Business School
UNIVERSITY OF COLORADO DENVER

Information Systems Program

Module 11
Normalization Concepts and Practice

Lesson 5: Normalization problems

Lesson Objectives

- Gain confidence on practice problems
- Identify modification anomalies
- Identify sample rows that falsify FDs
- Apply both conversion rules and normalization

Modification Anomaly Problem

Big University Table

StdNo	StdCity	StdClass	OfferNo	OffTerm	OffYear	EnrGrade	CourseNo	CrsDesc
S1	SEATTLE	JUN	O1	FALL	2017	3.5	C1	DB
S1	SEATTLE	JUN	O2	FALL	2017	3.3	C2	VB
S2	BOTHELL	JUN	O3	SPRING	2018	3.1	C3	OO
S2	BOTHELL	JUN	O2	FALL	2017	3.4	C2	VB

Problem requirements

- Specify one insert, update, and deletion anomaly
- Each anomaly should involve student representation in the table.

Modification Anomaly Problem Solution

Big University Table

StdNo	StdCity	StdClass	OfferNo	OffTerm	OffYear	EnrGrade	CourseNo	CrsDesc
S1	SEATTLE	JUN	O1	FALL	2017	3.5	C1	DB
S1	SEATTLE	JUN	O2	FALL	2017	3.3	C2	VB
S2	BOTHELL	JUN	O3	SPRING	2018	3.1	C3	OO
S2	BOTHELL	JUN	O2	FALL	2017	3.4	C2	VB

Problem solution

- Insertion anomaly: cannot insert a student (S3) unless an OfferNo is provided.
- Update anomaly: must change multiple rows if S1 moves to a different city.
- Deletion anomaly: deleting third row also removes details about offering O3 and course C3.

FD Falsification Problem

Big University Table

StdNo	StdCity	StdClass	OfferNo	OffTerm	OffYear	EnrGrade	CourseNo	CrsDesc
S1	SEATTLE	JUN	O1	FALL	2017	3.5	C1	DB
S1	SEATTLE	JUN	O2	FALL	2017	3.3	C2	VB
S2	BOTHELL	JUN	O3	SPRING	2018	3.1	C3	OO
S2	BOTHELL	JUN	O2	FALL	2017	3.4	C2	VB

Problem requirements

- List possible FDs with StdCity as determinant (LHS)
- Identify at least one falsification if it exists for each FD
  - Pair of sample rows for an FD falsification
  - Same LHS (determinant) value in each row but a different RHS value

FD Falsification Problem Solution

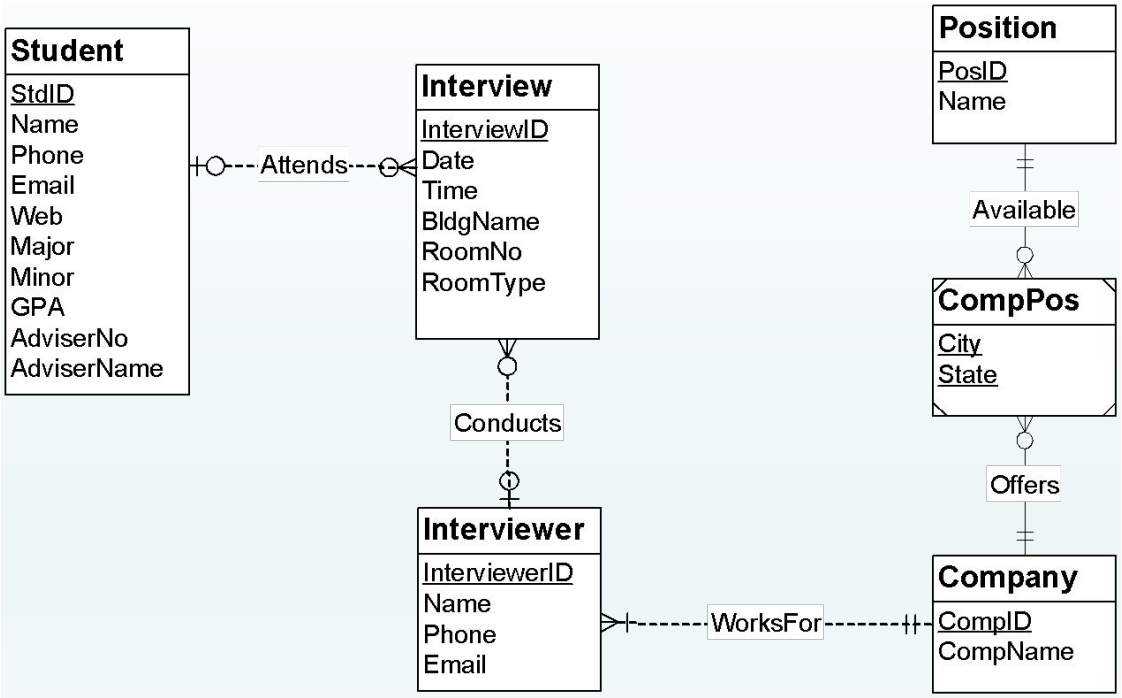
Big University Table

StdNo	StdCity	StdClass	OfferNo	OffTerm	OffYear	EnrGrade	CourseNo	CrsDesc
S1	SEATTLE	JUN	O1	FALL	2017	3.5	C1	DB
S1	SEATTLE	JUN	O2	FALL	2017	3.3	C2	VB
S2	BOTHELL	JUN	O3	SPRING	2018	3.1	C3	OO
S2	BOTHELL	JUN	O2	FALL	2017	3.4	C2	VB

FD Falsification List

FD	Falsifications
StdCity → *OfferNo*	(1,2), (3,4)
StdCity → *OffTerm*	(3,4)
StdCity → *EnrGrade*	?, ?
StdCity → *CourseNo*	?, ?
StdCity → *CrsDesc*	?, ?
StdCity → *OffYear*	?, ?
StdCity → *StdNo*	None
StdCity → *StdClass*	?,?

Conversion/Normalization Problem



Problem requirements

- Convert the ERD into tables using the conversion rules
- For each table, list FDs and split if the table violates BCNF.

Conversion Rule Application

Entity type rule

- Student, Interview
- Interviewer
- Company
- Position, CompPos

1-M relationship rule

- Interview: StdId (O), InterviewerId (O)
- Interviewer: CompId
- CompPos: CompId, PosId

M-N relationship rule

- Not used

Identifying relationship rule

- CompPos.PosId (PK)
- CompPos.CompId (PK)

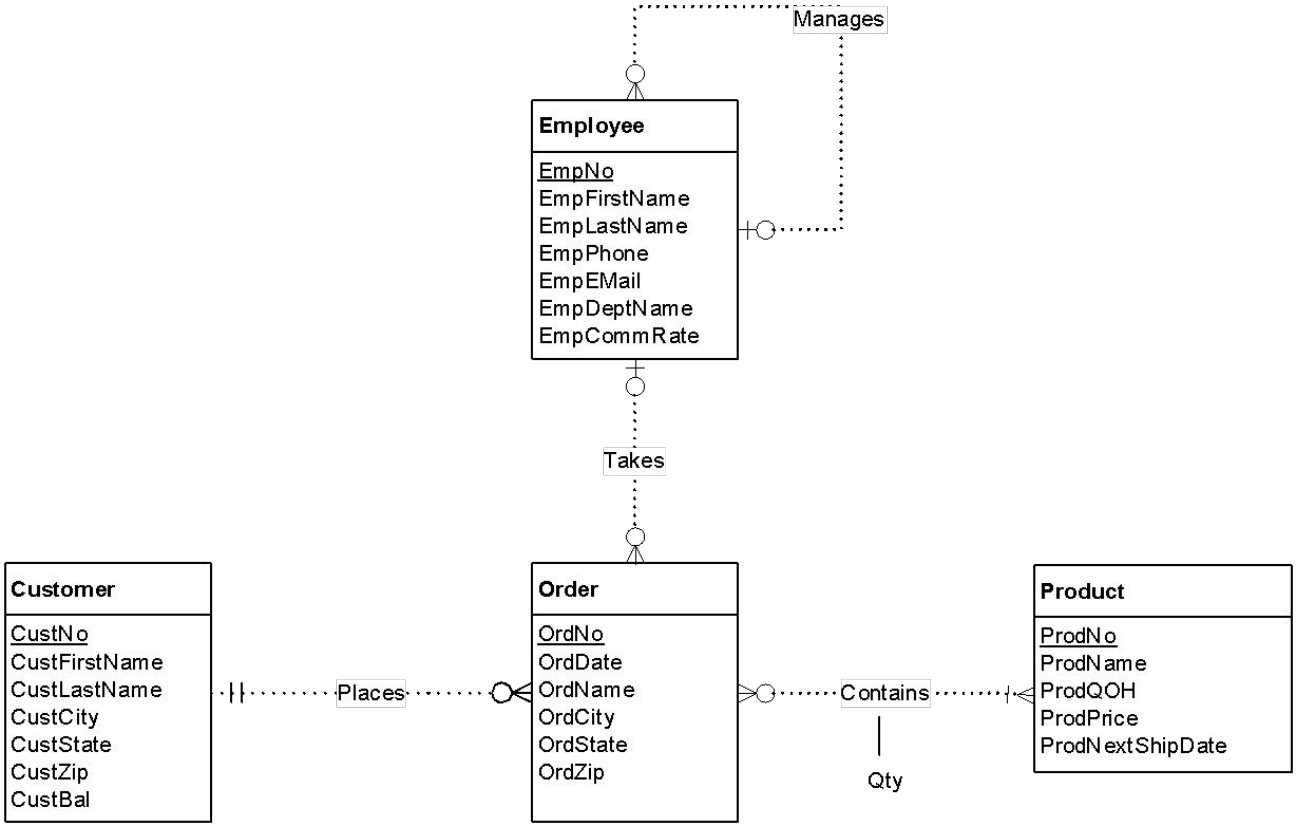
Additional Normalization

- Only list FDs not implied by PKs
- Additional FDs
  - AdviserNo → AdviserName
  - Possible FD: BldgName, RoomNo → RoomType
  - Possible FD: RoomNo → BldgName, RoomType

Summary

- Practice using sample rows to falsify FDs
- Practice combining conversion and normalization
- Useful practical skills

Practice Conversion Problem



Conversion Rule Application