Module 11
Normalization Concepts and Practice
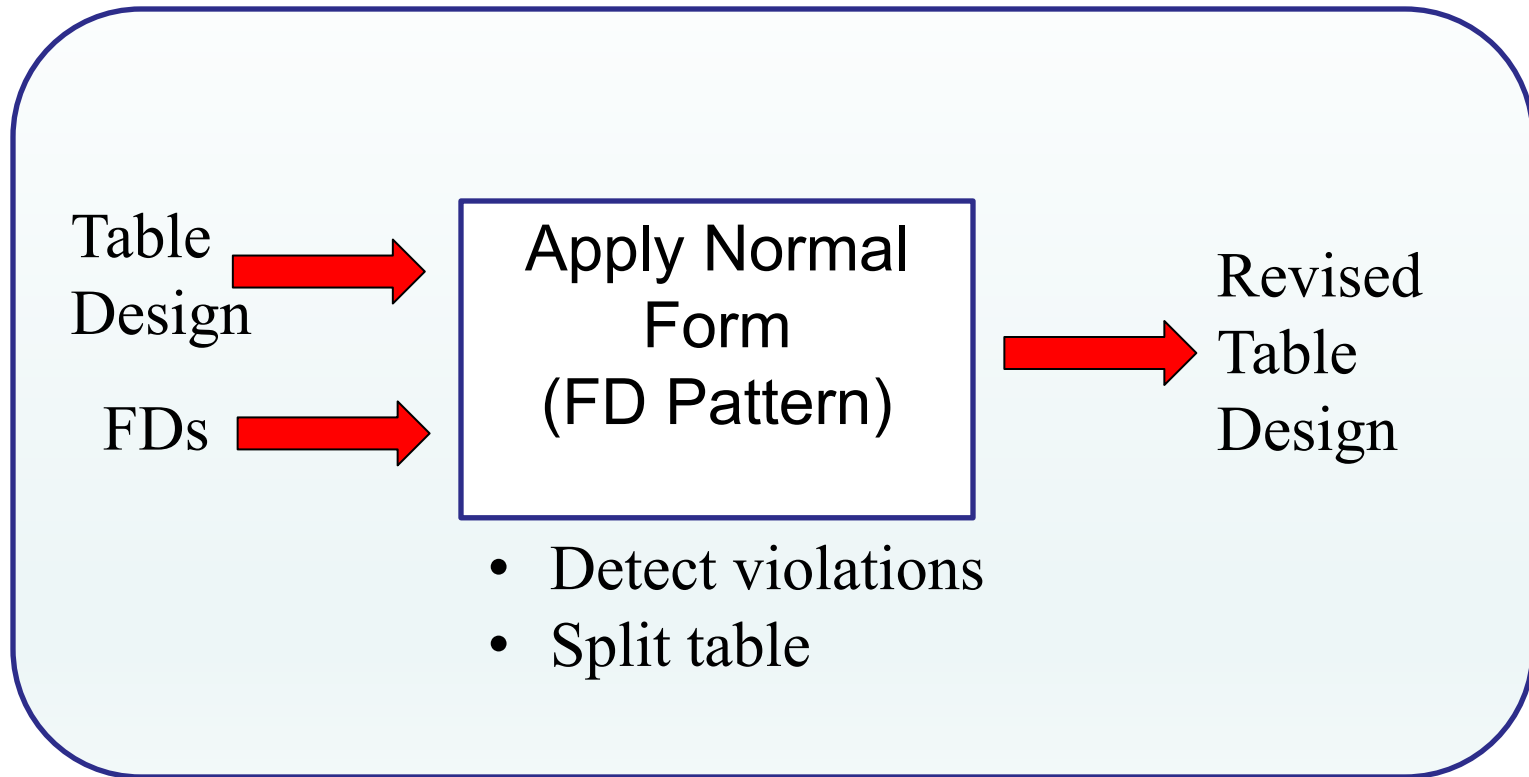
Lesson 3: Normal Forms

Lesson Objectives

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

Normalization

Table Design → Apply Normal Form (FD Pattern) → Revised Table Design

FDs →

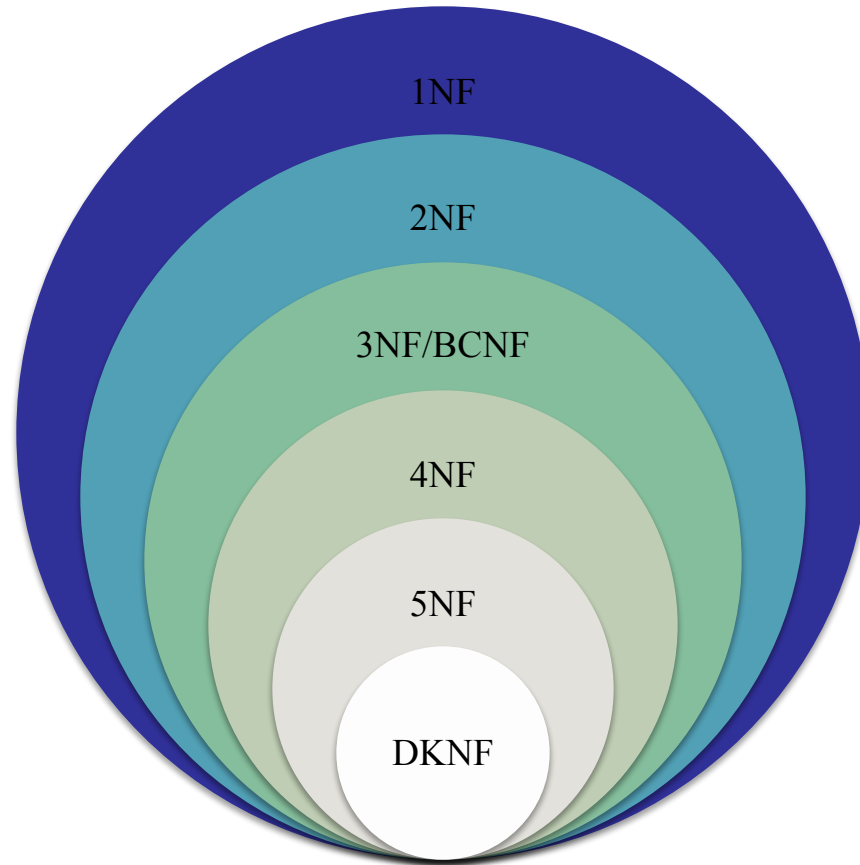- Detect violations
- Split table

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

1NF
2NF
3NF/BCNF
4NF
5NF
DKNF

Boyce-Codd Normal Form (BCNF)

Simple definition

Every determinant must be unique.

Apply with BCNF procedure

Big University Database Table

StdNo	StdEmail	StdClass	OfferNo	OffYear	EnrGrade	CourseNo	CrsDesc
S1	joe@bigu.edu	JUN	O1	2017	3.5	C1	DB
S1	sue@bigu.edu	JUN	O2	2017	3.3	C2	VB
S2	mj@bigu.edu	JUN	O3	2018	3.1	C3	OO
S2	tom@bigu.edu	JUN	O2	2017	3.4	C2	VB

Business School
UNIVERSITY OF COLORADO DENVER

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BCNF Example

- Unique columns in the big university table
  - <StdNo, OfferNo>
  - <StdEmail, OfferNo>
- Many BCNF violations
  - ✔ StdNo → StdCity, StdClass, StdEmail
  - ✔ StdEmail → StdNo
  - ✔ OfferNo → OffTerm, OffYear, CourseNo
  - ✔ CourseNo → CrsDesc
  - StdNo, OfferNo → EnrGrade

BCNF Procedure

Group FDs
- Same determinant

Define tables
- Each FD group
- Determinant as PK
- FKs

Merge tables
- Containment
- Prevents excessive splitting

Information Systems Program

BCNF Procedure Example

Group FDs

- StdNo
- StdEmail
- OfferNo
- CourseNo
- OfferNo, StdNo

→

Define tables

- Student
- StudentEmail
- Offering
- Course
- Enrollment

→

Merge tables
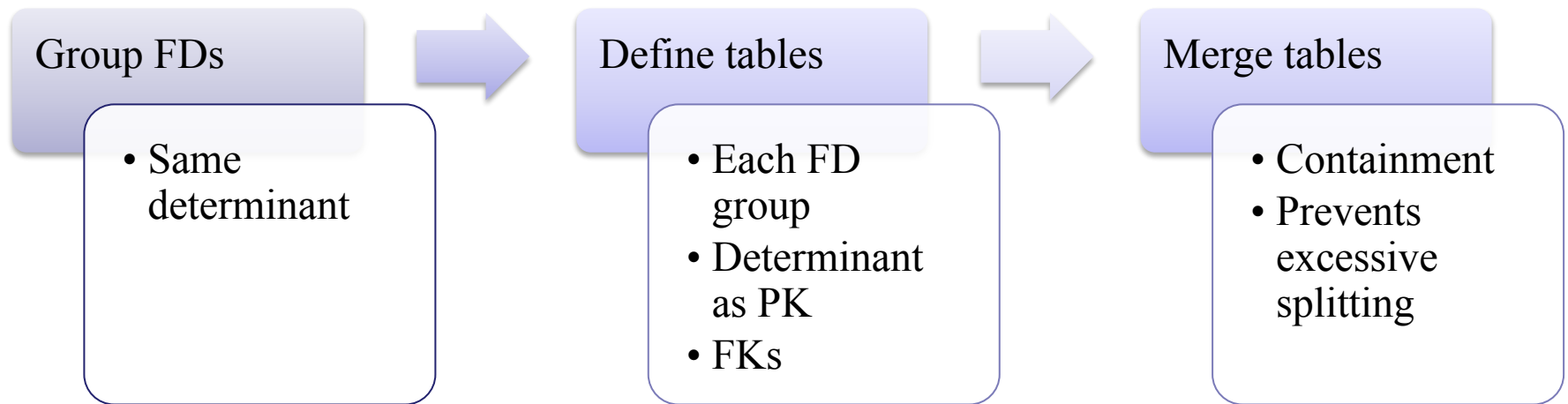
- Student
- StudentEmail
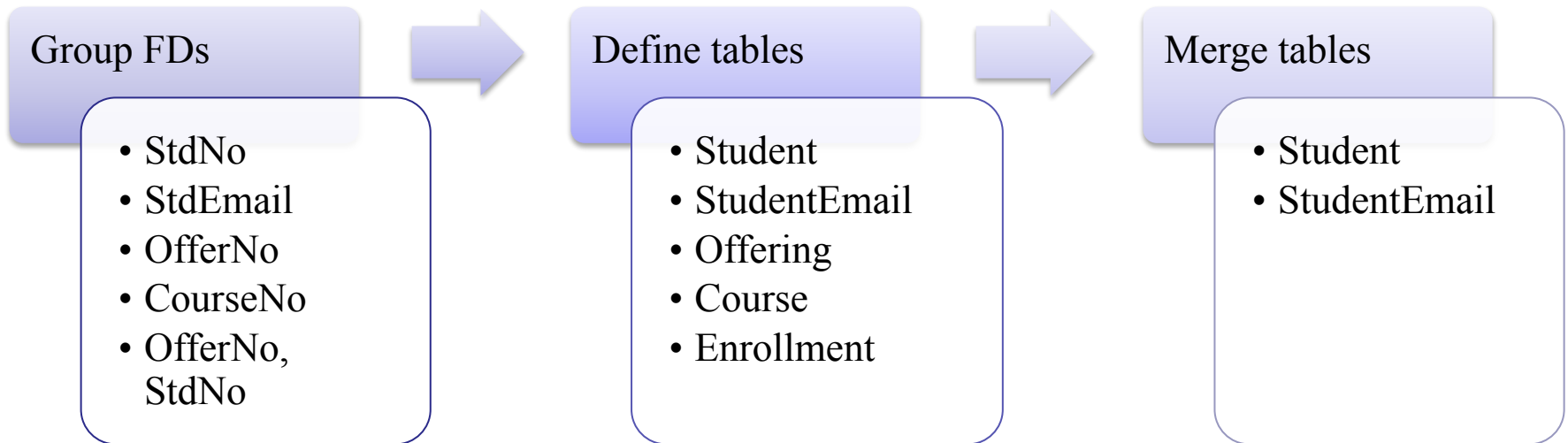
FKs in step 2
- Student.StdEmail,
- StudentEmail.StdNo
- Offering.CourseNo
- Enrollment.StdNo, Enrollment.OfferNo

Merging Tables

- Step 2 defines too many tables when two columns determine each other.
  - StdNo → StdEmail
  - StdEmail → StdNo
- Merge tables with a containment relationship
  - Student(StdNo, StdEmail, StdCity, StdClass)
  - StudentEmail(<u>StdEmail</u>, 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