Lecture # 5
Chemistry Dept.

Number Systems

2nd Class
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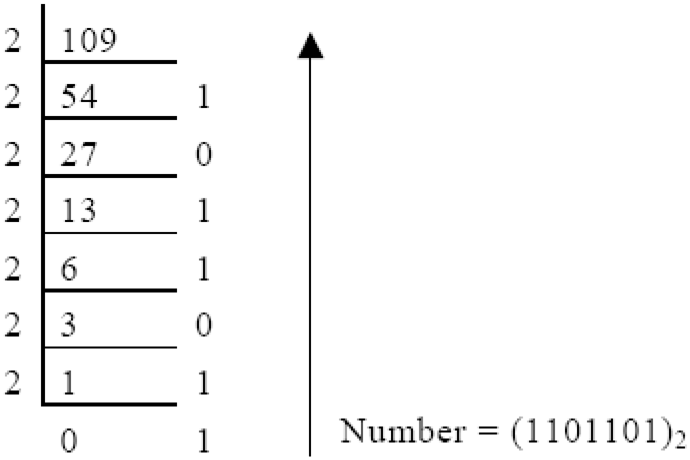
The number system that we use in day-to-day life is called **Decimal Number System**. It makes use of 10 fundamental digits i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Computer doesn't make use of decimal number system. Internally it makes use of another number system, called **Binary Number system**. Binary number system is the fundamental base of computers. It makes use of two digits only i.e. 0 and 1. All other numbers in binary number system are formed using these digits.

Conversion Of Decimal Number Into Binary Number:

A given decimal number can be converted into equivalent binary number by following method:
1. Since binary number system makes use of only two digits hence divide the decimal number by 2. Write the quotient below the number and remainder on the right hand side.
2. Now divide the quotient by 2 and repeat above-mentioned process till the time quotient becomes 0.
3. Now arrange the remainders (x1, x2, x3 …. etc.) in reverse order (…. x3, x2, x1)
The number thus obtained will be binary equivalent of given decimal number. To understand the procedure of conversion, consider following examples:

Example -1
Convert decimal number $(109)_{10}$ to equivalent binary number.



2	109	
2	54	1
2	27	0
2	13	1
2	6	1
2	3	0
2	1	1
	0	1

Number = $(1101101)_2$

Thus above mentioned process yields: $(109)_{10} = (1101101)_2$

How do you convert fractional numbers (that have decimal point in them) into equivalent binary numbers?

1. Since binary number system consists of only two digits hence multiply fractional decimal part by 2. When you do so, integer part obtained on the left hand side of the decimal number will either be 1 or 0. Whatever you get, write it separately (say you write x1. Here x can either be 1 or 0).
2. Now take the resultant fractional part and multiply it by 2 again. Repeat the process, as many times as number of digits are required on the right hand side of the binary point (thus obtaining x2, x3, x4 etc.). For example, if 4 digits are required on the right hand side of the binary point, repeat above-mentioned process 4 times.
3. Arrange the digits that were written separately in the sequence, in which they were obtained (e.g. x1, x2, x3, and x4). The number thus obtained (x1x2x3x4) will be binary equivalent of given fractional decimal number.

Example (1):

Convert decimal number $(0.862)_{10}$ to equivalent binary number.

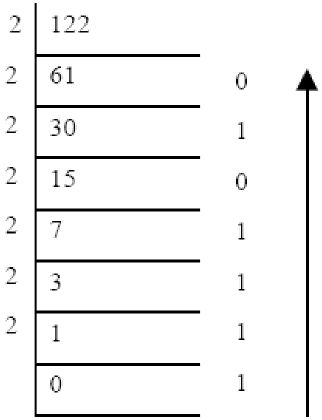
0.862 × 2 = 1.724	1
.724 × 2 = 1.448	1
.448 × 2 = 0.896	0
.896 × 2 = 1.792	1
.792 × 2 = 1.584	1
.584 × 2 = 1.168	1

Thus above mentioned process yields: $(0.862)_{10} = (0.110111)_2$

Example (2)

Convert decimal number $(122.486)_{10}$ to equivalent binary number.

First Step: Integer part of the number is taken:



2	122	
2	61	0
2	30	1
2	15	0
2	7	1
2	3	1
2	1	1
	0	1

Thus $(122)_{10} = (1111010)_2$

Second Step:

In second step, fractional part of the number is taken:

.486 × 2 = 0.972	0
.972 × 2 = 1.944	1
.944 × 2 = 1.888	1
.888 × 2 = 1.776	1

Number = $(0.0111)_2$

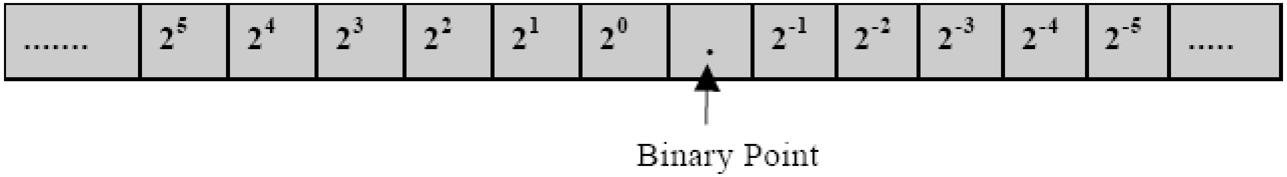
Third Step:

Joining both the parts together will result in following number:

$(122.486)_{10} = (1111010.0111)_2$

Converting Binary Numbers into Equivalent Decimal Numbers

Positional values for different positions in binary number are illustrated below:



....	2^5	2^4	2^3	2^2	2^1	2^0	.	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	.....

Perform following steps to convert a binary number into equivalent decimal number:
1. Multiply each digit of the number, by its positional value.
2. Now add all the products to get the sum.
The sum, thus obtained will be the equivalent decimal number of given binary number.

Example:
Convert (1100110)2 into equivalent decimal number.

Solution:

$(1100110)_2 = (1\times2^6 + 1\times2^5 + 0\times2^4 + 0\times2^3 + 1\times2^2 + 1\times2^1 + 0\times2^0)_{10}$

$= (64+32+4+2)_{10} = (102)_{10}$

ONE'S COMPLEMENT:

In computers, one's complement is used for *representing negative numbers*.
When 0's in a binary number are replaced by 1s and 1s are replaced by 0s then the resultant number is said to be 1's complement of the number.

For example:
1's complement of 100110 will be 011001.
Similarly 01011100's one's complement will be 10100011.

BIT:

Computer stores all its data in the form of 0s and 1s. Digit 0 and 1 and called **Bits**. That means 0 is one bit and 1 is another bit. The data 1100 comprises of 4 bits. You can say that bit is the *smallest storage unit of computer*.

BYTE:

8 bit put together form 1 **byte**. For example, 10101011 will occupy one byte space.

WORD:

Number of bits that are used for representing a character within the computer are called **word**. Note that in most of the computers 8 bit are used to represent a character. Thus in those computers words comprises of one byte.

MS-DOS Operating System

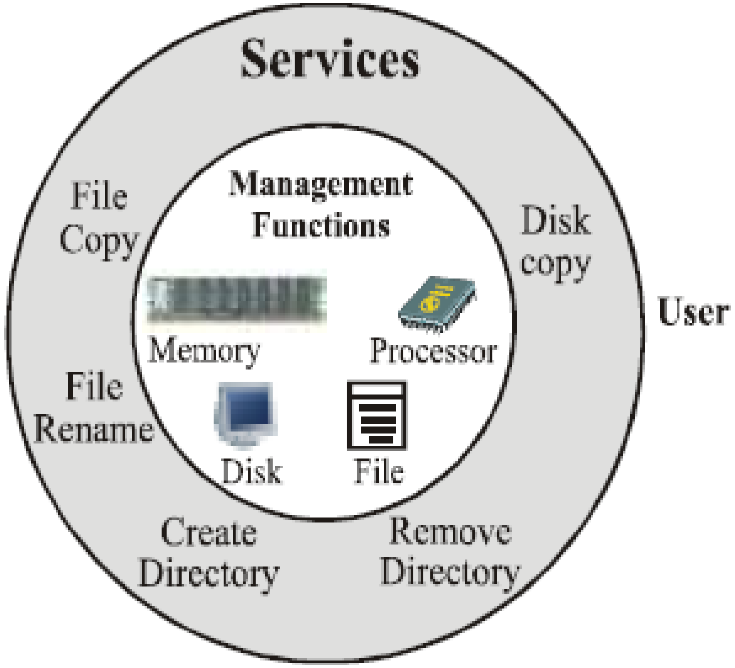
A computer system is basically combination of hardware and software. For its functioning it requires different types of hardware devices, electronic components and various types of software. Operating system is one of the software, which computer uses for its internal functioning.

Operating System is essential software that is required for a computer to become operational. It provides functionality to computer hardware so that electro-mechanical components of it perform read, write and processing functions as human beings do. Without operating system, computer cannot work. Any instruction given by the user to the computer to perform a function is actually carried out by operating system. Operating system is essential software, purpose of which is to activate the computer and:

1. perform internal management functions

2. provide services.

Internal management functions are the functions that have to be essentially performed to make the computer work. For example, managing the processor, memory, devices, input /output functions, data etc. Services are bunch of commands and utilities that operating system provides to its users to have better control over computer.



Block diagram, showing the basic structure of operating system

EXAMPLES OF OPERATING SYSTEM:

To activate the computer and to perform different types of activities on computer, many operating systems are available these days. **MS-DOS**, **Windows**, **Linux**, **UNIX** etc. are few popular operating systems of modern time.

MS-DOS is one of the most popular, powerful and useful operating system. It was designed and developed in the initial days of Personal Computers (PC) by Microsoft Corporation of USA. Due to its versatility and ease of operations, it became quite popular, within short span of time.

MS-DOS is Character User Interface (CUI) based operating system. To execute any command in MS-DOS, you need to know the command and its format. Any mistake in its spelling or format leads to error.

MS-DOS not only activates computer resources and controls them but it also provides many commands for performing day-to-day tasks.

CONSTITUTION OF MS-DOS

MS-DOS is a modular operating system and comprises of many files. It utilizes these files as and when required. Following files put together constitute MS-DOS operating system:

1. IO.SYS: It gets loaded into computer's memory at the time of booting the system. It primarily activates basic input and output devices like keyboard, VDU etc. and makes them functional.

2. MSDOS.SYS: It automatically gets loaded at the time of booting the operating system. It controls internal resources like memory, ALU, Control Unit etc. of computer.

3. COMMAND.COM: It comprises of few frequently used MS-DOS commands. For example, DIR, COPY, TYPE, REN etc. are internal commands. To execute an internal command, you need to type the command from the keyboard in its recommended format. When you do so, it is directly read from the memory and executed.

4. External Command Files: Each command exists in the form of executable file and resides on the disk. For example, FORMAT, XCOPY etc. They exist in the form of FORMAT.COM, XCOPY.EXE files respectively. To execute an external command, you need to type the name of the command from the keyboard and press Enter key. When you do so, computer reads the file from the disk, loads it into memory and executes it. When its execution is complete, it is removed from the memory.

FILES AND FILE TYPES

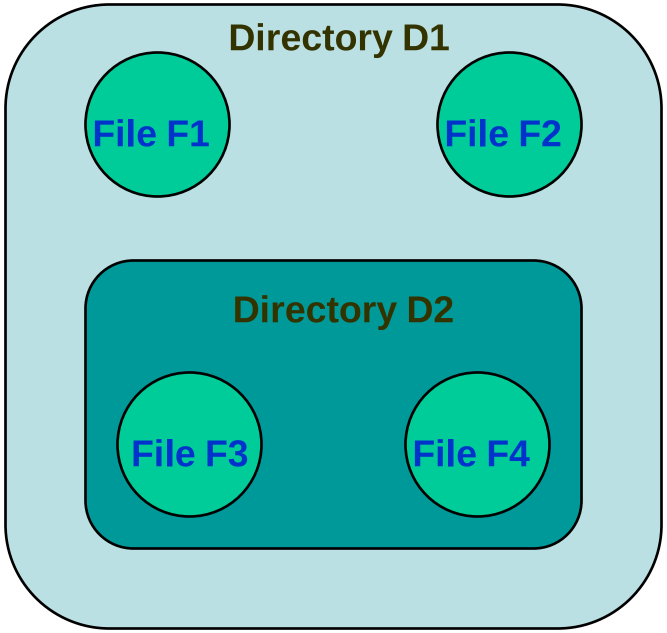
Whatever computer has to store on media like floppy hard disk or CD, it stores in the form of files. Whenever it has to make use of the contents, stored in the file, it accesses the file and reads them from it. In other words you can say that all read/write operations, in computer are done through files. Computer files can be broadly classified into two categories:

1. **Executable files**: are basically command files, which when executed perform specific task. For example, DISKCOPY.COM is a command file, which copies the contents of a floppy on another floppy.

2. **Data files**: are the files, which contain data, program or some information in them.

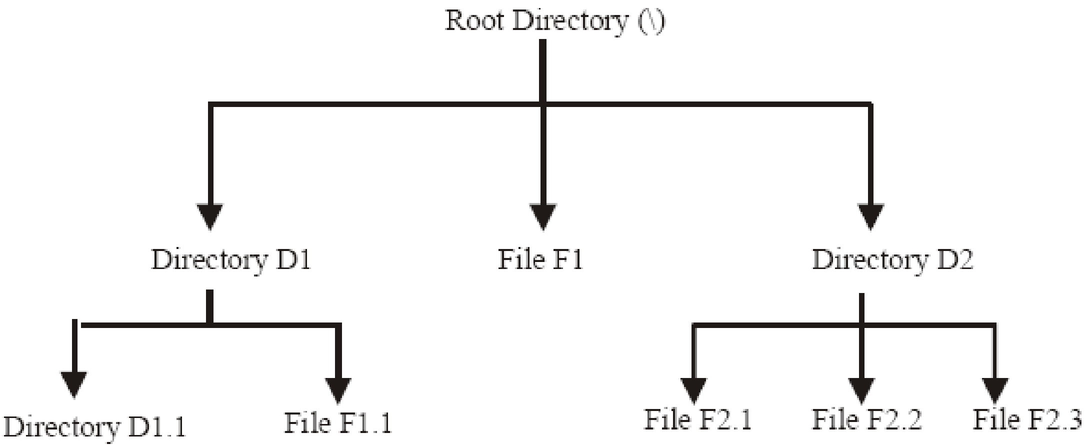
CONCEPT OF DIRECTORY:

Directory can be conceptualized as special file, which can hold files and directories in it. From this figure, it is quite clear that directories can be utilized for classified storage of files on the disk.



MS-DOS FILE SYSTEM

The mechanism of arranging the files and directories on the disk is called **file system**. In MS-DOS, file system looks like an inverted tree. Root directory appears at the top of the tree. Other directories branch off from there and files act as leafs. Such a file arrangement is often referred to as **Hierarchical File System**. A hierarchical file system consisting of few files and directories is illustrated in figure beside.



CONCEPT OF PATH

Path of a file or directory is the list of directory names in descending sequence, starting from root and each directory name separated by a back slash (\), following which you reach to the desired file or directory.
For example, refer figure above.
The path for file F1.1 will be \D1\F1.1.
Similarly the path name for F2.2 file will be \D2\F2.2.
Note that first backslash in the path name denotes root directory, while other backslashes serve the purpose of separators.

BOOTING COMPUTER USING MS-DOS

When you switch on the computer, it performs self-test. If self-test passes through correctly, operating system is read from the disk and loaded in computer's memory. Immediately after that following sign appears on VDU screen:

C:\>

Above mentioned sign is called system prompt. Different characters in system prompt signify different things. C: indicates that the system was booted from C drive. Character \ indicates that root is the current directory. The > sign is a terminator. Any thing written after this sign is treated as command. The dash sign is called cursor. It keeps blinking. It acts like tip of the pen. Whatever you type from the keyboard, gets typed at current cursor location and it shifts towards right.

❑ ❑ INTERNAL COMMANDS

All those commands, which are part of COMMAND.COM file and remain resident in memory from the time of booting to the time of shutdown, are called internal commands. For example, DIR, COPY, EDIT, CLS, PROMPT, REN, DEL etc.

DIR Command

DIR command is used for displaying the names of all the files residing on media like floppy hard disk, CD etc. In its simplest form, it can be executed in following format:

```
C:\> DIR [Enter]
```

EDIT Command

EDIT command is used to create a text file and type text in it. It is executed in the following format:

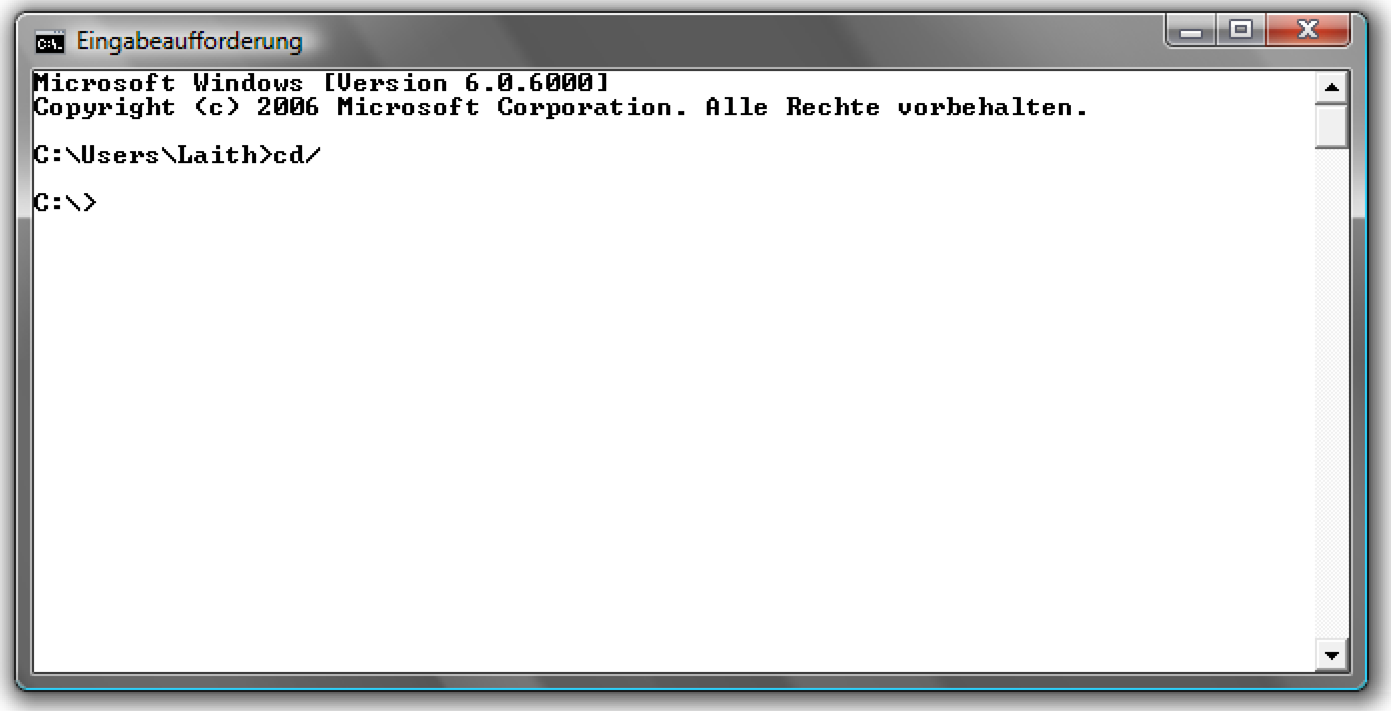
```
C:\> EDIT [file name] [Enter]
```

TYPE Command

TYPE command is used for displaying the contents of a file on the screen. It is executed in the following format:

```
C:\> TYPE <file name.> [Enter]
```

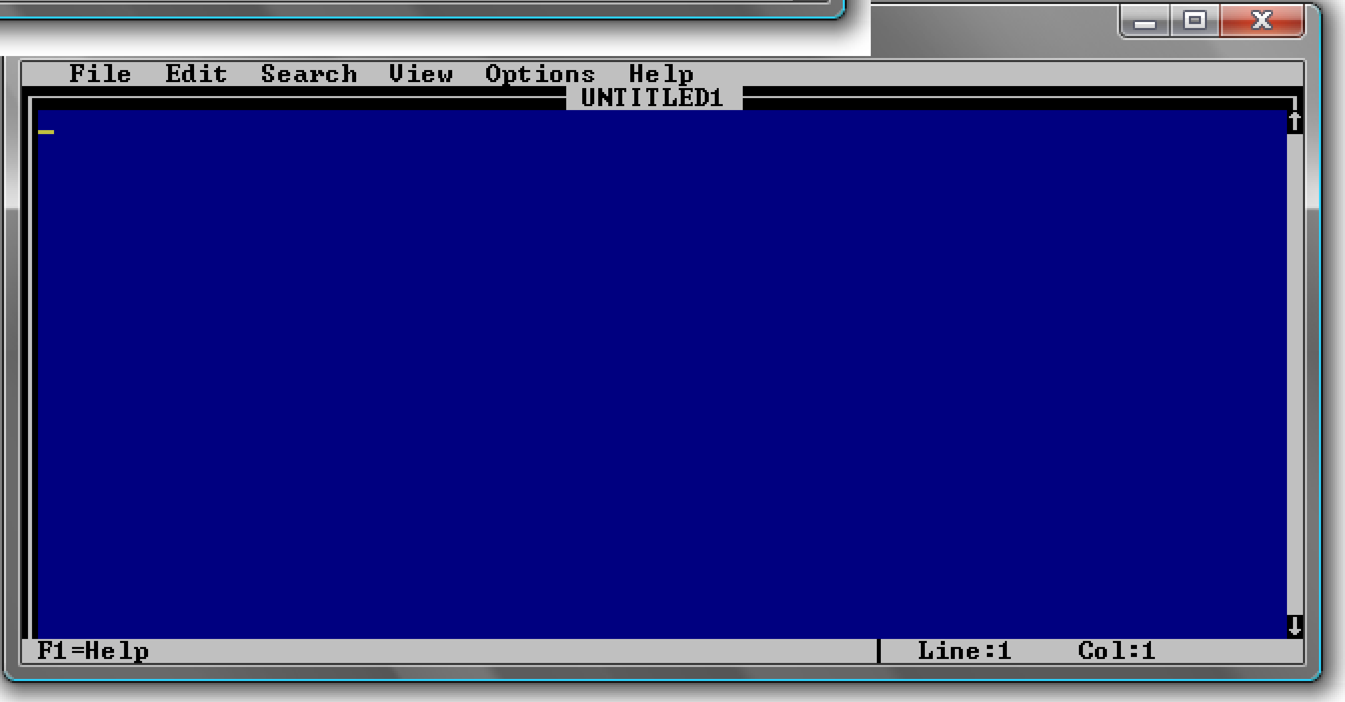
MS-DOS Window



```
Microsoft Windows [Version 6.0.6000]
Copyright (c) 2006 Microsoft Corporation. Alle Rechte vorbehalten.

C:\Users\Laith>cd/

C:\>
```



EDIT Window

COPY Command

COPY command is used to make a duplicate copy of a given file. It is executed in the following format:

```
C:\> COPY <Source file name> <Destination file name> [Enter]
```

REN Command

REN command is used for renaming an existing file. General syntax for REN command is as follows:

```
C:\> REN <Existing file name> <New file name> [Enter]
```

DEL Command

DEL command is used for removing a file from the disk. In its simplest form, it can be executed as follows:

```
C:\> DEL <File name> [Enter]
```

CD Command

CD is short form of Change Directory. It is used for moving from one directory to another directory:

```
C:\> CD <Directory name> [Enter]
```

MD Command

MD is short form of Make Directory. This command is used for creating a new directory:

```
C:\> MD <Directory name> [Enter]
```

RD Command

RD is short form of Remove Directory. This command is used for removing the directory from the disk, provided it is blank. It is used in the following format:

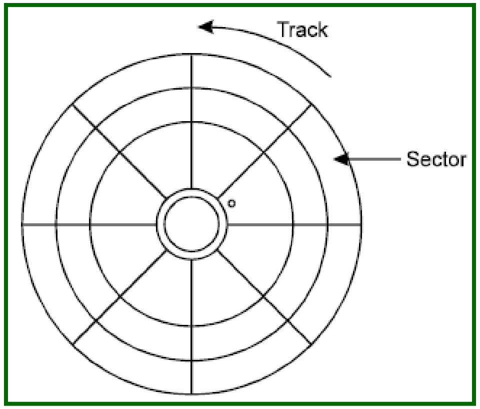
```
C:\> RD <Directory name> [Enter]
```

❑ ❑ EXTERNAL COMMAND

All those commands of MS-DOS, which are not part of COMMAND.COM file and reside on the disk, in the form of executable files, fall into the category of external commands. For example, FORMAT, MOVE, MORE, TREE, DISKCOPY etc. are external commands.

FORMAT Command

Format command makes internal logical arrangement on the media like floppy, hard disk etc. to store the data. This arrangement is made by dividing the surface of the media into concentric circles and concentric circles into small segments, called *sectors*. Internal logical format of a typical floppy is illustrated in figure below. FORMAT command, in its simplest form can be executed as follows:



```
C:\> FORMAT [Drive name]
```

MOVE Command

MOVE command, physically moves files and directories from one place to another. It is used in the following format:

```
C:\> MOVE <Source file name> <Destination directory>
```

TREE Command

TREE command displays the file system, present on the disk, in graphical form. In its simplest form, it is executed in the following format:

```
C:\> TREE [Enter]
```