



Business School
UNIVERSITY OF COLORADO **DENVER**

Information Systems Program

Module 11

Normalization Concepts and Practice

Lesson 3: Normal Forms

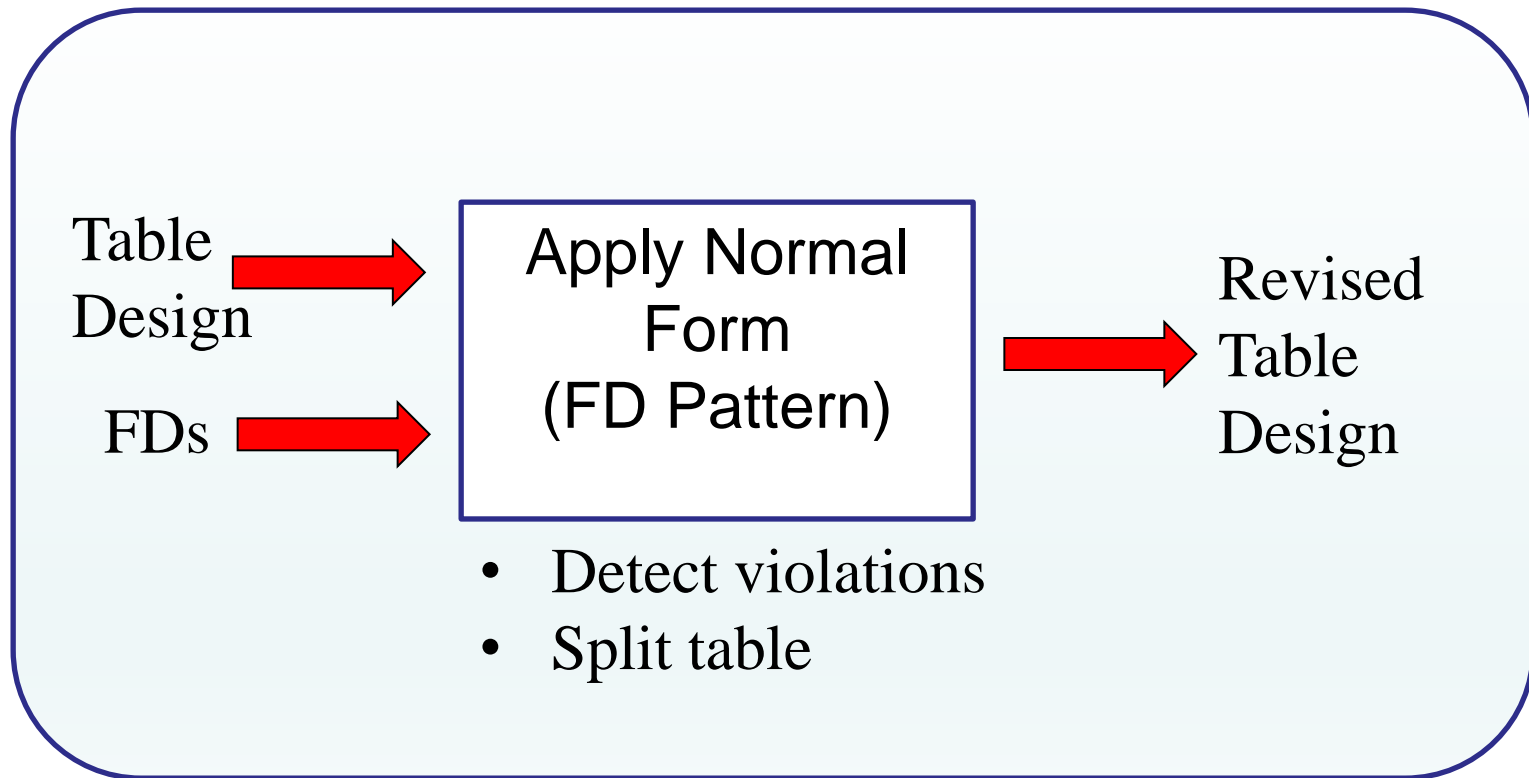


Lesson Objectives

- Understand the nature of normal forms
- Define Boyce-Codd Normal Form (BCNF)
- Apply BCNF to a list of functional dependencies



Normalization

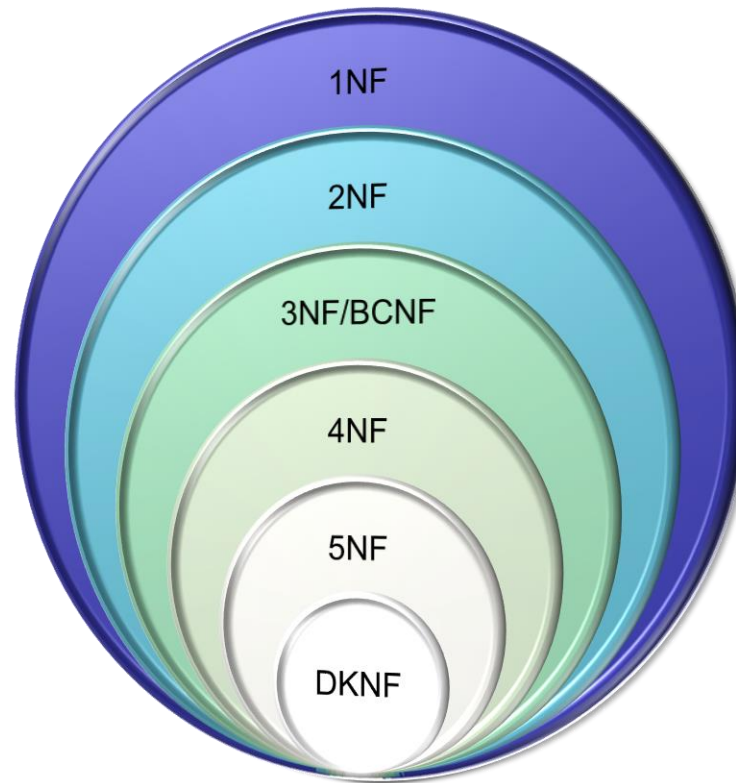


Normalization Simplification

- Determination of a complete and minimal list of FDs
- Determination of unique columns from FDs
- Details too complex and specialized for this course



Relationships of Normal Forms



Boyce-Codd Normal Form (BCNF)

Simple
definition

Every
determinant
must be
unique.

Apply with
BCNF
procedure



Big University Database Table

<u>StdNo</u>	StdEmail	StdClass	<u>OfferNo</u>	OffYear	EnrGrade	CourseNo	CrsDesc
S1	joe@bigu.edu	JUN	O1	2020	3.5	C1	DB
S1	sue@bigu.edu	JUN	O2	2020	3.3	C2	VB
S2	mj@bigu.edu	JUN	O3	2021	3.1	C3	OO
S2	tom@bigu.edu	JUN	O2	2020	3.4	C2	VB

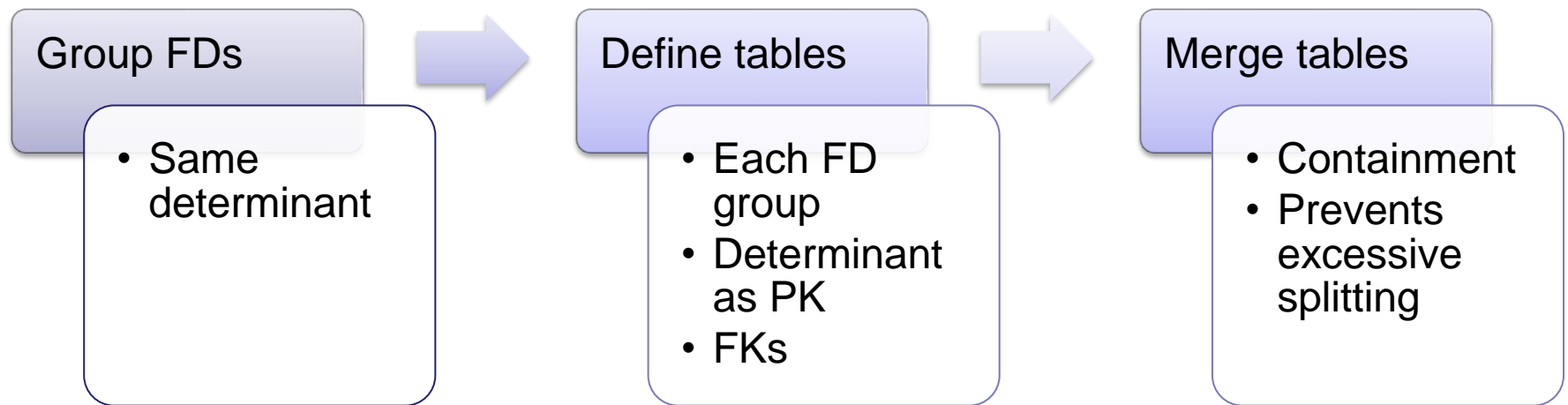


BCNF Example

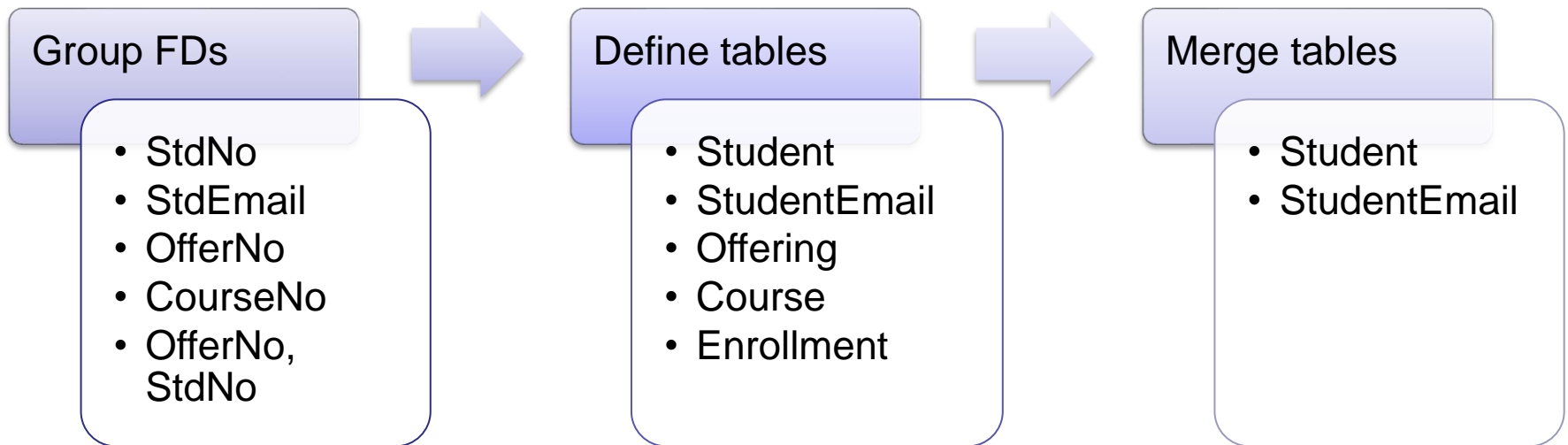
- Unique columns in the big university table
 - $\langle \text{StdNo}, \text{OfferNo} \rangle$
 - $\langle \text{StdEmail}, \text{OfferNo} \rangle$
- Many BCNF violations
 - ✓ $\text{StdNo} \rightarrow \text{StdCity}, \text{StdClass}, \text{StdEmail}$
 - ✓ $\text{StdEmail} \rightarrow \text{StdNo}$
 - ✓ $\text{OfferNo} \rightarrow \text{OffTerm}, \text{OffYear}, \text{CourseNo}$
 - ✓ $\text{CourseNo} \rightarrow \text{CrsDesc}$
 - $\text{StdNo}, \text{OfferNo} \rightarrow \text{EnrGrade}$



BCNF Procedure



BCNF Procedure Example



FKs in step 2

- Student.StdEmail,
- StudentEmail.StdNo
- Offering.CourseNo
- Enrollment.StdNo, Enrollment.OfferNo

Merging Tables

- Step 2 defines too many tables when two columns determine each other.
 - StdNo \rightarrow StdEmail
 - StdEmail \rightarrow StdNo
- Merge tables with a containment relationship
 - Student(StdNo, StdEmail, StdCity, StdClass)
 - StudentEmail(StdEmail, StdNo)
 - Merge tables because Student contains columns of StdEmail
- Multiple unique columns do not violate BCNF



Summary

- Covered general idea of normal forms and details of BCNF
- Know BCNF definition and simplified procedure
- Study examples for work on practice and graded problems

