15CSE302 Database Management Systems

Lecture 17 **Functional Dependency**

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

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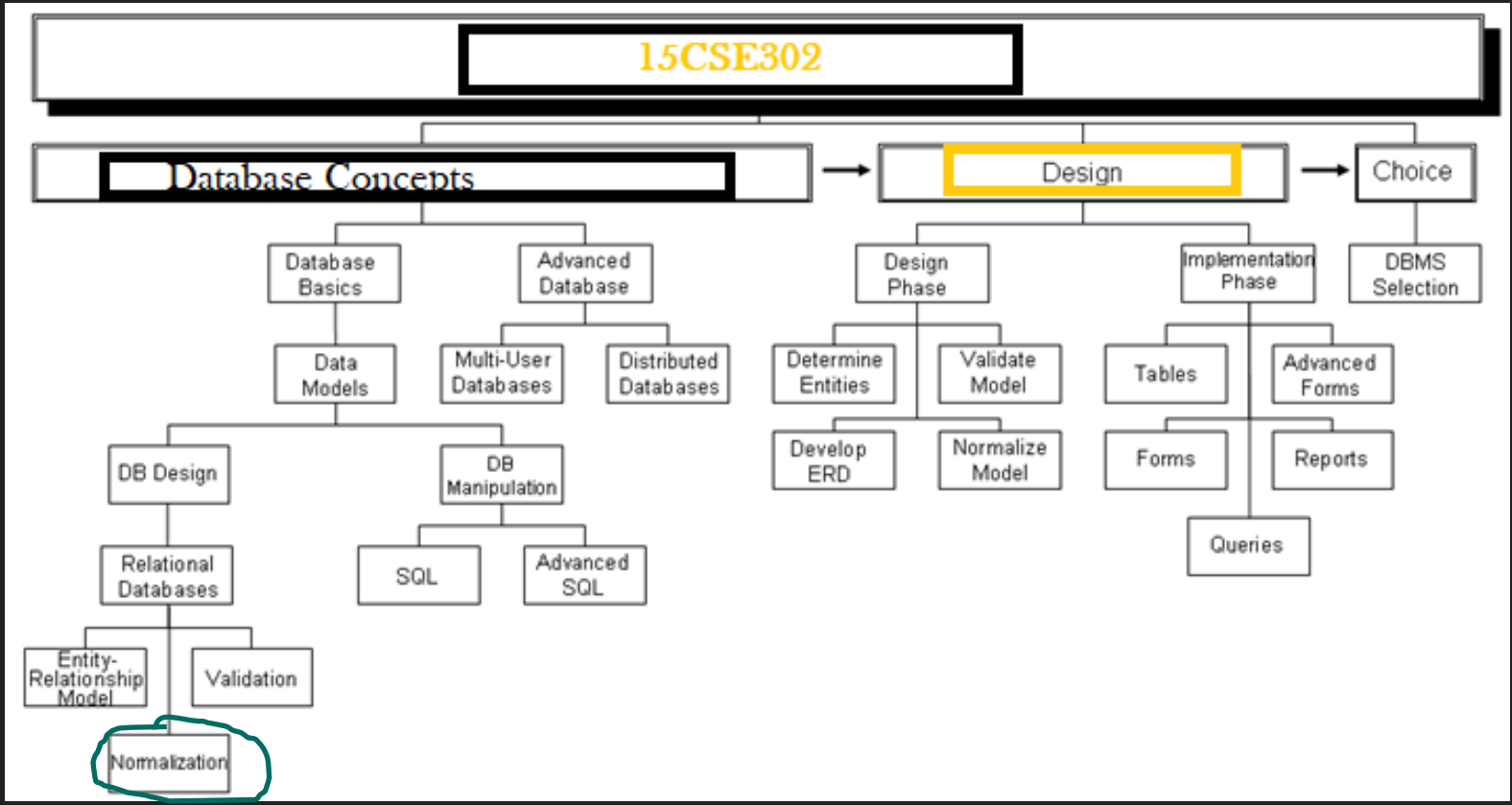
Syllabus


15CSE302
Database Concepts
Design
Choice
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Determine Entities
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Validation
Normalization

Brief Recap of Previous Lecture

- First Normal Form
- Examples

Today we'll discuss

Functional Dependency

Armstrong Axioms –Rules for Functional Dependency

Overview

Today we'll discuss

- Functional Dependency
- Armstrong Axioms –Rules for Functional Dependency

Functional Dependency

- **Functional dependency** is a relationship that exists when one attribute uniquely determines another attribute.

- If R is a relation with attributes X and Y, a **functional dependency** between the attributes is represented as

X->Y

which specifies **Y is functionally dependent on X.**

Functional Dependency

- A **Functional Dependency** (FD) is a relationship between or among attributes

i.e. given a unique value for one or more attributes, such as the **CustomerAccountNumber**, we can find a corresponding value for another attribute such as the **CustomerBalance** attribute.

- Equations represent functional dependencies.

Consider the equation:

- **TotalPrice = ItemPrice x Quantity**

Functional Dependency

- Unlike equations, however, **FDs** cannot be worked out using arithmetic; instead, they are listed in the database.
- **FDs** are written following standard notation.
- For example, if the attribute **A** determines the attribute **B**, we write the notation:

A -> B (read A functionally determines B)

- The attribute "**A**" is called a **determinant**, here it is a determinant of **B**.

Armstrong Axioms-Rules of Functional Dependencies

- Reflexive rule
- Augmentation rule
- Transitivity rule
- Union rule
- Decomposition rule
- Pseudotransitivity rule

Armstrong Axioms-Rules of Functional Dependencies

If **W**, **X**, **Y**, and **Z** are attributes of a table, then:

Reflexive rule **X -> X**

It means that if we know X, then we know X.

Augmentation rule **If X-> Y, then XZ ->Y**

Note :Y is not really dependent on Z, but if we know X and can determine a value for Y from X, then knowing Z has no effect on our ability to determine a value for Y.

Armstrong Axioms -Rules of Functional Dependencies

- If **W**, **X**, **Y**, and **Z** are attributes of a table, then:
- TRANSITIVITY RULE
  - **If X -> Y and Y ->Z, then X -> Z**
    - (transitivity rule - useful for avoiding transitive dependencies).

Armstrong Axioms -Rules of Functional Dependencies

If **W**, **X**, **Y**, and **Z** are attributes of a table, then:

UNION RULE

If X -> Y and X ->Z, then X -> YZ

union rule - useful for combining tables

Armstrong Axioms -Rules of Functional Dependencies

If **W**, **X**, **Y**, and **Z** are attributes of a table, then:

DECOMPOSITION RULE

If X -> Y then X -> Z , if Z is a subset of Y

Armstrong Axioms -Rules of Functional Dependencies

If **W**, **X**, **Y**, and **Z** are attributes of a table, then:

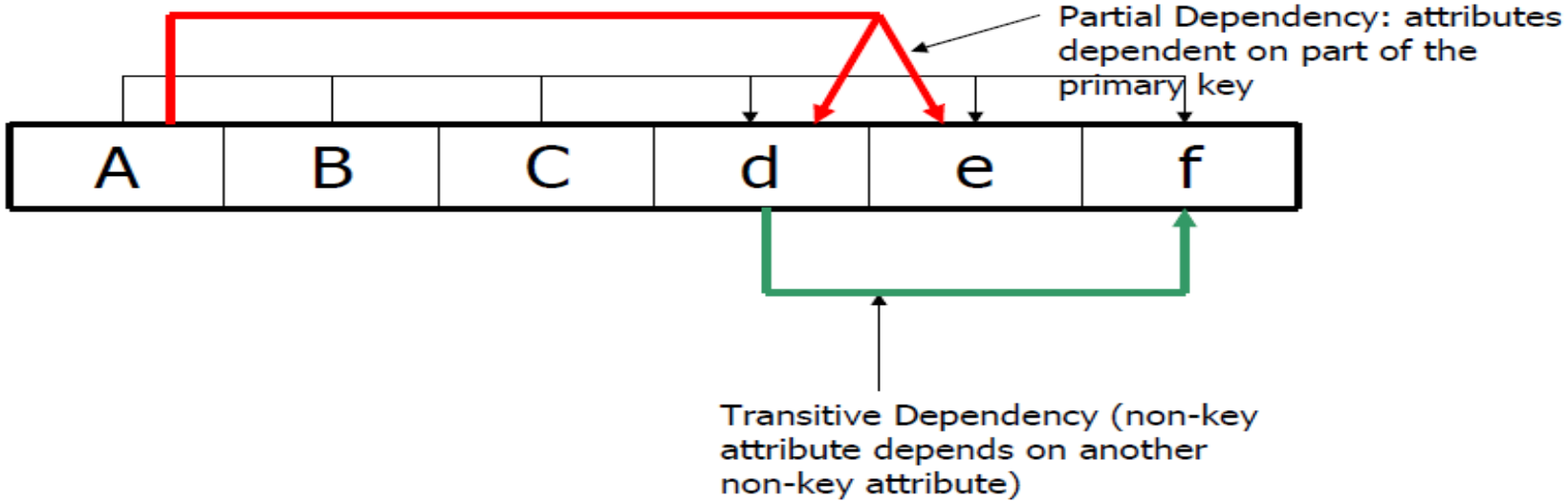
PSEUDOTRANSITIVITY RULE

If X -> Y and YZ -> W, then XZ -> W

useful in understanding multivalued dependencies.

Dependency Diagram

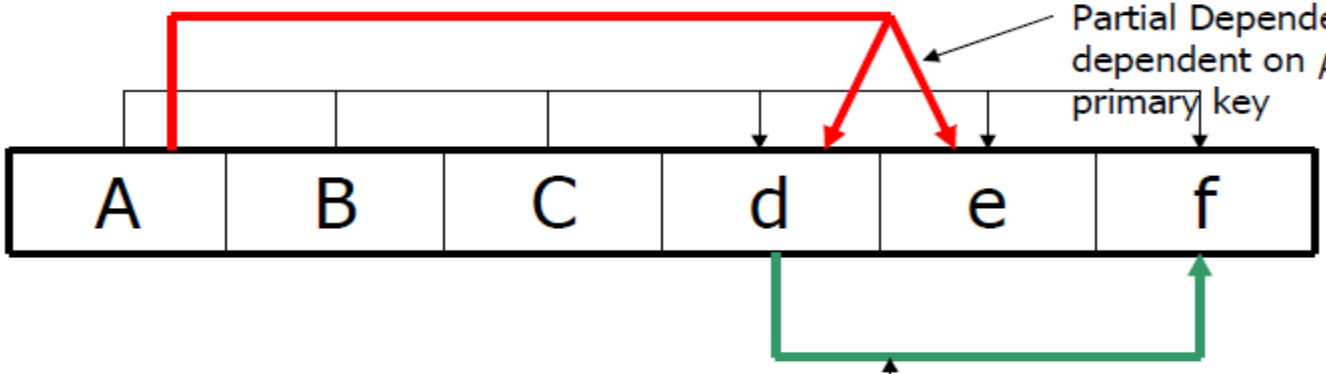
First Normal Form: identify dependencies



Note: Capital letters refer to primary key, lower case letters refer to attributes.

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)

References

- Hillyer Mike, MySQL AB. An Introduction to Database Normalization, http://dev.mysql.com/tech-resources/articles/intro-to-normalization.html, accessed October 17, 2006.

- Microsoft. Description of the database normalization basics, http://support.microsoft.com/kb/283878 , accessed October 17, 2006.

- Wikipedia. Database Normalization. http://en.wikipedia.org/wiki/Database_normalization.html , accessed October 17, 2006.
https://www.db-book.com/db6/index.html
- https://www.youtube.com/watch?v=mfVCesoMaGA&list=PLroEs25KGvwzmvIxYHRhoGTz9w8LeXek0&index=22

Summary

- Functional Dependency

Next Lecture

Second Normal Form

Thank You

Happy to answer any questions ! ! !