

Assignments 1

- 1) Describe different file allocation methods.
 Explain free disk space management with example
 → There are different kinds of methods that are used to allocate disk space we must select the best method for the file allocation because it will directly affect the system performance and system efficiency. With the help of the allocation method, we can utilize the disk, and also files can be accessed.

There are different types of file allocation method:

- | | |
|--------------------------|----------------------------------|
| 1) Contiguous allocation | 6) Index allocation |
| 2) Extents | 7) Linked Indexed allocation |
| 3) Linked allocation | 8) Multilevel Indexed allocation |
| 4) Clustering | |
| 5) FAT | 9) Inode |

Though there are different types of file allocation methods, we mainly use three types of file allocation methods:

- 1) Contiguous methods of allocation
- 2) Linked list allocation
- 3) Indexed allocation

These methods provide quick access to the file blocks and also the utilization of disk space in an efficient manner.

4) Configuous Allocation : configuous allocation is one of the most used methods for allocation. Configuous allocation means we allocate the block in such a manner, so that in the hard disk, all the blocks get the configuous physical block.

we can see in the below figure that in the directory, we have three files. In the table, we have mentioned the starting block and the length of all the files. For each file, we have allocated a configuous block.

Directory

file name	start	Length	Allocated Blocks
A.txt	0	3	0, 1, 2
B.mp3	6	5	6, 7, 8, 9, 10
C.docx	14	4	14, 15, 16, 17

Hardisk

Configuous Allocation

Advantages

- 1) The configuous allocation method gives excellent read performance.
- 2) Configuous allocation is easy to implement.
- 3) The configuous allocation method supports both types of file access methods that are sequential.

access and direct access.

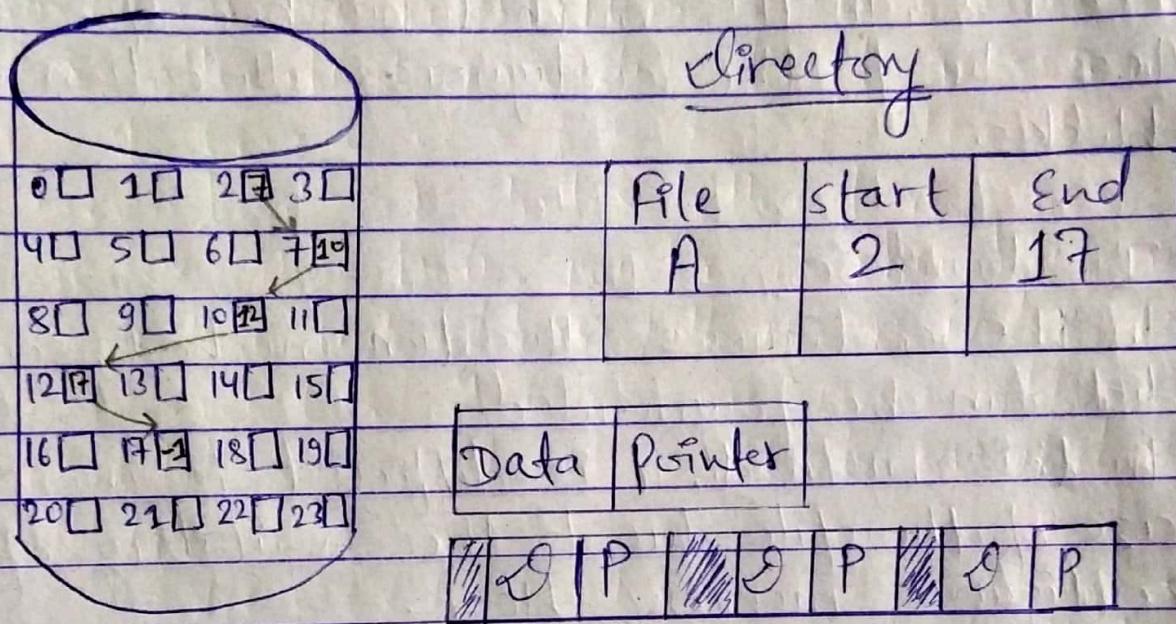
- 4) The contiguous allocation method is fast because, in this method number of seeks is less due to the contiguous allocation of file blocks.

Disadvantages

- 1) In the contiguous allocation method, sometimes disk can be fragmented
- 2) In this method, it is difficult to increase size of the file due to the availability of the contiguous memory block
- 3) Linked List Allocation :- The linked list allocation method overcomes the drawbacks of the contiguous allocation method. In this file allocation method, each file is treated as a linked list of disk blocks. In the linked list allocation method, it is not required that disk blocks assigned to a specific file are in the contiguous order on the disk. The directory entry comprises of a pointer for starting file block and also for the ending file block. Each disk block that is allocated or assigned to a file consists of a pointer and that pointer points the next block of the disk, which is allocated to the same file.

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Example of linked list allocation



Advantages of linked list allocation

- 1) In linked list allocation, there is no external fragmentation. Due to this, we can utilize the memory better.
- 2) In linked list allocation, a directory entry only comprises of the starting block address.
- 3) The linked allocation method is flexible because we can quickly increase the size of the file because, in this to allocate a file, we do not require a chunk of memory in a contiguous form.

Disadvantages of Linked List allocation

- 1) Linked list allocation does not support direct access or random access.
- 2) It needs some extra space for the disk block for the pointer.
- 3) If the pointer in the linked list break in linked list allocation, then the file gets corrupted.
- 4) In the linked list allocation, we need to traverse each block.

3) Indexed Allocation :- The Indexed allocation method is another method that is used for file allocation. In the index allocation method, we have an additional block, & that block is known as the index block. For each file, there is an individual index block. In the index block, ~~there~~ the i th entry holds the disk address of the i th file block. We can see in the below figure that the directory entry comprises of the address of the index block.



Directory

File	Index Block
A	7 (2, 17, 10, 6, 20)
B	9 (16, 4, 22)

Advantages of Index Allocation

- 1.) The index allocation method solves the problem of external fragmentation.
- 2.) Index allocation provides direct access.

Disadvantages of Index Allocation

- 1.) In index allocation, pointer overhead is more.
- 2.) We can lose the entire file if an index block is not correct.
- 3.) It is totally a wastage to create an index for a small file.

A single index block cannot hold all the pointer for files with large sizes.

To resolve this problem, there are various mechanism which we can use:

- 1.) Linked Scheme
- 2.) Multilevel Index
- 3.) Combined Scheme

(Free disk space management)

The system keeps tracks of the free disk blocks for allocating space to files when they are created. Also, to reuse the space released from deleting the files, free space management becomes crucial. The system maintains a free space list which keeps track of the disk blocks that are not allocated to some file or directory. The free space

list can be implemented mainly as:

- i) Bitmap or Bit vector: A Bitmap or Bit Vector is a series of bits (collection of bits) where each bit corresponds to a disk block. The bit can take two values: 0 and 1. 0 indicates that the block is allocated and 1 indicates a free block.

The given instance of disk blocks on the disk in fig - i) can be represented by a bitmap of 16 bits as: 0001001110100.



fig 11-

Advantages

- (i) Simple to understand
- (ii) This technique is very efficient to find the free space on the disk.

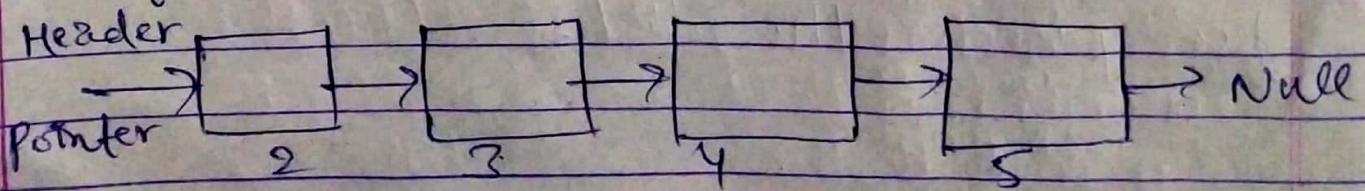
Disadvantages

- (i) This technique requires a special hardware support to find the first 1 in a word if it is not 0.
- (ii) This technique is not useful for the longer disks.

For example:- Consider a disk where blocks 2, 3, 4, 9, 12, 13, 14, 15, 24 & 25 are free & the rest of the blocks are allocated. The free space bitmap would be

001110000100111100000000011.

- 2) Linked List : This is another technique for free space management. In this approach, the free disk blocks are linked together i.e. a free block contains a pointer to the next free block. The block number of the very first disk block is stored at a separate location on disk and is also cached in memory. The block contains the pointer to the next block and the next block contains the pointer of another next and this process is repeated. By using this disk it is not easy to search the free list.



Advantages

- ① whenever a file is to be allocated a free block, the operating system can simply allocate the first block in free space list and move the head pointer to the next free block in the list.

Disadvantages

- ② Searching the free space list will be very time consuming; each block will have to be read from the disk, which is read very slowly as compared to the main memory.
- ③ Not efficient for faster access.

3) Grouping : This approach stores the address of the free blocks in the first free block. The first free block stores the address of some, say n free blocks. Out of these n blocks, the first $n-1$ blocks are actually free and the last block contains the address of next free n blocks. An advantage of this approach is that the addresses of a group of free disk blocks can be found easily.

4) Counting : This approach stores the address of the first free disk block and a number n of free contiguous disk blocks that follow the first block.

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Every entry in the list would contain:

- 1) Address of first free disk block
- 2) A number n

(Q102) Explain details about the device independent I/O software with example.

The basic function of the device independent I/O software is to perform the I/O functions that are common to all devices & to provide a uniform interface to the user-level software. Though it is difficult to write completely device independent software but we can write some modules which are common among all the devices. The function of the software are as follows:

- storage allocation on block devices
- Allocation and deallocating dedicated devices
- Error reporting
- Device naming
- Device protection.

(QNO4) Explain Principle of I/O software layers. Write the differences between single level directory system and hierarchical directory system

→ The principle of I/O software layers are given below:-

i) User level Libraries : This provide simple interface to the user program to perform input and output. For example: studio is a library provided by C, C++ programming language.

ii) Kernel level Modules : This provides the device driver to interact with the device controller & device independent I/O modules used by device drivers.

iii) Hardware : This layer includes hardware and hardware controllers which interact with the device drivers and make hardware alive.

(QNO5) The differences between single level directory system and hierarchical directory system are given below:-

S.N.	Single Level Directory System	S.N.	Hierarchical Directory System
1	It has root directories, user directories, sub-directories.	1	It has only one directory which is called root directory.
2	The directories contain many entries with many more files.	2	The directory contains one entry with per each of files.

(Q1) What do you mean by disk management? What are the major differences between error handling & formatting? Explain how FAT manages file.

→ Disk management is an extension of the Microsoft Management Console that allows full management of the disk-based hardware recognized by Windows. It is used to manage the drives installed in a computer - like hard drives (internal & external), optical disk drives, & flash drives. It can be used to partition and format drives, assign drive letters, and much more.

Error handling

- It refers to the anticipation, detection and resolution of programming, application and communication errors.

Formatting

- It means to delete all the data on the drive and set a file system to prepare an available space on operating system.

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FAT is the file system developed for hard drives that originally used 12 or 16 bits for each cluster entry into the file allocation table. A file allocation table (FAT) system has 4 different sectors. Each as a structure in the FAT partition. The four sections are as follows:-

- i) Boot sector: It is known as reserved sector. It contains the OS's necessary boot loader code to start the PC system.
- ii) FAT region: This region emphasizes two copies of FAT which is for redundancy checking & specifies how clusters assign. which is for
- iii) Data region: This is where directory data + existing files are stored.
- iv) Root directory region: It is used with FAT 16 + FAT 32 but not with other FAT file systems.