15CSE302 Database Management Systems

Lecture 18 **Second Normal Form**

B.Tech /III Year CSE/V Semester **L T P C 2 0 2 3**

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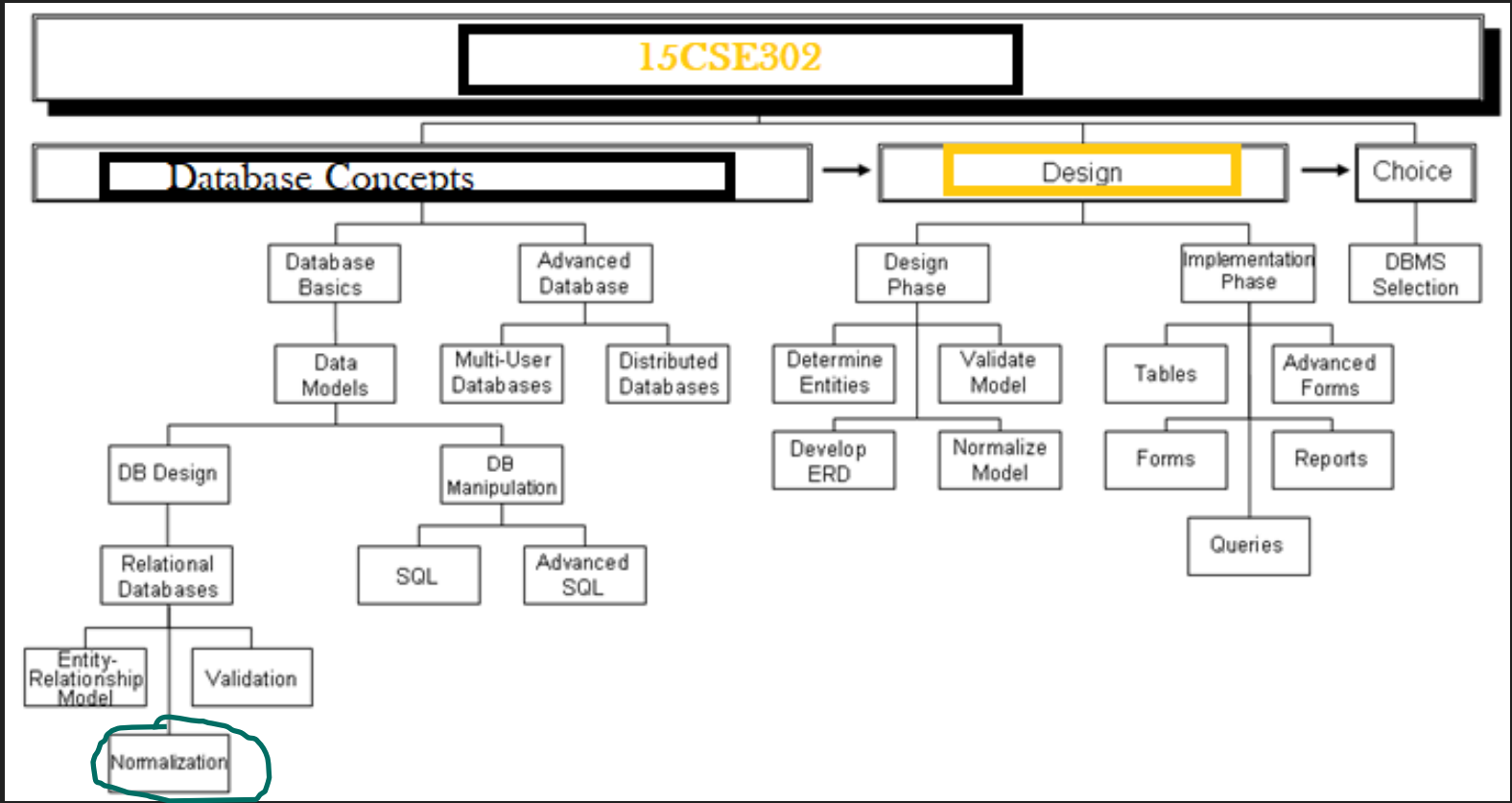
Syllabus


15CSE302
Database Concepts
Design
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Determine Entities
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Normalization

Brief Recap of Previous Lecture

- Functional Dependency
- Armstrong Axioms –Rules for Functional Dependency

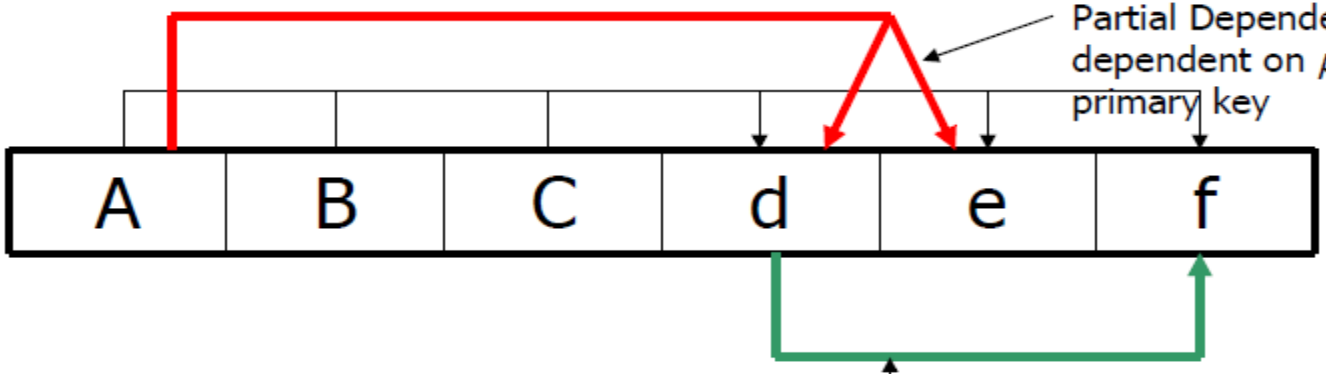
Today we'll discuss

Partial Dependency

Second Normal Form

Dependency Diagram

First Normal Form: identify ***all*** dependencies



Functional Dependency: A, B, C, d, e, f
Partial Dependency: A, d, e
Transitive Dependency: d, f

Transitive Dependency (non-key attribute depends on another non-key attribute)

Full Dependency

- R(S,T,U,V)
- S→T T→U U→V V→S
- S,T,U ,V are candidate keys

Partial Dependency

- Determinant FD is part of Candidate key
- Dependent FD is a Non Prime Attribute

R(A,B,C,D)

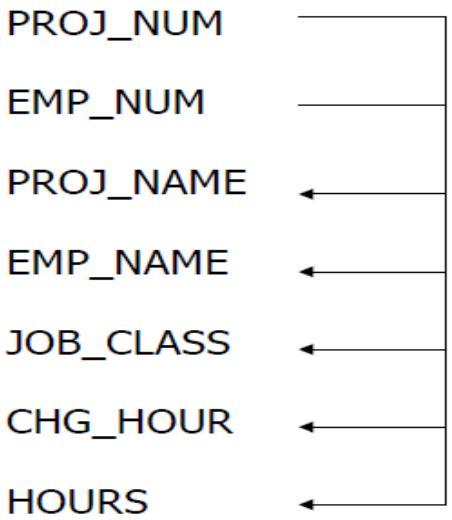
A-> C, B→D

AB is candidate key

A->C A is part of Candidate key,

C is Non Prime Attribute

Dependency Diagram



Functional Dependency: each attribute is uniquely identified by, or is dependent on the primary key.

Primary key is a composite primary key and is made up of PROJ_NUM and EMP_NUM

EMPLOYEE_PROJECT (PROJ_NUM (pk), EMP_NUM (pk), PROJ_NAME, EMP_NAME, JOB_CLASS, CHG_HOUR, HOURS)

First Normal Form (1 NF)

TABLE_PRODUCT

Product ID	Color	Price
1	red, green	15.99
2	yellow	23.99
3	green	17.50
4	yellow, blue	9.99
5	red	29.99

First Normal Form (1 NF)

- A database is in first normal form if it satisfies the following conditions:
  - Contains only atomic values
  - There are no repeating groups

TABLE_PRODUCT

Product ID	Color	Price
1	red, green	15.99
2	yellow	23.99
3	green	17.50
4	yellow, blue	9.99
5	red	29.99

- An atomic value is a value that cannot be divided.
- For example, in the table shown below, the values in the [Color] column in the first row can be divided into "red" and "green", hence [TABLE_PRODUCT] is not in 1NF.

First Normal Form (1 NF)

- This table is not in first normal form because the [Color] column can contain multiple values. For example, the first row includes values "red" and "green."
- To bring this table to first normal form, we split the table into two tables and now we have the resulting tables:

TABLE_PRODUCT

Product ID	Color	Price
1	red, green	15.99
2	yellow	23.99
3	green	17.50
4	yellow, blue	9.99
5	red	29.99

First Normal Form (1 NF)

TABLE_PRODUCT_PRICE

Product ID	Price
1	15.99
2	23.99
3	17.50
4	9.99
5	29.99

TABLE_PRODUCT_COLOR

Product ID	Color
1	red
1	green
2	yellow
3	green
4	yellow
4	blue
5	red

Second Normal Form (2NF).

A database is in **second normal form** if it satisfies the following conditions:

- It is in first normal form
- All non-key attributes are fully functional dependent on the primary key

Second Normal Form (2NF).

- In a table, if attribute B is functionally dependent on A,
  - but is not functionally dependent on a proper subset of A, then B is considered fully functional dependent on A.
- If a table is in 2NF , all non-key attributes cannot be dependent on a subset of the primary key.

Second Normal Form (2NF).

- Note that if the primary key is not a composite key, all non-key attributes are always fully functional dependent on the primary key.
- A table that is in 1st normal form and contains only a single key as the primary key is automatically in 2nd normal form.

Second Normal Form (2NF)

Second Normal Form Example

Consider the following example:

TABLE_PURCHASE_DETAIL

Customer ID	Store ID	Purchase Location
1	1	Los Angeles
1	3	San Francisco
2	1	Los Angeles
3	2	New York
4	3	San Francisco

Second Normal Form (2NF).

TABLE_PURCHASE_DETAIL

Customer ID	Store ID	Purchase Location
1	1	Los Angeles
1	3	San Francisco
2	1	Los Angeles
3	2	New York
4	3	San Francisco

2nd Normal Form Example
Consider the following example:

- This table has a composite primary key [Customer ID, Store ID].
- The non-key attribute is [Purchase Location].
- In this case, [Purchase Location] only depends on [Store ID], which is only part of the primary key.
- Therefore, this table does not satisfy second normal form.
- To bring this table to second normal form, we decompose the table into two tables, and now we have the following:

Second Normal Form (2NF).

- **Second Normal Form Example**

TABLE_PURCHASE

Customer ID	Store ID
1	1
1	3
2	1
3	2
4	3

TABLE_STORE

Store ID	Purchase Location
1	Los Angeles
2	New York
3	San Francisco

Second Normal Form (2NF).

Second Normal Form Example

- What we have done is to remove the partial functional dependency

- Now, in the table [TABLE_STORE], the column [Purchase Location] is fully dependent on the primary key of that table, which is [Store ID].

First normal form (1NF)

- First normal form: **A relation is in first normal form if every attribute in every row can contain only one single (atomic) value.**
- A university uses the following relation:

Student(Surname, Name, Skills)

First normal form (1NF)

- A university uses the following relation:

  Student(Surname, Name, Skills)

  The attribute Skills can contain multiple values and therefore the relation is not in the first normal form.

  But the attributes Name and Surname are atomic attributes that can contain only one value.

First Normal Form(1NF)

Students

FirstName	LastName	Knowledge
Thomas	Mueller	Java, C++, PHP
Ursula	Meier	PHP, Java
Igor	Mueller	C++, Java

Startsituation

Result after Normalisation

Students

FirstName	LastName	Knowledge
Thomas	Mueller	C++
Thomas	Mueller	PHP
Thomas	Mueller	Java
Ursula	Meier	Java
Ursula	Meier	PHP
Igor	Mueller	Java
Igor	Mueller	C++

References

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Summary

- Partial Dependency
- Second Normal Form

Next Lecture

Transitive dependency

Third Normal Form

Thank You

Happy to answer any questions ! ! !