① Concurrency Control :-

—> A mechanism ensures that simultaneous execution of more than one transaction does not lead to any database inconsistency is called Concurrency Control.

—> The Basic property of Concurrency Control is isolation. A database can have multiple transactions running at same time this is called Concurrency.

—> To preserve the isolation property a system must control a iteraction among the concurrent by Concurrency control mechanism.

Need for Concurrency Control :-

—> To ensure isolation.
—> To resolved read-write or write-write
—> To preserve Consistency of database.

Problems of Concurrency execution :-

—> Lost update problem (W-W Conflict)
—> Dirty read problem (W-R Conflict)
—> Unrepeatable read problem (W-R Conflict)

Lost update problem :-

—> The problem occurs when two different database transactions perform the read / write operations on the same database items in an interleaved manner. (i.e. Concurrent execution). This makes the value of database will be incorrect.

Time	T_1	T_2
t_1	READ (A)	-
t_2	A = A - 50	-
t_3	-	READ (A)
t_4	-	A = A + 100
t_5	-	-
t_6	WRITE (A)	-
		WRITE (A)

Dirty read problem :-

The dirty read problem occurs when one transaction updates an item of the database and somehow the transaction fails and before the data gets rollback the updated database item is accessed by another transaction. These comes the read write conflicts between two transaction.

Time	T_x	T_y
t_1	READ(A)	-
t_2	A = A + 50	-
t_3	WRITE (A)	-
t_4	-	READ(A)
t_5	Server down rollback	-

Unrepetable read Problem:-

→ It is also known as inconsistent retrievals problem that occurs when in a transaction two different values are read for the same database item.

Time	Tx	Ty
t_1	READ(A)	-
t_2	-	READ(A)
t_3	-	A = A+100
t_4	-	WRITE(A)
t_5	READ(A)	-

Lock phase Protocol:-

A mechanism that is responsible to prevent a transaction from reading or writing data until the necessary lock is obtained. The Concurrency problem can be solved by securing or locking a transaction to a specific user.

Two types of locks:-

→ Shared lock
→ Exclusive lock.

Shared Lock:

→ Shared lock:

Shared locks which are often denoted as lock-S are defined as locks that provide read only access to the information associated with them. whenever a shared lock is used on a database it can be read by several users but these users who are reading the information or the data it will not have the permission to edit or make any changes to the data items.

Exclusive lock:

Exclusive lock allows the data item to be used as well as written. This is a one time use mode that can't be utilized on the exact data item twice. It is denoted as lock-x. After finishing the wide step transaction can unlock the data times.

Types of lock phase protocol:-

→ Simplistic lock protocol.
→ pre-claiming lock protocol.
→ Two phase locking protocol.
→ Strict two phase locking protocol.
→ Timestamped phase protocol.

Simplistic lock protocol:

A basic locking protocol that uses locks to prevent concurrent accen to shared data.

pre claiming lock protocol:-

A Concurrency Control protocol that requires transactions to preclaim (or declare) their resource usage before executing.

Two phase locking protocol:-

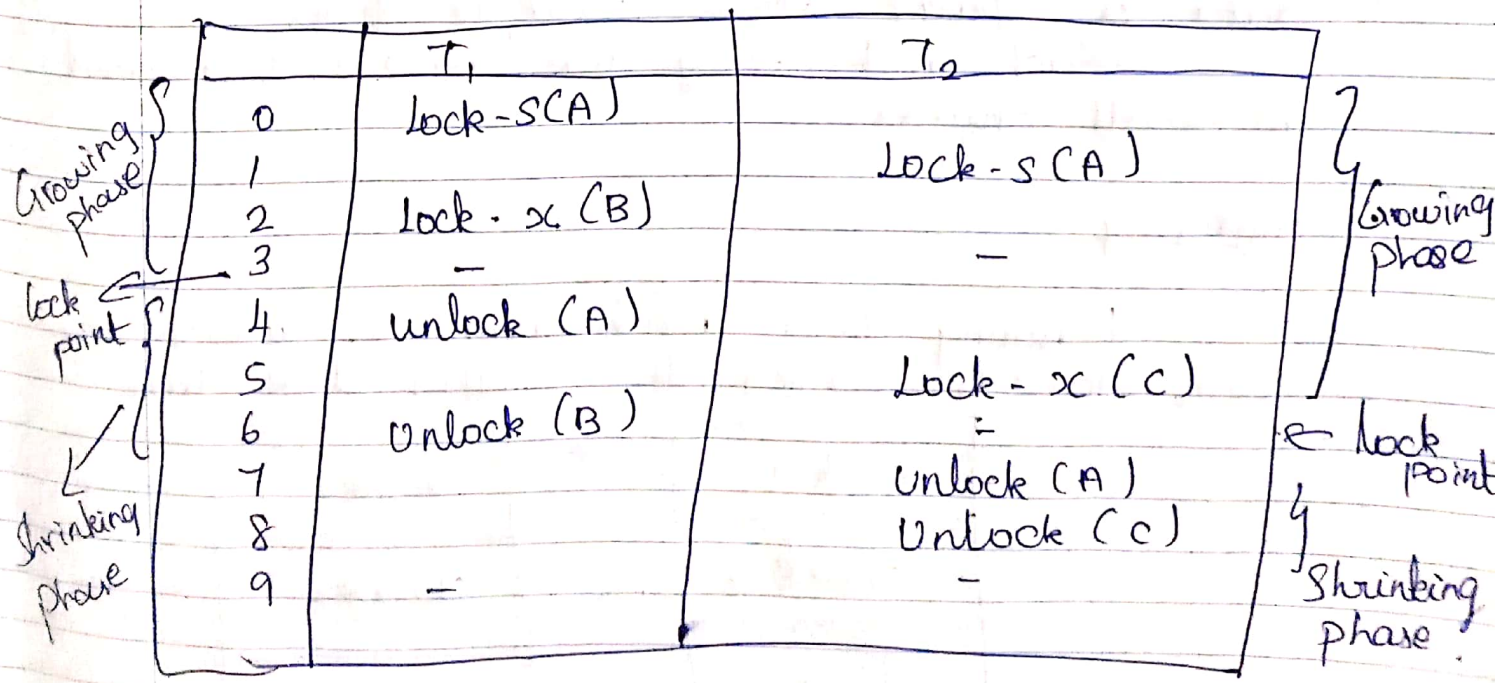
If locking as well as the unlocking can be performed in a phases, a transaction is considered to follow the two phase locking protocol. The two phase are known as the growing and shrinking phase.

Growing phase:-

In the phase, we can acquire new locks on data items but none of these locks can be released.

Shrinking phase:-

In this phase the existing locks can be released but no new locks can be obtained.



2. RAID Levels:

—> Redudant array of independent disks.
—> It is a technique which make use of a combination of multiple hard disks.
—> Disk Drives are independent and are multiple in number.
—> The way the data is distributed between these drives are dependent on the RAID level.

Advantages:

—> To the OS, the array of disks can be presented as a single disk.
—> RAID is fault tolerant.
—> Data loss is prevented.

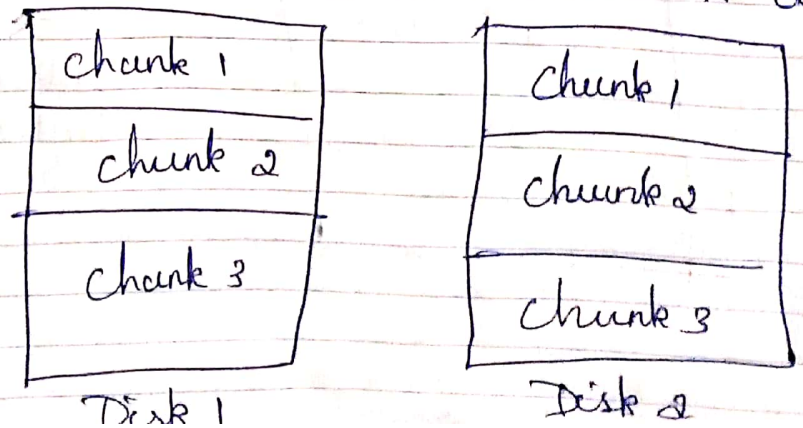
RAID Storage Techniques:

Stripping:

—> Stripping is a mechanism in which data is spread across multiple disks.
—> Each and every disk drive is partitioned in small chunks.

mirroring:

Mirroring is a mechanism in which the same data is written to another disk drive



Parity:

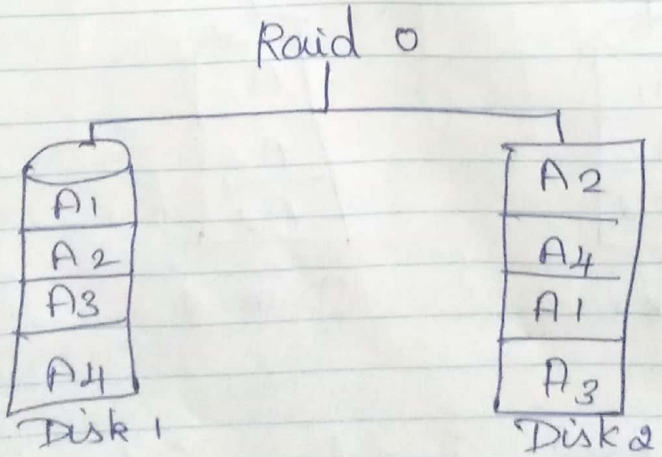
→ Parity is a method used to rebuild data in case of failure of one of the disks.
→ Parity makes use of a very famous mathematical binary operation called as "XOR"
→ XOR is a mathematical operation that's done to produce one output from two inputs.
→ Some examples of XOR are.

1st operator	2nd operator	XOR output
1	1	0
1	0	1
0	1	1
0	0	0

Raid levels

Raid 0 (Disk Striping):

→ In a RAID 0 system, the data are split up into multiple blocks.
→ By using multiple disks (at least 2) at the same time.



Advantages:

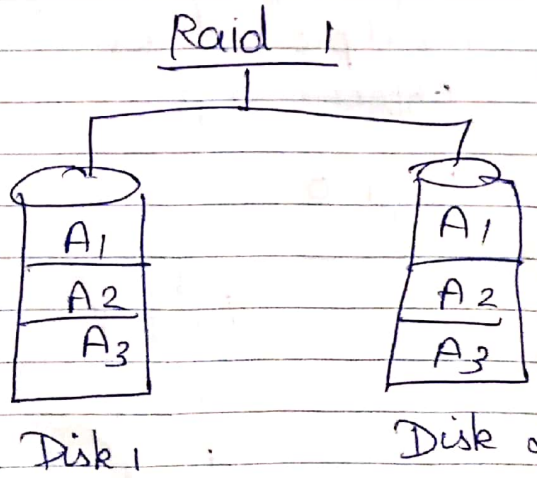
→ RAID 0 offers great performance both in read and write operation.
→ All storage capacity is used, there is no overhead.
→ The technology is easy to implement.

Disadvantages:-

→ RAID 0 is not fault tolerant.

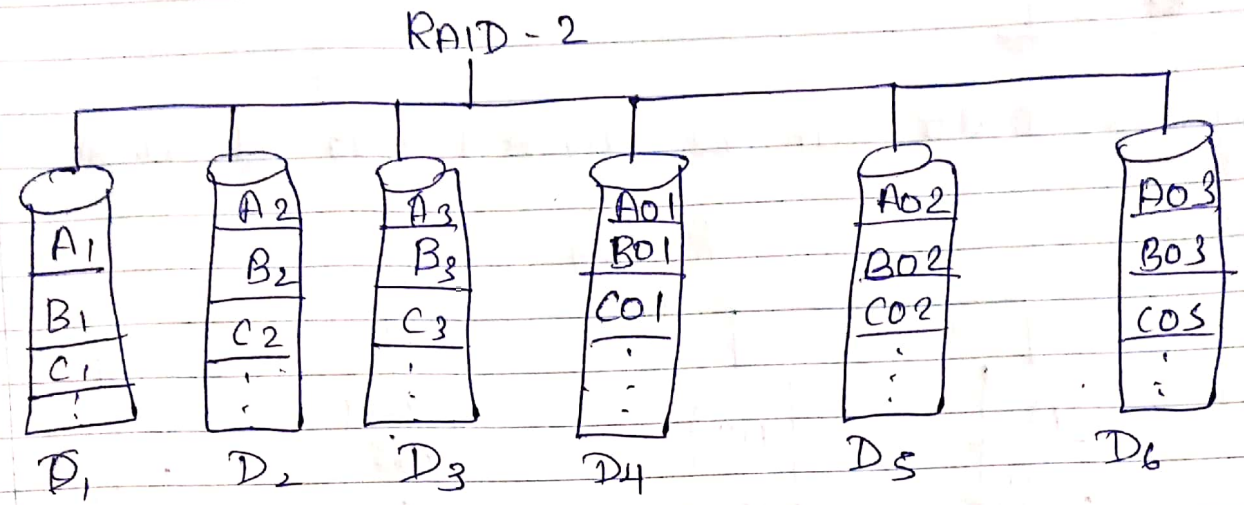
RAID 1 (mirroring):-

→ Data are stored twice by writing them to both the data drive and a mirror drive.
→ If a drive fails the controller uses either the data drive or the mirror drive for data recovery and continuous operation.
→ ~~Bee~~ Need atleast 2 drives for a RAID 1 array.



RAID 2:

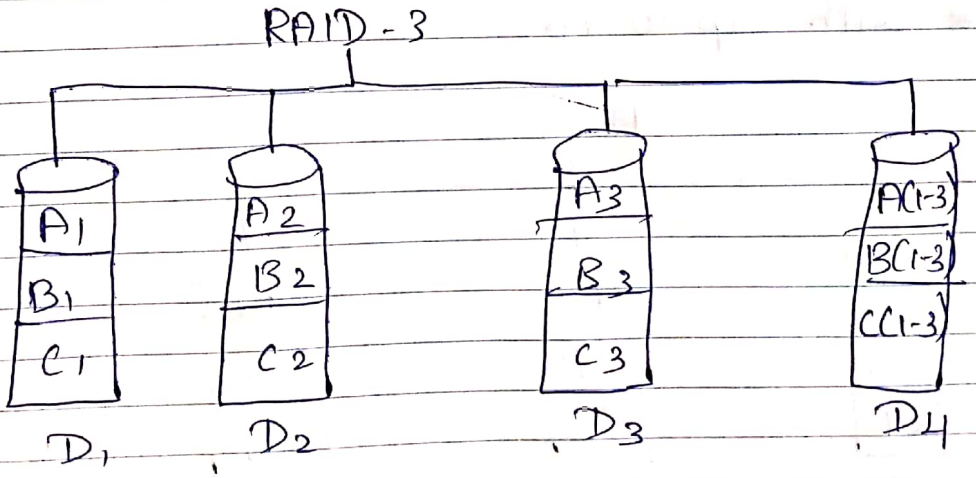
→ Error Correction Codes like Hamming Code.
→ we split the data bitwise on few disk.



→ It is so expensive because it requires more disk to store error Correction Codes.

RAID (3)

→ Instead of error Correcting Code we use parity bits.

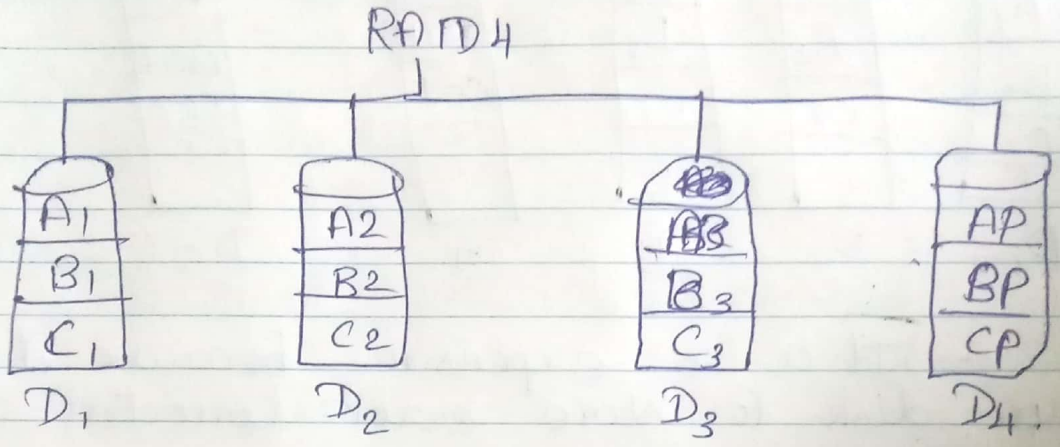


Disadvantages:

If any error occurs in XOR parity bits total disk fail.

RAID 4 :-

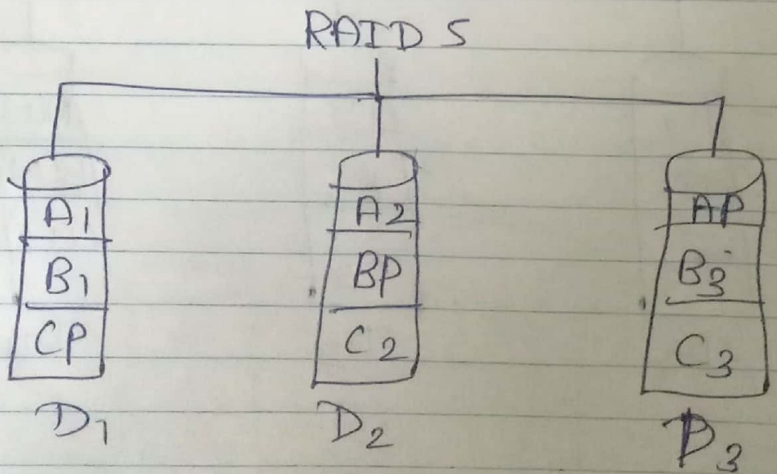
Data can be divided into blockewise.



RAID 5 (Stripping with parity) :-

→ RAID 5 is the most common secure RAID level.

→ It requires at least 3 driver but can work with up to 16.



→ The parity data are not written to a fixed drive they are spread across all drives.

RAID 6 (striping with double parity) :-

→ RAID 6 is like RAID 5 but the parity data are written to two drives. That means it requires at least 4 drives and can withstand 2 drives dying simultaneously.

→ However if a drive in RAID 5 system dies and is replaced by a new drive it takes hour or even more than a day to rebuild the swapped drive. If another drive dies during that time you still lose all of your data. with RAID 6 the RAID array will even survive that second failure.