Anomaly and its types

What is an anomaly in database design?

- Anomalies are **problems that can occur in poorly planned, un-normalized database** where all the data are stored in one table.

- There are three types of anomalies that can arise in the database because of redundancy are
  - Insert anomaly
  - Delete anomaly
  - Update / Modification anomaly

Insert anomaly

- Consider a relation Emp_Dept(EID, Ename, City, DID, Dname, Manager) EID as a primary key

Emp_Dept

EID	Ename	City	DID	Dname	Manager
1	Raj	Rajkot	1	CE	Shah
2	Meet	Surat	1	CE	Shah
NULL	NULL	NULL	2	IT	NULL

An insert anomaly occurs when certain attributes cannot be inserted into the database without the presence of another attribute.

Want to insert new department detail (IT)

- Suppose a **new department (IT) has been started** by the organization but **initially there is no employee appointed** for that department.
- We **want to insert that department detail** in Emp_Dept table.
- But the **tuple for this department cannot be inserted** into this table as the **EID will have NULL value**, **which is not allowed because EID is primary key**.
- This kind of problem in the relation where some tuple cannot be inserted is known as insert anomaly.

Delete anomaly

- Consider a relation Emp_Dept(EID, Ename, City, DID, Dname, Manager) EID as a primary key

Emp_Dept

EID	Ename	City	DID	Dname	Manager
1	Raj	Rajkot	1	CE	Shah
2	Meet	Surat	1	CE	Shah
3	Jay	Baroda	2	IT	Dave

A delete anomaly exists when **certain attributes are lost because of the deletion of another attribute**.

Want to delete (Jay) employee's detail

- Now consider **there is only one employee in some department (IT)** and that **employee leaves the organization**.
- So we **need to delete tuple of that employee (Jay).**
- But in addition to that **information about the department also deleted**.
- This kind of problem in the relation where deletion of some tuples can lead to loss of some other data not intended to be removed is known as delete anomaly.

Modification anomaly

- Consider a relation Emp_Dept(EID, Ename, City, Dname, Manager) EID as a primary key.

Emp_Dept

EID	Ename	City	Dname	Manager
1	Raj	Rajkot	C.E.	Ravi
2	Meet	Surat	C.E.	Ravi
3	Jay	Baroda	Computer	Shaah
4	Hari	Rajkot	IT	Dave

Modification Anomaly exists, when we have to update a single piece of information at all of its tuples.

Want to update manager of CE department

- Suppose the **manager of a (CE) department has changed**, this requires that the **Manager in all the tuples corresponding to that department must be changed** to reflect the new status.
- If we **fail to update all the tuples of given department**, then **two different records of employee working in the same department might show different Manager lead to inconsistency** in the database.

How to deal with insert, delete and modification anomaly

Emp_Dept

EID	Ename	City	DID	Dname	Manager
1	Raj	Rajkot	1	CE	Shah
2	Meet	Surat	1	C.E	Shah
3	Jay	Baroda	2	IT	Dave
NULL	NULL	NULL	3	EC	NULL

Emp

EID	Ename	City	DID
1	Raj	Rajkot	1
2	Meet	Surat	1
3	Jay	Baroda	2

Dept

DID	Dname	Manager
1	CE	Shah
2	IT	Dave
3	EC	NULL

Such type of anomalies in the database design can be solved by using **normalization.**