality Computers' EasyDrive and RAMUP packages.

G.R.M.
S.M.R.
Cordova, TN
3/15/88

This book was composed on an Apple //e which included a RAMWORKS II memory expansion card, a CMS 20 Megabyte hard disk, two DISK II's, and an Apple Unidisk 3.5 using AppleWorks enhanced with Beagle Brothers UltraMacros. Spelling was checked using the Sensible Speller. The final draft of the book was transferred to a Macintosh computer where it was placed into final form using PageMaker and printed on an Apple Laser Writer.

Table of Contents

Chapter 1
Introduction to the PRODOS Hard Disk

In the early days of the Apple // microcomputers, most users found the software very friendly and even the most complicated programs easy to use. Most of the applications instructed the user to remove one disk from the disk drive and insert another disk at the appropriate times. Users were able to accomplish quite a bit with very little knowledge of the computer or its commands. This ease of use continued even during the first few years of the PRODOS operating system. Soon, users found that they were no longer limited by the storage space offered by the floppy disk, but could use 3.5 inch disks and hard disks. Today, the Apple // user has a wide variety of mass storage devices available. Unfortunately, no one has developed an artificial intelligence program to make these devices as easy to use as the old Apple][machines with one disk drive.

This book is designed to help you get the most from your Apple // computer that has a hard disk, 3.5 disk, RAM disk, or simply two floppy disk drives. We have written this book with the new and inexperienced users in mind, but hope that experienced users will find it beneficial. We like to think of this book as the Apple //

user's first book on PRODOS. Its purpose is to familiarize you with PRODOS and help you use your hard disk and large RAM disk.

THE BEGINNING

Before beginning this book, we interviewed several individuals who sell hard disks and software to Apple // users. One of the major problems consistently mentioned was the users' lack of understanding of PRODOS which hampered both their setting up of a hard disk and using it efficiently. As the variety and availability of hard disks increase, more and more users have decided to include one with their system. Few, however, understand the power they will gain when switching from an application such as AppleWorks with two floppy disks to an AppleWorks system based on a hard disk.

We are of the strong opinion that if you are going to use a hard disk or other large capacity PRODOS disk, you must learn something about PRODOS if you are going to use the disk efficiently. Few people would consider buying a car and then calling a friend or asking the dealer to teach them how to drive it. We can just see someone stopped at the corner and calling the dealer to find out how to make a right turn. Users, however, often purchase a hard disk with no knowledge of PRODOS, and then call their dealer for operating instructions. This book is designed to teach you how to "drive" your hard disk out of the dealer's showroom and directly into your computer at home or at the office. When you finish this book, you will understand the

basics of PRODOS, know the PRODOS commands required to use your hard disk, and know how to organize your hard disk for maximum efficiency.

THE PLAN

This book includes 11 chapters to prepare you for using your hard disk. In the next few pages, we will provide you with an overview to the chapters and explain the conventions used in the illustrations.

"Please I Can't Wait" is for users who are in a hurry to set up their hard disks; Chapter 2 provides an overview of the process as well as several reasons for completing the book before you take the plunge. In Chapter 3, "PRODOS for Amateurs and Pros" you will learn about the PRODOS operating system and the rules for volume names and filenames. In Chapter 4, "Not All Directories are Phone Books," you will be introduced to how PRODOS organizes a disk and stores files in the volume directory and subdirectories. Chapter 5, "The Rosey Path to a Happy Hard Disk," will introduce you to pathnames and prefixes which establish the "routes" or "road maps" your hard disk follows. In Chapter 6, "Controlling PRODOS: The Commands," we will introduce you to the basic commands you will need to use PRODOS. Once we have established a good foundation, we will move to Chapter 7, "Planning for Your Hard Disk," and show you how to organize your hard disk for maximum efficiency. Then, in Chapter 8, "A Hard Disk with a View," we will show you how to improve the organization of your hard disk with standard

subdirectories. Chapter 9, we will explain how to manage you hard disk for optimum performance. In Chapter 10, we will explain some of the common PRODOS error codes and what you can do to correct these errors. Chapter 11 will explain the startup process for PRODOS 16 and an explanation of the files on the system master disk. Also included is a listing of programs you can use to test some of the PRODOS rules in Appendix A. In Appendix B we have provided a list of our favorite resources, if you would like to learn more about PRODOS. Finally, Appendix C includes a sample map of a disk which you can use with the exercises at the end of the chapters.

Figure Conventions

In some of the later chapters we have included figures which show the organization of various directories of a disk. Figure 1-1 is an example. Volume names always appear at the top of the figure and have a slash mark both before and after the name (/GAMES/). When referring to a volume name in the text, it is preceded by a slash (/GAMES). Subdirectories are indicated by a slash after the name (ADVENTURE/). We have also indented files and subdirectories that are part of another directory. For example, in Figure 1, ADVENTURE/ and SPORTS/ are both subdirectories in the /GAME volume; BASEBALL/ is a subdirectory in SPORTS/.

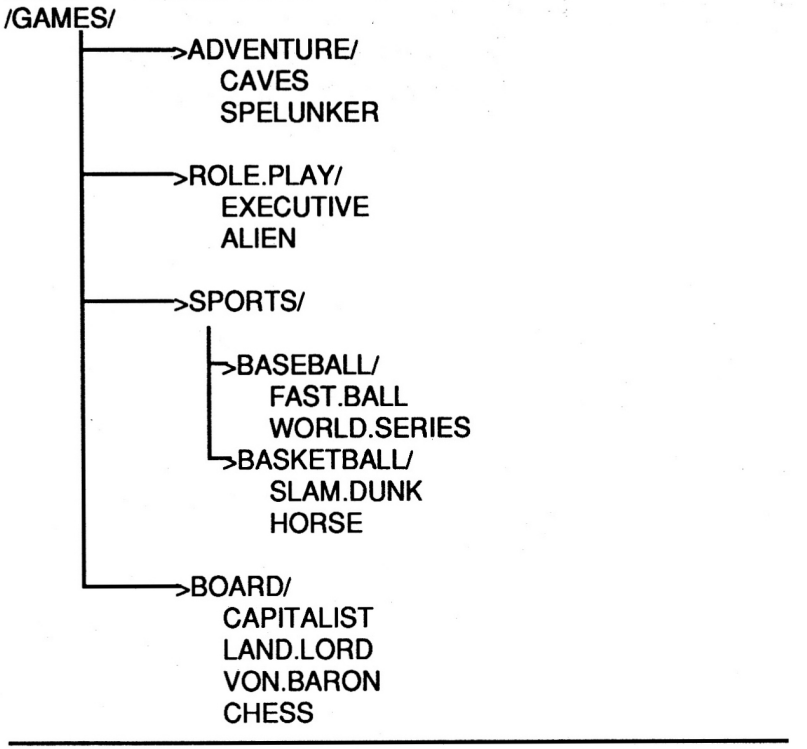

Figure 1-1 Sample Figure

PRACTICE

At the end of some of the chapters we have included questions and exercises to help you build your knowledge of PRODOS. This practice appears under the

heading of PRODOSercise. There is also a disk included with this package that you can use with the PRODOSercises. So, if you are ready, let's move our attention to chapter 2 and begin working with PRODOS and our hard disks.

Chapter 2

Please, I Can't Wait

We have a strong aversion to reading directions when assembling Christmas toys, bicycles, and lawn mowers. One of life's many challenges is determining how far we can go without resorting to the fine print. However, when it comes to computers, many of us learned the hard way that following the instructions (humiliating as it may be) is the safest and fastest way of getting everything operational. This chapter is for individuals who prefer to take the short cuts and accept the associated risks. It will provide only a basic overview of the main procedures for setting up your hard disk, without much background explanation or details about specifics. You will then have the option to be adventuresome by trying the operation procedures on your own. Of course, we are going to try to convince you to read the rest of this book so that you setup your hard disk correctly the first time. Just think of reading the book as another of life's challenges.

PRODOS HARD DISKS

Have you ever wondered why many people regard a hard disk with a certain amount of reverence, maybe even fear? Let's first compare a floppy disk to a hard disk, to help us better understand our hard disks. Then, we will see why respecting our hard disk is both healthy and smart.

The 5.25 inch floppy disk has been the standard method of storing programs and data for the Apple // series of computers. In fact, the availability of a low-priced floppy disk drive system helped launch the Apple // computer series to its present day success. The floppy disk used with the Apple computers can hold approximately 143,000 bytes of information (often abbreviated as 143K). Now, look around your computer at your floppy disks. How many do you have—50, 100, 150, 200, 300, or maybe more? Now, look at your hard disk. Today's most popular hard drives hold approximately 20,000,000 or 20-megabytes of information. Newer models for the Apple // series are rapidly becoming available that can hold 40, 60, 80 megabytes, or more of information.

Let's translate the size of these hard disks into more meaningful numbers. A 20-megabyte hard disk can store 20,971,520 bytes of information. Most of us store our floppy disks in plastic cabinets that hold approximately 50 diskettes. What would your life be like if someone walked in and took three of your diskette

storage cabinets? On a more positive note, how would you like to store all of those disks in the space of one of your cabinets? That's it—a 20-megabyte hard disk can hold the equivalent capacity of 144 floppy disks! Table 1-1 compares the approximate capacities of several hard disks to a 143K floppy disk and to a 800K 3.5 inch disk.

Hard Disk Capacity	Equivalent Floppy disks	3.5 Disks
20 MB	144	25
40 MB	276	49
60 MB	436	78
80 MB	537	96

Table 2-1 Comparisons of Hard Disk Capacities

Note: The hard disk capacity is not always equivalent to common name given. For example, an 80 MB disk might only have 76.9 MB.

We hope you can see why it is important to treat your hard disk with care—losing 144 floppy disks at once could be quite depressing. Yet, the hard disk offers the ability to access any one of those 144 disks with just a few commands or keypresses. Now that we

understand the basic properties of the hard disk, let's turn to the procedure for setting up a hard disk for use.

Getting Started

The first step in setting up your hard disk is to make sure it is properly formatted. Some hard disks are formatted at the factory while others require the user to format the disk. The actual formatting process is beyond the scope of this book, however, the instructions you received with your hard disk will carefully explain the process. Formatting a hard disk is similar to the process you may have already used with floppy disks, it just takes longer. Some types of hard disks may require you to partition your disk for other operating systems such as DOS 3.3 or Pascal. This means you will need to give careful consideration to how much space you will allocate to these different operating systems. You will probably want to devote the largest space to the operating system you use most. If you work primarily with AppleWorks and similar programs, you will want PRODOS to have the largest partition. In fact, you may want the DOS 3.3 and Pascal partitions to be as small as possible to make the most efficient use of your disk's space. If you decide to change the partitioning in the future, you will need to start from scratch as though your disk was brand new and reformat it.

First Files. Under PRODOS, you will need two system files that are required by most programs. Since the disk is blank, these files should be copied first. They are are PRODOS and BASIC.SYSTEM. The PRODOS file is a must for such programs as AppleWorks, EasyDrive, RAMUP, and other PRODOS programs. BASIC.SYSTEM is necessary for applications written in BASIC as well as for certain binary files. You can use a variety of copy programs to move these two files. One of the most common copy programs is FILER which comes with your PRODOS system disk. We recommend EasyDrive which will not only copy your files, but will help you create menus that will make it easier to select the programs you want after your hard disk is set up.

Subdirectories. Your second step is to create the appropriate subdirectories. We will explain how to create these directories and give you some special hints later in chapter 4. Careful planning is again required to make efficient use of your hard disk and to provide you with easy access to your programs and files.

Copying files. Your final step will be to copy the appropriate programs and files into the selected directories. This task can be time consuming if you plan to copy many floppy disks to the hard drive. For example, do you really need to copy your spreadsheet file for 1984's taxes onto the hard disk (of course, we are assuming you have already passed the I.R.S. audit)? Remember, you want to leave enough room on the hard disk to add

new data base files, wordprocessing documents, spreadsheet files, and programs.

Summary

Setting up your hard disk is not a difficult task. It simply requires some careful planning and time consuming work to copy your files into the correct subdirectories. Although we have briefly mentioned four basic steps to setting up your drive, we encourage you to continue reading the rest of this book while your disk is formatting (several minutes). A little time spent now for careful planning will save many hours of reorganization at a later date.

PRODOSercise

The following questions will help you become acquainted with your hard disk.

1. How many megabytes is your hard disk?
_____ Megabytes

2. Approximately how many 5.25 in. floppy disks will your hard disk hold? _____ floppies

3. Was your hard disk formatted at the factory or by your dealer? Y N

4. Do you need to partition your hard disk for different operating systems? Y N

If yes, how much will you allow for

_____ PRODOS

_____ DOS 3.3

_____ PASCAL

5. What will be the first files you will copy to your hard disk?

_____

_____

Chapter 3

PRODOS for Amateurs and Pros

If your computer consisted of nothing more than a microprocessor chip, a keyboard, and memory storage chips you would not need PRODOS or any other operating system. In fact, some of the early microcomputers were simply a few chips with toggle switches instead of a keyboard. Each time you wanted to run a program, you had to enter it by flipping the toggle switches—a time-consuming task. To be practical, the microcomputer needed a means of recalling programs and data from a storage medium such as a disk. The system that manages and translates this stored data into a usable format for the microcomputer is called a disk operating system (DOS). This chapter will introduce you to the PRODOS operating system and the rules for naming PRODOS files.

The Disk Operating System

The central processing unit or brain of the Apple // computer must have a way of communicating with disks, printers, modems, and other peripheral devices. PRODOS is the disk operating system that the Apple //'s use for such communications. As you can see, the term disk operating system only gives a limited

description of its functions. For example, if you want to save a program or a letter you have written using your wordprocessor, you would use PRODOS to save your data on the disk. Then, when you want to use the letter or program in the future, you would use PRODOS to bring the information from the disk to the computer's memory. If you want to print your letter, PRODOS would again be used to direct each character of the letter to the printer. PRODOS is also used to control the sending of information from your Apple to your modem, and to control the information sent from your modem to your computer. As you can see, PRODOS plays a very important role in the management of communications in your computer. In addition, PRODOS also manages the available memory in the computer by keeping track of where everything is located. PRODOS will also keep track of the date and time if you have a clock or set the date and time manually. Each time you save a file, PRODOS will include the current date and time.

VARIATIONS OF PRODOS

As the Apple // computer series has advanced from the //e and //c to the IIGS, so has the PRODOS disk operating system. The following is a description of the variations of PRODOS. If you have a //e or //c, your primary interest will be PRODOS 8. If you have a IIGS, you will also be interested in PRODOS 16.

PRODOS 8. There have been several versions of PRODOS since the initial version was released in 1983. The current version is 1.4. Earlier versions of PRODOS

(1.1.1, 1.2, and 1.3) contained bugs which could cause technical problems. You should make every effort possible to obtain the most current version of PRODOS, and copy that version to your hard disk.

P8 AND P16. When Apple introduced the Apple IIGS, they introduced a new disk operating system, PRODOS 16, for use with this new computer. Apple also changed the name of PRODOS to P8 or PRODOS 8 for use on the IIGS. PRODOS 16 (or P16) and P8 can both use the same disks (e.g., floppy, 3.5 inch, and hard disks) to store files. Thus, your hard disk can have both P16 and PRODOS (P8) files stored on it. For our present purposes, the commands we will use to set up our hard disk are applicable for both P16 and P8 files. If you are using a //c or //e, you will use PRODOS 8, but it will be named PRODOS.

VOLUME AND FILENAMES

All disks in PRODOS have a name. You may recall being asked for a name when you formatted a disk. This name is stored in a special place on the disk and is referred to as the volume name. In PRODOS a volume is typically a 5.25 inch floppy disk, 3.5 inch disk, or a hard disk. We can have one other type of disk, a RAM disk, which usually carries the volume name of "/RAM." Files such as an AppleWorks data base file, wordprocessing file, or a game have filenames. Thus, volume names refer to a disk and filenames refer to individual files stored on a volume.

By giving PRODOS a volume name (see Table 3-1) you can tell it where to save your files or where your program is located. You can also tell PRODOS the location of your files by specifying the slot and drive number. We will find, however, that the slot and drive number will be used less and less frequently as we increase the usage of our hard disk and begin to use pathnames.

WHERE IS YOUR FILE? /GAMES
[entering volume name as location]

WHERE IS YOUR FILE? SLOT: 6 DRIVE: 1
[entering slot and drive as location]

Table 3-1 PRODOS Volumes

When you save a file, PRODOS requires you to provide a filename. PRODOS will use this filename to keep track of where the file is stored on the volume. To save any file, whether a spreadsheet file, wordprocessing document, data base, BASIC program, binary data, a picture, or a text file, PRODOS requires you to first provide a filename. All PRODOS filenames and volume names must follow the same rules. Let's take a closer look at what these rules involve.

How to Name Your Volumes and Files. Invalid filenames or volume names will not be accepted by PRODOS. Fortunately, the rules are quite simple.

1. The name can be from 1 to 15 characters long.

2. A name must begin with a letter (A-Z). (You can enter lower-case letters, but they will be automatically changed to upper-case letters by PRODOS).

3. You can only use letters, numbers, and periods for subsequent characters in the name. Thus, PRODOS will not allow commas, percent signs, exclamation marks, or even a blank space.

Table 3-2 illustrates some examples of correct and incorrect names.

Remember, PRODOS filename rules apply to all the files on the disk or volume. They also apply to both PRODOS 16 and PRODOS 8 filenames as well as volumes names. We should also note a unique characteristic of volume names. Volume names begin with a slash mark. Thus, the RAM disk is identified as /RAM, and a volume named GAMES would be displayed as /GAMES. The slash helps us and PRODOS distinguish between filenames and volume names.

Correct Name	Explanation
BASIC.SYSTEM	Correct filename
/TAXES	Correct volume name
/INCOME83	Correct volume name
K	Correct filename
INCOME.83.TAX84	Correct filename
Incorrect Names	
JET.FLIGHT.SYSTEM	More than 15 characters
JET.SYSTEM	Correct version
TEAM RECORDS	Contains a space
TEAM.RECORDS	Correct version
83TAXES	Does not begin with a letter
TAXES.83	Correct version

Table 3-2 PRODOS Filenames and Volume Names

Summary

There are two types of PRODOS for the Apple // series of computers. The first was simply referred to as PRODOS and works on most of the Apple // series computers. When Apple introduced the IIGS, they also introduced a new version of PRODOS called PRODOS 16 or P16. PRODOS 16 will only work on the Apple IIGS. Apple renamed the original version PRODOS to PRODOS 8 or P8 for use on the Apple IIGS.

PRODOSercise

1. Which operating system will only work on an Apple IIGS?

___ PROODOS 1.4
___ PRODOS 8
___ PRODOS 16

2. Which of the following are invalid PRODOS filenames?

___ GAMES:INSTR
___ P31
___ AERONAUTICS.JETS
___ DATES
___ CAVES TROLLS
___ TOYS.KIDS
___ COMBAT
___ 1,2,3.SHEET
___ 89.STOCKS

3. What is the maximum length of a PRODOS filename or volume name? ___

Chapter 4

Not All Directories are Phone Books

One of the major advantages of PRODOS over the older DOS 3.3 operating system, besides speed, is the ability to use disks or storage devices with a capacity greater than the floppy disk. A second advantage of PRODOS is the ability to store files in a hierarchical structure. In this chapter we will describe how a PRODOS disk is organized, in other words, where your files are stored on the disk.

Volume Directory

As described in the last chapter, when you format a new volume with PRODOS, you must give it a name. This volume name is also the name of the volume directory. The volume directory is sort of like your personal phone book which you use to keep track of your family, friends, and associates. If you meet someone new, you can add his/her name to the book, and if you become angry with someone you can delete the name. Given the enormous size of the hard disk, it would seem as if we could keep adding and adding names forever. But, like most phone books, the volume directory has only so many lines for entering information. Specifically, a volume can only hold 51 filenames.

If you try to save a 52nd file, you will be told the DIRECTORY IS FULL even though there are enough free blocks on the volume to save your file. Unlike the phone book, the volume directory will not allow us to write on the edges of the disk or squeeze a new file in a space between two others if there are already 51 files in the directory. If you want to prove this for yourself, you can run PROGRAM 1 in Appendix A. You might begin to question the usefulness of your hard disk. If, for example, you were running a business, you could easily fill the volume directory in a week's time with your internal memos, accounting reports, office announcements, customer databases, and correspondence.

We mentioned at the beginning of this chapter that there were two advantages to PRODOS. First, PRODOS can use disks that have more storage capacity than the standard 140K of a floppy disk. Actually, PRODOS will allow us to have a volume with up to 32 - megabytes of memory. That's approximately 220 floppy disks. Some manufacturers make disks for the Apple // series that are larger than 32-megabytes! They have designed their hardware so that PRODOS believes there are two "big" volumes or two disk drives in a slot. For example, the hardware might tell PRODOS that a 40-megabyte volume is actually two 20-megabyte volumes. PRODOS would find a 20-megabyte volume in slot 7, drive 1, and a 20-megabyte volume in slot 7, drive 2. If you thought it was difficult figuring out which floppy disk you used for last year's taxes, what would you do if you had over 40,000,000 possible storage

places on your hard disk? But, again, we come back to the question of how that storage space could ever be used anyway if we can only save 51 files to the volume directory? That brings us to the second major advantage of PRODOS—hierarchical directories or more simply, the use of subdirectories.

PRODOS Subdirectories

Let's go back to the address book example for a moment and assume that we expected our address book to grow by leaps and bounds over the next few years (we are either very gregarious or successful in our business). Rather than being limited to the 26 pages (one for each letter of the alphabet) in our little black address book, we decide to buy a three-ring type binder that we will fill with a set of alphabetical index tabs. Then, we can add individual sheets behind each letter tab as our list grows. Our address book is only limited by how many pages the binder can hold. Think of your hard disk as a three-ring binder 1 1/2 in., 3 in., or maybe 5 in. thick. Rather than 26 tabs like the alphabet, it has places for 51 "tabs" in the main directory. Each one of these tabs, however, can have several other tabs or sheets behind it. In PRODOS terms we are describing subdirectories.

Subdirectories are directories of files within the main volume directory. They provide the hierarchical structure for saving files and for helping PRODOS keep track of other files. Subdirectories are not limited to the 51 files of the volume directory. In fact, a subdirectory is

only limited by the size of the volume itself. For example, a floppy disk has 273 blocks available for data. If we create a subdirectory it will take 1 block. We then have 272 blocks we can use for saving files, however, we cannot save 272 files in the subdirectory. As we add files to the subdirectory, it will grow in size. You will actually be able to save 253 files that are 1 block long on the floppy disk. If you want to experiment for yourself, follow the directions for Program 2 in Appendix A to see if you can save more than 51 files in a subdirectory.

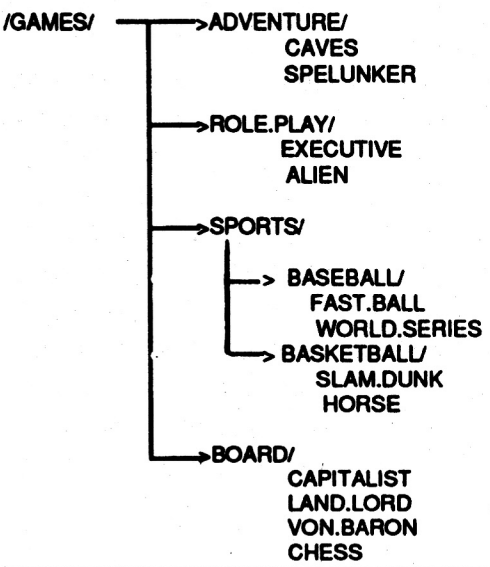

Figure 4-1 Hierarchical Structure

A map of a PRODOS volume would look something like a family tree. Figure 4-1 illustrates a sample

structure that might exist on a volume titled /GAMES. In the main volume directory, /GAMES, there are four subdirectories. The first level of subdirectories includes ADVENTURE, ROLE.PLAY, SPORTS, and BOARD. The SPORTS subdirectory includes two other subdirectories, BASEBALL and BASKETBALL. PRODOS allows you to establish up to 64 levels of readable directories. Our /GAMES volume has three levels of directories if we include the volume directory. We can store our programs and files in any one of the subdirectories. As you can see, we have the CAVE and SPELUNKER program saved in the ADVENTURE subdirectory, and the files FAST.BALL and WORLD.SERIES are stored in the BASEBALL subdirectory . Although we could add 61 more levels of subdirectories, we believe that a maximum of three or maybe four levels is the most practical. We'll see why in the next chapter when we talk about prefixes and pathnames.

Let's look at another example where we have created a series of subdirectories to store our clients' files for use with a spreadsheet program. Figure 4-2 illustrates how we organized our volume to make it easier for us to access the files. The volume name is /HARD1 and it has four subdirectories in the volume directory. The first subdirectory which is called SS, is for our spreadsheet files. The other subdirectories included in the volume directory are GAMES, WP for our wordprocessing programs, and APW for our AppleWorks program and files. The SS subdirectory has three additional subdirectories (our second level) which

we have used to organize the files. The subdirectories in the SS directory are CRUNCHER (which holds the spreadsheet program), TAX, and MONTHLY. The TAX subdirectory includes additional subdirectories (our third level) created for each of our clients (SMITH and GLEASON). Within the SMITH and GLEASON subdirectories are the spreadsheet files for their BUSINESS (BUS) and PERSONAL (PER) accounts. If we had decided to keep all of the tax information in the TAX subdirectory, we would have files like SMITH.PERSONAL and SMITH.BUSINESS. For GLEASON, though, we would be over the 15 character limit for a filename if we added these suffixes. Thus, the subdirectories allow us to stay within the filename length limits while knowing the exact function of each file; in the process, our files are also organized in a logical fashion by client.

We can also create 12 subdirectories in the QUALITY subdirectory, one for each month of the year. We have illustrated various techniques for naming subdirectories—some include abbreviations while others have a fully descriptive name. With the help of PRODOS, we have created four levels of directories to organize our files. The use of subdirectories also allows us to exceed the 51 file limit of the volume directory.

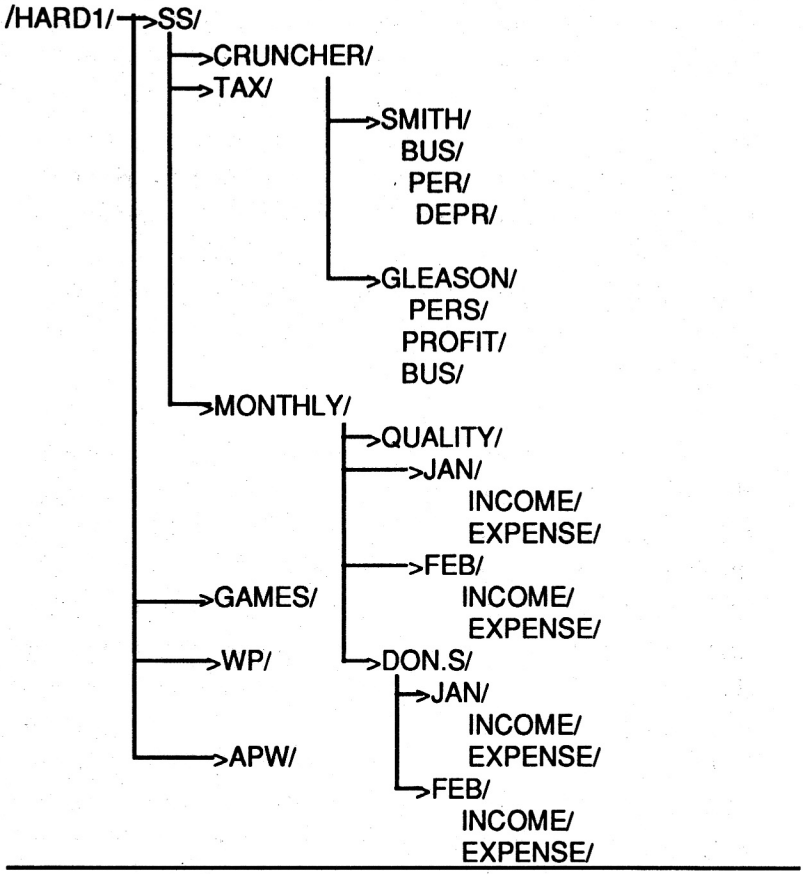

Figure 4-2 Spreadsheet Directory

Our task in the future chapters of this book will be to organize our hard disk for efficient storage and use of our files. We will define efficient storage as an organized approach which allows us to find and save our files without having to search the entire disk. That is, we

have established the right number of levels of subdirectories, and we have given meaningful names to our subdirectories. Efficient use of our files is a balance between organization and the number of subdirectory names we have to type to reach our file. We want to avoid a hard disk so organized that we have to go through 10 or 12 levels of subdirectories to recall our rich uncle's address for his birthday card. In the next chapter, we will learn more about pathnames which are the different levels of subdirectories between the volume name and our filename.

Summary

PRODOS provides us with a means of using disk drives with large capacities such as 3.5 inch disks and hard disks. This feature alone will not help us to use this increased capacity because PRODOS will only allow us to save 51 files in the volume directory. The second feature of PRODOS is the use of hierarchical directories. This feature allows us to create subdirectories which can hold a larger number of files. Subdirectories then, allow us to make efficient use of storage space on large volumes. They also provide us with a way of organizing our files into smaller groups so that we do not have to look through long lists to find the one we want.

PRODOSercise

1. Which of the following are valid volume names?

___ /TAXES ___ SCHEDULE/FALL
___ GAMES ___ /TESTS

2. What is the maximum number of files you can have in the main volume directory on your hard disk?

___ Limited only by the disk space
___ 100
___ 73
___ 51
___ 46

3. What is the maximum number of files you can have in a subdirectory on your hard disk?

___ Limited only by the disk space
___ 100
___ 73
___ 51
___ 46

Chapter 5

The Rosey Path to a Happy Hard Disk

We have seen in previous chapters how PRODOS uses a hierarchical structure to store files on a volume. This structure allows us to go well beyond the limit of 51 files in the volume directory, as well as providing a means of organizing our files in a logical manner like a well-organized file cabinet. By now, you may be asking how you can access a file that is buried three, four, five, or maybe even ten levels deep in subdirectories. This chapter will introduce you to PRODOS pathnames and how they are used to access the files.

PATHNAME: THE PRODOS ROADMAP

Let's start by defining pathname. A pathname is a list of directories PRODOS must go through to reach the filename you have specified. Pathnames are similar to directions you would give someone to go from your house to the ice cream store—"Go down Main Street for two blocks, left on Central, and then take the first right on Third Avenue." Similarly, a pathname tells PRODOS which directories to "travel" through to get to your file. Let's take another look at the volume, /GAMES, we created in chapter 4 (see Figure 5-1). Say that one morning, we become bored with our work and decide to

take a slight diversion while the boss is away and play SPELUNKER (an interesting adventure game set in a cave). After leaving our spreadsheet, PRODOS is asking for the pathname. What will we enter? We can see from Figure 5-1 that PRODOS will need to know the volume name, /GAMES, and subdirectory, ADVENTURE/, where SPELUNKER is stored. We cannot just type these names, because PRODOS requires a special format for pathnames.

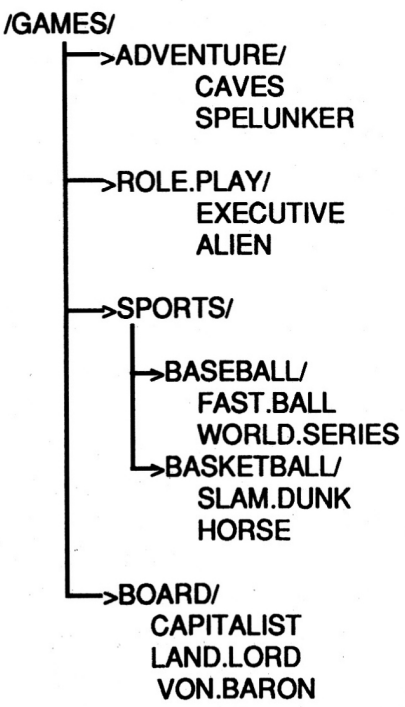

Figure 5-1 Hierarchical structure

PRODOS requires you to enter the pathname in sequence beginning with the volume name, /GAMES in this case, followed by the subdirectories, and then the filename. Each volume, directory, and filename must be separated by a slash. To play SPELUNKER we would have to type /GAMES/ADVENTURE/SPELUNKER. Now, we can become lost in an underground adventure game until the boss returns. After losing too many points against the trolls, we decide to play HORSE against a few NBA stars. What pathname do we enter now? Looking at Figure 5-1, we can see that there are two subdirectories between the volume directory, /GAMES, and HORSE. The pathname for HORSE must begin with the volume name, /GAMES, include the two subdirectories, SPORTS/ and BASKETBALL/, and finally the filename, HORSE. The pathname we would enter would be /GAMES/SPORTS/BASKETBALL/HORSE. If you make a typing mistake, PRODOS will tell you PATH NOT FOUND.

THE PREFIX

Pathnames probably sounded like a wonderful idea until you found that you had to do all that typing just to play against the NBA guys. There is a shorter path, especially to those files you use all the time. You may recall from programs such as AppleWorks, that you can set the standard location of your data disk. This standard location can be specified by selecting a slot and drive, or by specifying a PRODOS pathname. Each time you want to save a file or get an old file, AppleWorks will go to this standard location until you change

it. Similarly, when working with PRODOS or with one of your other programs, you can set a prefix.

A prefix is used to tell PRODOS that you will be working with the files in a specific path. For example, assume that it's a nice spring afternoon and we've decided to play baseball with our Apple. If we look back at our /GAMES volume, we can see that there are two baseball games in one subdirectory. If we want to play FAST.BALL we would have to type RUN /GAMES/SPORTS/BASEBALL/FAST.BALL. Then, when we want to replay the World Series, we would have to type RUN/GAMES/SPORTS/BASEBALL/WORLD.SERIES. Typing that much might discourage us from playing games and send us back to our work even before the boss returns.

Let's take a closer look at how the prefix command can make life easier for us, especially with a hard disk. The prefix command is a way of having PRODOS remember which pathname we want to use. We can "set" the prefix so that we do not have to continually enter it each time we want a different file in the same path. For our afternoon of baseball excitement, we might want to set the prefix so that we need only type RUN FAST.BALL or RUN WORLD.SERIES.

To set the PRODOS prefix you type the command PREFIX followed by the pathname. The prefix pathname begins with the volume name and ends with a directory name, not a program or data filename. A

prefix can be just the volume name, or it can be the volume name plus several subdirectories. For our baseball games, we would type PREFIX/GAMES/SPORTS/BASEBALL. We could also set the prefix to /GAMES or /GAMES/SPORTS. One of the purposes of setting the prefix is to reduce our typing. It makes sense to set the prefix to the last directory in the path we want to access. If you attempt to set the prefix to a file other than the volume directory or subdirectory, PRODOS will respond with the message, FILE TYPE MISMATCH. If we typed PREFIX /GAMES/SPORTS/BASEBALL/WORLD.SERIES, PRODOS would tell us that we had a FILE TYPE MISMATCH because WORLD.SERIES is not a subdirectory. The correct entry is PREFIX /GAMES/SPORTS/BASEBALL which points PRODOS to the BASEBALL/ subdirectory.

PREFIXES AND PARTIAL PATHNAMES

Pathnames actually come in two varieties. Full pathnames begin with the volume name plus a leading slash, (e.g., /GAMES), include any subdirectories in the path, and end with the filename. Full pathnames are required when the prefix has not been set, or when you want to access a file in a path different from the prefix. An example of a full pathname is /GAMES/SPORTS/BASEBALL/WORLD.SERIES.

Partial pathnames are those files in the final directory of the prefix. Our current prefix (/GAMES/SPORTS/BASEBALL/) is pointing PRODOS to the BASEBALL/ subdirectory. Two partial pathnames we could use are

WORLD.SERIES and FAST.BALL. They are referred to as partial pathnames because they do not include the prefix which has been set. If we set the prefix to PREFIX /GAMES/SPORTS, then we could use several partial pathnames to access different files. Table 5-1 illustrates several examples of partial pathnames.

Prefix is /GAMES/SPORTS
Partial pathnames:
BASEBALL/FAST.BALL
BASEBALL/WORLD.SERIES
BASKETBALL/SLAM.DUNK
BASKETBALL/HORSE

Table 5-1 Partial Pathnames

Partial pathnames do not begin with a slash like a prefix, but they still use the slash to separate additional filenames. If we decide to play just basketball games, we can change the current prefix by entering PREFIX BASKETBALL. PRODOS will automatically append the BASKETBALL directory to the above prefix, /GAMES/SPORTS. Our new prefix is /GAMES/SPORTS/BASKETBALL.

We can also access files in other paths when the prefix is set differently. For example, we can access LAND.LORD when the prefix is set to /GAMES/SPORTS by entering the full pathname for LAND.LORD, /GAMES/BOARD/LAND.LORD (see

Figure 5-1). Note that once a path is set, we can append (i.e., extend) it, but we cannot alter part of it. Thus entering only BOARD/LAND.LORD would be incompatible with the existing path /GAMES/SPORTS. We need the full pathname to establish our new route to the file LAND.LORD (/GAMES/BOARD/LANDLORD).

A prefix can be up to 64 characters long. If you have set the prefix to a specific directory, you can use a pathname consisting of additional subdirectories and filenames of up to 64 additional characters. Although PRODOS allows us to be so verbose, it seems to be a bit of an overkill to use that many subdirectories to store a file. (We will let you figure out how many possible subdirectories you can have. Each slash counts as one character and the maximum length of the subdirectory name is 15 characters.)

WHERE AM I?

With so many pathnames and prefixes, it is possible to become lost and not know where you are on your hard disk. If you become disoriented you can use the PREFIX command to have PRODOS tell you the current pathname set by the prefix. At the Applesoft prompt ("]"), you need only enter the PREFIX command by itself. After you press <RETURN>, PRODOS will display the current prefix on the screen. If you include only a slash after the prefix command, PREFIX/, the prefix will be set to the default disk, normally the one you booted. For example, we might boot our Apple from the hard disk, /HARD1, in the morning. Then, at

midmorning, we set the prefix to /DESK/TOOLS on a floppy disk to use a utility program. To reset our prefix to the hard disk (or the disk we booted from) we would enter PREFIX/.

If you do not know the volume name and want to set the prefix to the volume directory, you do so by specifying the slot and drive, PREFIX, S6, D1. Table 5-2 is a summary of the prefix commands.

Command	Result
PREFIX /GAMES/SPORTS	Sets prefix to the SPORTS directory
PREFIX BASEBALL	Sets above prefix to /GAMES/SPORTS/BASEBALL
PREFIX, S6, D1	Sets prefix to volume in slot 6, drive 1
PREFIX	Causes PRODOS to display current prefix
PREFIX/	Change prefix to default drive.

Table 5-2 Prefix Commands

Setting the prefix to a specific volume or subdirectory tells PRODOS where to look for files that we want to load into memory and where to store files when we want

to save them. The prefix is a form of shorthand that can help us shorten the pathname. For example, if we refer back to Figure 5-2, we will see four different subdirectories that are in the main volume directory of /GAMES. If we were interested in playing only the board games, we might set the prefix to /GAMES/BOARD. When we wanted to switch between games, we would need only type the name of the game, VON.BARON, and not the complete prefix, /GAMES/BOARD/VON.BARON. Thus, setting a prefix is a way to save you from having to type the full pathname when you are working in a specific directory.

Some Secrets of Pathnames

We can easily see the importance of pathnames, particularly in helping us to organize our files. Before we complete this chapter, we would like to provide some recommendations for naming subdirectories. We have two basic "rules." First, the subdirectory name should be meaningful. For example, L8 might seem great today to indicate letters written in 1988, but in 1990 will we remember that L8 was 1988 or just the 1980's? A better name might be LTR.88. Our second rule is to keep the name as short as possible. This rule is naturally to reduce the amount of typing and to leave room for additional subdirectories that we might add (within the 64 character limit). For example, in creating a subdirectory for wordprocessing files we might first think of a name such as WORD.PROCESS. Sounds like a nice name which meets the requirements of Rule 1. But, does it conform with Rule 2? We decided to

change the name on our hard disk to WP since it is a fairly common acronym for wordprocessing. Besides, it is much easier to type /HARD1/WP/P.BOOK to work on this book's manuscript.

Summary

The prefix command is used to tell PRODOS a specific path that we want to use. Once we have specified a prefix, we use partial pathnames consisting of filenames or subdirectories plus filenames to access specific files. For example we can type just LAND.LORD as opposed to the full pathname of /GAMES/BOARD/LAND.LORD if we have set the prefix to /GAMES/BOARD. We can also access other files by entering the full pathname which begins with a slash before the volume name. If you are using P-SHOOTER you will not have to remember the pathnames. You can use P-SHOOTER to select both volumes and various directories with your arrow keys. Of course, you can also use EasyDrive to set up a menu that makes the selection of your applications much easier.

PRODOSercise

The illustration in Appendix C is needed for this exercise. You can also use the PRODOSercise Disk to actually try out your answers and see if they work. You

might also want to try to enter the commands from the Basic prompt and then repeat the exercise with P-SHOOTER to gain experience.

1. Using Appendix C, our current prefix is set to / HARD1. What would you enter to set the prefix so that you can work on the INVENTory file in the HOME directory?

   _____

3. The current prefix is /HARD1/MONEY, how can we change it so that the prefix is to the EXPENSE subdirectory?

   _____

4. What command do you use if you want to revert back to the prefix you booted from?

   _____

5. The current prefix is set to /HARD1/MONEY/ CARS. What pathname would you use to list the files stored in KIDS/NUMB?

   _____

You can also experiment with P-SHOOTER to select different subdirectories from the sample disk.

Chapter 6

Controlling PRODOS: The Commands

In the past four chapters we have learned about PRODOS, volume names, filenames, pathnames, and prefixes. Now we are ready to take charge and make PRODOS work for us. In this chapter, we will learn some of the fundamental PRODOS commands to use with our volumes, and the messages PRODOS uses to inform us of errors.

Issuing a PRODOS Command

The simplest way to issue a PRODOS command is to type it from the keyboard when Applesoft BASIC is available. To gain access to Applesoft BASIC, you can boot your SYSTEMS UTILITIES disk or your PRODOS SYSTEM disk. Then, you will need to select exit to BASIC.SYSTEM. This application will translate your commands into a form that PRODOS can understand and use. If you want to try these commands, you should have your computer on and have the Applesoft BASIC prompt ("]") on the screen. You might also want to change to an 80 column display by typing PR#3 and then pressing <RETURN>. You will need to press <RETURN> after each of the PRODOS commands.

PRODOS Commands

CATALOG

If you type CATALOG at the Applesoft prompt, you will see a listing of the files on your volume, as illustrated in Figure 6-1. Let's take a closer look at what each column tells us. The first column, NAME, is a listing of the filenames. Each of these filenames follows the three rules for PRODOS filenames (no longer than 15 characters; must begin with a letter; can only include letters, numbers, or periods). In the second column is a three letter abbreviation identifying the type of file. Apple has made plans for a total of 256 different file types which are used to identify BASIC, AppleWorks, and System files just to name a few.

The first file, TEST.123, is a BASIC program as indicated by the BAS abbreviation. There are four AppleWorks wordprocessing files (AWP), 1 database file (ADB), and 1 subdirectory (DIR). The third column tells how many blocks of space the file takes on the volume. The longest file is TEST.123 which uses 10 blocks. Each block represents 512 bytes (PRODOS gives your file credit for the whole block even if it uses only 1 byte). The fourth and fifth columns tell us the date and time the file was last modified. If you do not have a clock card in your computer and did not set the date when you started, you will see [NODATE] and the time will be listed as 00:00. The sixth and seventh columns list the

date and time the file was created. Again, [NODATE] and 00:00 will be listed if the time and date were not set before creating the file. The remaining columns provide us with additional information about the files concerning their length, and record size in the case of random access files.

At the top of the catalog listing there is a name preceded by a slash, /JENNI.88. This name is the name of the volume we cataloged. We can tell it is a volume because of the slash in front of the name. The bottom line of our catalog gives us information about the storage space on the volume. First, we can see how many blocks are left for us to use for saving other files. On /JENNI.88 we still have 243 blocks available. Second, the listing tells us that the files we have saved on the volume take up 37 blocks of space. A quick calculation indicates our files account for only 30 blocks. What happened to the other 7? The first 7 blocks on a volume are used by PRODOS to store information. Third, we are told that the TOTAL BLOCKS available for use on the volume, a 5 1/4 inch floppy disk, is 280 blocks.

```
/JENNI.88
NAME                TYPE BLOCKS   MODIFIED CREATED      ENDFILE SUBTYPE

TEST.123            BAS    10  12-FEB-88 16:40 12-FEB-88 16:40   4553
PRICES              AWP     4  12-FEB-88 16:41 12-FEB-88 16:41   1516
BABY.SITTER         AWP     4  12-FEB-88 16:42 12-FEB-88 16:41   1515
JOB                 AWP     4  12-FEB-88 16:42 12-FEB-88 16:42   1035
WEEKLY.READER       AWP     3  12-FEB-88 16:42 12-FEB-88 16:42    959
PLACES              ADB     3  12-FEB-88 16:42 12-FEB-88 16:42    618
JET                 BAS     1  12-FEB-88 16:51 12-FEB-88 16:44    239
LETTERS             DIR     1  12-FEB-88 18:51 12-FEB-88 17:44    512

BLOCKS FREE: 243  BLOCKS USED: 37  TOTAL BLOCKS: 280
```

Figure 6-1 Catalog Command

There is a shorter version of the CATALOG command that you can use to view only some of the file information shown in Figure 6-1. The CAT command produces a catalog listing that displays only the filenames, file type, blocks, and the last date and time modified. A sample list from the CAT command is shown in Figure 6-2. Also note that the TOTAL BLOCKS count is left off the bottom line.

```
/JENNI.88
NAME                TYPE  BLOCKS    MODIFIED

TEST.123            BAS     10   12-FEB-88 16:40
PRICES              AWP      4   12-FEB-88 16:41
BABY.SITTER         AWP      4   12-FEB-88 16:42
JOB                 AWP      4   12-FEB-88 16:42
WEEKLY.READER       AWP      3   12-FEB-88 16:42
PLACES              ADB      3   12-FEB-88 16:42
JET                 BAS      1   12-FEB-88 16:51
LETTERS             DIR      1   12-FEB-88 18:51

BLOCKS FREE: 243  BLOCKS USED: 37
```

Figure 6-2 CAT Command

When you type the CATALOG or CAT command,

you will see a list of files in the current prefix. The catalog in Figure 6-1 is of the volume directory. We can tell it is the volume directory because the first line of the listing tells which directory we are cataloging, and all volume directories are preceded by a slash. If we had cataloged a subdirectory, we would see only the name of the subdirectory (without a preceding slash). For example, if we cataloged the LETTERS subdirectory, the first line would simply read LETTERS.

The CATALOG and CAT commands can be used with full and partial pathnames which end with a directory name. Full pathnames are used to catalog a directory that is outside the current prefix. Table 6-1 provides some illustrations. Remember that any of these variations can be used with either CAT or CATALOG—the only difference is in the amount of information provided. If you try to catalog a nondirectory file PRODOS will give you the error message, FILE TYPE MISMATCH (we will explain error messages in detail later).

Command	Results
CAT /GAMES	Will show the files in the volume directory.
CAT /GAMES/SPORTS	Will show the files in the SPORTS subdirectory only.
Prefix set to /GAMES	
CAT	Will show the files in the volume directory.
CAT SPORTS	Will show files in the SPORTS subdirectory
CAT /JENNI	Will show files in the volume directory /JENNI even though prefix is set to /GAMES (of course, we assume you have two disk drives)

Table 6-1 CATALOG Commands

CREATE

The CREATE command is used to create subdirectories on your volume. To create a subdirectory, you type the command followed by the name of the subdirectory to be created. For example, we could create a new subdirectory on the /GAMES volume for war games by typing CREATE WAR or we could do it with the full pathname, CREATE /GAMES/WAR. If we cataloged our /GAMES volume we would find a new subdirectory named WAR and the type would be DIR (for "directory" file). We can also create another level of subdirectories

with the CREATE command. Suppose we wanted to create a new subdirectory under the ROLE.PLAY directory on the /GAMES volume for management role plays. If the prefix were set to /GAMES, we would enter CREATE ROLE.PLAY/MGMNT. If the prefix were set to /GAMES/ROLE.PLAY, we only need to type CREATE MGMNT. We can catalog the directory to verify that the directory was created. Table 6-2 illustrates some of the possible variations that can be used with the CREATE command.

Command	Results
CREATE/GAMES/ADVENTURE/DUNGEON	Will create a subdirectory titled DUNGEON in the ADVENTURE subdirectory.
CREATE GOLF	Will create a subdirectory titled GOLF in the current prefix.
Prefix set to /GAMES/SPORTS	
CREATE FOOTBALL	Will create a subdirectory titled FOOTBALL in the /GAMES/SPORTS directory.
CREATE /JENNI/PROFIT	Will CREATE the subdirectory PROFIT on the volume /JENNI when the prefix is set to /GAMES/SPORTS.

Table 6-2 CREATE Command

DELETE

If you need to delete a file from a disk or volume directory, you can do so with the DELETE command. To delete the file named PRICES on the /JENNI volume you could enter DELETE/JENNI/PRICES at the keyboard. If your prefix was set to /JENNI you would only need type DELETE PRICES. Again, you can use the full pathname to delete a file in another directory, or use a partial pathname to delete a file in a different subdirectory of the current prefix. If you want to delete a subdirectory, you must first delete all of the files in the subdirectory. If the subdirectory you are trying to delete has files in it, you will be told FILE LOCKED. This message means that there are still files in the subdirectory that must be deleted before you can delete the subdirectory. Table 6-3 illustrates the variations of the DELETE command used with the volume described in Figure 5-1. Once you delete a file, you can use the CATALOG command to verify that it is truly deleted.

Command	Results
DELETE /GAMES/ADVENTURE/SPELUNKER	Will delete the file SPELUNKER in the ADVENTURE subdirectory
DELETE /GAMES/ADVENTURE	Will delete the subdirectory ADVENTURE if all the files in the subdirectory have been deleted.
Prefix set to /GAMES/SPORTS/BASEBALL	
DELETE /SPEEDBALL	Will delete SPEEDBALL
DELETE /JENNI/PRICES	Will delete the file PRICES on the volume /JENNI even though prefix is set to /GAMES

Table 6-3 DELETE Command

LOCK AND UNLOCK

The LOCK and UNLOCK commands are used to protect you from tragic mistakes. The LOCK command allows you to "lock" a file so that it cannot be changed or deleted. The UNLOCK command restores the file to its unprotected state so that you may change or delete it. When you CATALOG a volume, locked files will have an asterisk in the left-hand column beside the filename.

Thus, as shown in Figure 6-3, the files TEST.123 and JET are both locked. The format for the LOCK and UNLOCK commands is simply the command (LOCK OR UNLOCK) followed by the full or partial pathname. Examples are LOCK TEST.123 or LOCK/JET/TEST.123, and UNLOCK TEST.123 or UNLOCK /JET/TEST.123. Table 6-4 lists some examples. You can use the LOCK and UNLOCK command with any file that is displayed with the CATALOG command. However, using the LOCK and UNLOCK command on a subdirectory will have no affect. Files in the subdirectory can still be changed and deleted. Quality Computer publishes a program, FILE PROTECTOR, which will allow you to keep others from viewing your AppleWorks files.

/JENNI.88

NAME	TYPE	BLOCKS	MODIFIED
*TEST.123	BAS	10	12-FEB-88 16:40
PRICES	AWP	4	12-FEB-88 16:41
BABY.SITTER	AWP	4	12-FEB-88 16:42
JOB	AWP	4	12-FEB-88 16:42
WEEKLY.READER	AWP	3	12-FEB-88 16:42
PLACES	ADB	3	12-FEB-88 16:42
*JET	BAS	1	12-FEB-88 16:51
LETTERS	DIR	1	12-FEB-88 18:51

BLOCKS FREE: 243 BLOCKS USED: 37

Figure 6-3 LOCKED Files

Command	Results
LOCK PRICE	Locks the file PRICE in the current prefix.
UNLOCK PRICE	Unlocks the file PRICE in the current prefix.
LOCK /GAMES/ADVENTURE/CAVES	Locks the file CAVES in the ADVENTURE subdirectory.
Prefix set to /GAMES/SPORTS	
UNLOCK BASEBALL/WORLD.SERIES	Unlocks the file WORLD.SERIES in the BASEBALL subdirectory of the current prefix.
LOCK /JENNI.88/PROFIT	Locks the file PROFIT on the volume /JENNI when the prefix is set to /GAMES/ SPORTS.
LOCK /JENNI.88/LETTERS	Has no affect on the directory or files in the directory.

Table 6-4 LOCK and UNLOCK Commands

RENAME

The last PRODOS command we will learn is used to rename files. You can rename any PRODOS file, including directories, that are not locked. To rename a file, simply type RENAME followed by the present

name, a comma, and the new name. For example, to rename the file PRICE to PROFIT on the JENNI volume you would type RENAME PRICE, PROFIT or RENAME /JENNI/PRICE, /JENNI/PROFIT. Remember, the rename command requires a comma between the old filename and the new filename. You can catalog the disk to verify that your command worked. When you rename a volume, be sure to include the slash mark. For example to rename /JENNI to JAMIE you would type RENAME /JENNI, /JAMIE. RENAME, like the other PRODOS commands, can be used with both partial and full pathnames. Table 6-5 provides some examples of the use of the RENAME command.

Command	Results
RENAME PRICE,PROFIT	Changes the name of the file PRICE to PROFIT.
RENAME /GAMES/SPORTS, /GAMES/BALL	Renames the subdirectory SPORTS to BALL.
RENAME BOARD,GENERAL	Renames the subdirectory BOARD to GENERAL.
RENAME /GAMES, /TOYS	Renames the volume GAMES to TOYS.
Prefix set to /GAMES/SPORTS	
RENAME BASEBALL/WORLD.SERIES, /BASEBALL/SERIES	Renames the file WORLD.SERIES to SERIES in the BASEBALL directory.
RENAME /JENNI/PROFIT, /JENNI/PRICE	Renames the file PROFIT on the volume JENNI to PRICE even though the prefix is set / GAMES/SPORTS.

Table 6-5 RENAME Command

PRODOS Error Commands

When we misspell or misuse a command or filename, PRODOS gives us a message indicating that we made an error. Sometimes these error messages are rather cryptic and do very little to help us determine what we have done wrong (let alone helping our egos). Most of the time, however, (despite any damage to our egos), these messages will be quite helpful in setting us on the proper path. The following is a brief listing of some of the PRODOS error messages and an explanation of each. You can find a more complete listing in chapter 10 and in your PRODOS User's Manual.

NO DEVICE CONNECTED

This message is usually given when you specify a slot or drive that does not exist. For instance, if you have your 20 megabyte hard disk in slot 7 set up as one disk drive as opposed to two drives, and you specify SLOT 7 DRIVE 2, PRODOS will answer with NO DEVICE CONNECTED. This error message is given by PRODOS when you try to access a disk drive that does not exist.

WRITE PROTECTED

If you try to save, delete, rename, or lock a file on a disk that has been write-protected, PRODOS will tell you WRITE PROTECTED. If it is a floppy disk, you can remove the tape from the notch on the upper right side. If it is a 3.5 disk you can move the small square on the

right hand corner so that the window is closed. If you received this message when using your hard disk, you will need to refer to the manufacturer's instructions regarding write protection.

PATH NOT FOUND

You will typically find this message beeping at you when you misspell a filename (we could never understand why computers cannot be as forgiving as our fifth-grade teachers). You will also receive this message when you specify any type of file that does not exist.

I/O ERROR

This message could mean several things. First, you may have simply forgotten to put a disk in the drive. Second, you may have a disk in the drive that has not been formatted with PRODOS. Third, your disk may not be properly centered in the drive. Fourth, you may have a bad disk. Fifth, there may be a problem with the disk drive. To solve your problem, you might first remove the disk (assuming you are using floppy or 3.5 in. disks) and place it back in the drive closing the door securely. If you are still receiving the I/O ERROR, you might try the disk in a different drive or on a different computer. Finally, you might try another disk in the drive to see if it works properly before taking your drive in for repair.

FILE LOCKED

If you are working with any type of file besides a directory file, you can unlock the file and then proceed. You will receive this message if you try to save a file or

delete a file that is locked. You will also receive this PRODOS message if you try to delete a directory file which still has files in it. You must first delete all of the files in the directory.

FILE TYPE MISMATCH

This message usually appears when you include a file other than directory files in your prefix. For example, if you include a program at the end of your prefix pathname, PRODOS will answer with this error message. It also occurs when you try to use a file incorrectly, such as attempting to RUN an AppleWorks file or a graphics file (BIN) as opposed to a BASIC file.

Summary

This chapter has presented you with six PRODOS commands you can use to manage the files on your volumes. These six PRODOS commands were CATALOG, CREATE, DELETE, LOCK, UNLOCK, and RENAME. Each of these commands can be used with full pathnames and partial pathnames. If you fail to follow the rules for using the commands or make a typing error, PRODOS will respond with an error message. The error messages mentioned in this chapter were NO DEVICE CONNECTED, WRITE-PROTECTED, PATH NOT FOUND, I/O ERROR, FILE LOCKED, AND FILE TYPE MISMATCH. A complete listing of the PRODOS commands and error messages can be found in your *PRODOS User's Manual.*

PRODOSercises

The illustration in Appendix C is needed for this exercise. You can also use the PRODOSercise Disk to actually try out your answers and see if they work. You might also want to try to enter the commands from the Basic prompt and to repeat the exercise with P-SHOOTER to gain experience.

1. What PRODOS command and pathname would you use to list the files in the CLUBS subdirectory?

---

2. What command would you use to create another subdirectory under the GRAPHICS directory named PEN if the prefix is set /HARD1/GRAPHICS?

---

3. If the prefix is set to /HARD1/RECREAT, could you delete BOARD? Explain your answer.

4. How would you lock ID in the CARS subdirectory if the prefix is set to /HARD1?

5. If the prefix is set to /HARD1/EDIT, how would you change the name of LINE to WORD?

Chapter 7
Planning for Your Hard Disk

We are just about ready to start setting up our hard disk. Before we begin copying files, we should spend some time determining how we are going to organize our disk. Where will we put all of our floppies so that we can find the files? If we begin copying all of our floppies over to the hard disk, we are bound to end up with an overly long catalog listing that makes it difficult, if not impossible, to find the file we wanted. In this chapter, we will give you some basic steps to consider when planning the organization of your hard disk.

WHAT COULD A HARD DISK WANT OUT OF LIFE?

If you were to stop a moment and ask your hard disk what it wanted most out of life, it would probably respond in fairly simple screen characters that it wants its space used efficiently. Efficiency for a hard disk is determined by how easy it is for you, the user, to access the files on the disk. There are three things you can do to improve this efficiency. First, you can carefully plan the number of files in the volume directory. Second, you can select subdirectory names that are both short and meaningful. Third, you can use an optimum level of subdirectories to organize your files. Let's see how we can use each of these ideas to organize our hard disk efficiently.

Taking Inventory

Our first step to an efficient hard disk is to take inventory of our programs and files. We will need to start thinking about our disks in a different fashion. We can no longer reach for the light blue disk with the AE LOGO on the front to boot up AppleWorks. With a hard disk, we need to think about the different types of applications we have in our cabinets and on our desk. A good way to start is to sort the floppy disks (and 3.5 inch disks if you have them) into several piles. Put the wordprocessing programs over here, the games there, and the money management program next to games. And, don't forget to sort all of your data disks that have your wordprocessing, data base, and spreadsheet files. Of course, you might have several other categories or even a different set of categories than we have suggested. Our intent is to help you organize your disk into meaningful categories which you can then use to create the subdirectories on your hard disk.

Once you have sorted your disks into several stacks, go through each pile and see if all the disks belong in the same group. You may decide to add another group in some cases, or to combine a couple of stacks. Finally, go through each group and arrange the disks according to frequency of use (or some other classification that meets your needs). Now is also a good time, to search through your data disks and see which ones should be stored in the closet as archives rather than taking up space on your hard disk.

MAP MAKING

Our next step is to create a map for our hard disk. This "map" will help us identify the various subdirectories and the levels of subdirectories. Let's begin by picking our most popular stack of program disks, say our games. In our stack of games, we have identified five types—adventure, role plays, sports, board games, and puzzles. As a result, we will create a subdirectory on our hard disk for games and call it GAMES. To make our search for individual games much easier, we have decided to make five subdirectories in the game directory for the five types of games. We also have decided to make three subdirectories under sports for our baseball, basketball, and football games. The map we created for our hard disk (named /HARD1) might look like the one shown in Figure 7-1. Notice how we abbreviated the subdirectories under SPORTS to save typing time.

```
/HARD1
        GAMES/
                ADVENTURE
                ROLE.PLAY
                SPORTS/
                        BASE
                        BASKET
                        FOOT
                BOARD/
                PUZZLES/
```

Figure 7-1 Hard Disk Map for GAMES Directory

Our next most popular software is AppleWorks which also includes several of the Beagle Brother's TimeOut programs and Sensible Speller. We have decided to place all the AppleWorks-related programs in one directory which we will call APW, short for AppleWorks. Since we have a hard disk, we can copy all of the files from both sides of the AppleWorks floppy disk into one subdirectory on our hard disk. Thus the files APLWORKS.SYSTEM, SEG.00, SEG.EL, SEG.M0, SEG.M1, SEG.PR, SEG.RM, and SEG.XM will all be in the *same* directory on the hard disk even though they appear on *two* different floppy disks (see Figure 7-2). Next, we will make a subdirectory for the TimeOut programs, called T.O.FILES/, and a directory for Sensible Speller, called SPELL/. We will also create the subdirectory D1/ in the SPELL/ directory for the dictionaries that come with the speller program. We will put the two Random House Dictionaries and our personal

dictionary in subdirectory D1.

/HARD1/	Comments
APW/	
APLWORKS.SYSTEM	AppleWorks program files from the
SEG.00	two floppy disks
SEG.EL	
SEG.M0	
SEG.M1	
SEG.PR	
SEG.RM	
SEG.XM	
T.O.FILES/	For TimeOut programs
SPELL/	For Sensible Speller
D1/	For the dictionaries
HOME/	Subdirectories for the AppleWorks
BUDGET/	files
INVEN/	
FOOD/	
ADDRESS/	
LTRS/	
BUS.LTRS/	
NOVEL/	

Figure 7-2 AppleWorks Directory

Now, we need to make subdirectories for all of our wordprocessing, data base, and spreadsheet files. At first, we might be tempted to create only one subdirectory for all of our AppleWorks files, or three subdirectories so we can separate them by type. One subdirectory may work for people who seldom use AppleWorks; however, moderate to heavy users will run into prob-

lems once the number of files in the subdirectory grows larger than 85. Presently, AppleWorks 2.0 will only display 85 files from a directory. Any additional files simply are not displayed on the menu which prevents you from working with those files. We strongly encourage you to set up several subdirectories to keep the number of files below 45 or 50 in each directory. It is very tedious and time-consuming to move through a long list of files. Most of our subdirectories are divided so that we never have more than 20 files in any one directory. You must also use caution when naming your subdirectories. AppleWorks limits a prefix to 30 characters including slashes. If you store a file in a directory with a pathname to the directory that is greater than 30 characters, AppleWorks will not let you access the file because you cannot enter the full pathname (prefix) to the directory. Of course, this would only be a problem if you created several directories and then moved existing AppleWorks files to the subdirectory.

If you are using the hard disk for personal use, you might create subdirectories for letters, budgets, addresses, business correspondence, inventories, recipes, etc. using shorter, but meaningful names. If you are setting your hard disk up for your business, consider looking at the way you have the folders organized in your desk drawer, and how you have organized your file cabinets and the files within a drawer. We will give some specific examples of the subdirectories that we used in the next chapter.

This same process of identifying subdirectories is continued as we work through each stack of our disks. We might have other subdirectories for our graphics packages with subdirectories for the different types of drawings we create, and a subdirectory for our utilities like RAMUP and other copying and formatting programs. If you are a programmer, you might want to create a subdirectory for your programming utilities and the software you are developing.

/HARD1/

- GAMES/
- APW/
- COMMUNICATIONS/
- GRAPHICS/
- UTILITIES/
- EDUCATION/
- LANGUAGE/

Figure 7-3 /HARD1 Volume Directory

THE MAP

One of our concerns in working with the hard disk has been to keep the number of files in the volume directory under 51. As you can see from Figure 7-3, we have only seven files in the volume directory. Why then must we be so conservative? First, we now have room to grow. Who knows what new software will appear on the market tomorrow that we will want to add to our disk? We are also missing some important software. We have not added the PRODOS operating system and BASIC.SYSTEM. As described in the following para-

graphs, these programs are needed to boot your hard disk (PRODOS) and to run BASIC programs (BASIC.SYSTEM). Adding these programs will bring our total to 9 files.

PRODOS FILES

If you are using an Apple II+, //e, or //c, you will need to copy PRODOS (or P8) and BASIC.SYSTEM to your hard disk. If you copy P8 you will need to rename it PRODOS using the rename command. When you start creating your subdirectories and copying files to your hard disk, you need to be aware of a specific order PRODOS follows when booting. When you boot your computer, it looks for a file named PRODOS that is a system file. When it finds it, it loads and executes PRODOS. PRODOS then begins looking for the first system file in the volume directory. Many times the first one is BASIC.SYSTEM. PRODOS will run the first SYSTEM file it finds. If you are using EasyDrive, EZDRV.SYSTEM will be the first SYSTEM file in the volume directory.

If you have an Apple IIGS, you will want to set your hard disk up for PRODOS 16. PRODOS 16 requires a different setup than the standard PRODOS 8 hard disk. When PRODOS 16 boots, it expects to find a subdirectory called SYSTEM with several files in it (see Figure 7-4). This subdirectory is not a SYSTEM file like BASIC.SYSTEM. You will want to create a subdirectory named SYSTEM on your hard disk. Then, copy the files from the SYSTEM subdirectory on the GS system

master to the SYSTEM subdirectory on your hard disk. Also, the PRODOS file on the PRODOS 16 disk is a special loader file and not the PRODOS 8 or PRODOS on a //e or //c. On the PRODOS 16 disk, the file named PRODOS will load the P16 file. Although all of the files in Figure 7-4 are not required by all applications, they should be included on your hard disk since they will be used by a variety of different applications. You can delete any extra files later.

/HARD1	**Comments**
PRODOS	Loader program
SYSTEM/	Subdirectory
P8	
P16	
START	Required if a program selector is used
LIBS/	
TOOLS/	Subdirectories for resources.
FONTS/	
DESK.ACCS/	
SYSTEM.SETUP/	
TOOL.SETUP	
BASIC.SYSTEM	Required for Applesoft BASIC programs

Figure 7-4 P16 Setup

The map of the volume directory for our sample hard disk is illustrated in Figure 7-5. The SYSTEM directory would only be included in hard disks used with the Apple //GS since the directory contains files required for PRODOS 16. Our volume directory now includes 10 files, leaving us room for another 41 files. We can use these 41 files to add new subdirectories or applications.

PRODOS 16 Disk	PRODOS 8 Disk
/HARD1/	/HARD1/
PRODOS	PRODOS
GAMES/	GAMES/
APW/	APW/
COMMUNICATIONS/	COMMUNICATIONS/
GRAPHICS/	GRAPHICS/
UTILITIES/	UTILITIES/
EDUCATION/	EDUCATION/
LANGUAGE/	LANGUAGE
SYSTEM/ (for GS machines only)	EZ.DRIVE.SYSTEM
EZ.DRIVE.SYSTEM	BASIC.SYSTEM
BASIC.SYSTEM	

Figure 7-5 /HARD Volume Directory with PRODOS and BASIC.SYSTEM Files

A Caveat

We have one last factor to consider before we begin copying files to our hard disk. Let's first review how PRODOS works when it boots a PRODOS 8 disk. First, PRODOS loads into memory. Second, PRODOS looks for the first system file in the volume directory. If there is more than one in the volume directory, PRODOS will take the one closest to the top of the catalog listing. When PRODOS finds the system file, it will execute it. Often, this file is BASIC.SYSTEM which in turn looks for a file titled STARTUP to run. Why this explanation? You may not want to execute BASIC.SYSTEM, rather, you might want to run a program selector like EasyDrive or some other system file such as

APLWORKS.SYSTEM. By arranging your directory, you can determine which SYSTEM file PRODOS will execute. If you are using EasyDrive you do not need to worry about the sequence of the files since EasyDrive takes care of the order.

Now, our warning. Several of the copy utility programs have an option to sort the directory listing. Thus, in theory you can place PRODOS last in the list and BASIC.SYSTEM first, or some other sequence and then sort the directory. In the past, there have been several reports that these sorters DO NOT WORK properly. If you decide to use one, make a copy of your PRODOS USER'S DISK or similar disk and try to sort it. If you can still boot the disk and select the various programs, all may be well.

If you are using PRODOS 16, PRODOS will first look in the SYSTEM directory for a file titled START which is a program selector (either Apple's or other). If the file is found, it is executed. If START is not found, PRODOS looks for the first SYSTEM file, either P8 or P16, to execute. Similar to the P8 disk, you will need to consider which SYSTEM program, if any, you want to execute when the disk is booted. Or, you might decide to use the program selector that is typically the START file. A program selector, like P-SHOOTER on your EasyDrive disk, provides you with a menu for selecting your applications. Thus, you do not have to be bothered with entering pathnames to run an application.

Summary

You can increase the efficiency of your hard disk through careful planning. This planning begins with an inventory of your application disks and data disks. Next, you need to plan which directories you will create in the volume directory and the additional subdirectories you will need for storing your files. Last, you need to determine the order of the SYSTEM files on your hard disk so that PRODOS can execute the correct file. This extra effort in planning your hard disk will make the management of the disk much easier in the future.

PRODOSercise

This PRODOSercise is designed to help you organize your hard disk for efficiency by following the steps we described in the chapter.

1a. List the major categories of software you want to copy to your hard disk.

b. Do you need to combine or create any additional categories?

2a. List the major categories for your data disks.

b. Are there any data disks that you should store some place besides on your hard disk?

3. Begin creating the map of your hard disk by making the map of the volume directory.

4. Indicate the various subdirectories for each of the directories in the volume directory.

5. Determine which versions of PRODOS you want to copy to your hard disk.

6. Will EZDRV.SYSTEM be your first system file, or will you use another system file first? Explain

Chapter 8
A Hard Disk with a View

If you have worked with us through the seven previous chapters of this book, you have a good understanding of the basic commands you will need to use with PRODOS. Youl also know how to use pathnames, subdirectories, and prefixes to save and load files on your hard disk. Chapter 7 introduced you to a process for organizing your floppy and 3.5 inch disks so that you can organize your hard disk for maximum efficiency. In this chapter, we will take a closer look at organizing a hard disk for use with AppleWorks and other applications.

AppleWorks on the Hard Disk

In our volume directory, we have created a subdirectory titled WP for our AppleWorks program and related files (we called it WP because we use the AppleWorks Wordprocessor more than any of the other modules). The WP subdirectory for AppleWorks is illustrated in Figure 8-1. The first directory, APW, is for our AppleWorks program and utilities. The second subdirectory, SPELL, is for our Sensible Speller and dictionaries. The remaining subdirectories represent the directories we use to store the various documents, data bases, and

spreadsheets we create with AppleWorks. Let's take a closer look at the APW subdirectory and some of the others to show you how we have made efficient use of our hard disk. Keep in mind that your requirements may differ from ours, making the organization we have used inappropriate for your specific needs. We believe, however, you can gain valuable ideas for setting up your hard disk by looking at other examples.

```
/HARD1/
        WP/
            APW/
            SPELL/
            HOME/
            BUDGET/
            BUS/
            C7071/
            C7072/
            C7073/
            E4350/
            E3600/
            RES.88/
```

Figure 8-1 Our WP Subdirectory

The APW Directory

Figure 8-2 shows the contents of our APW directory. As can be seen, that directory includes the AppleWorks files and Beagle Brothers' UltraMacros. In addition, we copied all of the AppleWorks files that were on both of the floppy disks we received when we purchased the package into one directory on the hard disk. If you take

a moment to catalog your AppleWorks program disks, you will see that both the STARTUP and PROGRAM disk have the same volume name, AppleWorks. AppleWorks has been designed so that it will work from a hard disk (or a RAM disk) if all of the different segments are placed in the same directory as APLWORKS.SYSTEM. There is also subdirectory, T.O.FILES/, where we have copied various files used by the TimeOut programs. If we were using SuperFonts or QuickSpell, we might add additional subdirectories under T.O.FILES/ for fonts and dictionaries.

```
/HARD1/
        WP/
            APW/
            SEG.00
            SEG.XM
            SEG.RM
            SEG.EL
            APLWORKS.SYS
            SEG.M0
            SEG.M1
            SEG.PR
            ULTRA.SYSTEM
            T.O.FILES/
            MACRO.GARY
```

Figure 8-2 APW Subdirectory

As you can see, we have limited our APW directory to the AppleWorks files and associated utilities. Thus, when a new version of AppleWorks is released, it is easy for us to delete the old AppleWorks program files

and copy the new ones into the directory. We also have an easy way to add other Beagle Brother's TimeOut enhancements by copying them to the T.O.FILES/ subdirectory. This type of organization makes it much easier to update your programs when new releases become available. The various subdirectories also keep the list of files fairly short when we catalog a directory, or use a program such as EasyDrive to select files.

Document Subdirectories

Looking back at Figure 8-1, you can see several subdirectories in the WP subdirectory which we use to save documents created with AppleWorks. We have one for HOME which has our Christmas card list, birthday list, and personal correspondence. The BUDGET subdirectory is used to keep a spreadsheet detailing each month's expenses and to gather data for our taxes. The BUS directory is used for our small business correspondence, billings, and income. The cryptic directories that start with a letter and are followed with four numbers (e.g., C7071, E3600) are the subdirectories for some of the courses we teach. The final directory, RES.88, has several subdirectories for the different research projects we run.

One problem encountered when we first set up our hard disk was trying to remember all the different subdirectory names. This problem was especially pronounced when it came time to find the final test for each course we were teaching. We found that life with a hard disk could be much easier if we standardized some of

our subdirectories. Figure 8-3 illustrates the subdirectories created for each of our courses. Now, when we want a test, we simply look in the test subdirectory for that course, (/HARD1/WP/C7071/TEST and /HARD1/WP/E3600/TEST). Lectures are all kept in a subdirectory titled LECT, handouts are in the HAND subdirectory, and the syllabus in the SYLLABI subdirectory. So, regardless of which course we are teaching, we have a standard set of subdirectories for storing similar information. This standardization makes it much easier to find the needed files.

```
/HARD1/
        WP/
            C7072/
            LECT/
            HAND/
            TEST/
            SYLLABI/
            GRADES/
```

Figure 8-3 Standard Subdirectories

You can create a similar standardization for your subdirectories if you are a teacher, professor, doctor, dentist, realtor or if you have a business in which you track different clients or projects. For example, if you are a financial manager, you might create a subdirectory for each client. Within this subdirectory you might have several other subdirectories to track the client's investments, life insurance, and personal data (see Figure 8-4). Then, when you look for Mr. Andrew's

investments you will not have to try STOCKS, then BONDS, then REAL.ESTATE. Rather, you simply set the prefix to ANDREW/INVEST and you will see that he has stocks, bonds, and real estate. As another example, a project manager might set up a subdirectory for the different projects he or she is managing. Each project might include subdirectories for correspondence, budget, timelines, and reports (see Figure 8-4). Note how the subdirectory has been created for the projects SHUTTLE and ROCKET which also include the standard subdirectories. You can determine standard subdirectories for your hard disk by studying your files or data disks to determine the most appropriate categories.

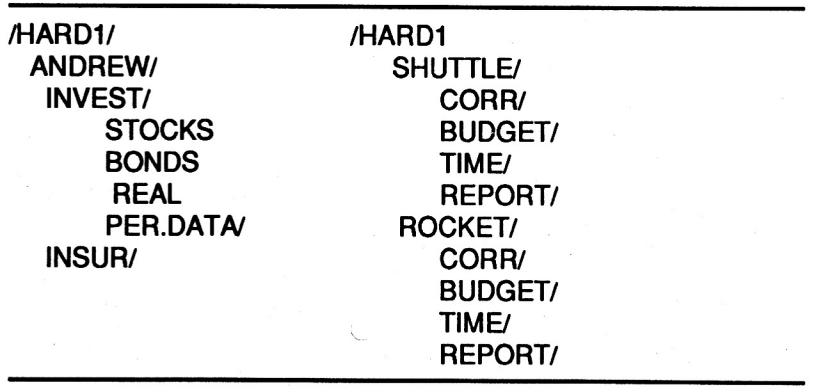

Figure 8-4 Sample Standard Subdirectories for Clients and Projects

Setting a Default Prefix

You can have AppleWorks default to a particular subdirectory if there is one that you are using more

frequently than others. We have seen many people who have their standard location still set to a floppy disk in slot 6, drive 1 even though all their files are on the hard disk. By setting the standard location of your data disk to a subdirectory, you can access the files you need much more easily and quickly. To change the standard location of your data disk (that is, setting the prefix), select option 5 from the AppleWorks main menu, OTHER ACTIVITIES. Then, select option 6 from the OTHER ACTIVITIES MENU, "Select standard location of the data disk." You will need to select the option for PRODOS DIRECTORY and type in the PRODOS pathname to your directory. For example, while writing this book, we had the standard location on our hard disk set to /HARD1/WP/RES.88/P.BOOK. After we boot AppleWorks, our default prefix is set to the book subdirectory and we are ready to add files to our desktop. If you access one particular subdirectory more than others, consider setting the standard location to that subdirectory. Then, you can change the option from the "Add Files to Desktop" (option 2) menu when you want to access another directory.

Organizing Subdirectories

We have two additional points to make about organizing your subdirectories. First, be sure to check the instructions for copying your applications on a hard disk. Some applications include a special program that will automatically install (copy) the software if you provide the pathname. Others may give special instructions for creating specific subdirectories. If you do not find any

special instructions, you will most likely need to copy all of the files from the floppy disk(s) or 3.5 inch disk into one subdirectory on your hard disk. If the program will run from a hard disk, you can almost always be sure that all of the files belong in the same subdirectory unless special instructions are given. The EasyDrive program will also help you to install many of the more popular programs on your hard disk.

Second, if you have several utility programs such as different copy programs, telecommunication programs, and utility programs you may want to consider copying all of them into one subdirectory. When you use P-SHOOTER from EasyDrive, you will have access to all these files in one subdirectory rather than having to switch between subdirectories. For example, we use our computers to access several electronic bulletin boards to read messages and exchange files. We have one subdirectory that includes the telecommunication program plus several other utilities which are used to prepare the programs that we download into a usable format. By having all of these applications in one subdirectory, we can use P-SHOOTER to select the application we want without having to move through several different subdirectories. They are all easy to access since they are in one subdirectory.

Summary

The final step in the preparation of your hard disk is determining the organization of your subdirectories.

There are three important points you need to consider. First, most of your applications that involve more than one floppy disk will need to have all of the files on the floppies copied into one subdirectory on the hard disk. Second, you can improve the efficiency of your hard disk by creating standard subdirectory names when you have several similar directories. Third, placing related applications in the same directory can improve your access of the specific applications.

PRODOSercise

Now, that we have given you a detailed description of some of our directories, it is time to think about your directories. For this exercise, we suggest that you take your most important or biggest directory and create a detailed map of all of the subdirectories and files you will create or copy to your hard disk.

Chapter 9

Tender Loving Care for Your Hard Disk

Finally, you have your hard disk up and running. In this chapter we will provide you with some general guidelines for caring for your hard disk. Proper care and maintenance is a type of disaster insurance for accidents that are bound to happen. Let's see what you can do to keep your life and business from being disrupted because the "computer is down."

Backle Up for Safety

A hard disk is a delicate piece of equipment consisting of a coated metal platter, often about the size of a 45-rpm record, that spins at a very high speed. A read and write disk head floats (or flies) on a cushion of air just above the disk that stores your data. Occasionally, there is a disruption of this cushion of air (pilots often announce it as turbulence when you are cruising at 27,000 feet) and the disk head touches the metal platter. Sometimes, this collision causes irreparable damage called a head crash. When a head crash occurs, you will loose the data stored in the damaged area of the disk. Head crashes are rare, but they do happen. You can lessen the effect of this unfortunate event very

easily by backing up your hard disk. That is, keep a copy of your hard disk files on floppy disks, 3.5 disks, another hard disk, or on a tape backup. If your hard disk suffers some type of damage, you can restore the lost files provided you have made backup copies. The chapter moral: **If a file is important to you then back it up.** As a personal note, our hard disk had an unfortunate accident after the first draft of this chapter. Fortunately, we had several backup copies of the files. So, back*le* up for safety.

There are several backup programs available and each works in a different manner. In fact, most backup programs cannot read disks created by another backup program. Users also have different philosophies on backing up hard disks. Some advocate only backing up your data files since you have the original copy of all your applications. Others recommend backing up the whole volume including data files and application files such as AppleWorks. Our suggestion is to decide which method is best, for your situation, evaluate your backup software, and then make a decision. As a note, you will need approximately 144 floppy disks or 25 3.5 inch disks to backup a 20-megabyte volume.

Disks for Backup Programs

The first step in backing up your hard disk is to format and label your disks. You might want to name your backup volumes BACK.01, BACK.02, etc., so that you will know they contain your backup files. If you will

be backing up your hard disk to two floppy disk drives, we recommend that you format the disks with odd-numbered volume names in drive 1 (e.g., BACK.01, BACK.03,...BACK.143) and the even-numbered volume names in drive 2 (e.g., BACK.02, BACK.04,... BACK.144). Each disk drive varies slightly in the way it works. So, if you use the same disk drive for both formatting and backing up the files from the hard disk, you can improve the quality of your backup process.

Types of Backup

As indicated above, there are two types of backup procedures. One is volume backup in which every file in a whole volume or subdirectory is copied on another disk. A volume backup is a time consuming process that is typically not done more than weekly or monthly.

Between volume backups, you can use a special backup program to do an incremental backup. Anytime you change a file, PRODOS changes a special character in the file to indicate that a change has been made. (We cannot see this character because PRODOS does not display it.) For example, you might update your spreadsheet to include the money you received today and save the file back to the disk. When you save the file, PRODOS changes the backup character to indicate that the file was changed since the last backup. When you do an incremental backup, between your volume backups, the incremental backup program will make copies of only those files that have been changed since your last backup.

You will need a different set of backup disks for your incremental backups. The incremental backup is typically faster than the full volume backup since you are only making copies of the changed files. If your files are critical to your work, you may want to do incremental backups on a regular basis between your scheduled volume backups.

Another strategy is to simply copy your important files to a floppy or 3.5 inch disk at the end of each day or some other interval between your volume backups. This strategy is quite easy using EasyDrive's P-SHOOTER. Simply select the files you want to copy and then select the destination disk. We use a strategy similar to this one because we carry 3.5 inch disks between the home and office. We have one 3.5 inch disk for each course that we teach, and copy the changed files over to the hard disk on a regular basis. In a sense we are using the hard disk as our backup, but we keep two copies of files in two different locations. We also back up the hard disk on a regular basis. EasyDrive's backup program can also be used to backup your floppy and 3.5 inch disks to a file on your hard disk.

Determining a Backup Strategy

Now is a good time to develop your strategy for backing up your hard disk. First, determine how often you will need to do a volume backup. Ask yourself how much you use your hard disk and how often you change

the files stored on the disk. If you are using your disk in a small business, you may need to backup your disk weekly or twice weekly if it used heavily. If you use your disk primarily for personal work or if the data are not critical you may be able to backup the volume once a month. Second, how often do you need to do an incremental backup? If you need to restore your disk for some reason, you will loose all the work you have completed since your last backup session. Thus, the incremental backup is used to supplement your volume backup. Begin now by taking the time to do your first backup. Then, do your volume backup and incremental backup (or simply copy the files to another disk) on a regularly scheduled basis.

Parking the Heads

When you arrive at your destination, you do not leave your car in the middle of the street. Rather, you park it in a designated parking space or in a driveway. Similarly, when you finish with your hard disk, you need to "park" the head. This process actually moves the head to an unused area of the disk that will not cause problems if the head and disk make contact. Some disks will automatically park the head when you turn off the drive, while others use a special program that moves the head to safe location before you turn off the disk drive. You will need to read your owners manual to determine how the heads are parked. If your disk requires a special program to park the head, you will want to use P-SHOOTER to copy it onto your hard disk in the volume directory or some other directory that is

easy to access. When you are ready to turn your computer off, run this program and wait for the message to turn the power off.

You may also have a different program to park the head if you are physically moving your hard disk from one location to another. Use the program if you are, for example, moving the hard disk from one desk to another or shipping it across the country. It is very important to park the head when moving your hard disk to protect the data it contains.

Handling Your Hard Disk

There is only one word to describe how to handle your hard disk—carefully! Be very careful around your computer and avoid bumping or causing any unnecessary motion that might disturb the hard disk. Excessive motion could cause a disruption in the air cushion which would allow the head to touch the disk. The result could be a head crash for the disk and a headache for you.

Keep the area around the disk clean and free from dust. Hard disks are sealed and, in theory, are impervious to dust. However, the other working parts are not sealed and you will need to allow for adequate ventilation so that the machinery can stay cool.

Save the original box and packing material for your hard disk. That way, it will be available should you need to move it or return it to the manufacturer for repair. The hard disk needs to be packed carefully to cushion it

and to keep it from moving inside the box.

Hitting CONTROL-RESET

Many of us have made the mistake of saving a file with the wrong filename, destroying a file that we still need. On realizing our error, hitting CONTROL-RESET while the disk drive light is on is not the answer. Such action can cause serious damage to your hard disk or the directories on the disk. Remember, the electronic signals from the computer to the hard disk travel at the speed of light. The time it takes your eye to signal your brain that the drive is on, for your brain to recognize the mistake, and then signal your hands to hit CONTROL-RESET is simply too long. It's better to let your actions travel their course than to risk further damage because you think you are faster than the speed of light! If you have deleted a file, there are several utilities that can "undelete" files (if you do not save any additional files to the disk after the deletion).

The best insurance is to keep a backup of your volume and your files. Knowing that accidents do happen, we often keep two versions of the same file in the same directory. For example, if we are working on our taxes we might have the main file titled TAXES and backup version named TAXES.BA. Every so often, we save the TAXES file under the name TAXES. Once every hour or two, we save the TAXES file under the name TAXES.BA. Then, we always have a recent copy if we accidentally destroy the original file.

Summary

We have seen that a hard disk can be a time saving device if it is used efficiently. It can also be a major problem if something goes wrong because we loose access to all the files we need. To prevent these accidents from stopping your work, you need to establish a plan for backing up your hard disk on a regular basis. This plan can include both volume backups and incremental backups. **Remember, back*le* up for safety!**

Chapter 10
PRODOS Error Codes

Sometimes, we become careless and provide our computers with the wrong information. Our Apple typically responds with a resounding BEEP and message telling us we have done something wrong. Then, we must figure out what we have done wrong and correct it immediately if we want to proceed. In this chapter we will explain some of the PRODOS error codes and offer suggestions as to what you can do to correct the error.

Error Codes

Most of us are familiar with the typical error codes such as SYNTAX ERROR or PATH NOT FOUND. These are the standard PRODOS error codes we typically see. There is another type of error code you might find when running various application programs. Rather than returning a message such as SYNTAX ERROR, these error codes provide the user with a number such as $45 (but no money is every dispensed from a slot!). The dollar sign indicates the number is a base sixteen or hexadecimal number. These error codes are referred to as MLI (Machine Language Interface) error codes. Although these errors are seldom seen, they are occasionally displayed by a program. In the following sections, we will explain some of the standard PRODOS error codes and some of the MLI error codes.

PRODOS Error Codes

NO DEVICE CONNECTED. This error code indicates that you have tried to load or save a file to a disk that does not exist. For example, on our system we have a 20 MEG hard disk in slot 7. It is drive 1 and the only drive we have in slot 7. If we were to try to save a file to slot 7 drive 2, our Apple would respond with NO DEVICE CONNECTED. To solve this problem, we must save our file to slot 6, drive 1 or 2; or to slot 7, drive 1 where we have drives.

WRITE PROTECTED. You will seldom receive this error message when working with your hard disk as your disk will probably not be write protected. Some of floppy disks, however, might have a piece of tape over the write protect notch on the right side. This tape (or foil) prevents you from saving any old or new files to the disk. If you really want to use the disk, simply remove the piece of tape (or move the plastic slide on a 3.5 inch disk).

PATH NOT FOUND. If PRODOS cannot find the file or directory you have requested it will respond with PATH NOT FOUND. If we check our typing, we will usually find that we have made a spelling error or left off one of the slash marks. You will also receive this message if you forget to put the appropriate disk in one of the disk drives. PRODOS is simply telling you that you

do not have a file, directory, or volume with name you have specified.

I/O ERROR. This error message is sort of a catch-all when there is a problem with the disk drive. If you leave the door open on a disk drive or if the disk fails to seat properly in the drive, you will see this message. PRODOS will also display this message if the disk is damaged or has not been formatted. Your first action should be to check the disk drive door. Then, remove the disk and insert it again. If you receive the error message again, visually check the disk for defects. A last resort is to format the disk—but remember, you will loose any data that is on the disk. If you receive an I/O error with a hard disk, check with your dealer or the manufacturer.

DISK FULL. If you have used up all the available storage space or have 51 files in your volume directory, PRODOS will tell you the disk is full. If you have actually used all the available space (use the catalog command to see how many blocks are free), you will need to use a different disk. If you have plenty of space on the disk you will need to remove some of the files and

create some subdirectories (and reread the earlier chapters in this book).

FILE LOCKED. PRODOS will not let you save new data to a file that is locked (remember, locked files have an asterisk beside their names in the catalog). Often, we lock files to remind us to think before we change it. If you really want to change the file, use the UNLOCK command first.

SYNTAX ERROR. This message is displayed when you provide PRODOS with an illegal filename. If you tell PRODOS to CAT 5, you will see SYNTAX ERROR since volume, directory, and file names must all begin with a letter. SYNTAX ERROR is simply indicating you have entered the wrong command (CAR instead of CAT or CATALOG) or you have used an illegal filename.

NO BUFFERS AVAILABLE. You will seldom see this error message. It usually occurs after you hit CONTROL-RESET. You should reboot your computer to recover from this error.

FILE(S) STILL OPEN. This is another rare error message. If you see this message, simply enter CLOSE and press the <RETURN> key. The program you are running failed to close a file when it finished.

MLI ERRORS

MLI error are very similar to PRODOS errors, but are displayed as numbers. The Table 11-1 is a list of some of the MLI error codes. The numbers preceded by a dollar sign are hexadecimal numbers. You can refer to the PRODOS error codes for a full explanation of the error.

HEX	DECimal	Error
$27	39	I/O Error
$28	40	No Device Connected
$2B	43	Disk Write protected
$2E	46	Disk Switched: You have removed the disk that was in the drive. Return the original disk to the drive.
$40	64	Invalid Pathname Syntax (see SYNTAX ERROR)
$44	68	Path Not Found
$45	69	Volume Directory not found (see PATH NOT FOUND)
$46	70	File Not Found (see PATH NOT FOUND and SYNTAX ERROR)
$4E	78	Access Error (See FILE LOCKED)
$52	82	Not a PRODOS disk: You are trying to use a disk such as a DOS3.3 disk.

Table 10-1 MLI Error codes

Summary

There are two type of error codes you can receive from PRODOS. The most common are the PRODOS Error codes which are displayed when you enter PRODOS commands from the keyboards. You might also see MLI error codes when you run a program. MLI error codes are typically shown as a number while the PRODOS error codes are displayed as a message. If you need more information on error codes, you should consult the Apple books, BASIC Programming with PRODOS and the PRODOS Technical Reference Manual.

Chapter 11
PRODOS 16

When Apple introduced the Apple IIGS, they also introduced a new disk operating system called PRODOS 16. PRODOS 16 will only run on a GS computer, If you attempt to boot it on an Apple //e you will receive a message that says PRODOS 16 REQUIRES APPLE IIGS HARDWARE. This chapter will describe the files on the PRODOS 16 system disk and explain the process your computer goes through when booting PRODOS 16.

PRODOS 16 System Disk

To understand how PRODOS 16 boots we must first study the files on the PRODOS 16 system disk. If you catalog the system disk, you will see a listing similar to Figure 11-1.

```
PRODOS
BASIC.SYSTEM
SYSTEM/
   LIBS/
   P8
   P16
   START
   SYSTEM.SETUP/
      TOOL.SETUP
   TOOLS/
   FONTS/
   DESK.ACCS/
   DRIVERS/
   FINDER
```

Figure 11-1 PRODOS 16 System Disk

The PRODOS file at the very beginning of the directory listing is not the same PRODOS file that is used with the //e and //c. This PRODOS file is used to load the P16 (PRODOS 16) and P8 files. You may recall from an earlier chapter that the P8 file is the PRODOS file used with the //e and //c computers.

The SYSTEM subdirectory includes some very important files used by PRODOS 16. The following is a description of these files.

LIBS/. Special system library files are stored in the subdirectory. This directory is not on the current version of the GS system disk (3.1), but it may appear on future

releases if library files are needed by PRODOS.

START. The START file is run after PRODOS 16 is executed. It may be an application program, a program selector, or it may simply tell PRODOS 16 to run another application.

SYSTEM.SETUP/. This subdirectory includes files that are used during the boot process.

TOOL.SETUP. This program changes and modifies the tools stored in ROM. For example, Apple might at sometime need to make a change to the QUICK.DRAW tool to correct a problem or make a modification.

TOOLS/. This subdirectory contains the disk-based tools used by the GS' toolbox. The tools are loaded into memory and are used by various applications.

FONTS/. The FONTS subdirectory includes various fonts that are used by GS applications using the Apple DeskTop.

DESK.ACCS/. Various GS desk accessories can be stored in this subdirectory and then loaded into memory. Typical desk accessories include notepads, ASCII tables, phone dialers, and calendars. These accessories can be accessed with the CONTROL—OPEN-APPLE—ESCAPE keys.

FINDER. This program is often run by the START file. Finder is a DeskTop environment you can use to run various applications. It is similar to the Macintosh interface.

DRIVERS/. This directory contains special files that allow you to use printers, modems, Appletalk, and other devices connected to your GS.

Now, let's turn our attention to steps the GS goes through when booting PRODOS 16.

The PRODOS 16 Boot Process

When the Apple IIGS boots, it first looks in the main volume directory for a file with the name PRODOS (if this file is not found, you will see a message on your screen that says ***UNABLE TO LOAD PRODOS***). This file is a special file used to start PRODOS 16 on the GS, and thus is different from the PRODOS found on your PRODOS 8 disks. PRODOS installs some special instructions (PQUIT) in memory which are used each time an application is ended. For example, if you are running AppleWorks and select QUIT from the main menu, PRODOS will check these instructions to determine what action to take next. If you are using FINDER, then FINDER will be executed and you will see the Apple DeskTop which can be used to select another application. After the QUIT instructions are installed in memory, PRODOS looks in the SYSTEM/ for a file named P16.

P16 is a file which includes the System Loader and PRODOS 16. If P16 is found, PRODOS turns control over to the file and the System Loader begins. You will then see a message on your screen indicating the version number of the loader and the version of PRODOS 16 as P16 is loaded into memory.

Next, the System Loader must do some initialization. First, it executes the files in the SYSTEM/SYSTEM.SETUP/ directory. The first one executed is always the TOOL.SETUP file. This file makes any needed patches or modifications to the ROM based tool sets. You must have the TOOL.SETUP file in the appropriate directory for PRODOS 16 to work. There can be two other types of files in the SYSTEM/SYSTEM.SETUP directory. The first type is permanent initialization files ($B6) such as the TOOL.SETUP file. The second type is the temporary initialization files ($B7). Version 1.3 of the GS System disk does not include any temporary initialization files.

After the System Loader initializes or loads all of the files in the SYSTEM.SETUP/ directory, it moves to the DESK.ACCS directory. If you have stored any classic desk accessories (CDA) in the directory, they are placed in memory. The CDA's can be accessed through the control panel.

All of the previous steps are required to prepare the

GS for running various applications. Now, PRODOS 16 is ready to execute the first application. PRODOS 16 begins by looking in the SYSTEM/ directory for a file called START. This file could be the GS FINDER or program LAUNCHER, or it could be an application file. If a START file is located, it is executed.

If no START file is found, PRODOS 16 begins looking in the main directory for the first file with .SYS16 or .SYSTEM prefix. If a file name with .SYS16 is found, the file is executed. If PRODOS 16 finds a filename with the .SYSTEM suffix then PRODOS 16 must quit and start PRODOS 8. When PRODOS 8 (or P8 in the SYSTEM/ directory) is executed, you will see the same screen that appears on the //e or //c when you boot PRODOS. PRODOS 8 will then execute the .SYSTEM file found in the volume directory. If no Start or system file is found, then PRODOS 16 enters an interactive routine that prompts you for the filename of your application.

SUMMARY

PRODOS 16 is a disk operating system for the Apple GS which allows the user to execute PRODOS 16 files or PRODOS 8 files as long as PRODOS 8 (P8) is in the system subdirectory. If PRODOS fails to find P16 in the SYSTEM/ directory, a fatal error will occur.

Index

Appendix A

PRODOS Programs

PROGRAM 1

Program 1 demonstrates how many files a volume directory can hold. You will need a formatted PRODOS floppy disk or 3.5 inch disk with the volume name / TEST. We **DO NOT RECOMMEND** using your hard disk as the /TEST volume. You will not need any other files on the disk.

Boot your SYSTEM MASTER disk and select BASIC.SYSTEM so that you can enter the following progam. Make sure you have the /TEST volume in one of your drives. Type the following information and then watch for the results.

```
NEW
 10 D$ =  CHR$ (4)
 20  PRINT D$;"PREFIX /TEST"
 30  HOME
 40  VTAB 8
 50  PRINT "Floppy filler"
 60  FOR X = 1 TO 55
 70  VTAB 10
 80  CALL  - 868
 90  PRINT "File #"X
 100  PRINT D$;"CREATE TEST."X",TTXT"
 110  NEXT
 120  END
RUN
```

You will see a message on your screen as the program creates each of the text files. If you started with a blank disk, you will get the message DIRECTORY FULL when the program tries to create the 52nd file. You can enter CAT and see that all of the files are in the directory. However, note that the last file is TEXT.51. There should still be several blocks free on the disk. It does not matter what type of disk you use for this experiment, floppy, 3.5 inch, or hard disk, you can only have 51 files in the volume directory. You may want to enter the following program to delete the files.

```
NEW
 10 D$ =  CHR$ (4)
 20  HOME
 30  VTAB 8
 40  PRINT "Floppy filler delete program"
 50  FOR X = 1 TO 50
 60  VTAB 10
 70  CALL  - 868
 80  PRINT "File #"X
 90  PRINT D$;"DELETE TEST."X
 100  NEXT
 110  END
RUN
```

This program will delete all 51 files so that you can run PROGRAM 2.

PROGRAM 2

The following program demonstrates how you can save more than 51 files on a disk. Again, we recommend that you use a floppy disk or a 3.5 inch disk (preferably a floppy disk for this one). Enter the following lines and then watch the results.

```
NEW
 10 D$ = CHR$ (4)
 20 PRINT D$;"CREATE /TEST/SUB"
 30 PRINT D$;"PREFIX /TEST/SUB"
 40 HOME
 50 VTAB 8
 60 PRINT "Floppy subdirectory filler"
 70 FOR X = 1 TO 2000:REM  Will also work with 3.5 inch drive
 80 VTAB 10
 90 CALL - 868
 100 PRINT "File #"X
 110 PRINT D$;"CREATE TEST."X",TTXT"
 120 NEXT
 130 END
RUN
```

This time the program will run until it fills the volume and PRODOS issues the error message, DISK FULL. If you enter CAT, you will see that there are more than 51 files on the disk (you will see about 279 on a floppy).

Appendix B
Resources

The following is a list of our favorite resources on the PRODOS operating system.

Apple IIGS PRODOS 16 Reference: Includes System Loader. (1987). Reading, MA: Addison-Wesley Publishing Company, Inc.

BASIC Programming with PRODOS. (1984). Reading, MA: Addison-Wesley Publishing Company, Inc.

Open-Apple. Open-Apple, P.O. Box 11250, Overland Park, Kansas 66207. Although *Open-Apple* is a newsletter, we have found it to contain a wealth of information on PRODOS as well as general information on the Apple //e.

PRODOS Technical Reference Manual. (1985). Reading, MA: Addison-Wesley Publishing Company, Inc.

Doms, D. & Weishaar, T. (1986). *PRODOS Inside and Out.* Blue Ridge Summit, PA: TAB Books, Inc.

Little, Gary B. (1985). *Inside the Apple //e.* Bowie, MD: Brady Communications Company.

Little, Gary B. (1985). *Apple PRODOS: Advanced Features for Programmers.* Bowie, MD: Brady Communications Company.

Little, Gary B. (1987). *Exploring the Apple IIGS.* Reading, MA: Addison-Wesley Publishing Company, Inc.

Worth, D. and Lechner, P. (1984). *Beneath Apple PRODOS.* Chatsworth, CA: Quality Software.

There are several other magazines and books devoted to the Apple II series of computers which you can read for additional information.

Appendix C

PRODOSERCISE Resources

The following illustration is for use with PRODOSercise at the end of the chapters.

```
/HARD1/
   RECREAT/
      TROLLS/
      B.BALL/
      CARS/
      BOARD/
      JETS/
   WP/
      APW/
         HOME/
            B.DAYS
            LTRS/
            INVENT
         CLUBS/
            MAIL.LST
            DUES
         CHURCH/
            SCHEDULE
            BULLETIN
   MONEY/
      STOCKS/
         BLUE.CHIP/
         COMMON/
      EXPENSE/
```

```
        JAN
        FEB
        MAR
    LIGHT
    CARS/
        LOANS
        MAINT
        ID
GRAPHICS/
    DRAW/
        SCHEM/
        LAND/
        BLDG/
    PAINT/
        MISC/
KIDS/
    WHERE
    NUMB/
        COUNT
        BUGS
PROG/
    EDIT/
        PW
        LINE
        CMDS/
            TYPE
            LIST
            CONVERT
            DBL.HRES
            COPY
    GRAPHICS/
        FONTS/
            HVTICA
            BALLOON
        SHAPES/
            CIRCLE
            STAR
```

PRODOSercise Answers

CHAPTER 2

1. This information will be in your owner's manual for the hard disk.

2. First, multiply the number of megabytes on your disk by 1000.
   Divide this number by 143, the number of bytes (x1000) in a 5.25 in. floppy disk to obtain the answer.

3. This information will be in your owner's manual for the hard disk.

4. This information will be in your owner's manual for the hard disk. The amount of disk space you allocate to each operating system should be based on your usage of the system.

5. PRODOS and BASIC.SYSTEM or some other system file.

CHAPTER 3

1. Only P16 will work on a IIGS.

2. GAMES:INSTR (colon is an illegal character)
   AERONAUTICS.JETS (longer than 15 characters)
   CAVE TROLLS (Space is an illegal character)

1,2,3.SHEET (Must begin with a letter)
89.STOCKS (Must begin with a letter)

3. 15 characters

CHAPTER 4

1. /TAXES /TESTS

2. 51

3. Limited only by the disk space

CHAPTER 5

1. PREFIX WP/APW/HOME OR PREFIX /HARD1/WP/APW/HOME

2. PREFIX EXPENSE OR PREFIX /HARD1/MONEY/EXPENSE

3. PREFIX/

4. /HARD1/KIDS/NUMB

5. PREFIX

1. CATALOG /HARD1/WP/APW/CLUBS

CHAPTER 5

1. CATALOG/HARD1/WP/APW/CLUBS

2. CREATE PEN

3. DELETE BOARD All the files stored in the BOARD subdirectory must be deleted first.

4. LOCK MONEY/CARS/ID or LOCK /HARD1/ MONEY/CARDS/ID

5. RENAME LINE, WORD

CHAPTER 7

(Answers depend on the individual)

CHAPTER 8

(Answers depend on the individual)

About the Authors

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Gary and Steve have produced several computer-based instruction study guides for college textbooks. They also have an active research program at Memphis State University investigating various computer-based instructional strategies.