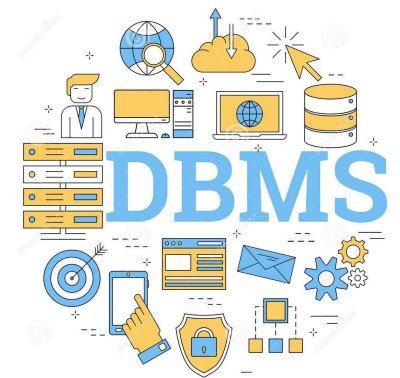


Unit III – Database Design

Dependencies and Normal forms - Functional Dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers - Non- loss decomposition -**First, Second, Third Normal Forms**, Dependency Preservation-Boyce/Codd Normal Form- Multivalued Dependencies and Fourth Normal Form- Join Dependencies and Fifth Normal Form



Normalization

- **Normalization** is the process of minimizing **redundancy** from a relation or set of relations.
- Redundancy in relation may cause insertion, deletion, and update anomalies. So, it helps to minimize the redundancy in relations.
- **Normal forms** are used to eliminate or reduce redundancy in database tables.

Normalization

S_ID	S_Name	Credits	Dept_Name	Building	Room No
1	Rahul	5	CSE	B1	101
2	Jiya	8	CSE	B1	101
3	Jenny	9	FT	B2	201
4	Payal	9	FT	B2	201
5	Ankur	7	Civil	B1	110
6	Aakash	7	ECE	B1	115
7	Vanishka	8	Civil	B1	110
8	Tanisika	7	CSE	B1	101
9					

Reptation

Large Relation Scheme

- Same entry for hundreds of data

Normalization

S_ID	S_Name	Credits	Dept_Name	Building	Room No
1	Rahul	5	CSE	B1	101
2	Jiya	8	CSE	B1	101
3	Jenny	9	FT	B2	201
4	Payal	9	FT	B2	201
5	Ankur	7	Civil	B1	110
6	Aakash	7	ECE	B1	115
7	Vanishka	8	Civil	B1	110
8	Tanisika	7	CSE	B1	101
9	NULL	NULL	Mech	B1	301

HoD_Name	HoD_P_No
aaa	123
aaa	123
bbb	456
bbb	456
ccc	789
ddd	234
ccc	789
aaa	123

Why do we need Normalization?

- Removing these anomalies.
- Failure to eliminate anomalies leads to data redundancy and can cause data integrity and other problems as the database grows.
- Data Anomalies



Why do we need Normalization?^{6/11}

Data Anomaly

- **Data modification anomalies can be categorized into three types:**
 - **Insertion Anomaly:** Insertion Anomaly refers to when one cannot insert a new tuple into a relationship due to lack of data.
 - **Deletion Anomaly:** The delete anomaly refers to the situation where the deletion of data results in the unintended loss of some other important data.
 - **Updatation Anomaly:** The update anomaly is when an update of a single data value requires multiple rows of data to be updated.

Anomalies

S_ID	S_Name	Credits	Dept_Name	Building	Room No
1	Rahul	5	CSE	C1	401
2	Jiya	8	CSE	C1	401
3	Jenny	9	FT	B2	201
4	Payal	9	FT	B2	201
5	Ankur	7	Civil	B1	110
6	Aakash	7	ECE	B1	115
7	Vanishka	8	Civil	B1	110
8	Tanisika	7	CSE	B1	101
9	NULL	NULL	Mech	B1	301

HoD_Name	HoD_P_No
aaa	123
aaa	123
bbb	456
bbb	456
ccc	789
ddd	234
ccc	789
aaa	123

OLTP - Online Transaction Processing
OLAP - Online Analytic Processing

Solution

- Decompose the relation or Table

Student

S_ID	S_Name	Credits	Dept_Name
1	Rahul	5	CSE
2	Jiya	8	CSE
3	Jenny	9	FT
4	Payal	9	FT
5	Ankur	7	Civil
6	Aakash	7	ECE
7	Vanishka	8	Civil
8	Tanisika	7	CSE

Department

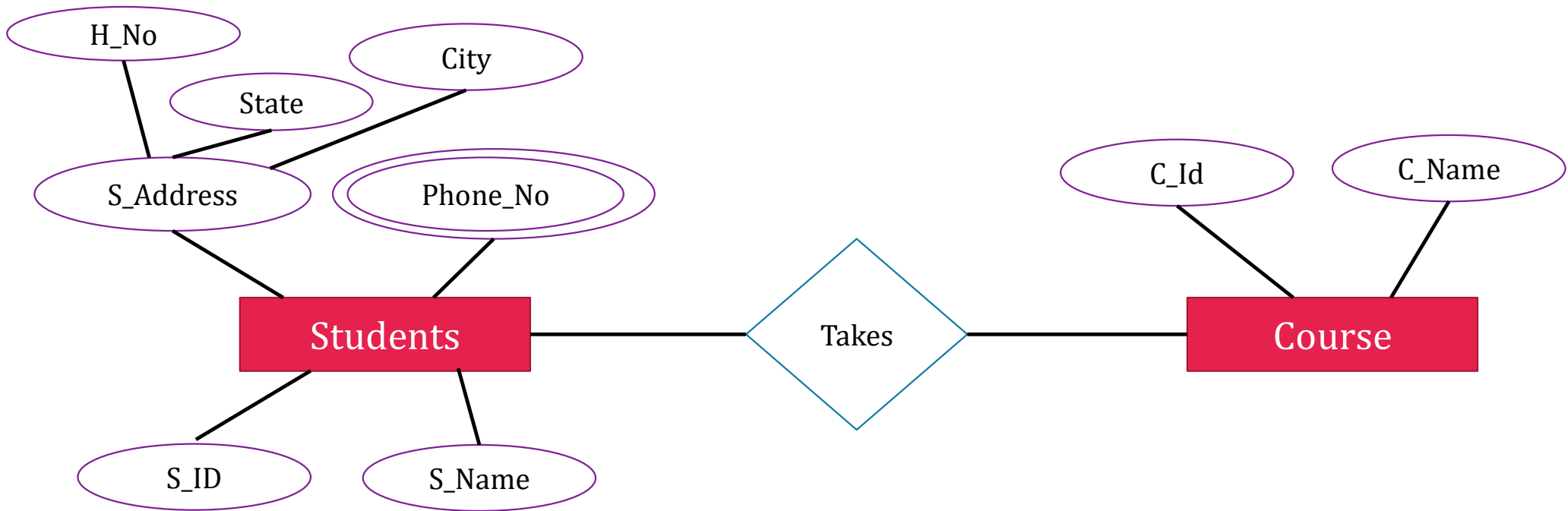
Dept_Name	Building	Room No
CSE	B1	101
CSE	B1	101
FT	B2	201
FT	B2	201
Civil	B1	110
ECE	B1	115
Civil	B1	110
CSE	B1	101



Benefits

- Reduce the redundancy from the table
- Compact the data, save the space
- Remove the I, D, U Anomalies
- Minimize the Null Values
- Simplify the Queries and Simplifies the database Structures

First Normal Form



First Normal Form

Should not contain Composite or multi-valued attribute

S_ID	S_Name	S_Address	Phone_No
1	Jenny	TN , India	P1,P2
2	Payal	Punjab, India	P3
3	Ankur	Rajasthan, India	P4,P5
4	Aakash	Haryana, India	P6
5	Vanishka	Karnataka, India	P7,P8
6	Shanvi	Delhi , India	P9,P10

Each attribute / tuples should be atomic values – cell contain single values

A column should contain from same type / Domain

Each column should have unique name

No Ordering of rows and columns

No Duplicates

First Normal Form

PK

<u>S_ID</u>	S_Name	State	Country
1	Jenny	TN	India
2	Payal	Punjab	India
3	Ankur	Rajasthan	India

S_ID	S_Name	State	Country	Phone_No
1	Jenny	TN	India	P1
1	Jenny	TN	India	P2
2	Payal	Punjab	India	P3
3	Ankur	Rajasthan	India	P4
3	Ankur	Rajasthan	India	P5

S_Id	FK	Phone_No
1		P1
1		P2
2		P3
3		P4
3		P5

S_ID	S_Name	State	Country	Phone_No2	Phone_No2
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Not suitable
Many Null Values

One to Many relationship

Thank You!