BS sir | CSE 3101 | 8/E | 6/8/19

Database Design

ER Model (Entity Relationship Model)

- ER Diagram
- Logical Structure of a database
- Graphical Representation an ER Model

Entity (Tuple)

- Object
- has → a set of properties
  - ↓
  - Attributes

Entity Set (Table/Relation)

- A set of entity(s) of same type
  - ↓
  - share same Properties

Entity Set
Relationship set
Attribute set

Simple / Atomic Attribute
- ↓
- Can't be divided

Vs

Composite Attribute
- ↓↓
- Can be divided into subparts

Composit

Person_Name

- First_Name
- Middle_Name
- Last_Name

Address

- Apartment
  - Apartment_No.
  - Apartment_Name
- Road
  - Road_No.
  - Road_Name
- City
- Zip Code

Single Valued Attribute Vs Multivalued Attribute

Roll no.	{Mobile no.}
Series no.	{Email no.}
Academic Session	

BS sir | CSE 3101 | 9/C | 20.08.19

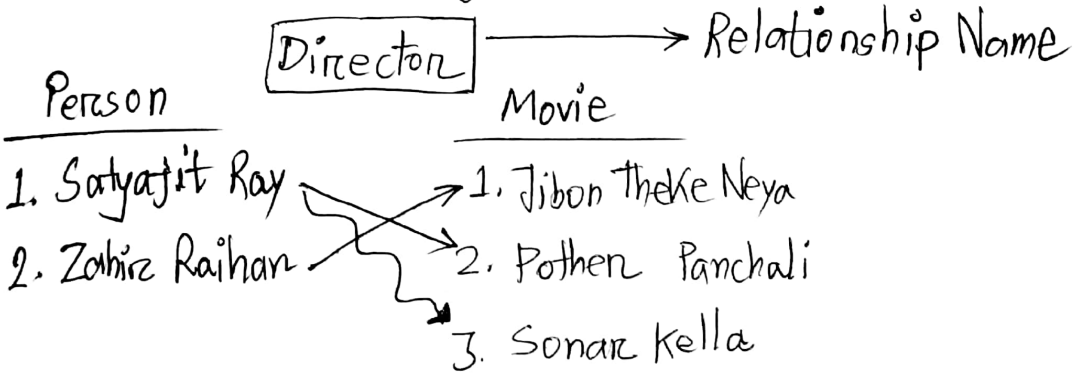
Derived Attribute

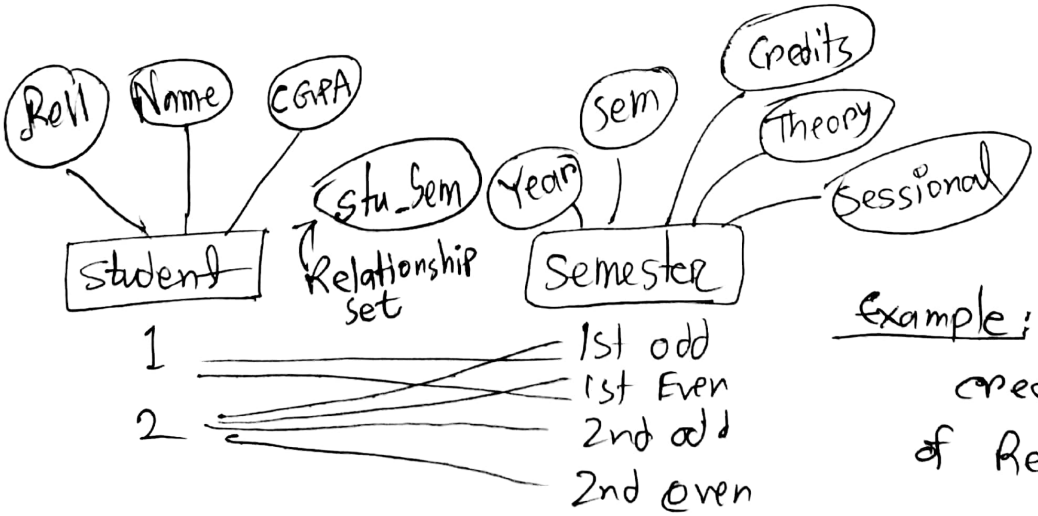
- Attribute that is derived from other attribute
- Example:

Date Of Birth	Current Age
Base Attribute (stored)	Derived Attribute (Computed)

Entity Relationship

- association among several entities





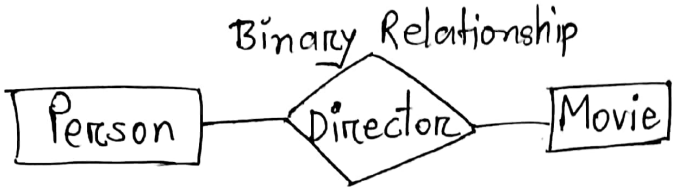
Example: Each sem_Earned_credit is the element of Relationship set.

Descriptive Attribute :

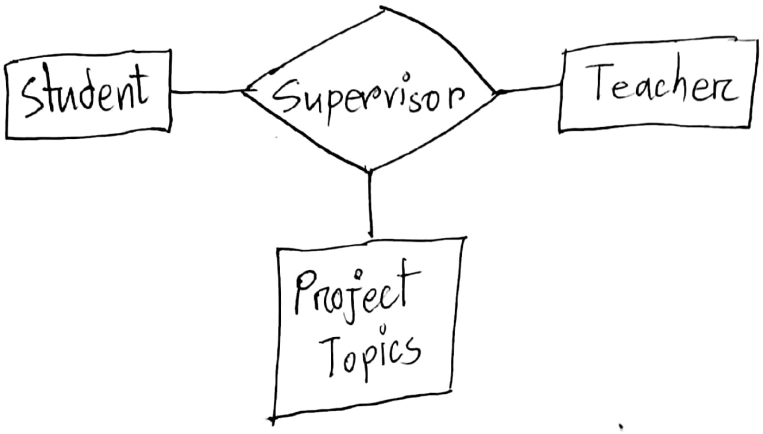
↳ Attributes of a relationship set

Degree of a Relationship Set :

Number of entity set participate in a relationship set



Degree - 2



Ternary Relationship

Degree - 3

BS sir

CSE 3101

9/D
21.8.19

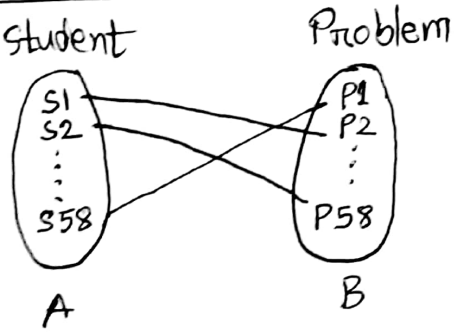
Relationship

Cardinality Ratio/Mapping Cardinality:

→ the number of entities to which another entity is associate

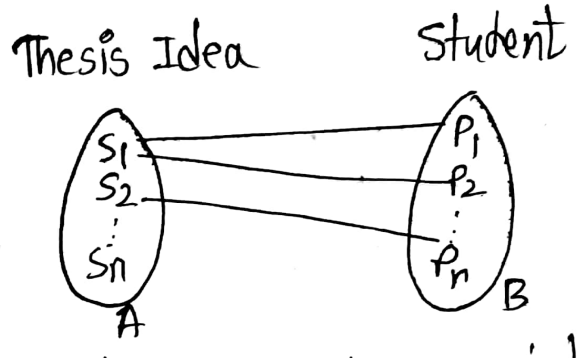
one to one
one to many
many to one
many to many

One to One



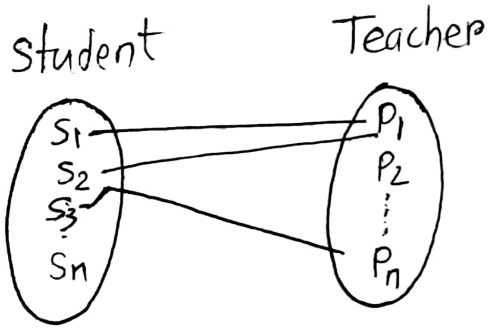
An entity of entity set A is associated with at most one entity in B and an entity is B associated with at most 1 entity in A.

One to many



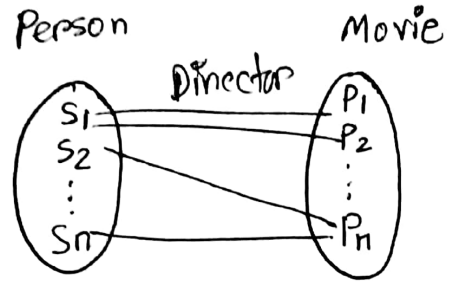
An entity in A is associated with zero or more entities in B and an entity in B is associated with at most one entity in A.

Many to one



An entity in B is associated with zero or more entities in A and an entity in A is associated with at most one entity in B.

Many to Many



An entity in B is associated with zero or more entities in A and an entity in A is associated with zero or more entity(s) in B.

Primary key in a relationship set

Primary Keys of A & B entity set comes from

For Many to many : Combination of Primary Key of A and B entity set

MovieID	DirectorID
1	1
2	1
3	1
4	2
4	3
5	2
5	3

For many to One : Primary key of A entity set

(A) Student ID	Teacher ID (B)
1	1
2	1
3	1
4	2
5	3

For One to Many : Primary key of B entity set

(A) Thesis ID	Student ID (B)
1	1
2	2
3	3
2	4
1	5

For One to One : Primary key of A & B → Candidate key

PK can be anyone between A & B.

Student ID	Problem ID

BS sir | CSE 3101 | 9/E | 24/9/19

□ Redundant Attribute

Director (D_ID, D_Name, Awards, Films)

Movie (M_ID, M_Name, Genre, IMDb_rating, D_ID)

Primary key (M_ID)	D_ID
1	3
2	3
3	3
4	1
5	2
10	4
10	5
11	4
11	5

if (Relationship)

↓

Many to Many or One to many

↓

Problem

else if (Relationship)

↓

One to one or Many to one

↓

No Problem

Redundant Attribute যে কোনো Table এর দুটি Attribute এর মাঝে Relationship তৈরি করা যাবে

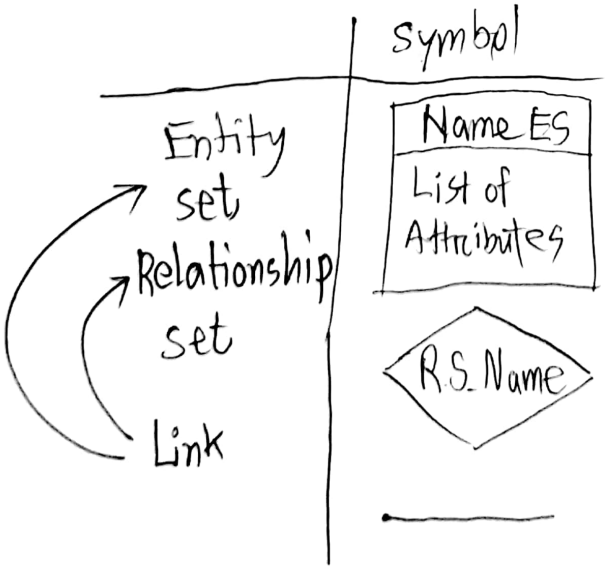
Relationship among the entites are recorded needs Seperate Table if many to many relationship

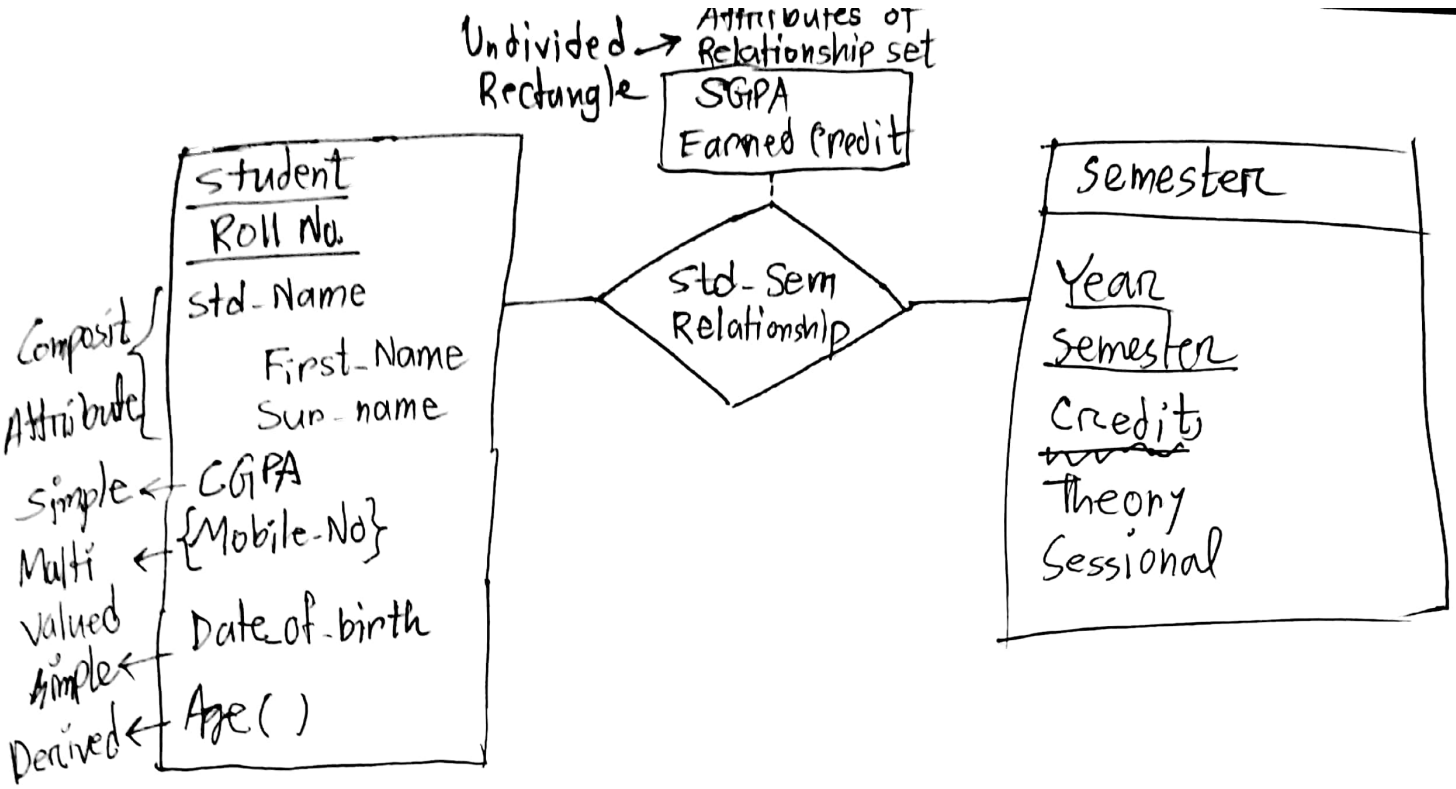
Movie_Director_Relationship

M.ID	D.ID
1	3
2	3
3	3
6	4
6	5
7	4
7	5

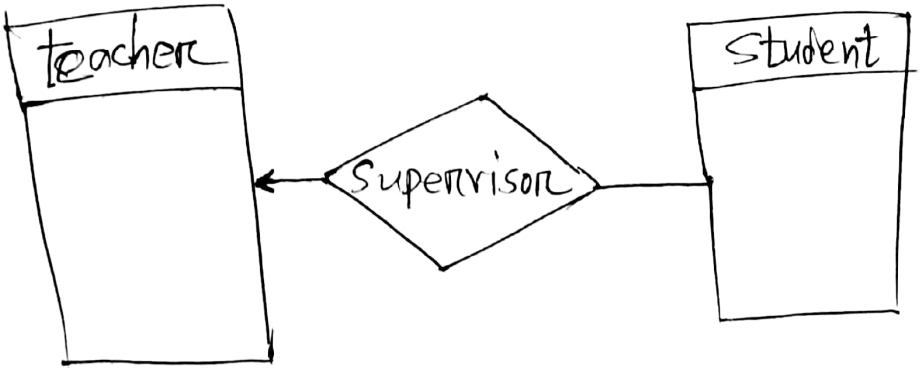
ER-Diagram (Entity Relationship Diagram)

Graphical representation of overall logical structure of a DB.

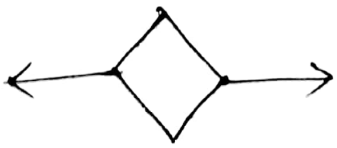




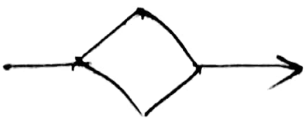
Cardinality Ratio



one to many



one to one



Many to one

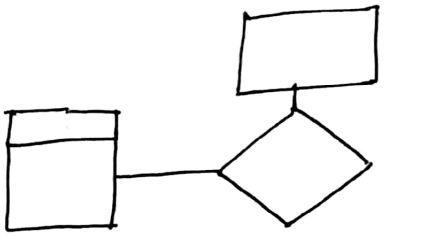
BS sir

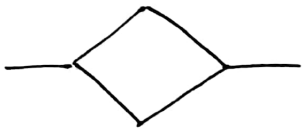
CSE 3101

10/C

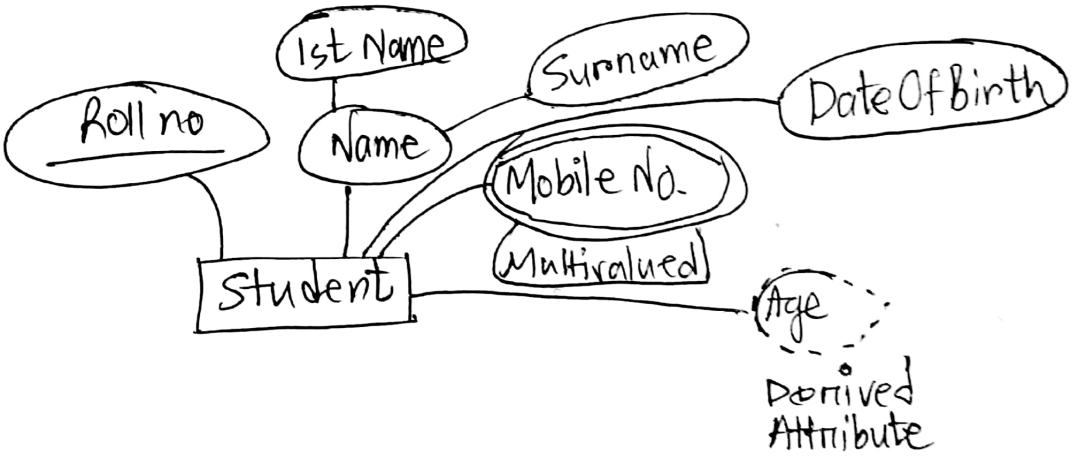
27.8.19

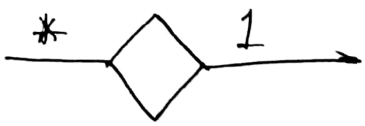
ER Diagram :





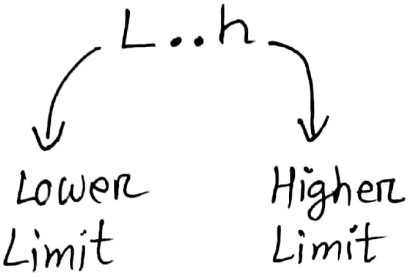
Alternative Representation

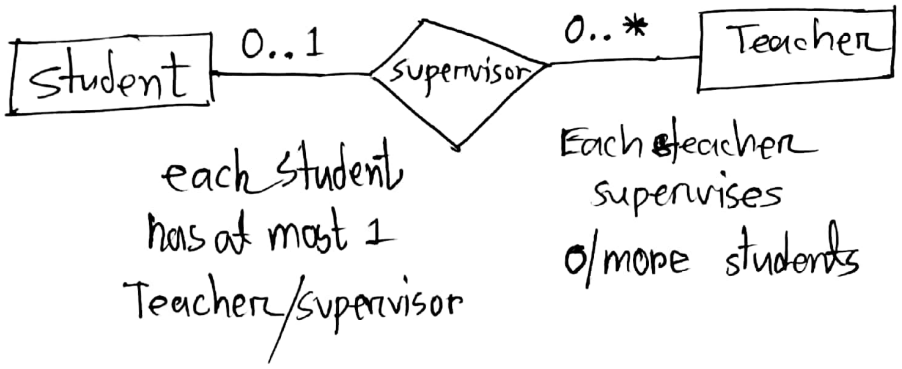




⊛ → No limit

Cardinality Limit :





Chapter-14
Transaction

→ Collection of operations
form → a single unit of work
indivisible

Access & Update
data items in DB

Data access >> 2 operations :

(1) Read (X) :

(2) Write (X) :

Read(X)
↳ data item

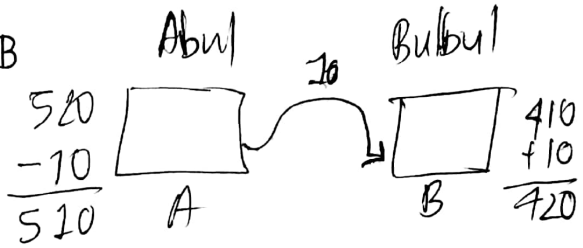
from DB (on disk) → Transfer → to a variable (X) in main memory buffer

Write (X) to DB (on disk) ← Transfer ← from a variable (X) in main Memory Buffer

Example:

T_1 : read(A); (Main memory ← DB)
A :- A − 10;
write (A);

read (B);
B :- B + 10;
write (B);



Properties of DB Transaction

ACID
- Atomicity
- Consistency
- Isolation
- Durability

BS sir CSE 3101 10/D 28·8·19

1. Atomicity: Transaction should atomic. That means the processes of the transaction will be occured entirely or not at all.

→ Either all the operations of a transaction will be reflected on DB.
or none.

```
T1 : read (A);
     A := A - 600;
     write (A);
     read (B);
     B := B+600 ;
     Write ( B);
```

2. Consistency:

DB must be in a consistent state after → successful completion of a transaction.

contraints: Primary key / foreign key / check.

এটার মাধ্যমে এটা নিশ্চিত করা যে ~~Fra~~ Database এ যে New value write হচ্ছে এটা কোনো Invalid value না।

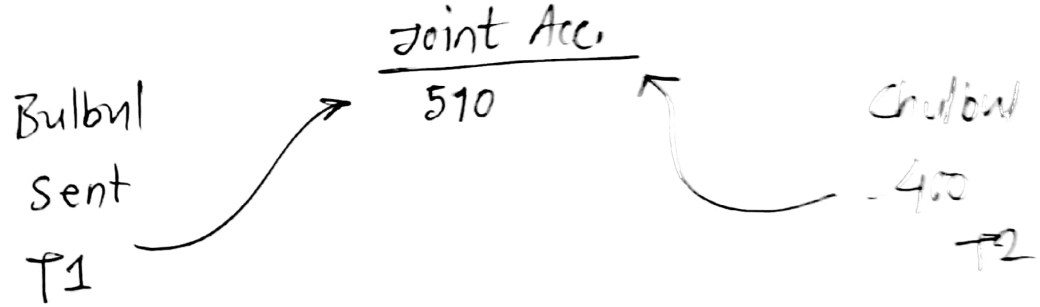
3. Isolation :

Several transactions —(can be executed)→ concurrently

it appears to T_i that

either T_i started execution after T_j completed

or T_i finished execution before T_j started.



4. Durability :

↳ After the successful completion of a transaction

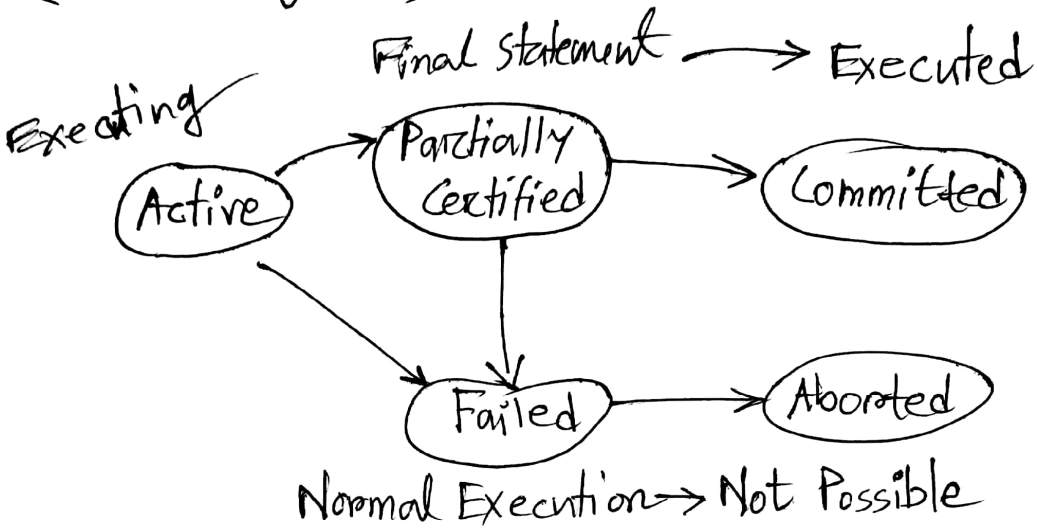
the changes made by it → will be preserved by the

DB. even if → system crashes.

RAID : Redunt Array of Independent Disk

Transaction States (★★★)

State Diagram

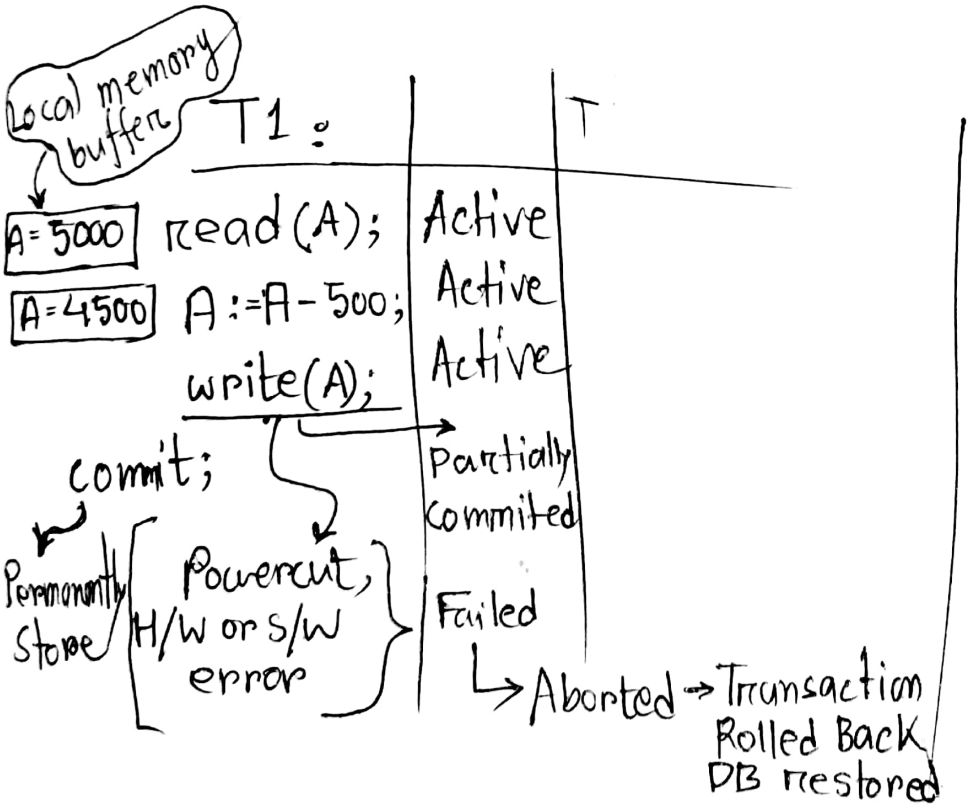


CT-3

View থেকে Relational Algebra

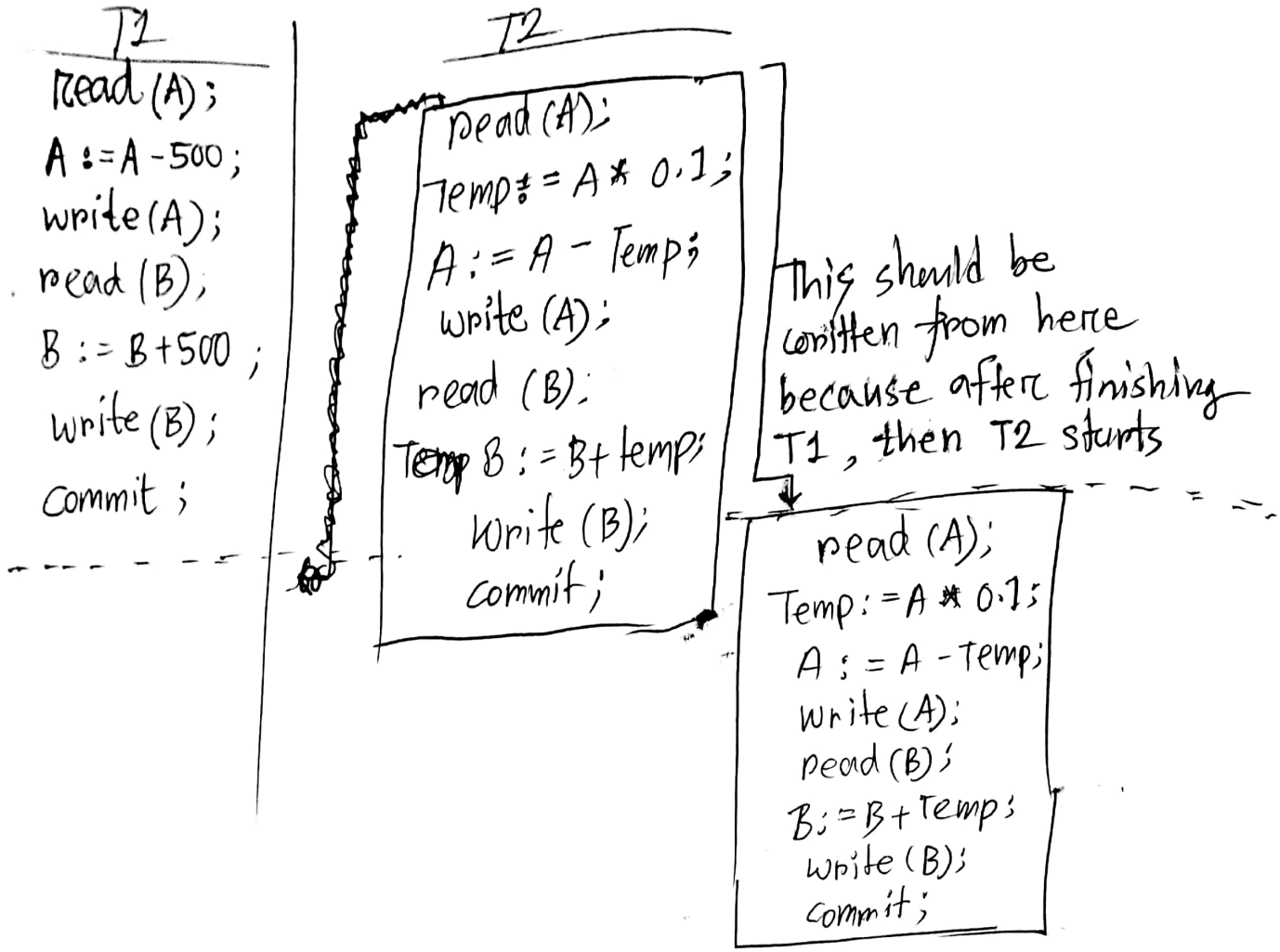
BS sir | CSE 3101 | 10/E

31.8.19



Transaction :

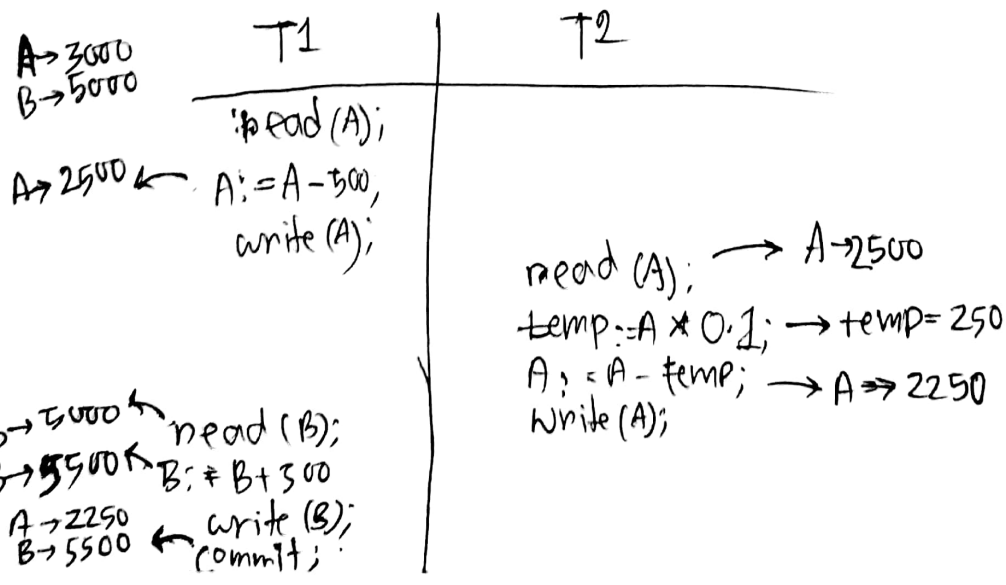
TCL : Transaction Control Language



Transaction

Schedule: Sequence of execution of several Transactions

Concurrent Schedule: Several transactions are executing concurrently.



T1	T2
	read(B); → B → 5500
	B := B + Temp; → B → 5750
	write(B);
	commit; → A → 2250, B → 5750

BS sir — CSE 3101 — 11/D — 07.9.19

Schedule

- → Serial
  - < T_3, T_2, T_1 > ; এখানে T3 complete, then T2 then T1.
- → Concurrent
  - Parallel

*[Concurrency ও Parallelism এর পার্থক্য]

*Parallelism হল Concurrency এর Subset.

* Concurrency মানে দুটো কাজ বা ততোধিক কাজ At এ Time এ Active বাট একসাথে হচ্ছে না। অপরদিকে Parallelism হল দুই বা ততোধিক কাজ At এ Time এ সংঘটিত হচ্ছে।

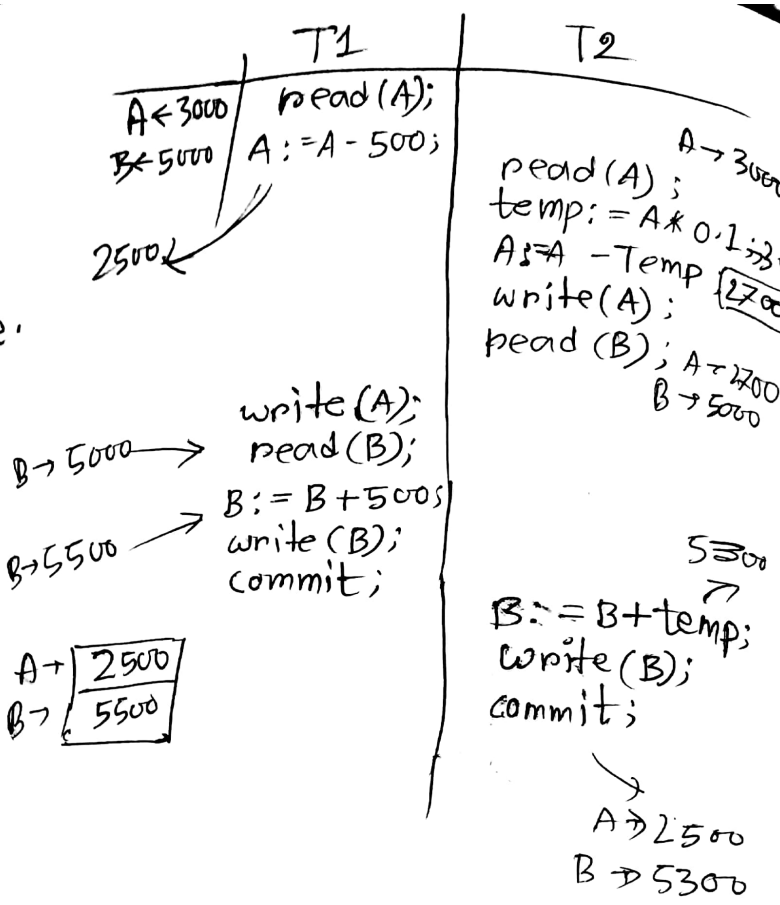
Advantage:

- → Improved Throughput & resource Utilization
- → Activities » I/O Activity, CPU Activity } T_i, T_j can be done in parallel
- → Reducing Waiting Time

DisAdvantage:

→ Concurrent schedule may create inconsistency in Database. [which is not present in serial schedule.]

এখানে, আমরা তিনটা করে,
Read()
write()



BS sir | GSE 3101 | 11/E | 08.9.19

Concurrent Schedule - 3

T1	T2
read(A);	
	read(A);
	write(A);
	write(B);
write(A);	
read(B);	
write(B);	
commit;	
	write(B);
	commit;

In search of Thamelas:

The order of read() & write()

2 consecutive instructions from different transactions

case 1:

T1	T2
read(D);	
	read(D);

No Problem

case 2:

T1	T2
read(D);	
	write(D)

problem

case 3:

T1	T2
write(D)	
	read(D);

No problem

case 4:

T1	T2
write(D)	
	write(D);

problem

Conflicting Instructions :

working on same data item
&
at least one of them is a write operation

→ 2 different Consecutive instructions from different transaction

Conflicting Instructions are the main causes of Inconsistency in Database.

If two consecutive instructions from different transaction

↳ if don't conflict → can be swapped

↓

To form an equivalent schedule

Conflict Equivalent :

schedule - 3

T1	T2
read(A);	
write(A);	
	read(A);
	write(A);
read(B);	
write(B);	
	read(B);
	write(B);

schedule - 5

T1	T2
read(A);	
write(A);	
	read(A);
read(B);	
	write(A);
write(B);	
	read(B);
	write(B);

They are swappable

Concurrent Schedule: 4

Conflict Equivalent Schedule:

If a schedule S can be transformed into schedule S' by a series of swaps of non-conflicting instructions, then schedule S' is conflict equivalent to the schedule S.

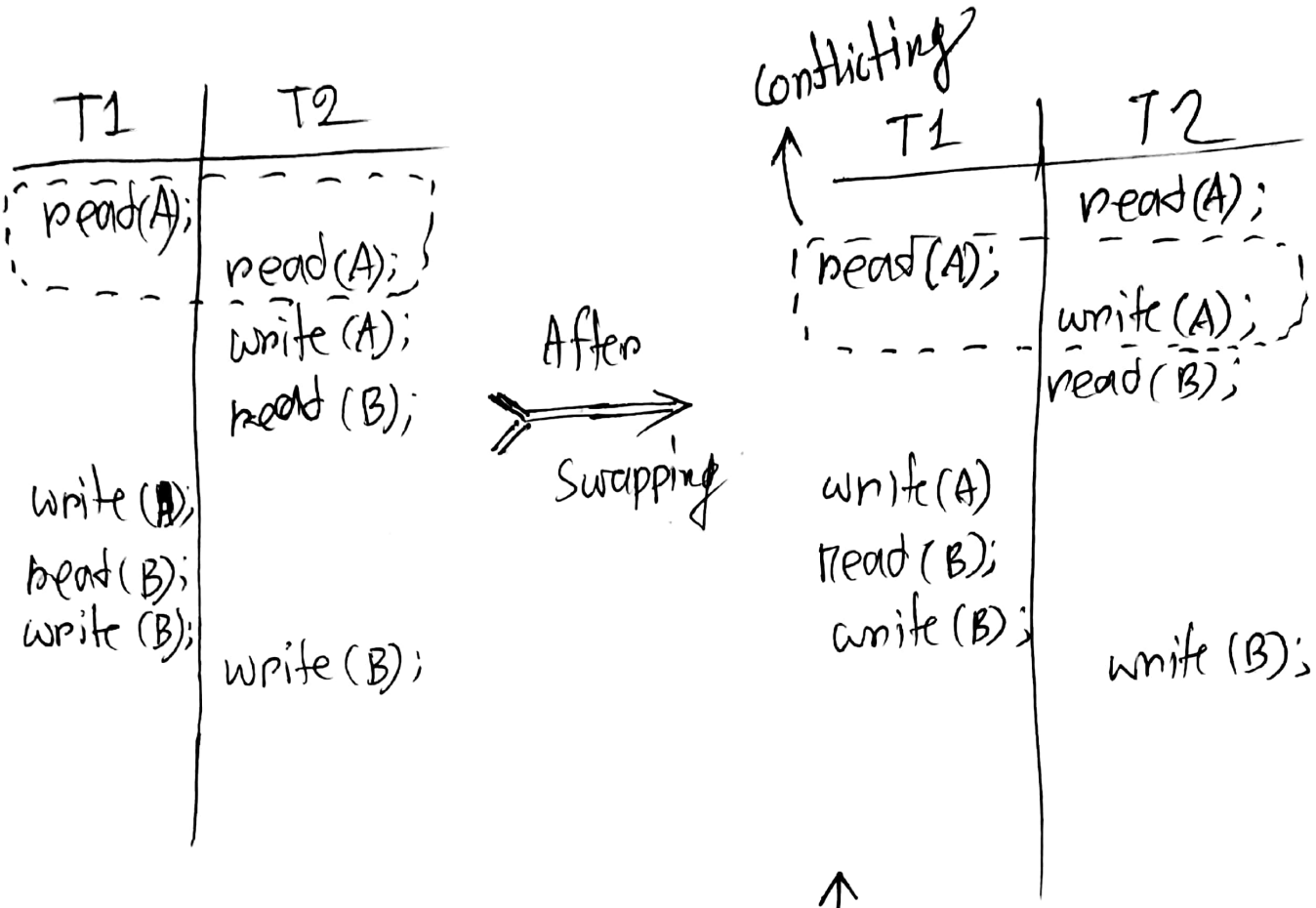
Serial Schedule <T1, T2> → no consistency problem
Concurrent Schedule
Serializable Schedule

↳ যেটি ও যেকোন Concurrent schedule যাকে Serial schedule এ convert করা যায়।

T1	T2
read(A);	
write(A);	
read(B);	
write(B);	
	read(A);
	write(A);
	read(B);
	write(B);

← Conflict Serializable Schedule

[* Exercise after every chapters should be practised.]



[As we got a conflicting case here, that's why this is not serializable schedule]

CT-4

Database Design

Transaction (serializable पर्यन्त)