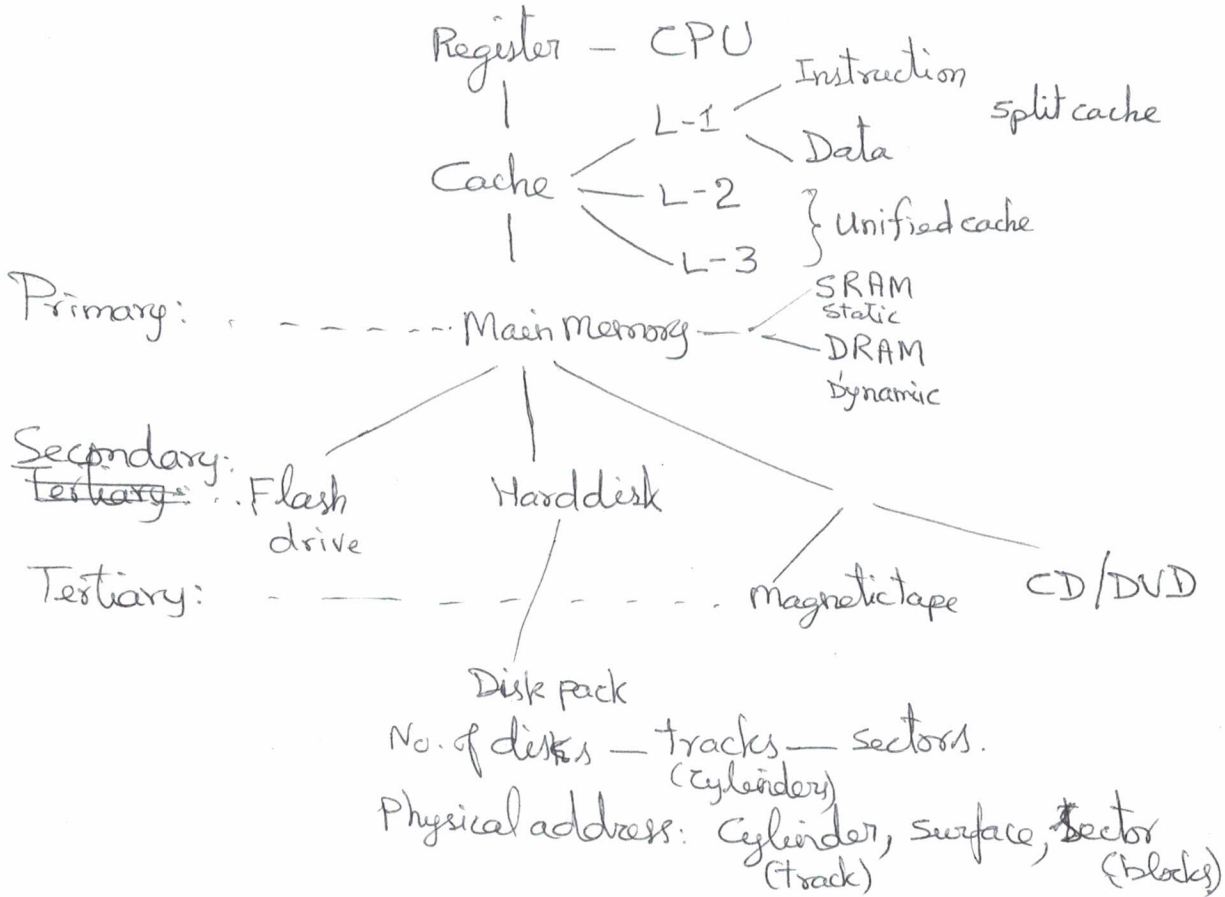


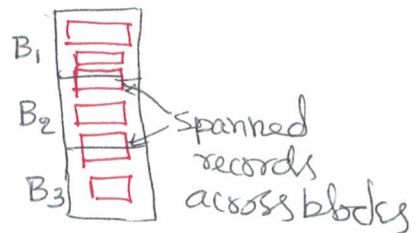
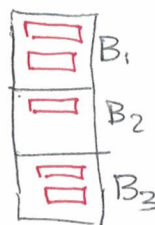
# Storage Device



## Block factor

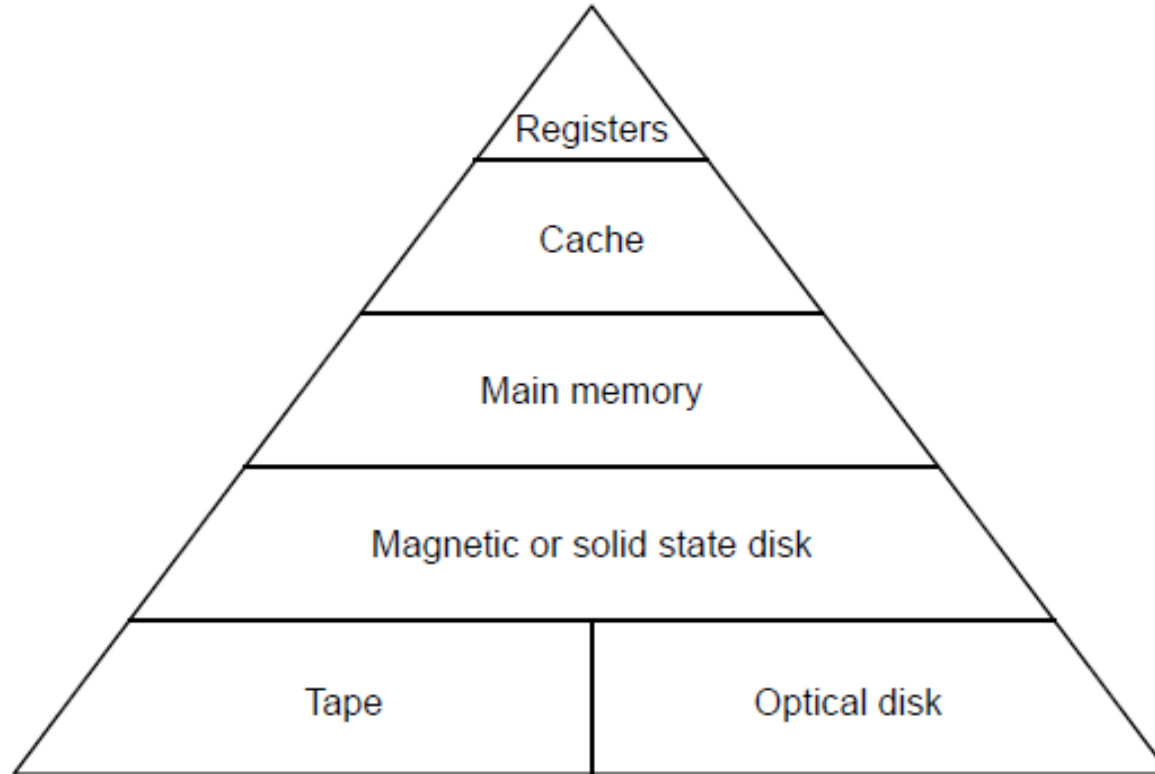
No. of records per disk block =  $\left\lfloor \frac{\text{block size}}{\text{record size}} \right\rfloor$

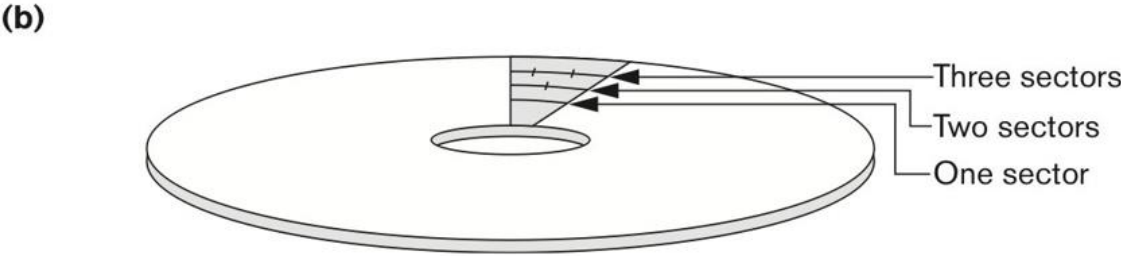
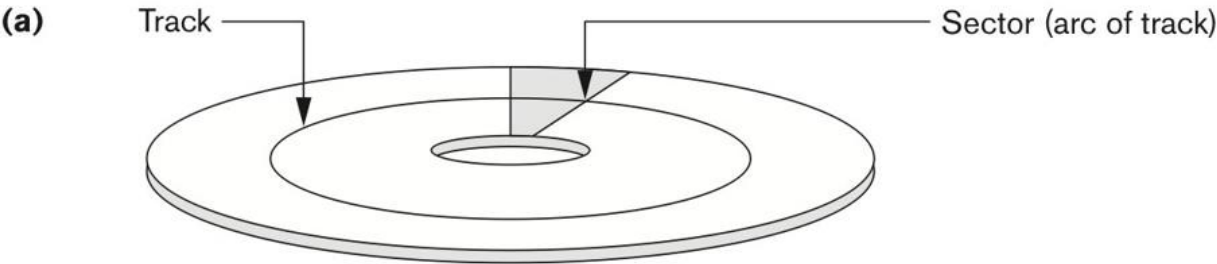
Spanned / unspanned records  
 X / ✓ preferred



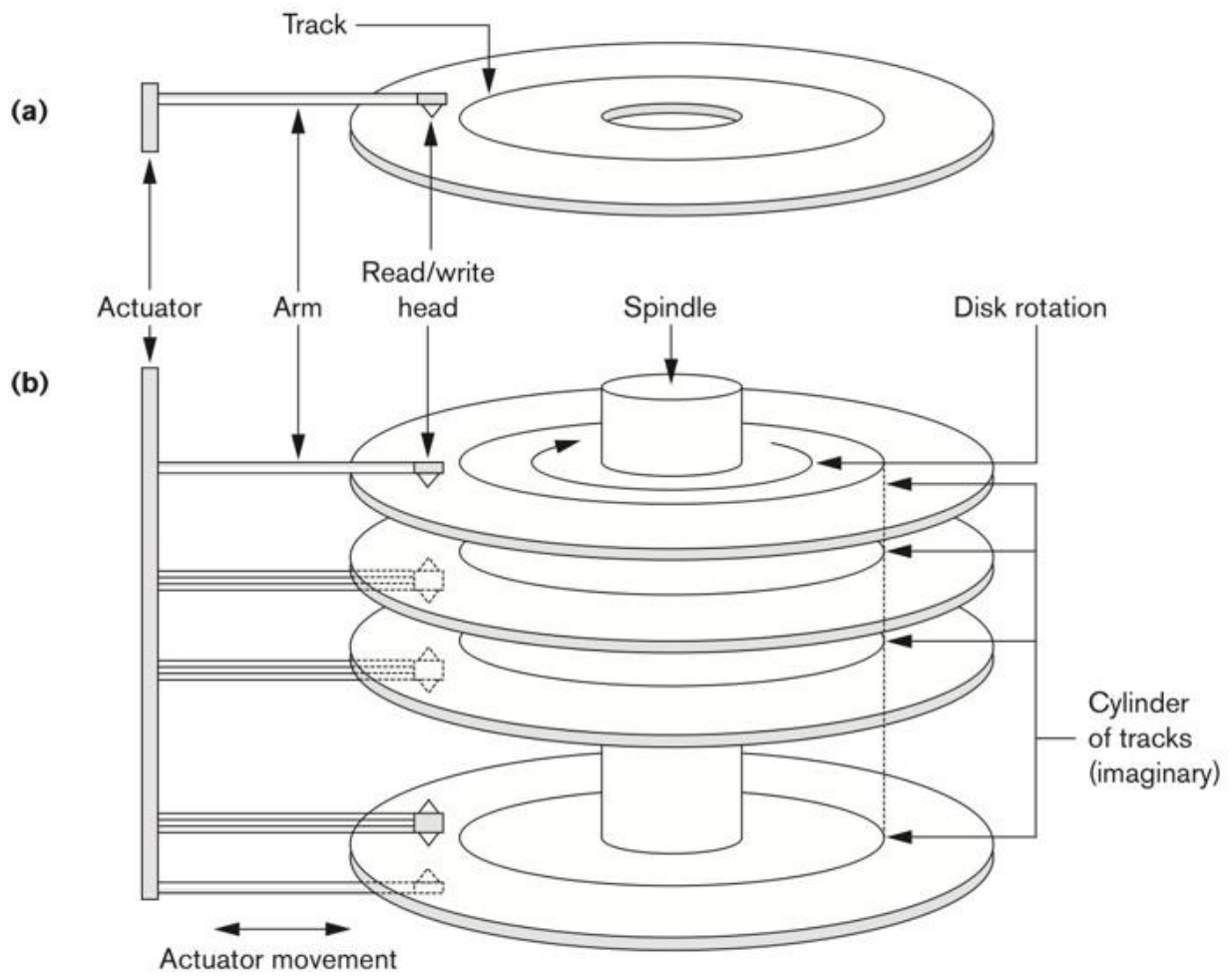
Fixed length record vs Variable length record  
 (field & row separators)  
 e.g. <CR><LF>

# Secondary Memory Memory Hierarchies

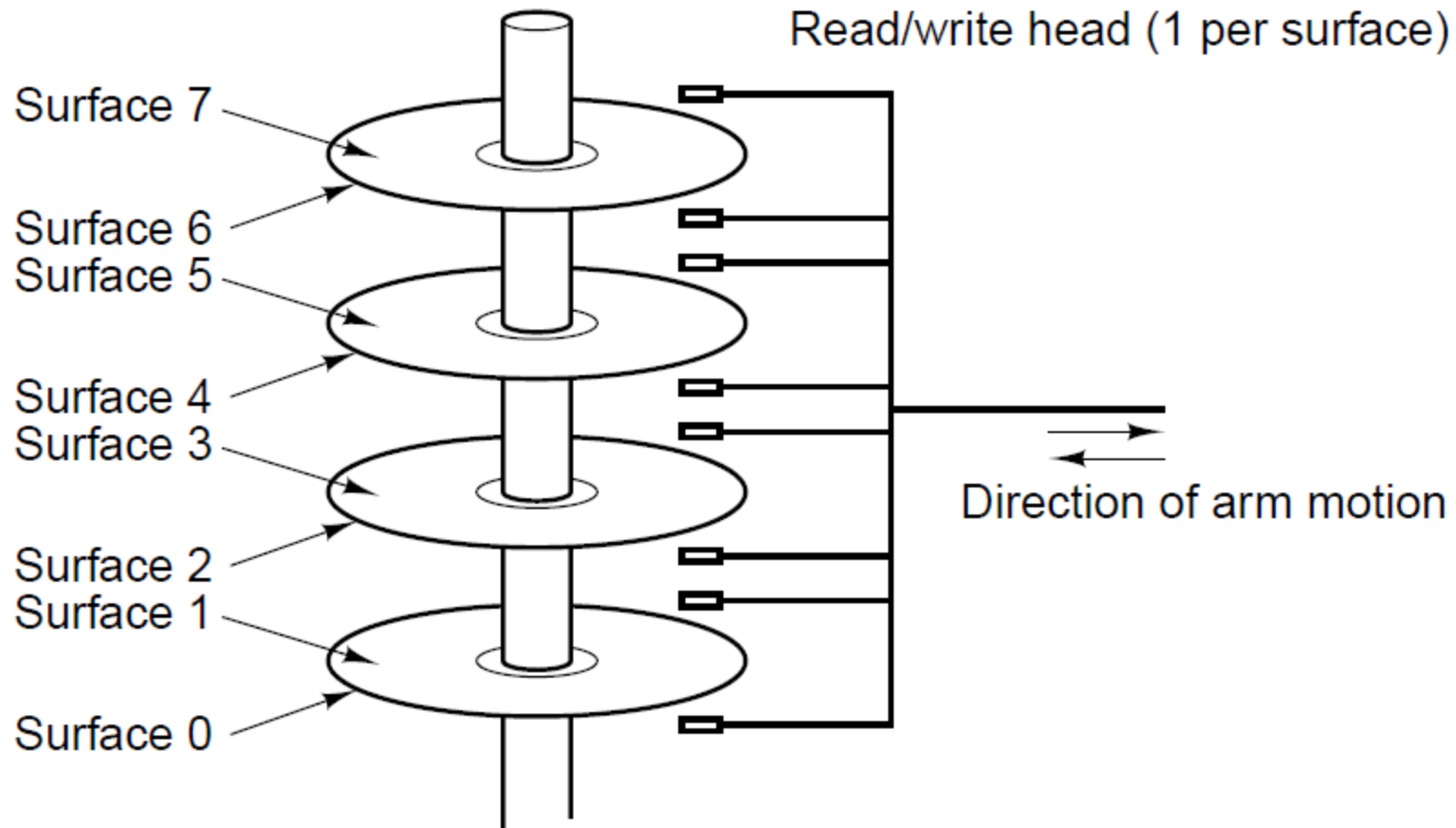




Different sector organizations on disk. (a) Sectors subtending a fixed angle. (b) Sectors maintaining a uniform recording density.

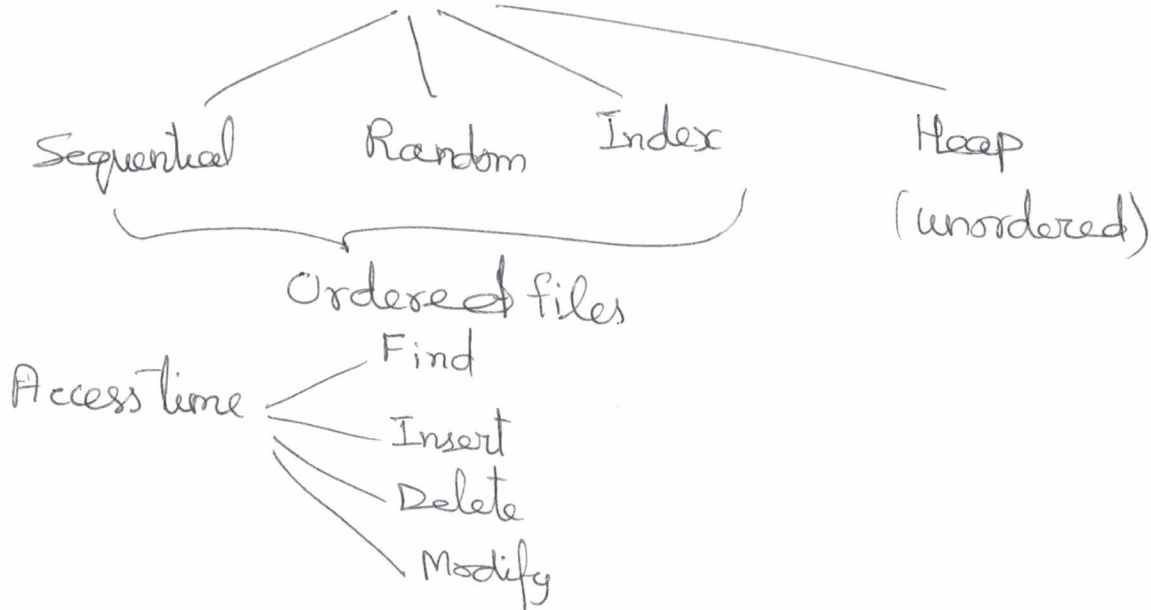


(a) A single-sided disk with read/write hardware. (b) A disk pack with read/write hardware.



A disk with four platters.

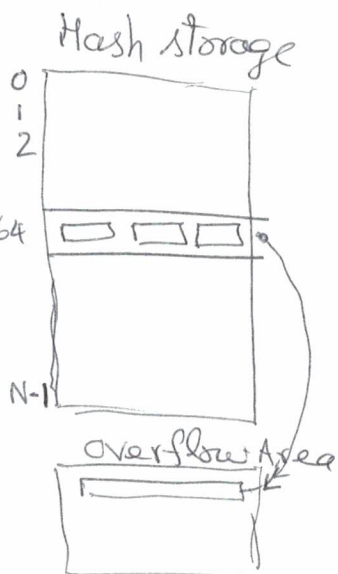
# File types



## Hashing

Hash function (key)  
 $\Rightarrow 0 \text{ to } N-1$   
 $(\text{key mod } N)$   
 $N=100$

78512:64

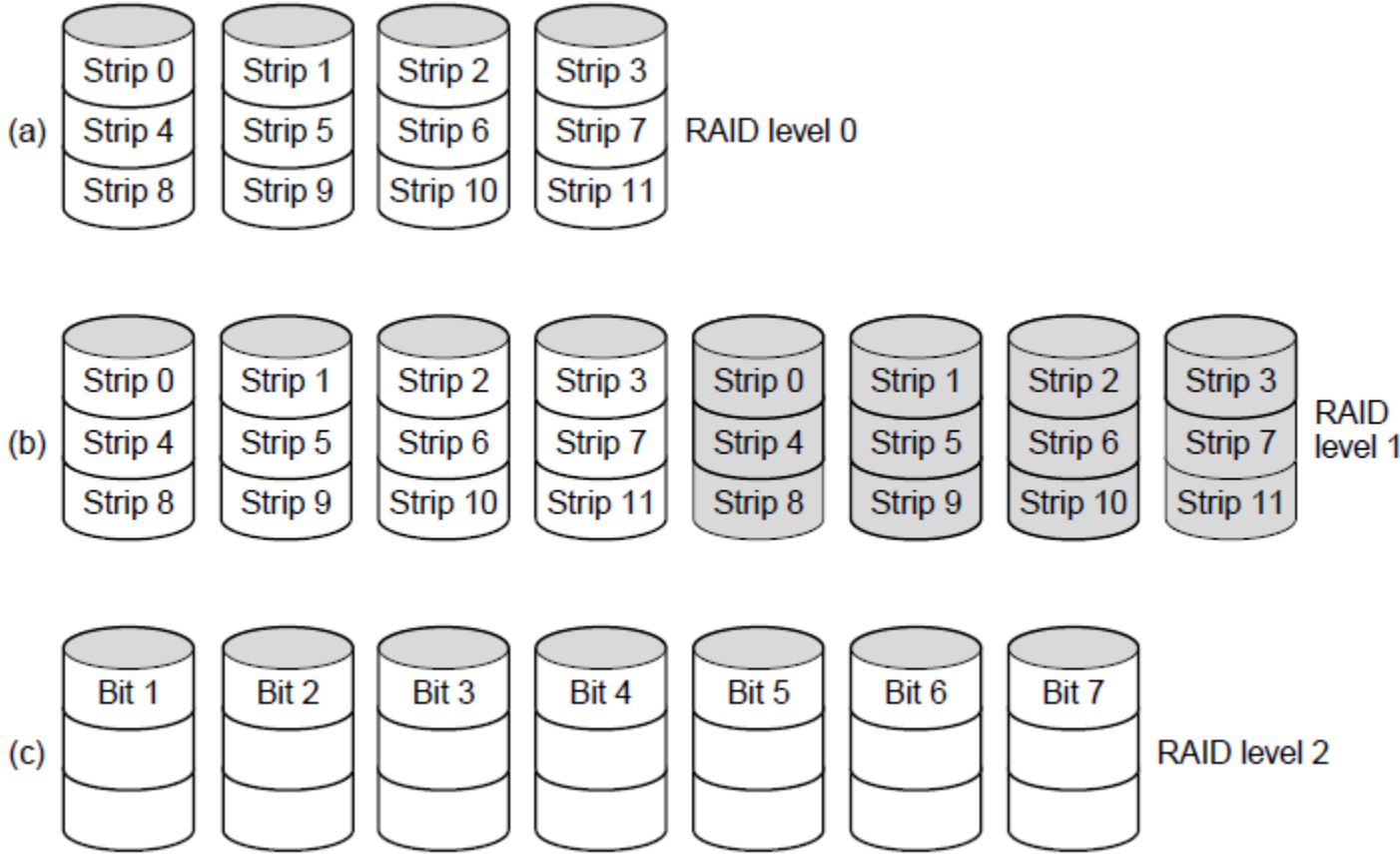


Fairly uniform distribution for the hash function is desirable  
(to improve the efficiency of hash storage)  
i.e. to minimize hash collision

## RAID (Redundant Array of Inexpensive Disks)

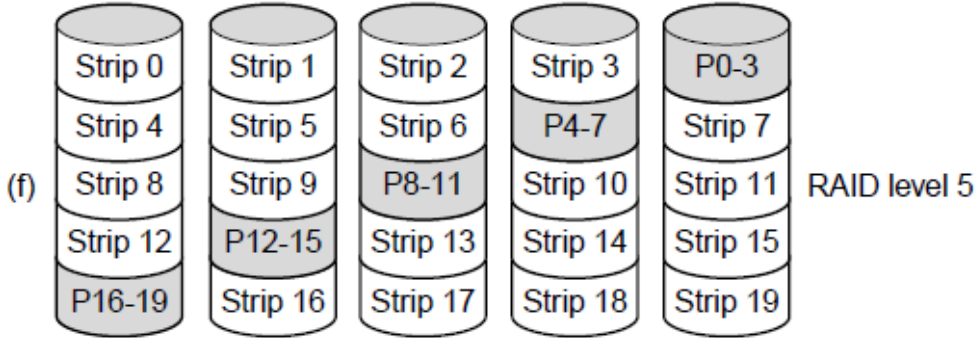
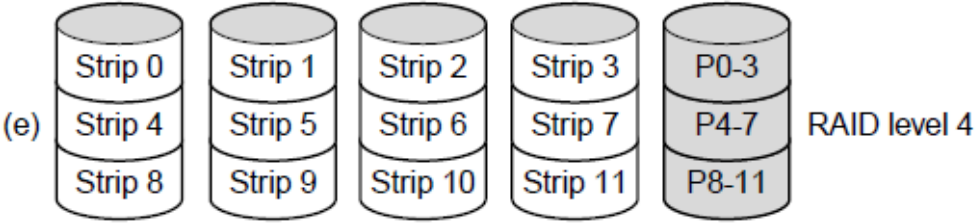
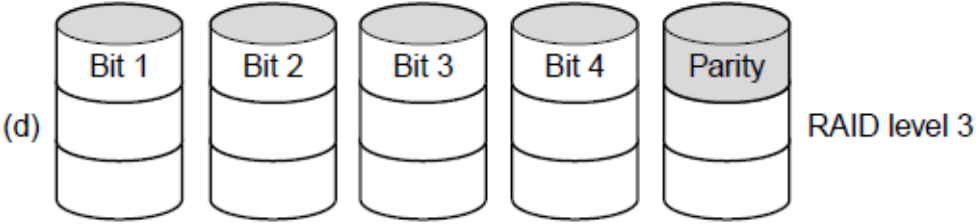
- RAID - level
- 0 Data block striping across disks
  - 1 Disk mirroring (supports one write operation or two read operations)
  - 2 Bit striping across disks (no fault tolerance)
  - 3 Bit striping with single parity bit (supports only 1 application)
  - 4 Striping of only data blocks (Parity blocks in one disk)
  - 5 — striping of data blocks and parity blocks

# RAID



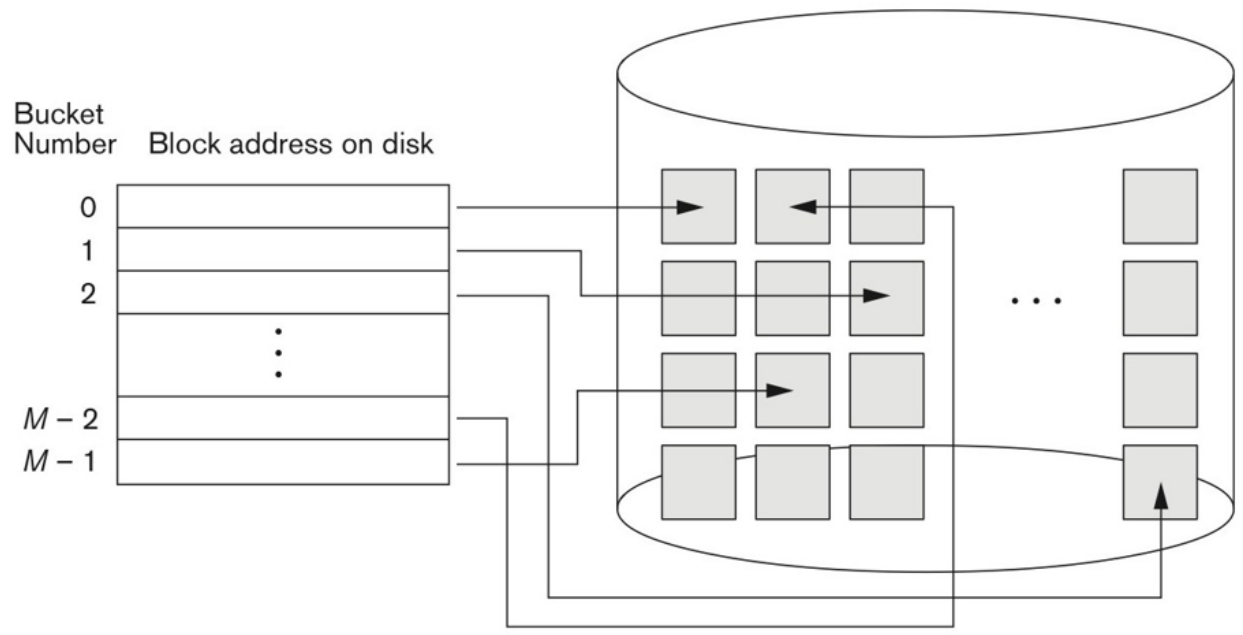
RAID levels 0 through 2. Backup and parity drives are shown shaded.

# RAID

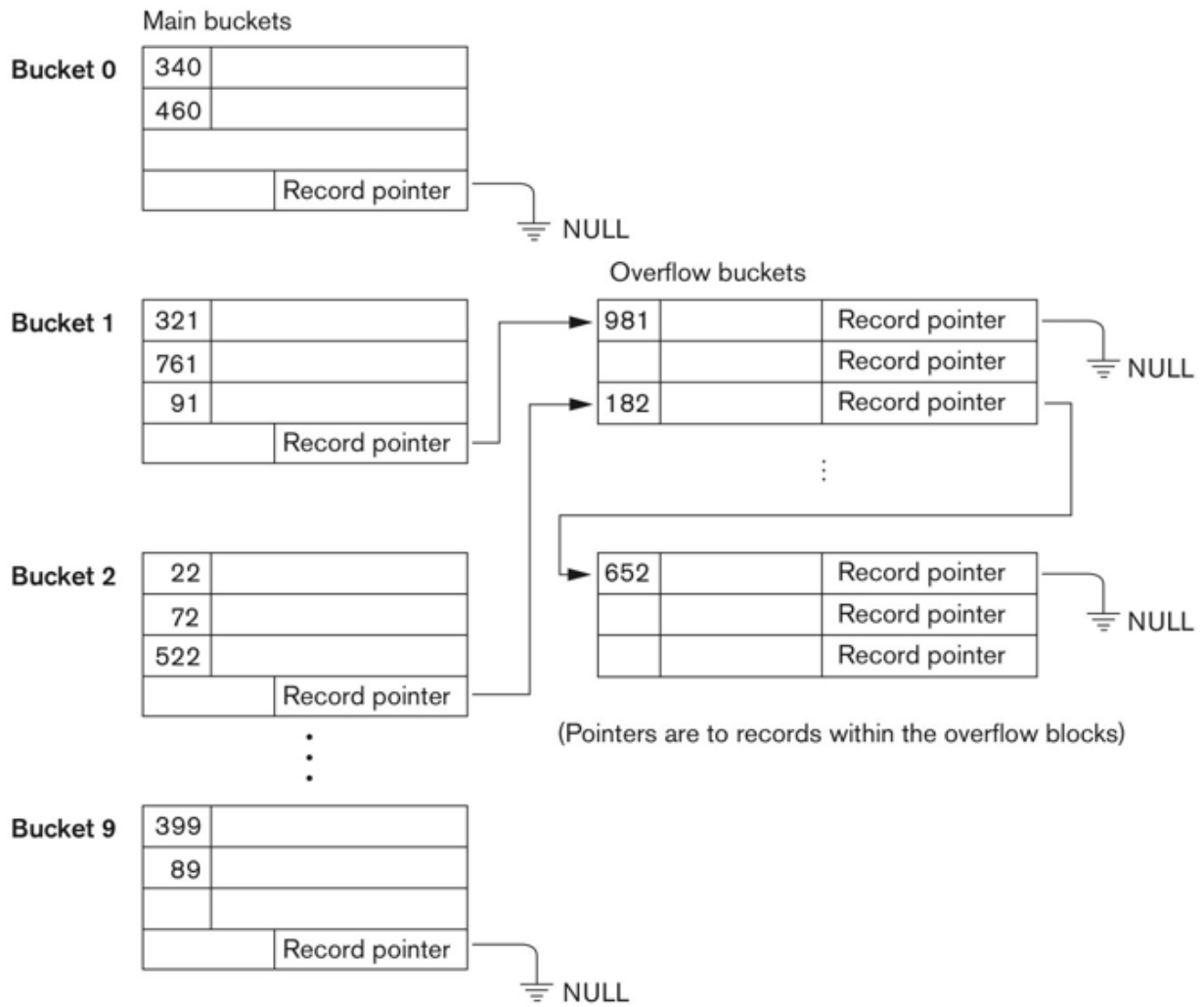


RAID levels 3 through 5. Backup and parity drives are shown shaded.

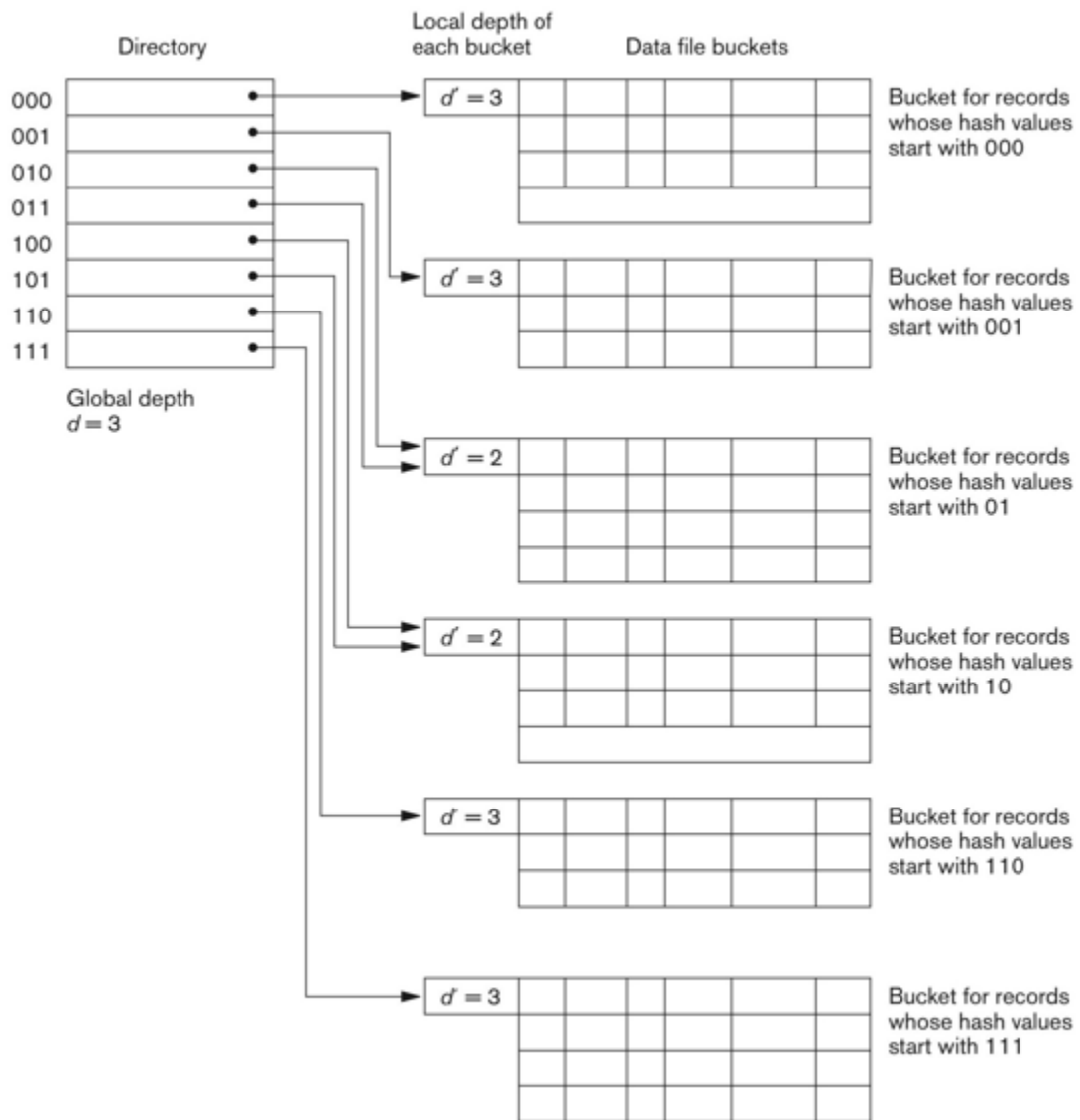




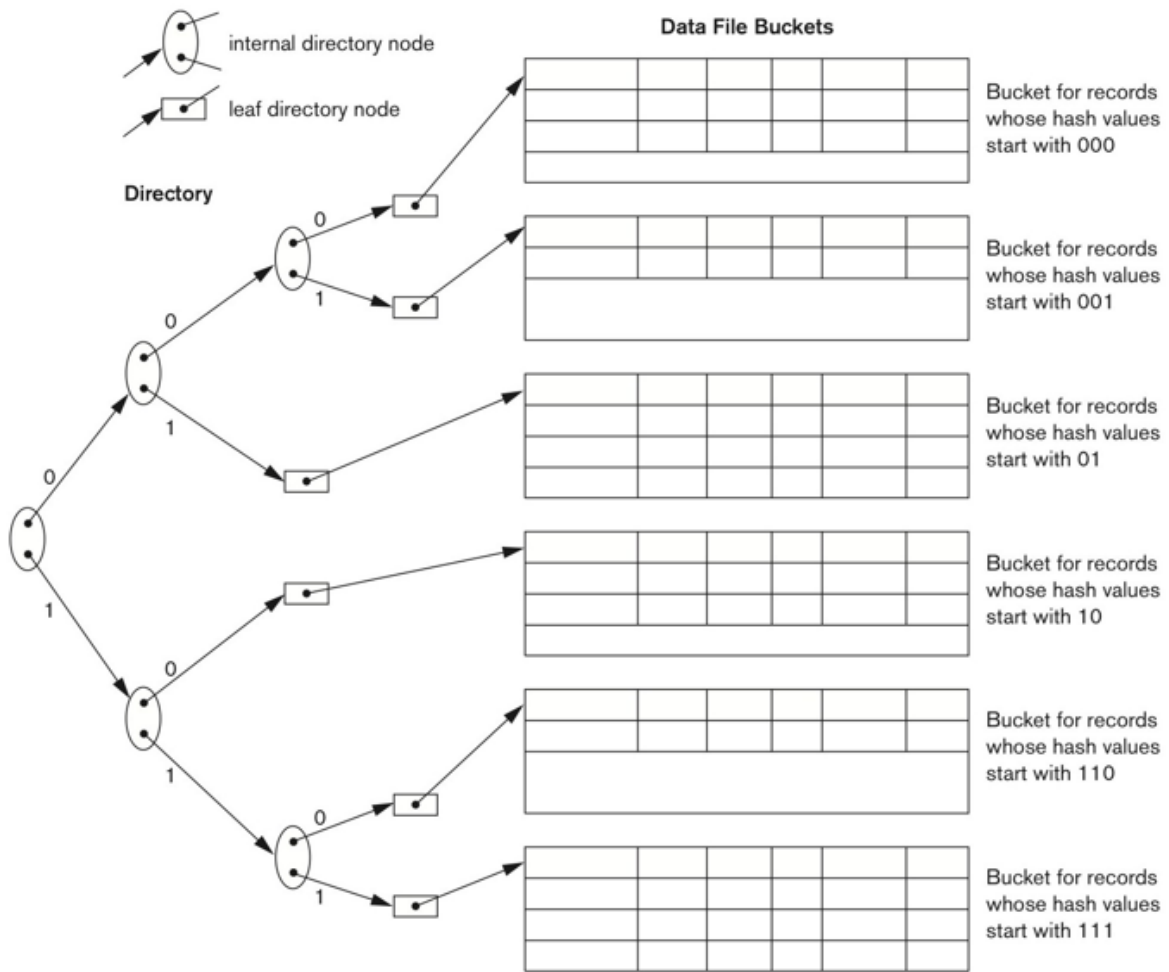
Matching bucket numbers to disk block addresses.



Handling overflow for buckets by chaining.



Structure of the extendible hashing scheme.



Structure of the dynamic hashing scheme.