Appendix D

Disk Organization

The data on a floppy disk is written in cylindrical paths called tracks. The most common disk format is to have a 5¼" disk with 40 tracks, spaced ¼$_{48}$" apart; this format is often called a 40-track or 48 TPI (tracks per inch) disk. A somewhat newer format places the tracks half as far apart, resulting in 80 tracks which are ¼$_{96}$" apart; this is usually called a 96 TPI disk. 3½" disks also come in 40- and 80-track versions, but their tracks are placed considerably closer together. Tracks are usually numbered starting at track 0, which is the outermost track, to track 39 or 79, which is the innermost track.

In addition, disks can be either single-sided or double-sided, although almost all modern disk drives write on both sides. Obviously, a double-sided disk can store twice as much data. Disks are often described as SS for single-sided or DS for double-sided.

Furthermore, disks can be either single-density, double-density, or quad-density, depending on how closely the bits are packed together on a track. The original floppy disks were all single-density, but the more modern double- and quad-density formats pack roughly twice as many, or four times as many, bits on a track (although as a practical matter, the actual improvement is usually about 20% less than expected.) Densities are often abbreviated as SD for single density, or DD for double density.

Finally, most floppy disks rotate at 300 rpm, which works out to 5 revolutions per second, although the so-called HD or high-density disks on IBM computers rotate at 360 rpm (the same speed, in fact, as the really old 8" disks.)

Since many people are familiar with the various disk formats available on an IBM personal computer, here is a comparison of some of these common formats:

Capacity (bytes)	Sides	Tracks	Density	RPM	Size
180K	1	40	Double	300	5¼"
360K	2	40	Double	300	5¼"
720K	2	80	Double	300	3½"
1.2 meg	2	80	High	360	3½"
1.44 meg	2	80	High	360	3½"

The original SK68K computer supported only the double-density formats in the above table; now it supports all of the above disk formats (although older versions require a newer HUMBUG ROM, and a plug-in IBM-style disk controller).

Although the typical double-density track can theoretically hold almost 6000 bytes, in practice only 4608 bytes are used for actual data storage; the remaining bytes are wasted. On an IBM disk running MS-DOS, these 4608 bytes are divided into 9 sectors of 512 bytes each; on the SK68K running the SK*DOS disk operating system, they are divided into 18 sectors of 256 bytes each. These sectors are then numbered, beginning with sector 1 at the beginning of a track.

On an SK*DOS disk, track 0 is used to hold system information, while the remaining tracks hold program and data files. On track 0, sectors 1 and 2 hold the *superboot* program which is used when starting (booting) the system; sector 3 is called the *System Information Sector* (SIS) because it stores system information such as how much of the disk is free; sector 4 is used for testing purposes, and the remaining sectors, beginning with sector 5, hold the disk directory; if more space is needed for the directory, then it may be continued on other tracks.

Each file on the disk has an entry in the directory which contains the file's name, size, time and date of creation or last update, location on the disk, and a one-byte attribute which provides further file information. The location of the file is specified by the track and sector where the file begins, and the track and sector where the file ends.

Since only the beginning and ending locations are specified in the directory, additional information which tells where to find the rest of the file is contained within the file itself. The first two bytes of every sector in the file contain a pointer to the next sector of the file, in the form of another track and sector number. Since each sector therefore points to the next, the sectors in each file form a *chain*; this type of disk organization is thus called a *linked chain* system.

The free space on the disk is treated as another linked chain of sectors, whose beginning and ending locations, as well as size, are stored in the SIS, sector 3 of track 0. As the SK*DOS disk operating system creates or deletes files, it simply moves sectors between chains. For example, when a file is deleted, its name is removed from the directory, and its sectors are added to the end of the chain of free sectors. One neat side-effect of this system is that, if there is enough free space on the disk, these sectors may not be overwritten for some time. It is therefore possible to pull back a deleted file,

sometimes even days or weeks later. SK*DOS is supplied with an UNDELETE program which does exactly that.