

Chapters – 7,8,9,10

**File Systems, File system
implementation , Disk management
,Protection and security**

IMPORTANT QUESTIONS

1.What is File?

- The operating system provides a uniform logical view of the information stored in terms of a logical storage unit is known as file.

2.Explain the types of files ?

- Text file
lines or pages, which are sequence of characters.
- Source file
It consists of subroutines and functions which consists of declarations followed by executable statement.
- Object file
It contains sequence of bytes forming blocks used by linker.
- Executable file
Consists of series of code which brought into the memory by the loader for execution.

3. What are the attributes of File?

- **Name** – only information kept in human-readable form
- **Identifier** – unique tag (number) identifies file within file system
- **Type** – needed for systems that support different types
- **Location** – pointer to file location on device
- **Size** – current file size
- **Protection** – controls who can do reading, writing, executing
- **Time, date, and user identification** – data for protection, security, and usage monitoring
- Information about files are kept in the directory structure, which is maintained on the disk
- Information kept in the directory structure

4. What are the File operations?

- **Create**

Free space on the disk is allocated.

An entry for the file is made in the directory.

- **Write**

Specify the name of the file and information to be written into the file. Write pointer is updated whenever write occurs.

- **Read**

Specify the name and location of the file. Read pointer stores the current file position.

- **Repositioning in a file**

The directory is searched for the required entry and the current file position pointer is set to a given value. Repositioning is also referred to as file seek.

- **Deleting a file**

The named file is searched in the directory ,on finding it, all of its free space is released and its entry in the directory is released.

- **Truncating a file**

Erase only the contents of a file and not the attributes.

Other operations are

Append , copy and rename

5. Explain the File Types – Name, Extension

file type	usual extension	function
executable	exe, com, bin or none	ready-to-run machine-language program
object	obj, o	compiled, machine language, not linked
source code	c, cc, java, pas, asm, a	source code in various languages
batch	bat, sh	commands to the command interpreter
text	txt, doc	textual data, documents
word processor	wp, tex, rtf, doc	various word-processor formats
library	lib, a, so, dll	libraries of routines for programmers
print or view	ps, pdf, jpg	ASCII or binary file in a format for printing or viewing
archive	arc, zip, tar	related files grouped into one file, sometimes compressed, for archiving or storage
multimedia	mpeg, mov, rm, mp3, avi	binary file containing audio or A/V information

6. Explain all File Access Methods.

- A file stores the information which is accessed by user programs.
- Sequential Access
- Direct Access
- Indexed sequential Access

Sequential Access

- It is the simplest method of accessing a file.
- In this scheme , information is processed in sequential order, one record after the other.
- Read operation
Reads the next record of the file and advances the file pointer.
- Write operation
It adds the records to the end of file and changes the file pointer to the end of the newly written record.
- These files are stored in magnetic tapes or disks.

Direct access methods

- It is based on the disk model of file, disks allow random access to any file block.
- Another name for this access is relative access
- A direct access is viewed as block of records.
- Any block can be read or written
- Read operation

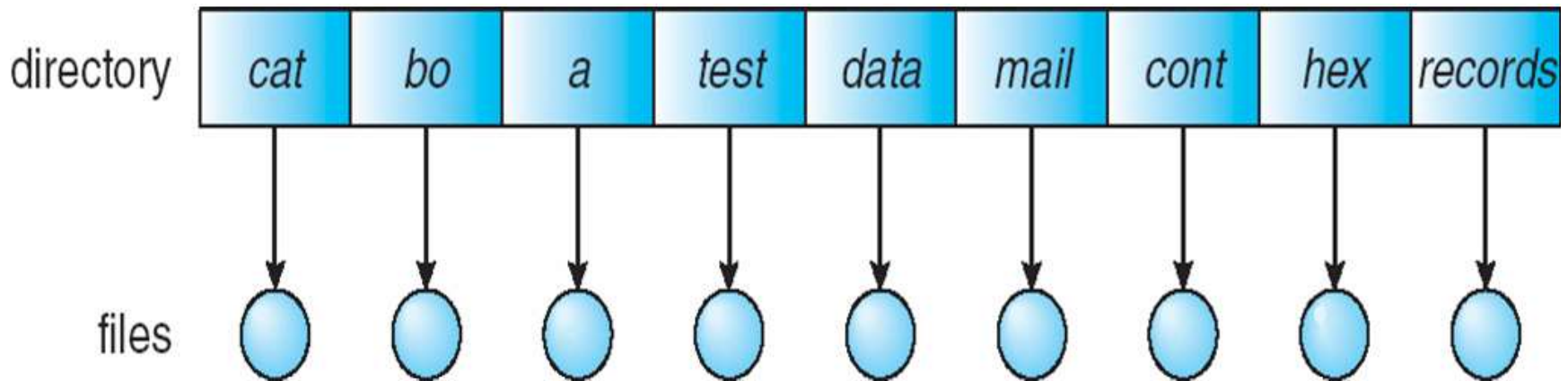
Read n means read the information in the block no n . Block numbers are $0,1,2,\dots,n$

Indexed sequential file

- This method involves construction of an index for the file.
- Index is organized in sequence based on the key field and contains the pointer to the various blocks.
- For large files , index files itself large.
- To overcome this problem, two index files are created. The primary index file contains pointers to the secondary index files which in turn point to the actual data in the memory.

7. Explain the various directory structure

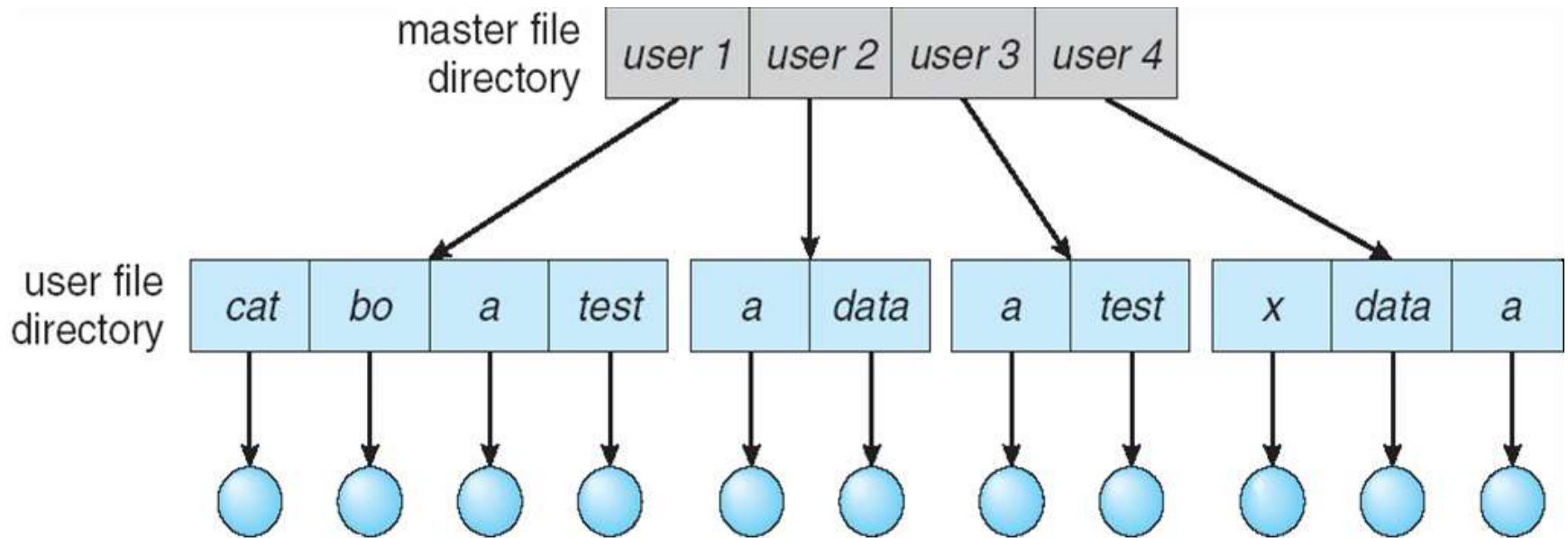
Single-Level Directory



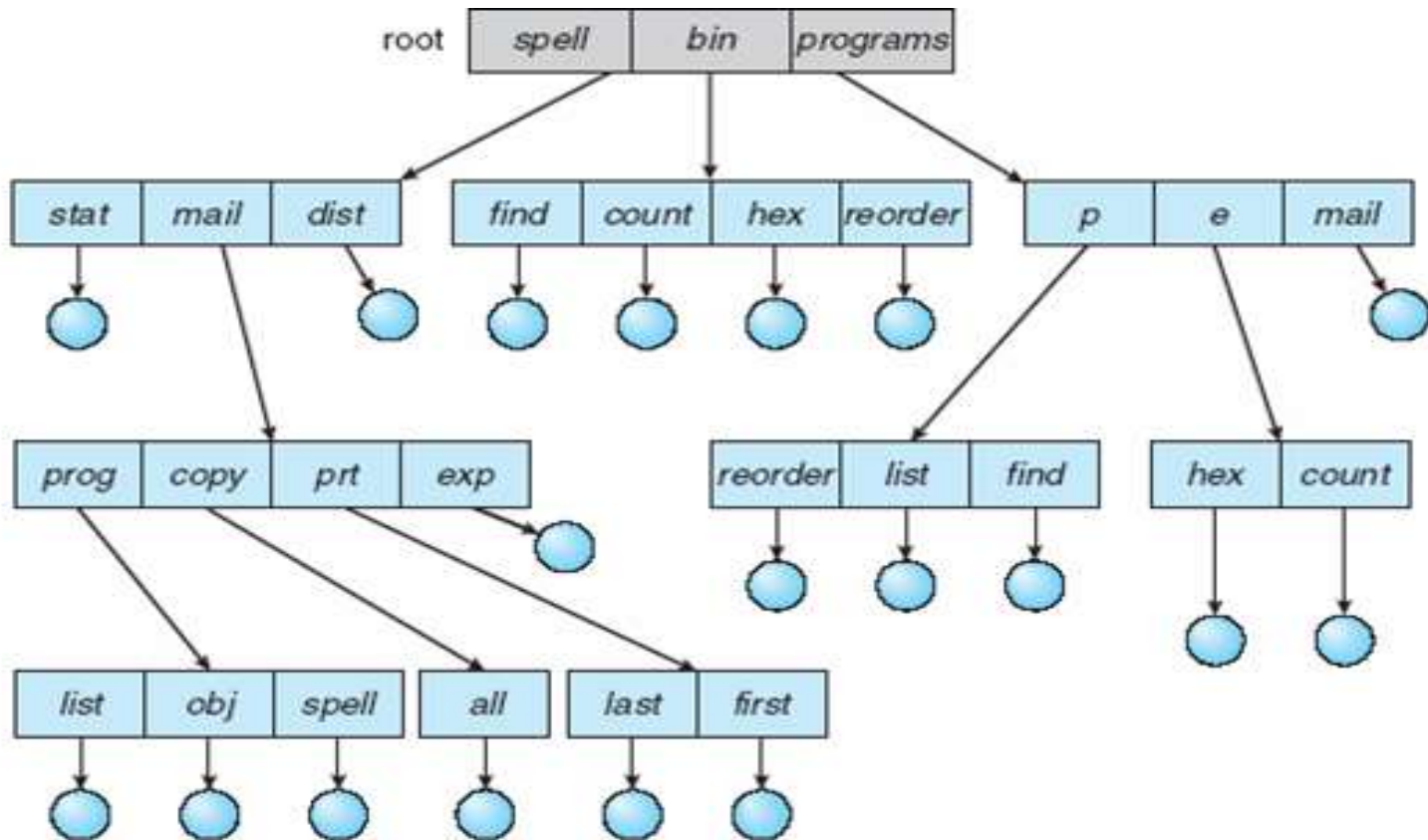
Two level directory

- Separate directory for each user – UFD (User File Directory)
- MFD (Master File Directory) – Root Directory
- Can have the same file name for different user
- Creation of file – File is created in UFD
- Deletion of file – OS searches for that file in UFD. It cannot delete another user's file with the same.
- The files are defined as leaf nodes.
- A user file directory name along with file name is defined as path name. (e-x)
D:\user2\sample.doc

Two level directory



Tree structured directories



Tree structured directory

- This structure allows the user to create their own sub directory and organize the files within them.
- A directory can consists of set of files or sub directories or both.
- A path name is the path from root through the sub directories to the required file.
- Absolute path
- Relative path

- Absolute path

It starts at the root and follows through its sub directories to the specified file

E-x BCA/BCA2/OS/B2

- Relative path

It describes the path starting from the current directory.

E-x OS/B2

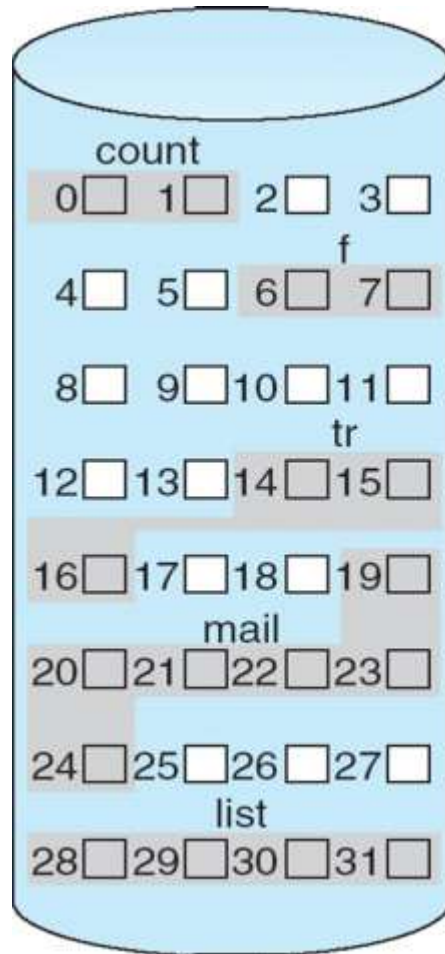
Deletion of a directory

- In MS-DOS , a directory cannot be deleted unless it is empty. The user must delete all the files and sub directories in the directory
- In UNIX, rm command is used to delete all the files and sub directory in that directory.
- Users can access the files of other users too in this tree structured system.
- The windows operating system uses two level directory structure.

8.Explain all file Allocation methods(Very very important)

- A file system must keep track of disk blocks allocated to files and free blocks available for allocation.
- The three methods for disk space allocation are
 - contiguous allocation
 - Linked allocation
 - indexed allocation

Contiguous allocation



directory

file	start	length
count	0	2
tr	14	3
mail	19	6
list	28	4
f	6	2

Contiguous allocation

- The file occupies the set of contiguous blocks on the disk.
- The directory entry for a file with contiguous allocation contains
 - Address of starting block
 - Length of the allocated portion.
- If the size of file n blocks long and starts at location L , then it occupies blocks $L, L+1, L+2, \dots, L+n-1$

Two main problems

- Finding contiguous free blocks of space for a new file
- External fragmentation (free blocks between two files)

Two common strategies for allocation of free blocks

- First fit

Searching is stopped as soon as the first free block big enough to hold the file is encountered.

- Best fit

It searches the whole list and allocates the smallest block to hold the file.

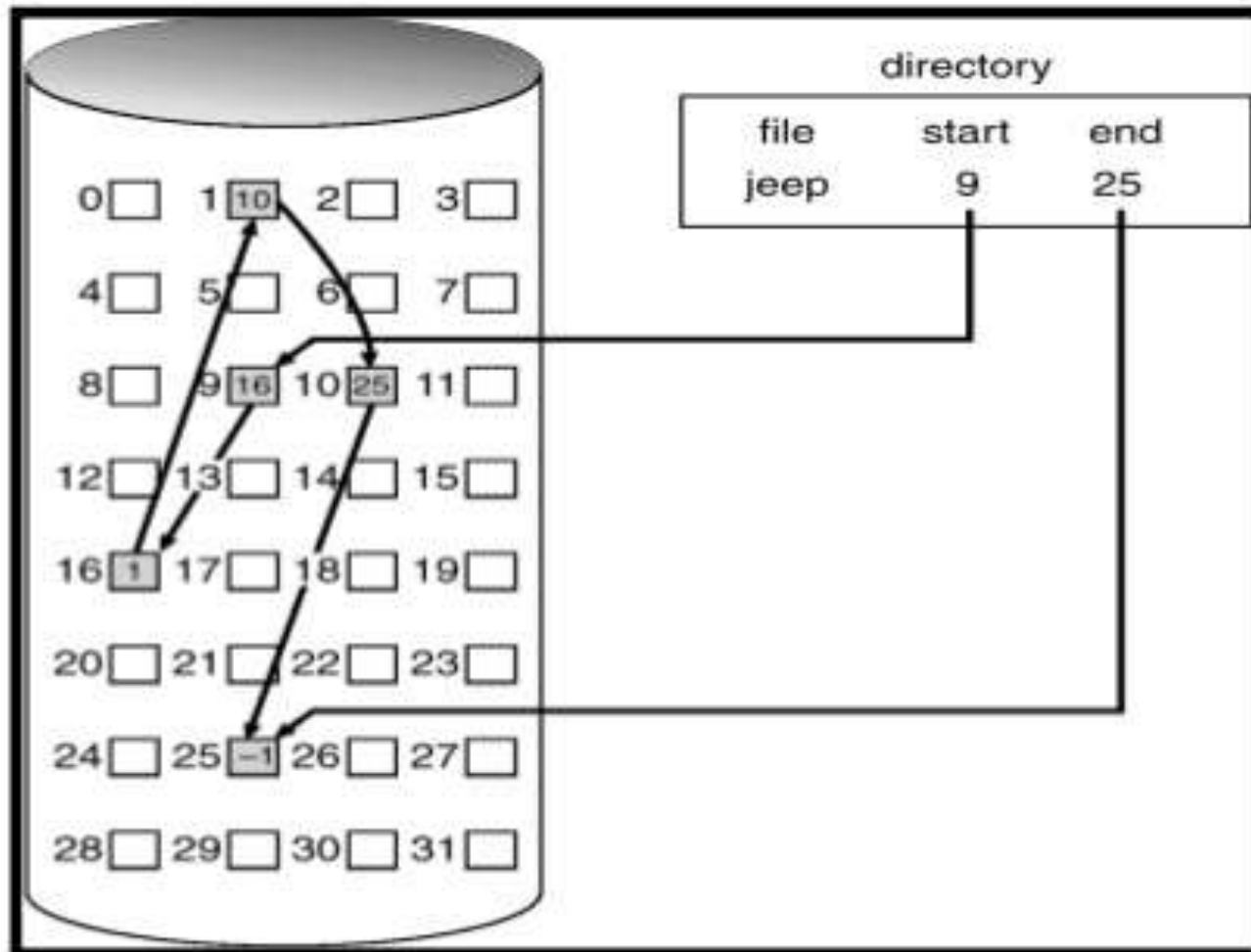
Advantages

- Accessing of files that are allocated continuously.
- Both sequential and direct access are supported.

Disadvantages

- It is difficult to find the contiguous free blocks
- External fragmentation
- When less space is allocated to a file it may be possible that the file cannot be extended
- When more space is allocated ,memory is wasted.

Linked Allocation



Linked allocation

- In linked allocation, each file is linked list of disk blocks. The disk block may be scattered thru out the disk.
- The file directory consists of a pointer to the first and last blocks of the file.
- Creation of a file
- Reading a file

File allocation table

- The table is stored at the beginning of each partition (either c: or D:)
- The table contains one entry for each block
- The table entry also contains a pointer , pointing to the next block.
- The directory entry contains block number of starting block.
- Free blocks are indicated by a 0 value in the table.

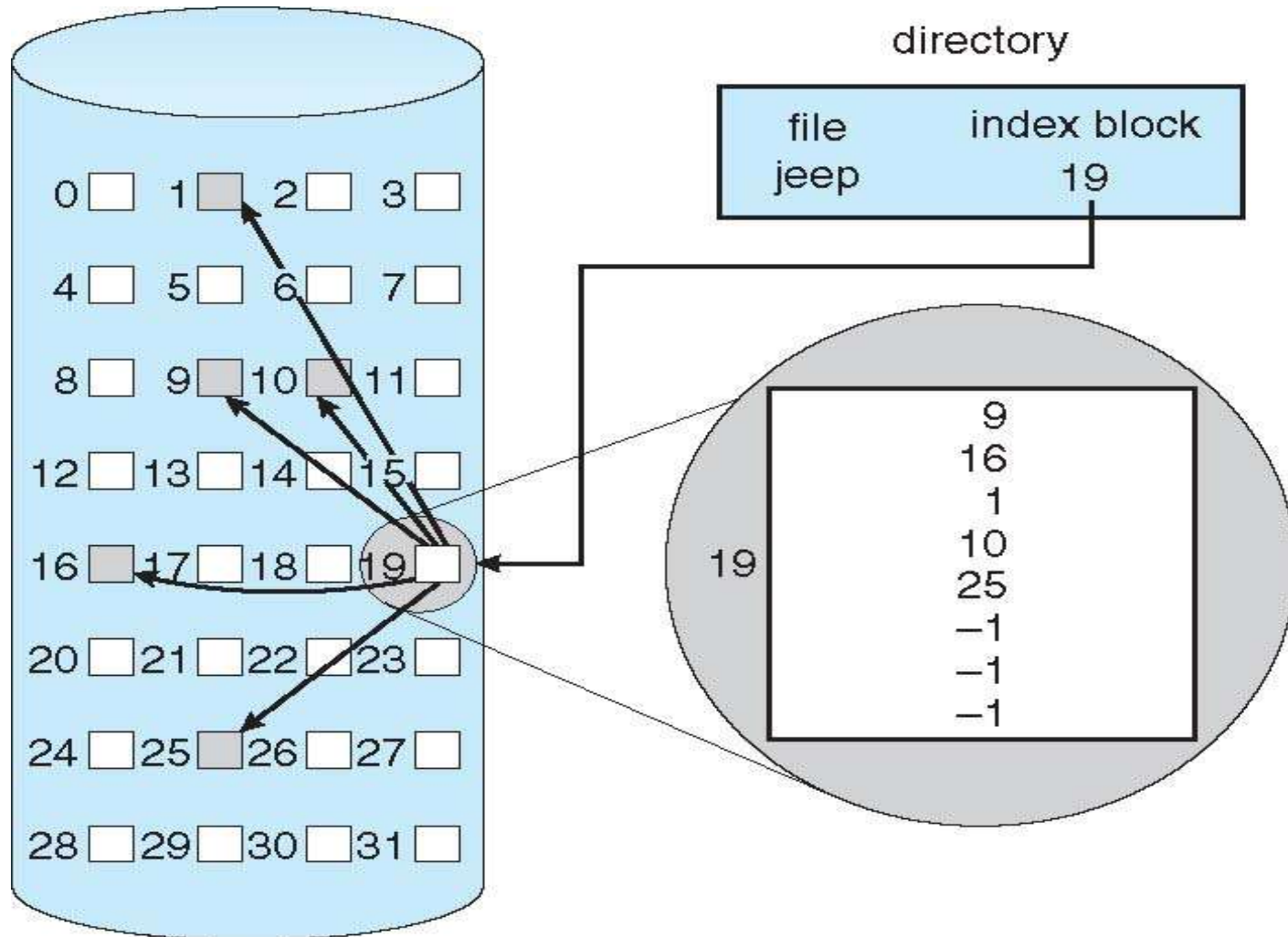
Advantages of linked allocation

- It is simple
- Disk compaction is not necessary
- No external fragmentation
- A file can continue to grow , since there are free blocks are available.

Disadvantages

- Direct accessing of a disk block is slow.
- Space is required for pointers and File allocation table.
- Non reliability – Disk blocks are linked together by a pointer , a single damaged pointer can make thousands of disk blocks inaccessible.

Indexed allocation



Indexed allocation

- Each file has its own index block which is an array of disk block pointers.
- The directory entry contains address of the index block.
- To access the k th block of a file , k th pointer is used.
- Creation of a file.

Schemes in index allocation

- Linked scheme
- Multi-level index
- Combined scheme

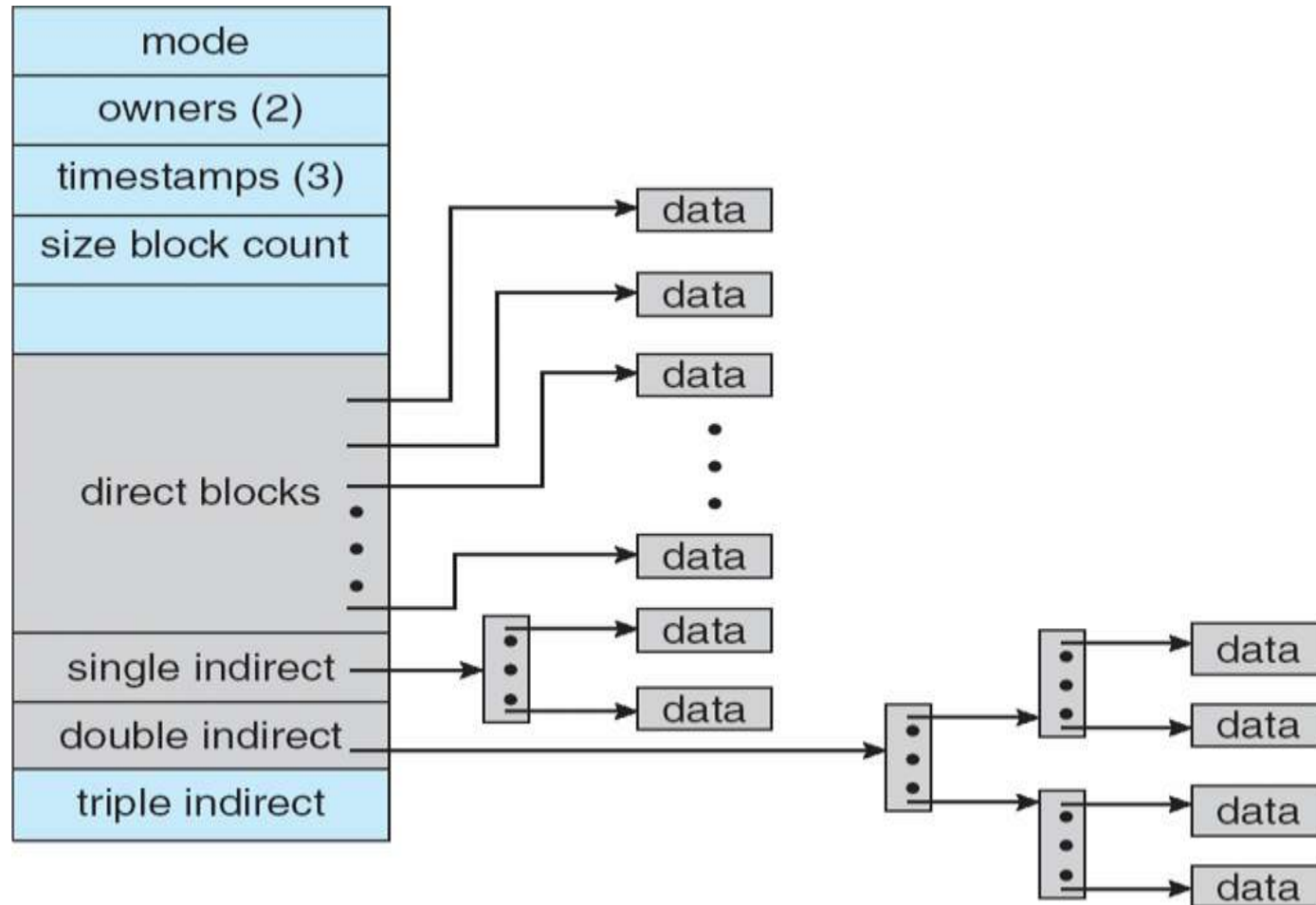
Linked scheme

- This scheme links two or more index blocks together for holding the pointers. Every index block would then contain a pointer or the address to the next index block.

Multi-level index

- In this policy, a first level index block is used to point to the second level index blocks which in turn points to the disk blocks occupied by the file. This can be extended to 3 or more levels depending on the maximum file size.

Combined scheme



Combined scheme

- In this scheme, a special block called the Inode (information Node) contains all the information about the file such as the name, size, authority, etc.
- The first few of these pointers in Inode point to the direct blocks i.e the pointers contain the addresses of the disk blocks that contain data of the file.
- The next few pointers point to indirect blocks. Indirect blocks may be single indirect, double indirect or triple indirect. Single Indirect block is the disk block that does not contain the file data but the disk address of the blocks that contain the file data.
- Similarly, double indirect blocks do not contain the file data but the disk address of the blocks that contain the address of the blocks containing the file data.

Advantages of indexing

- It supports direct accessing
- Does not suffer from external fragmentation

Disadvantages

- The number of disk accesses to get the address of the required block.
- Indexed allocation requires plenty of space to keep pointers.

9. Explain the concept of Free-space management in detail

When a file is deleted, its disk space is added to the free-space list. The methods to manage the free disk blocks are

- Bit vector
- Linked list
- Grouping
- Counting

Bit Vector

- List of free disk space is implemented as a bit map or bit vector. When a block is free, the bit is 0 and when the block is allocated, the bit is 1. For example

1 1 1 0 1 0 1 0
 3 5 7

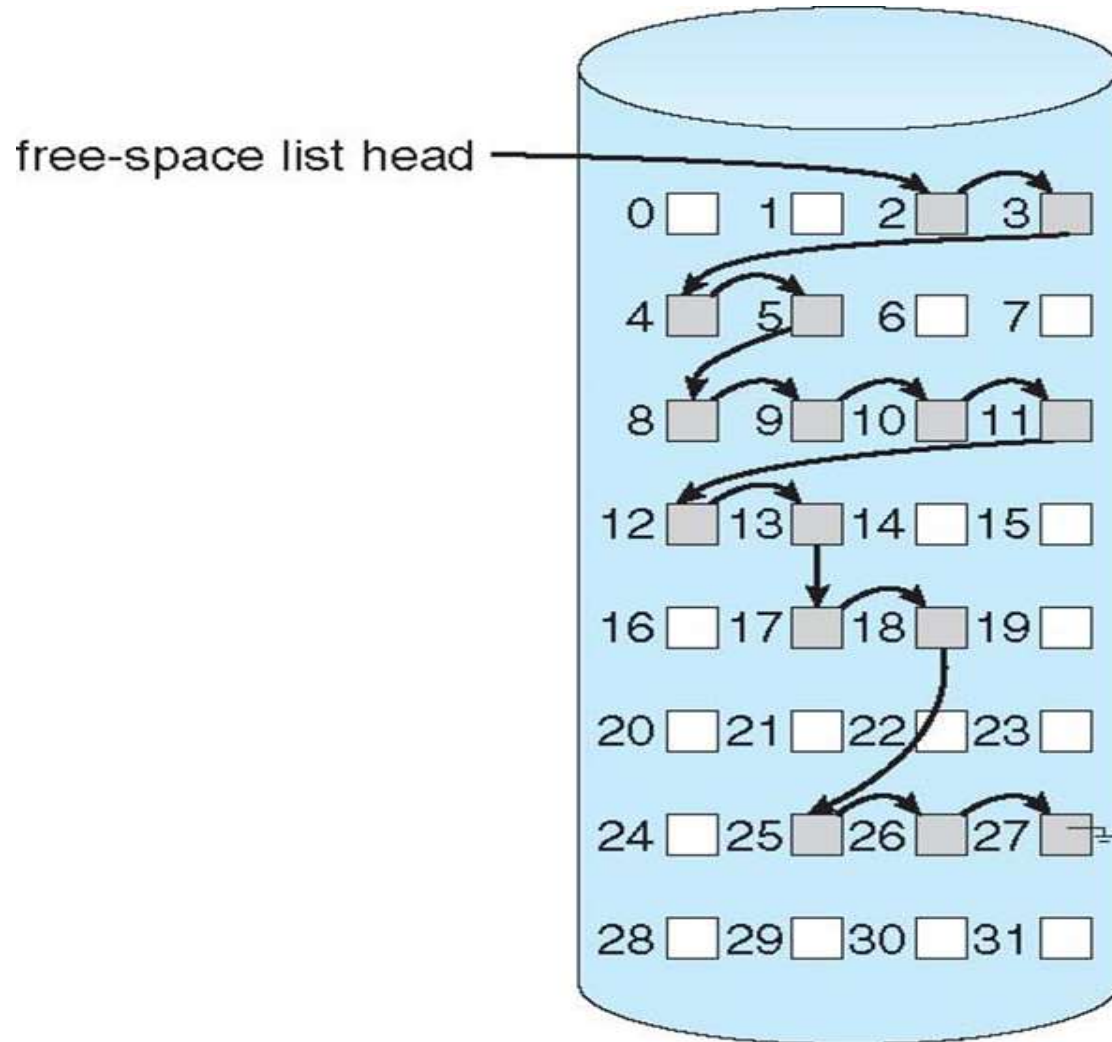
Advantages

- It is simple and efficient.

Disadvantage

It occupies large amount of memory. The amount of memory needed for a block bit map =
disk size in bytes/8 * block size

Linked list



Linked list

- In this approach , all the free blocks are linked together. A pointer pointing to the first free block is kept in the special location on the disk. The first block again contains a pointer, pointing to the next free block and so on.

Grouping

- It stores the address of n free blocks in the first free block. The last block consists of the address of another n free blocks.

counting

- It is used to allocate several contiguous blocks. It consists of address of the first free block and count which gives n free contiguous blocks.

10. WHAT ARE THE DISK SCHEDULING ALGORITHMS(VERY VERY IMPORTANT)

- FCFS (First Come First Served)
- Shortest Seek Time First (SSTF)
- SCAN
- Circular SCAN
- LOOK

11.What is seek time?

- Seek time is the time required for the disk arm to move the heads to the cylinder containing the desired sector. The seek time depends on two factors; the internal startup time and time taken to traverse the cylinders, that have to be crossed, to reach the required cylinder.

12.What is Worm?

- A worm is a process that uses reproduction mechanism to ravage the system performance. Network work programs use network connections to spread from system to system.
- To replicate itself network worm uses network vehicles including, electronic mail- by a worm copy of mail sent to other systems, remote execution- a worm executes copy of itself on another program, remote login-a worm logs into a remote computer and copies itself from one system to the other.

13.What is virus ?

- A computer **virus** is a [program](#), or [script](#), designed to cause damage, steal personal information, modify data, send e-mail, display messages, or some combination of these actions.

14.Types of virus

- File (Parasitic Virus): File virus attaches itself to executable files and replicates when the infected program executed and it leaves host program still functional.
- Boot virus: Boot sector virus infects a master boot record or boot record and spreads when a system is booted from disk containing the virus.

- Macro virus: macro viruses are written in a high-level language such as Visual Basic, MS Word or Excel. This virus triggered when a program run and uses a macro program.
- Source code virus: A source code virus generally searches for source code and modifies it to include the virus and spread the virus.

- **Encrypted Virus:** An encrypted virus includes a decryption code to avoid detection. When a infected program is invoked the virus first decrypts and then executes.
- **Tunneling Virus:** The tunneling virus avoids detection by installing itself in the interrupt handler chain. Similar type of viruses install themselves in device drivers.

15. What are goals of protection?

- To prevent mischievous , intentional violation of access restriction by a user.
- To ensure that each active program component , uses system resources according to the stated policies.
- To guard resources created and supported by an application programmer against misuse.