Printed Pages:03 **Sub Code:KCS-401**

Paper Id: 238341 **Roll No.** | | | | | | | | | | |

B.TECH.
(SEM IV) THEORY EXAMINATION 2022-23
OPERATING SYSTEMS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

(a) Define two main functions of an operating system.
(b) Explain the principal advantages of multiprogramming.
(c) Define the term busy waiting.
(d) Define semaphore and its types.
(e) Explain starvation problem and its solution.
(f) Explain internal and external fragmentation.
(g) Explain thrashing and locality of reference.
(h) Distinguish between physical and logical address space of a process.
(i) Explain various operations associated with a file.
(j) Explain tree level directory structure.

SECTION B

2. Attempt any *three* of the following: 10x3=30

(a) Explain the following terms in detail:
(i) Multiprocessor operating system
(ii) Real time system
(iii) Time sharing system

(b) For the following processes, draw Gantt chart to illustrate the execution using,
(i) Preemptive priority scheduling
(ii) Non-Preemptive priority scheduling.
Also, Calculate average waiting time and average turnaround time.
(Assumption: A larger priority number has higher priority.)

Process	Arrival Time	Burst Time	Priority
A	0	5	4
B	2	4	2
C	2	2	6
D	4	4	3

(c) Consider the given snapshot of a system with five processes (P0,P1,P2,P3,P4) and three resources (A,B,C).

	Allocation	MAX	Available
Process/Resource	A B C	A B C	A B C
P0	1 1 2	4 3 3	2 1 0
P1	2 1 2	3 2 2	
P2	4 0 1	9 0 2	
P3	0 2 0	7 5 3	
P4	1 1 2	11 2 3	

(i) Calculate the content of Need Matrix.
(ii) Apply safety algorithm and check the current system is in safe state or not.
(iii) If the request from process P1 arrives for (1,1,0), can the request be granted immediately?

(d) Define process and process control block. Also, describe process state transition diagram in detail.

(e) Explain the concept of paging. Also, explain paging hardware support using TLB with suitable diagram

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) Explain the term RAID and its characteristics. Also, explain various RAID levels with their advantages and disadvantages.

(b) Explain the concept of file system management. Also, explain various file allocation and file access mechanisms in details.

4. Attempt any *one* part of the following: 10x1=10

(a) Explain producer consumer problem and its solution using semaphore.

(b) Explain dinning philosopher problem and its solution using semaphore.

5. Attempt any *one* part of the following: 10x1=10

(a) Explain the concept of demand paging. Consider the given references to the following pages by a program:
0,9,0,1,8,1,8,7,8,7,1,2,8,2,7,8,2,3,8,3
How many pages faults will occur if the program has three-page frames available to it and uses:
(i) FIFO replacement
(ii) LRU replacement
(iii) Optimal replacement

(b) Explain the terms hit ratio and miss ratio. On a simple paged system, associative registers hold the most active page entries and the full-page table is stored in main memory. If references satisfied by associative registers take 100ns, and references through main memory page table takes 180 ns, what must the hit ratio be to achieve an effective access time of 125 ns?

6. Attempt any *one* part of the following: 10x1=10

(a) Explain the following terms:
(i) Multilevel feedback Queue Scheduling
(ii) Fixed portioning vs. variable partitioning

(b) Suppose the following disk request sequence (track numbers) for a disk with 100 tracks is given: 45, 20, 90, 10, 50, 60, 80, 25, 70. Assume that the initial position of the R/W head is on track 49. Calculate the net head movement using:
(i) SSTF
(ii) SCAN
(iii) CSCAN
(iv) LOOK

7. Attempt any *one* part of the following: 10x1=10

(a) Explain Deadlock and necessary conditions for deadlock. Also, Explain resource allocation graph with suitable diagram.

(b) Explain the followings:
(i) Buffering
(ii) Polling
(iii) Direct Memory Access (DMA)

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SECTION A

1. Attempt *all* questions in brief. 2*10 = 20

Q.no	Questions	Marks	CO
(a)	Define Operating system and mention its major functions.	2	2
(b)	Briefly define the term Real Time Operating System.	2	1
(c)	What do you mean by Concurrent Processes?	2	2
(d)	Define Seek time and Latency time.	2	1
(e)	What do we need Scheduling?	2	3
(f)	What are the Performance Criteria in CPU Scheduling?	2	3
(g)	Explain the Logical address space and Physical address space diagrammatically.	2	4
(h)	Explain in brief about the Multiprogramming with fixed partitions.	2	4
(i)	What do you mean by the safe state and an unsafe state?	2	5
(j)	What do you mean by the I/O Buffering?	2	5

SECTION B

2. Attempt any *three* of the following: 10*3 = 30

Q.no	Questions	Marks	CO
(a)	Explain in detail about the File system protection and security.	10	5
(b)	Explain in detail about the Mutual Exclusion and Critical Section Problem.	10	2
(c)	Explain in detail about the Process Control Block (PCB) in CPU Scheduling.	10	3
(d)	Explain in detail about the Disk storage and Disk scheduling.	10	4
(e)	Explain in detail about the Multiuser Systems and Multithreaded Systems.	10	1

SECTION C

3. Attempt any *one* part of the following: 10*1 = 10

Q.no	Questions	Marks	CO
(a)	Write short notes on following. i) File system protection and security and ii) Linked File allocation methods	10	5
(b)	Explain in detail about the Dining Philosopher Problem.	10	2

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4. Attempt any *one* part of the following: 10 *1 = 10

Q.no	Questions	Marks	CO
(a)	Explain in detail about the Operating System services.	10	1
(b)	Explain in detail about the Threads and their management.	10	3

5. Attempt any *one* part of the following: 10*1 = 10

Q.no	Questions	Marks	CO
(a)	Explain about the concept of File concept. Define in detail about the File organization and access mechanism.	10	4
(b)	A hard disk having 2000 cylinders, numbered from 0 to 1999. the drive is currently serving the request at cylinder 143,and the previous request was at cylinder 125.The status of the queue is as follows 86, 1470, 913, 1774,948,1509,1022,1750,130 What is the total distance (in cylinders) that the disk arm moves to satisfy the entire pending request for each of the following disk-scheduling algorithms? (i) SSTF (ii) FCFS	10	5

6. Attempt any *one* part of the following: 10*1 = 10

Q.no	Questions	Marks	CO
(a)	Explain in detail about the Inter Process Communication models and Schemes.	10	2
(b)	Explain in detail about the Monolithic and Microkernel Systems.	10	1

7. Attempt any *one* part of the following: 10*1 = 10

Q.no	Questions	Marks	CO
(a)	Explain in detail about the Deadlock System model and Deadlock characterization.	10	3
(b)	Illustrate the following page-replacement algorithms. i) FIFO ii) Optimal Page Replacement Use the reference string 7, 0,1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2,1, 2, 0, 1, 7, 0,1 for a memory with three frames.	10	4

MODULE-III

File System

File

- Contiguous logical address space
- Types:
    - Data
        - numeric
        - character
        - binary
    - Program

File Structure

- None - sequence of words, bytes
- Simple record structure
    - Lines
    - Fixed length
    - Variable length
- Complex Structures
    - Formatted document
    - Relocatable load file
- Can simulate last two with first method by inserting appropriate control characters
- Who decides:
    - Operating system
    - Program

File Attribute

- **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

File Types

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 com-pressed, for archiving or storage
multimedia	mpeg, mov, rm, mp3, avi	binary file containing audio or A/V information

File Operations

- **Create, Write, Read, Reposition within file, Delete, Truncate**
- *Open(F_i)* – search the directory structure on disk for entry F_i, and move the content of entry to memory
- *Close (F_i)* – move the content of entry F_i in memory to directory structure on disk

File Access Methods

n **Sequential Access**

read next

write next

reset

no read after last write

(rewrite)

n **Direct Access**

read *n*

write *n*

position to *n*

read next

write next

rewrite *n*

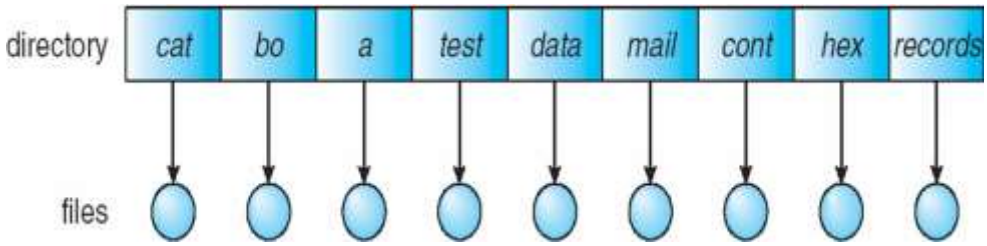
n = relative block number

sequential access	implementation for direct access
reset	*cp* = 0;
read next	*read cp*; *cp* = *cp* + 1;
write next	*write cp*; *cp* = *cp* + 1;

Directory Structure

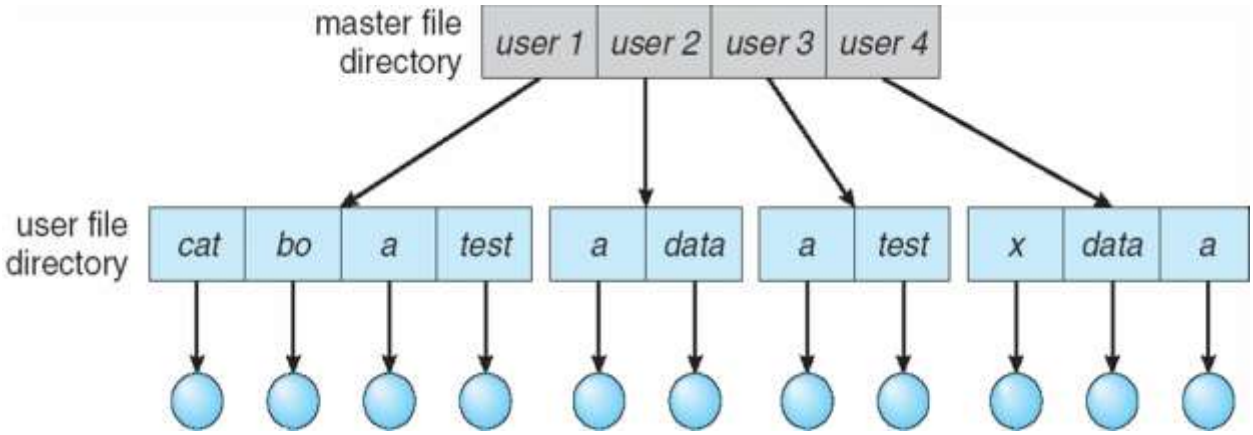
A. Single Level Directory

- A single directory for all users
- Naming problem
- Grouping problem



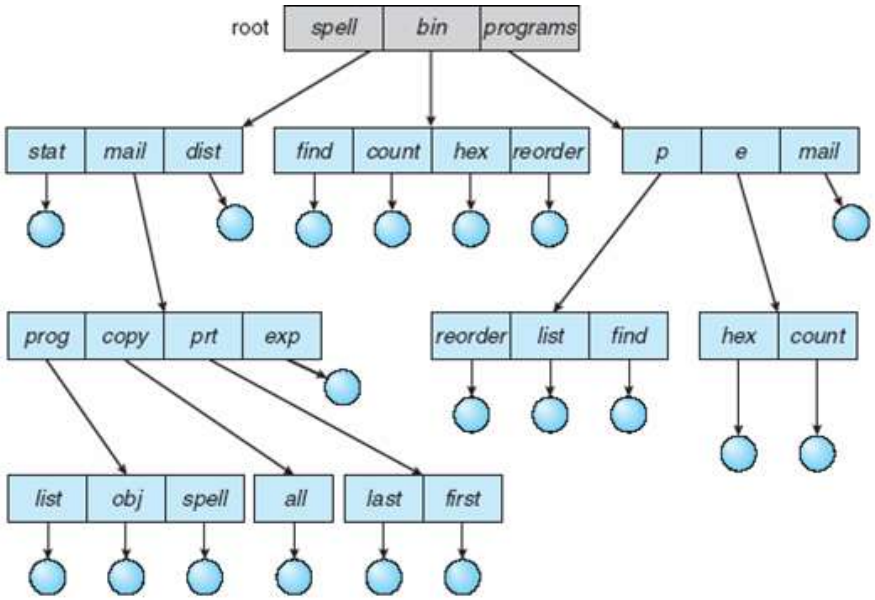
B. Two Level Directory

- Separate directory for each user
- Path name
- Can have the same file name for different user
- Efficient searching
- No grouping capability

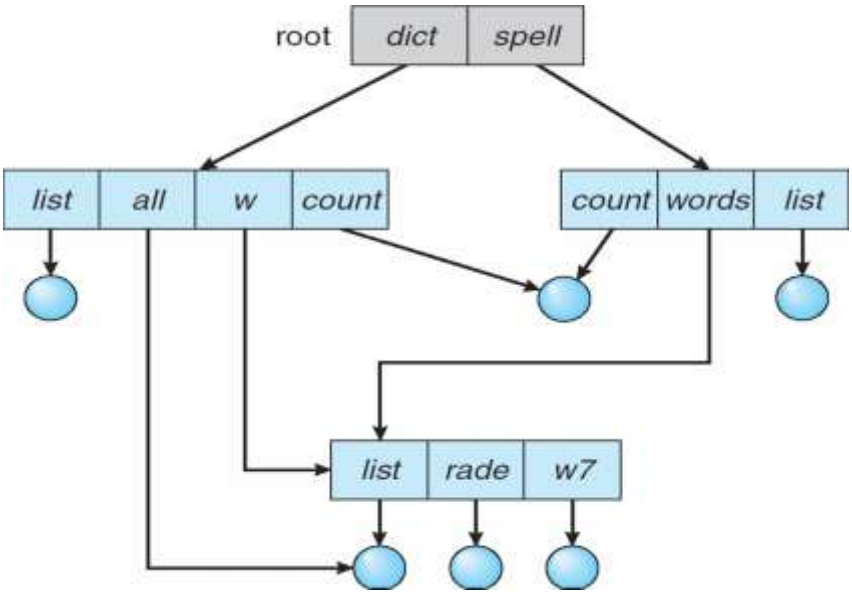


C. Tree Structure Directory

- Efficient searching
- Grouping Capability



D. Acyclic Graph Directories



- Have shared subdirectories and files

File Sharing

- Sharing of files on multi-user systems is desirable
- Sharing may be done through a **protection** scheme
- On distributed systems, files may be shared across a network
- Network File System (NFS) is a common distributed file-sharing method
- **User IDs** identify users, allowing permissions and protections to be per-user
- **Group IDs** allow users to be in groups, permitting group access rights
- Uses networking to allow file system access between systems
    - Manually via programs like FTP
    - Automatically, seamlessly using **distributed file systems**
    - Semi automatically via the **world wide web**
- **Client-server** model allows clients to mount remote file systems from servers
    - Server can serve multiple clients
    - Client and user-on-client identification is insecure or complicated
    - **NFS** is standard UNIX client-server file sharing protocol
    - **CIFS** is standard Windows protocol
    - Standard operating system file calls are translated into remote calls
- Distributed Information Systems **(distributed naming services)** such as LDAP, DNS, NIS, Active Directory implement unified access to information needed for remote computing
- Remote file systems add new failure modes, due to network failure, server failure
- Recovery from failure can involve state information about status of each remote request
- Stateless protocols such as NFS include all information in each request, allowing easy recovery but less security

- **Consistency semantics** specify how multiple users are to access a shared file simultaneously
    - Similar to Ch 7 process synchronization algorithms
        - Tend to be less complex due to disk I/O and network latency (for remote file systems
    - Andrew File System (AFS) implemented complex remote file sharing semantics
    - Unix file system (UFS) implements:
        - Writes to an open file visible immediately to other users of the same open file
        - Sharing file pointer to allow multiple users to read and write concurrently
    - AFS has session semantics
        - Writes only visible to sessions starting after the file is closed

File System Structure

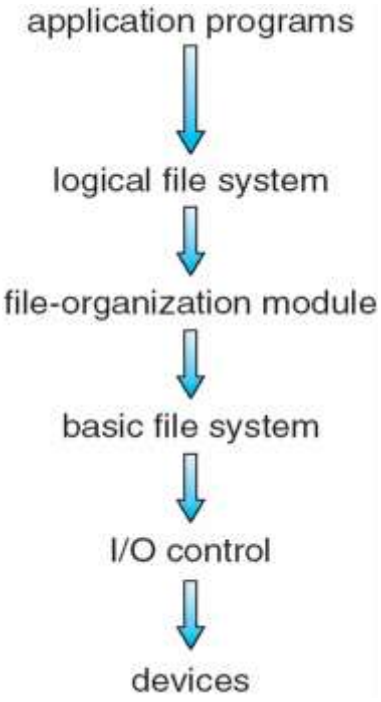
- File structure
    - Logical storage unit
    - Collection of related information

n File system resides on secondary storage (disks)

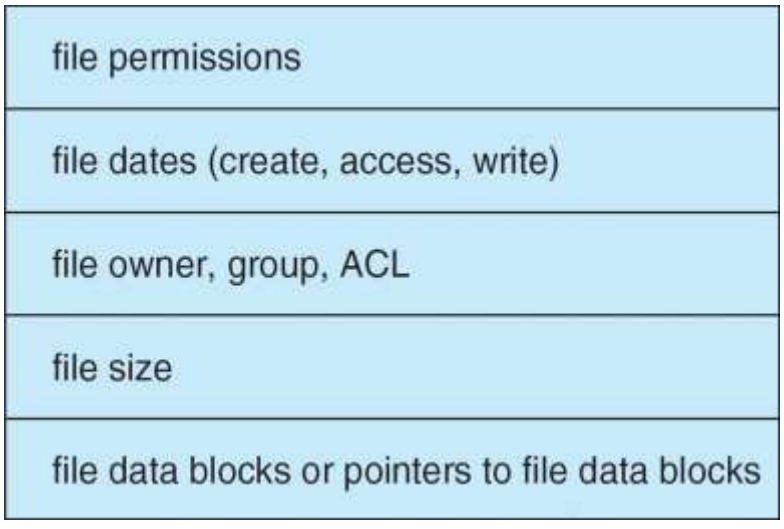
n File system organized into layers

n **File control block** – storage structure consisting of information about a file

Layered File System



File Control Block



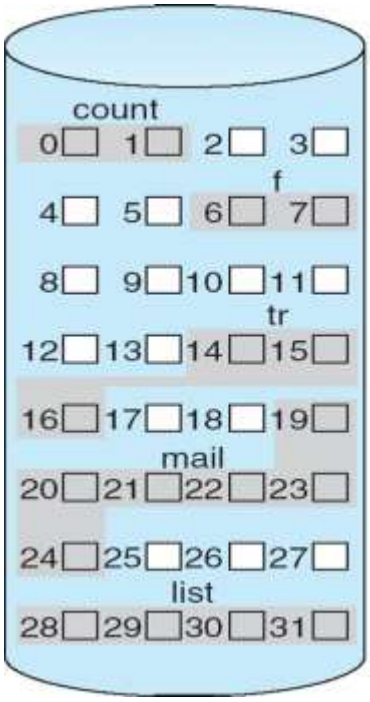
File Allocation Methods

An allocation method refers to how disk blocks are allocated for files:

A. Contiguous Allocation

- Each file occupies a set of contiguous blocks on the disk

- Simple – only starting location (block #) and length (number of blocks) are required
- Random access
- Wasteful of space (dynamic storage-allocation problem)
- Files cannot grow

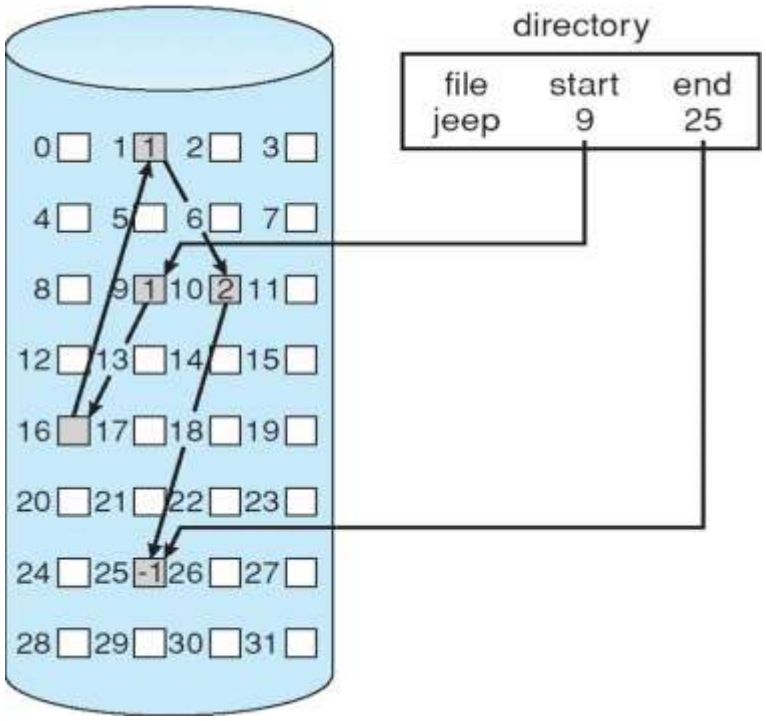


directory

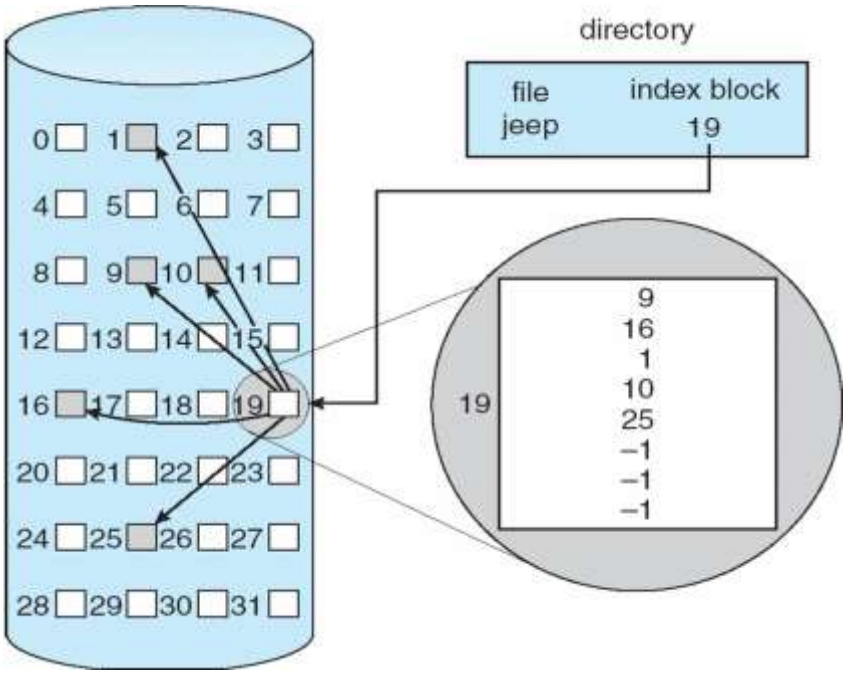
file	start	length
count	0	2
tr	14	3
mail	19	6
list	28	4
f	6	2

B. Linked Allocation

- Each file is a linked list of disk blocks: blocks may be scattered anywhere on the disk.
- Simple – need only starting address
- Free-space management system – no waste of space
- No random access
- Mapping



C. Indexed Allocation



- Brings all pointers together into the *index block.*
- Need index table
- Random access

- Dynamic access without external fragmentation, but have overhead of index block.

Secondary Storage Structure

Magnetic Disk

- Magnetic disks provide bulk of secondary storage of modern computers
  - Drives rotate at 60 to 200 times per second
  - **Transfer rate** is rate at which data flow between drive and computer
  - **Positioning time** (**random-access time**) is time to move disk arm to desired cylinder (**seek time**) and time for desired sector to rotate under the disk head (**rotational latency**)
  - **Head crash** results from disk head making contact with the disk surface
    - That's bad
- Disks can be removable
- Drive attached to computer via **I/O bus**
  - Busses vary, including **EIDE, ATA, SATA, USB, Fibre Channel, SCSI**
  - **Host controller** in computer uses bus to talk to **disk controller** built into drive or storage array