



Business School
UNIVERSITY OF COLORADO DENVER

Information Systems Program

Module 7

ERD Rules and Problem Solving

Lesson 1: Basic Diagram Rules



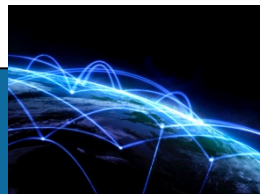
Lesson Objectives

- Apply completeness diagram rules to avoid obvious omissions
- Explain limitations of diagram rules



Diagram Rules

- Ensure that ERD notation is correctly used
- Similar to syntax rules for a computer language
- Completeness rules: no missing specifications

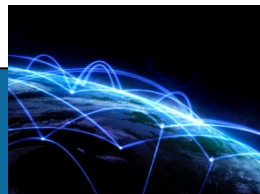
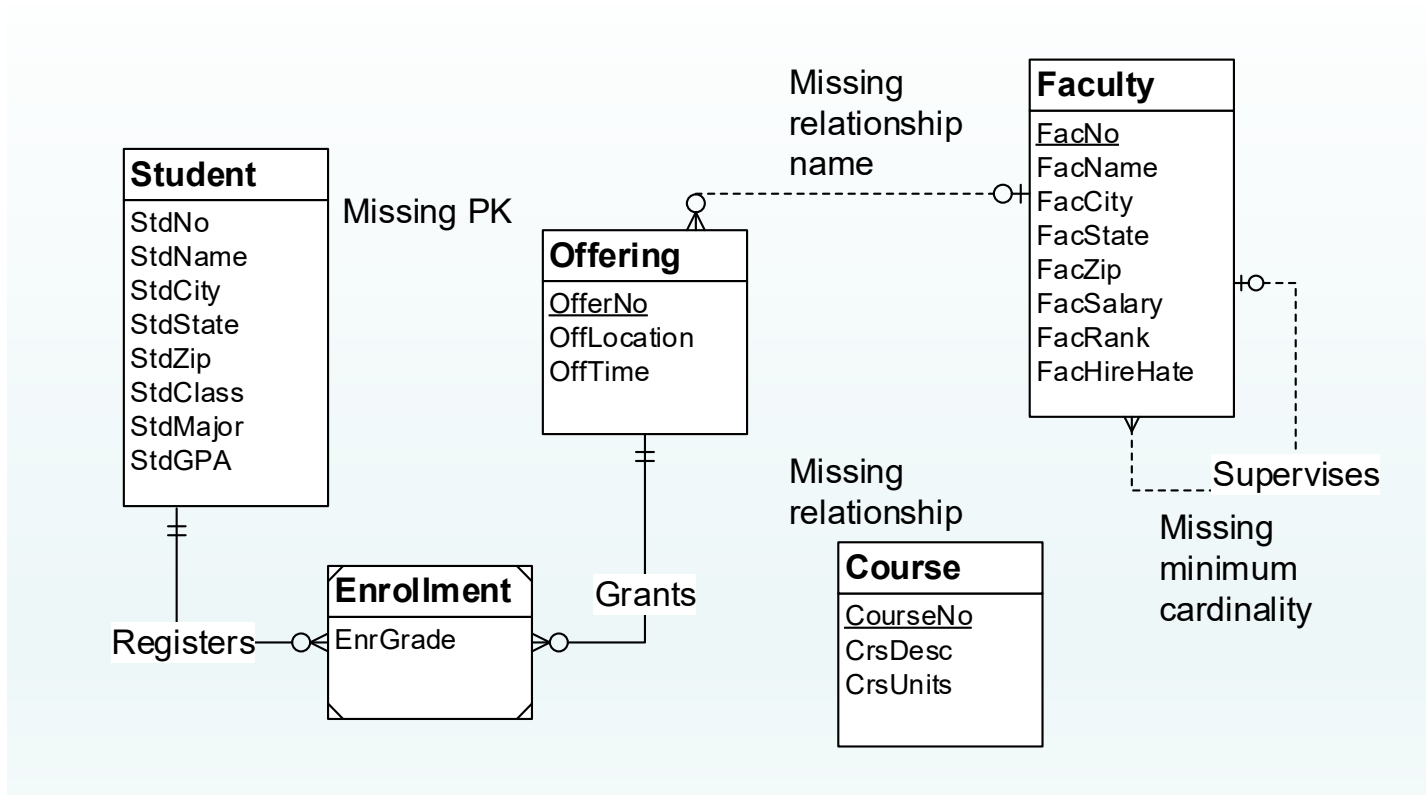


Completeness Rules

- Primary Key Rule: all entity types have a PK (direct or indirect)
- Naming Rule: all entity types, relationships, and attributes have a name
- Cardinality Rule: cardinality is specified in both directions for each relationship
- Entity Participation Rule: all entity types participate in an at least one relationship



Completeness Rule Violations



Primary Key Rule Issue

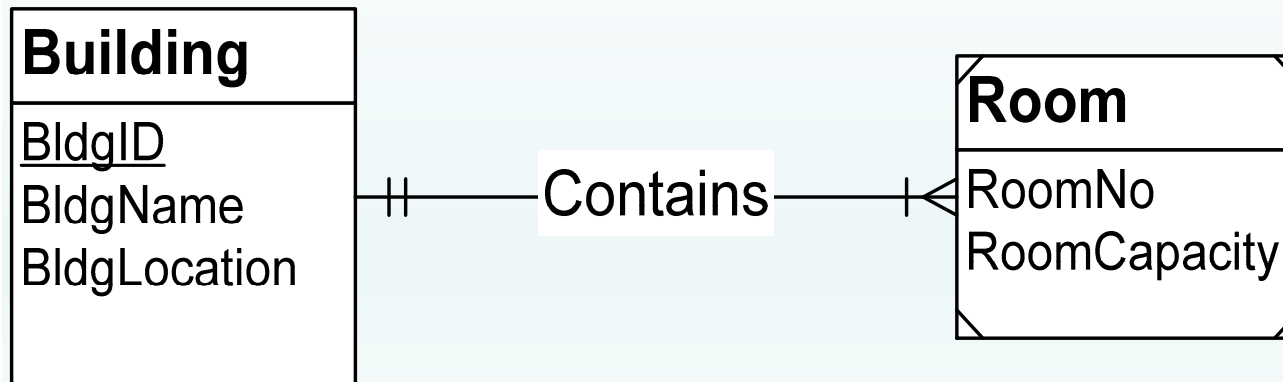
- Primary key rule is simple in most cases
- For some weak entity types, the PK rule is subtle
 - Weak entity type with only one 1-M identifying relationship
 - Weak entity type must have a local key to augment the borrowed PK from the parent entity type
 - Violation of PK rule if local key is missing



PK Rule Violation Example

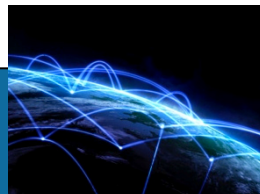
PK rule violation

- A single 1-M identifying relationship
- Room does not have a local key.



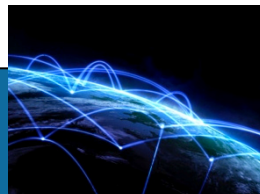
Naming Consistency Rules

- Entity Name Rule: entity type names must be unique
- Attribute Name Rule: attribute names must be unique within each entity type and relationship



Summary

- Use the diagram rules to ensure structural consistency and completeness
- Completeness easy to check





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Lesson 2: Extended Diagram Rules



Lesson Objectives

- Apply diagram rules to detect consistency errors in identification dependency representation
- Eliminate redundant foreign keys in an ERD
- Explain limitations of diagram rules



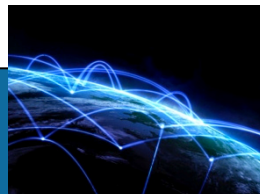
Diagram Rules

- Ensure that ERD notation is correctly used
- Similar to syntax rules for a computer language
- Consistency rules: no conflicts among specifications
- Supported by the ER Assistant

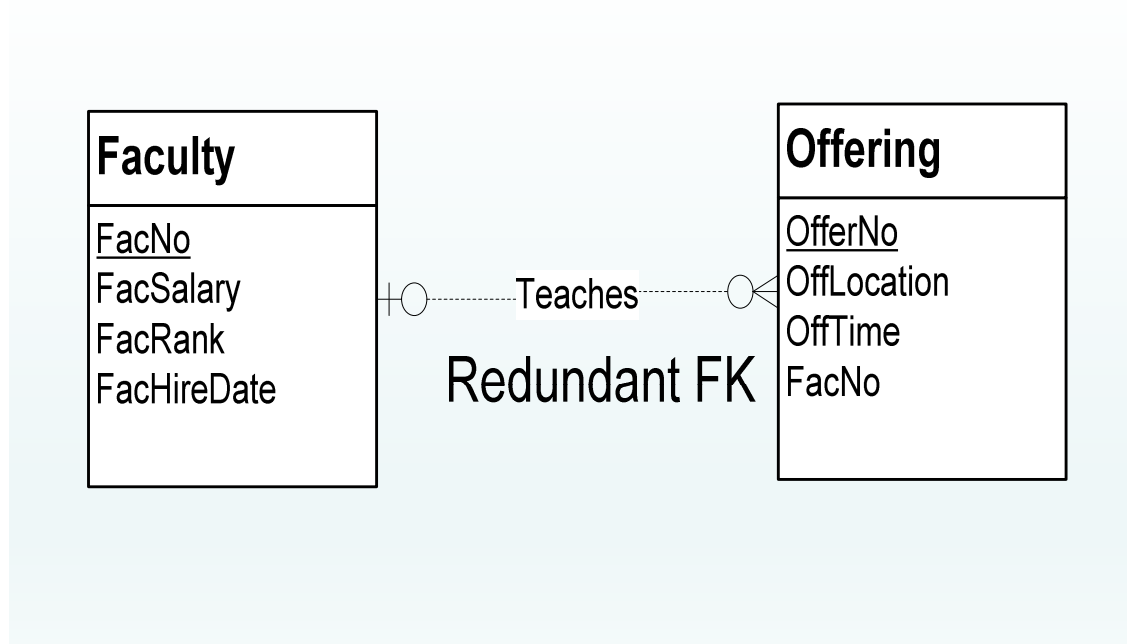


Connection Consistency Rules

- Relationship/Entity Connection Rule: relationships connect two entity types (not necessarily distinct)
- Relationship/Relationship Connection Rule: relationships are not connected to other relationships
- Redundant Foreign Key Rule: foreign keys are not used.



Redundant FK Violation

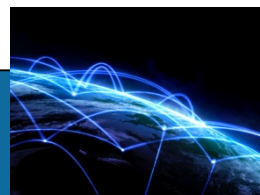
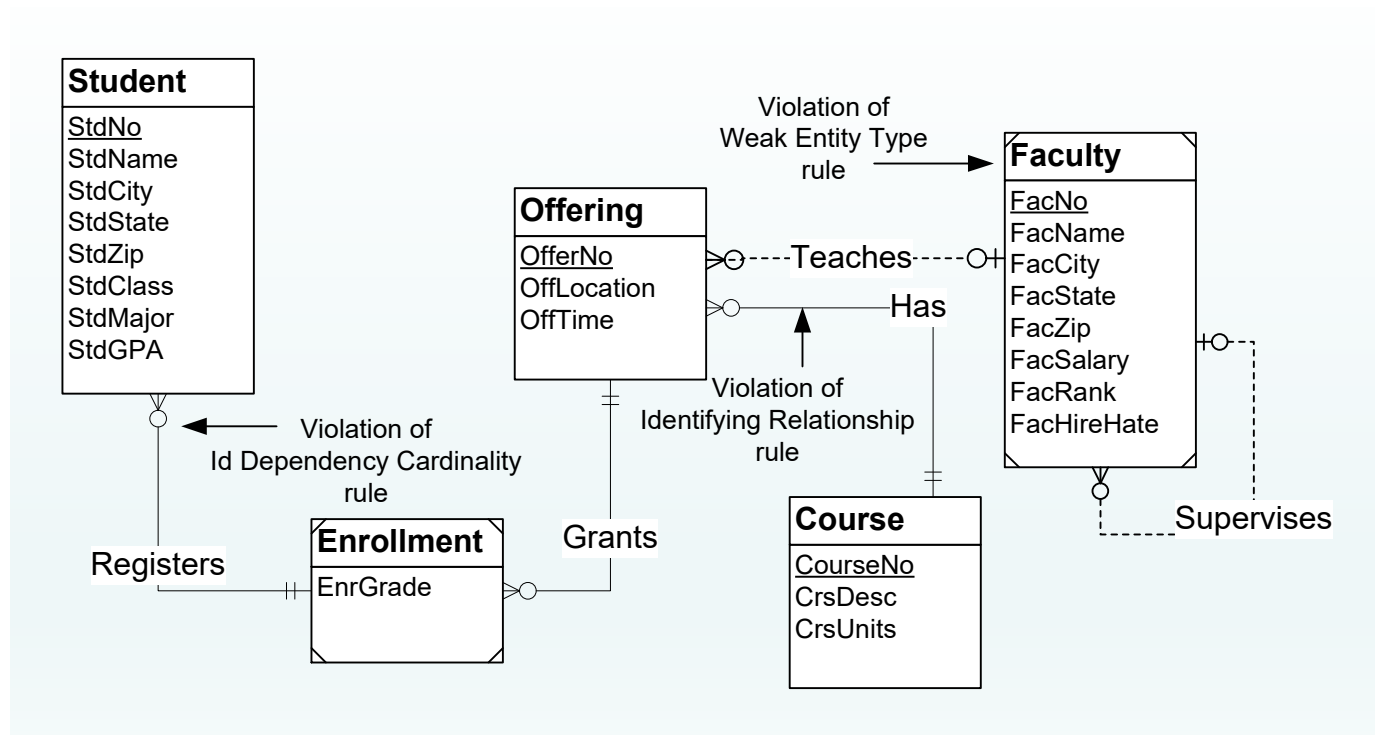


Identification Dependency Rules

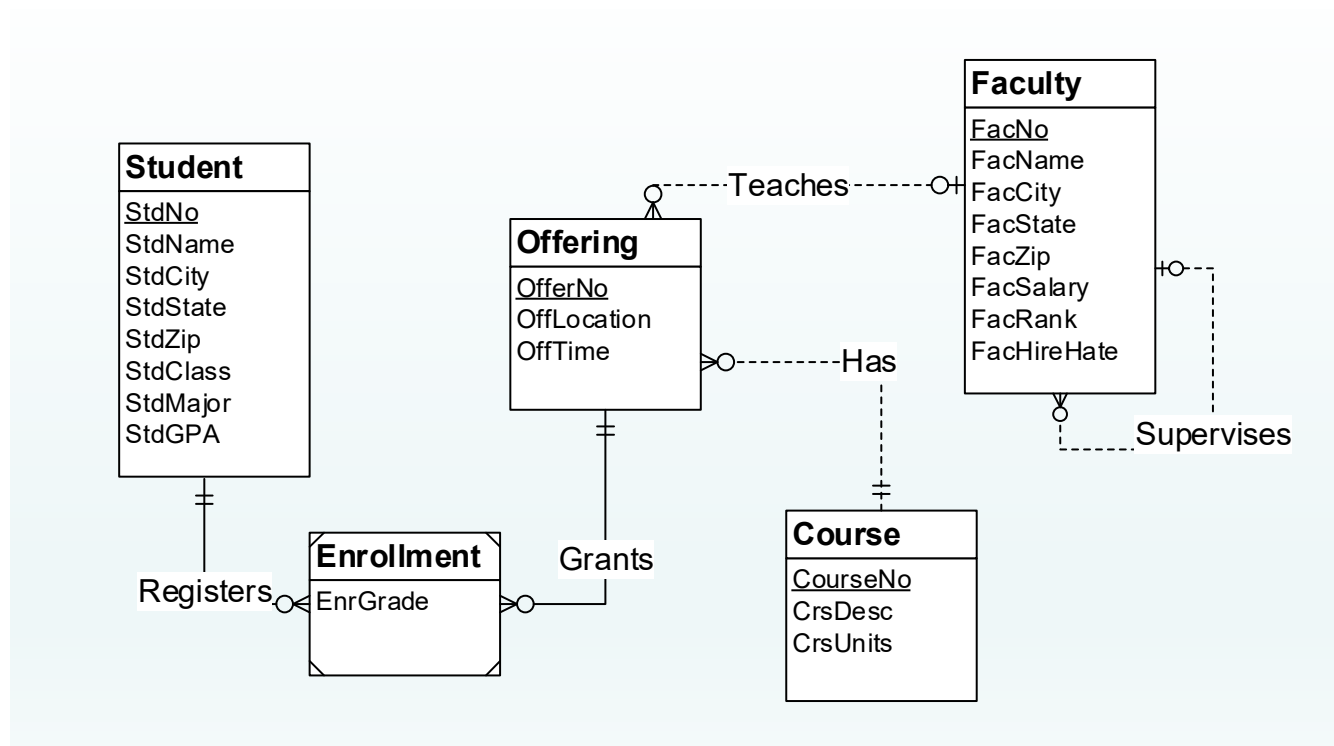
- Weak entity type rule: weak entity types have at least one identifying relationship
- Identifying relationship rule: at least one participating entity type must be weak for each identifying relationship
- Identification dependency cardinality rule: the minimum and maximum cardinality must equal 1 for a weak entity type in all identifying relationships



Identification Dependency Violations

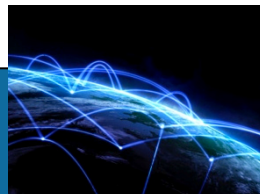


Corrected ERD



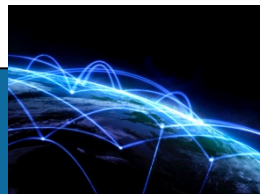
Support in the ER Assistant

- Relationship formation rules are supported by diagram construction
- Other rules are supported by the Check Diagram feature
- For the Redundant Foreign Key rule, the ER Assistant detects FKs that have the same name as the associated PKs



Support in Visual Paradigm

- Feature rich tool with community and commercial editions
- Support for relationship rules through diagram construction
- Limited support for identification dependency rules
- Explicitly shows foreign keys



Summary

- Use the diagram rules to ensure structural consistency and completeness
- Identification dependency is the most common source of errors
- Use the ER Assistant for detection of notational errors





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Lesson 3: ERD Problems I



Lesson Objectives

- Gain confidence to work assignment problems
- Work problems with entity types and 1-M relationships
- Use the ER Assistant or another tool to draw ERDs

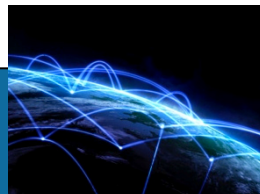
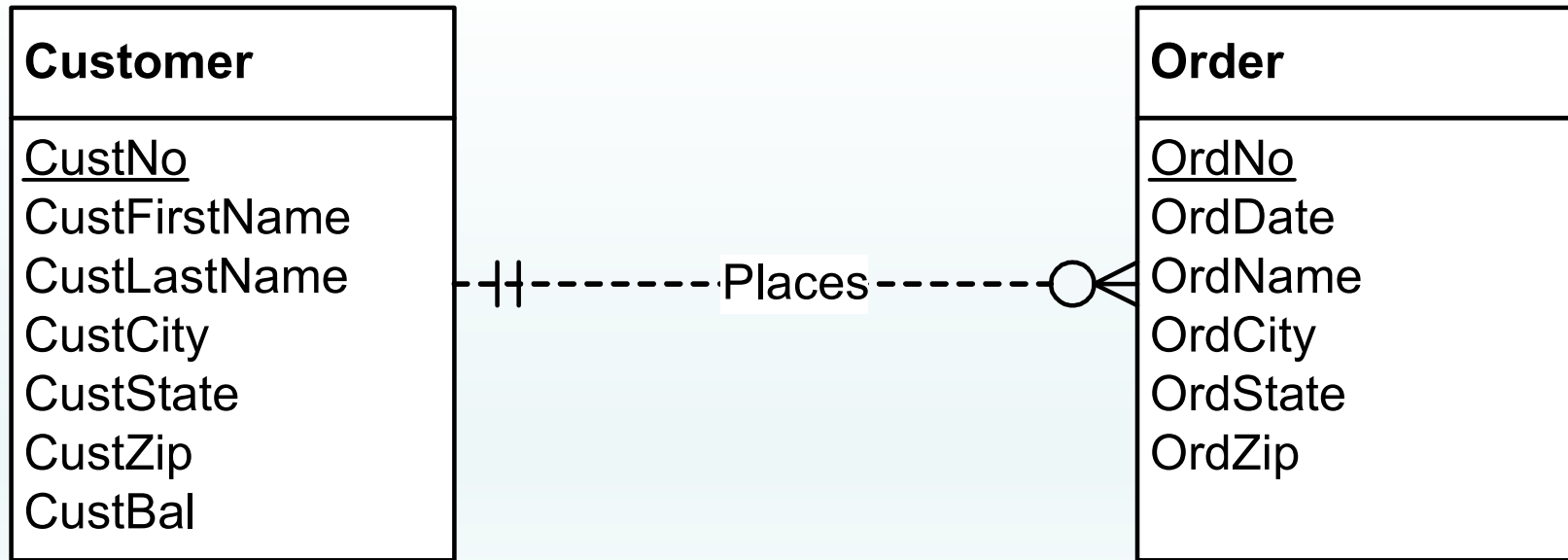


ERD Notation Problem 1

- Draw an ERD containing Order and Customer entity types
 - CustNo (PK), CustFirstName, CustLastName, address attributes, CustBal
 - OrdNo (PK), OrdDate, OrdName, address attributes
- Connect with a 1-M relationship
- Order optional for a customer
- Customer mandatory for an order

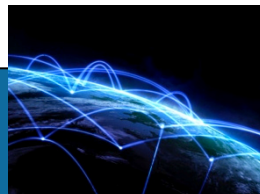


ERD Notation Problem 1 Solution

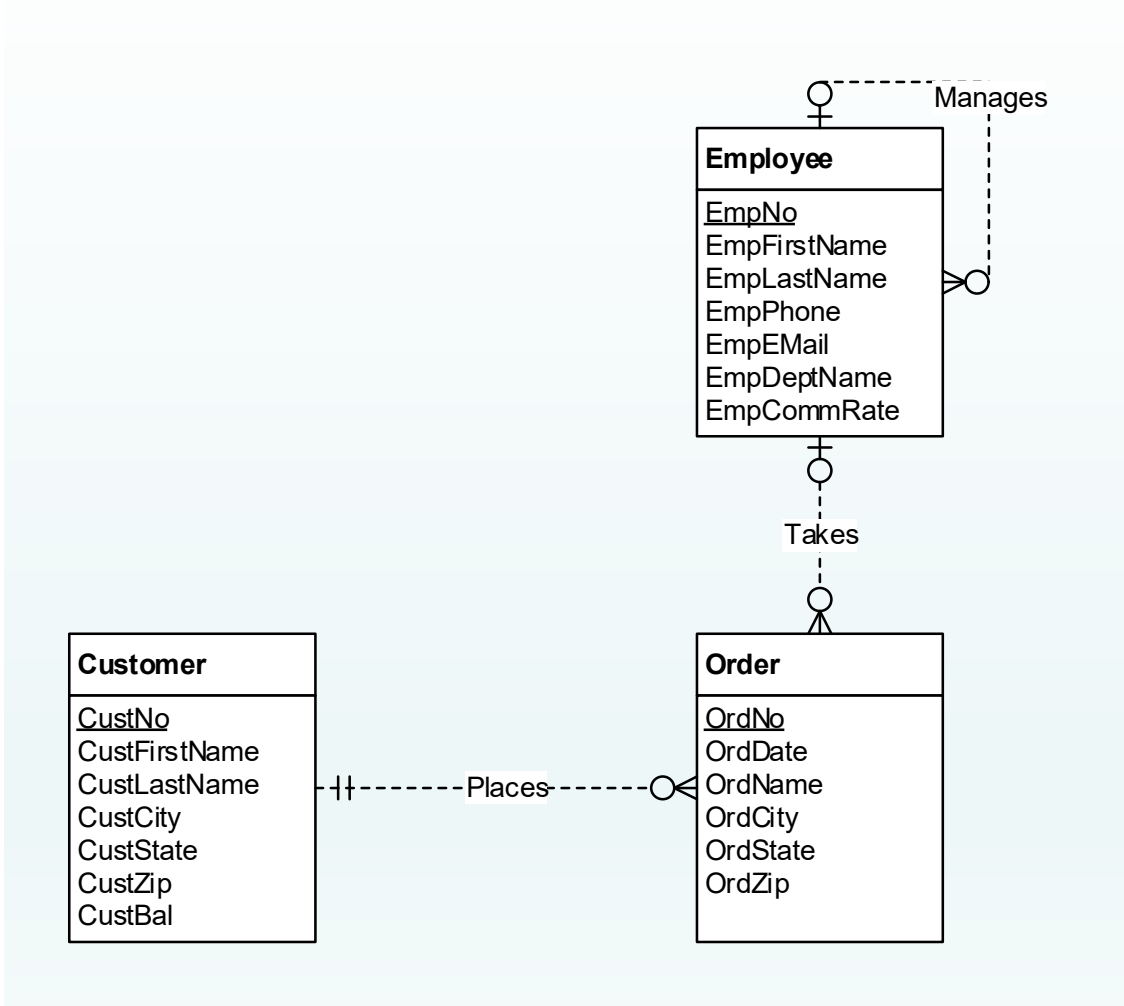


ERD Notation Problem 2

- Add employee entity type
 - EmpNo (PK), EmpFirstName, EmpLastName, EmpPhone, EmpEmail, EmpCommRate, EmpDeptName
- 1-M relationship from Employee to Order
- Employee optional to Order
- Employee not required to process any orders
- 1-M self-referencing relationship for employee, optional in both directions

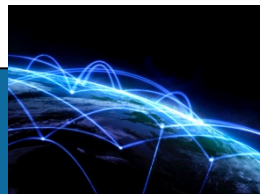


ERD Notation Problem 2 Solution



Summary

- Work problems to gain confidence with the Crow's Foot notation
- Use the ER Assistant or Visual Paradigm for MM1 creating ERDs
- Use notation precisely in business data modeling problems





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Lesson 4: ERD Problems II

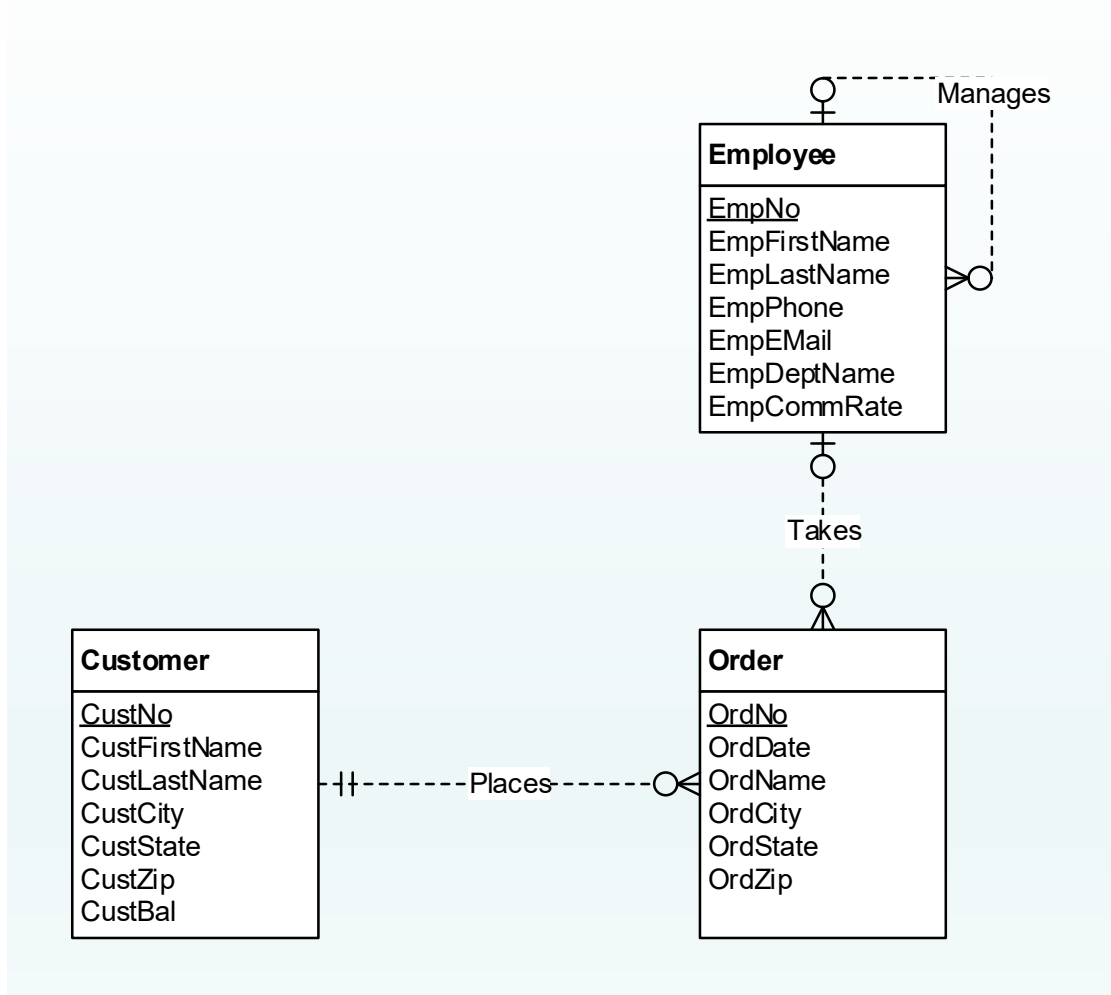


Lesson Objectives

- Gain confidence to work assignment problems
- Work problems with M-N relationships, associative entity types, and diagram error detection
- Use the ER Assistant or another tool to draw ERDs

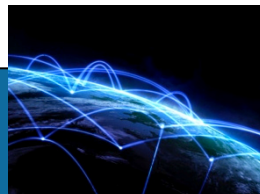


ERD Notation Problem 2 Solution

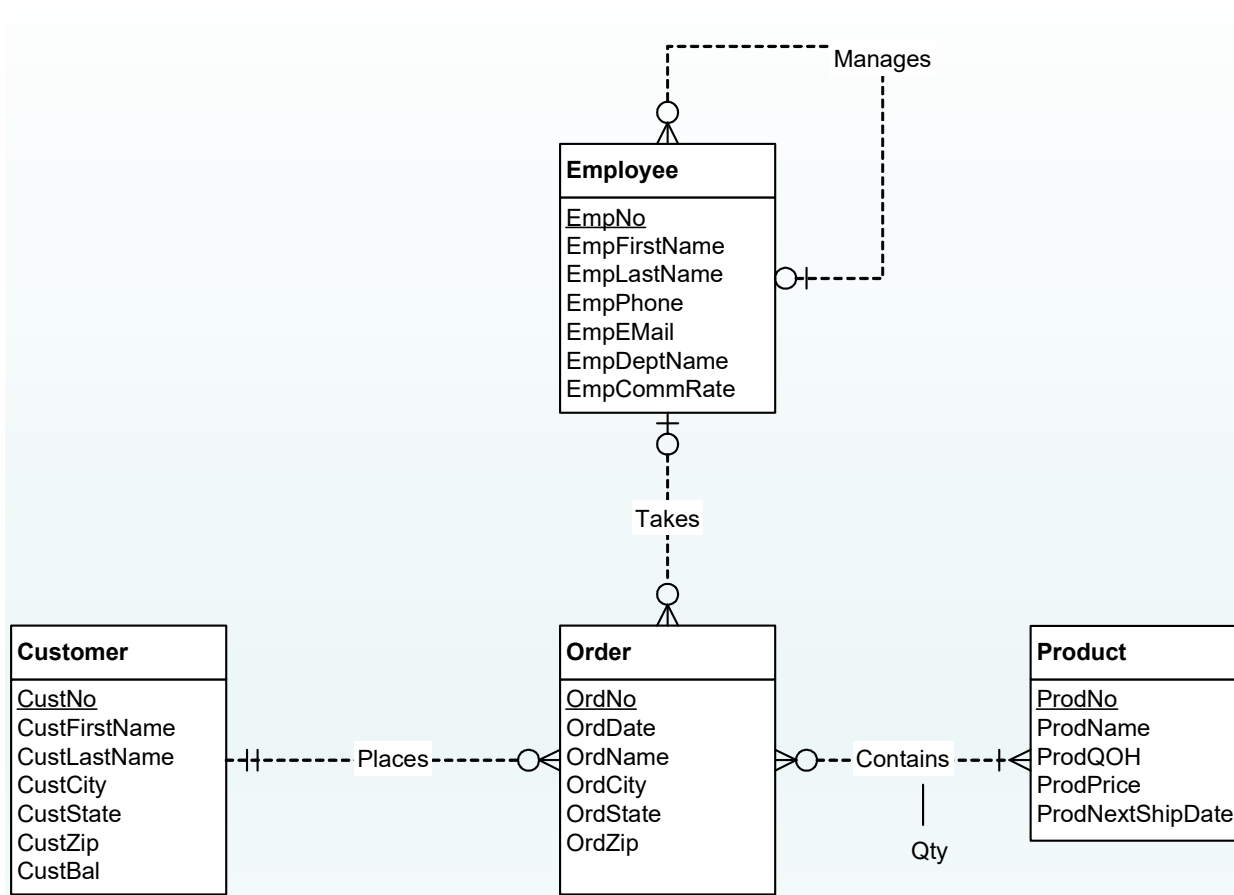


ERD Notation Problem 3

- Product entity type
 - ProdNo (PK), ProdName, ProdQOH, ProdPrice, ProdNextShipDate
- M-N relationship between product and order with order quantity attribute
- Order optional for product
- Product mandatory for order



ERD Notation Problem 3 Solution



ERD Problem 4

- Transform M-N relationship
- Associative entity type
- Two identifying, 1-M relationships



ERD Notation Problem 4 Solution

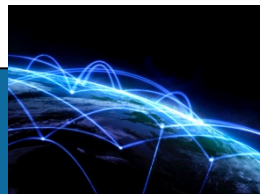
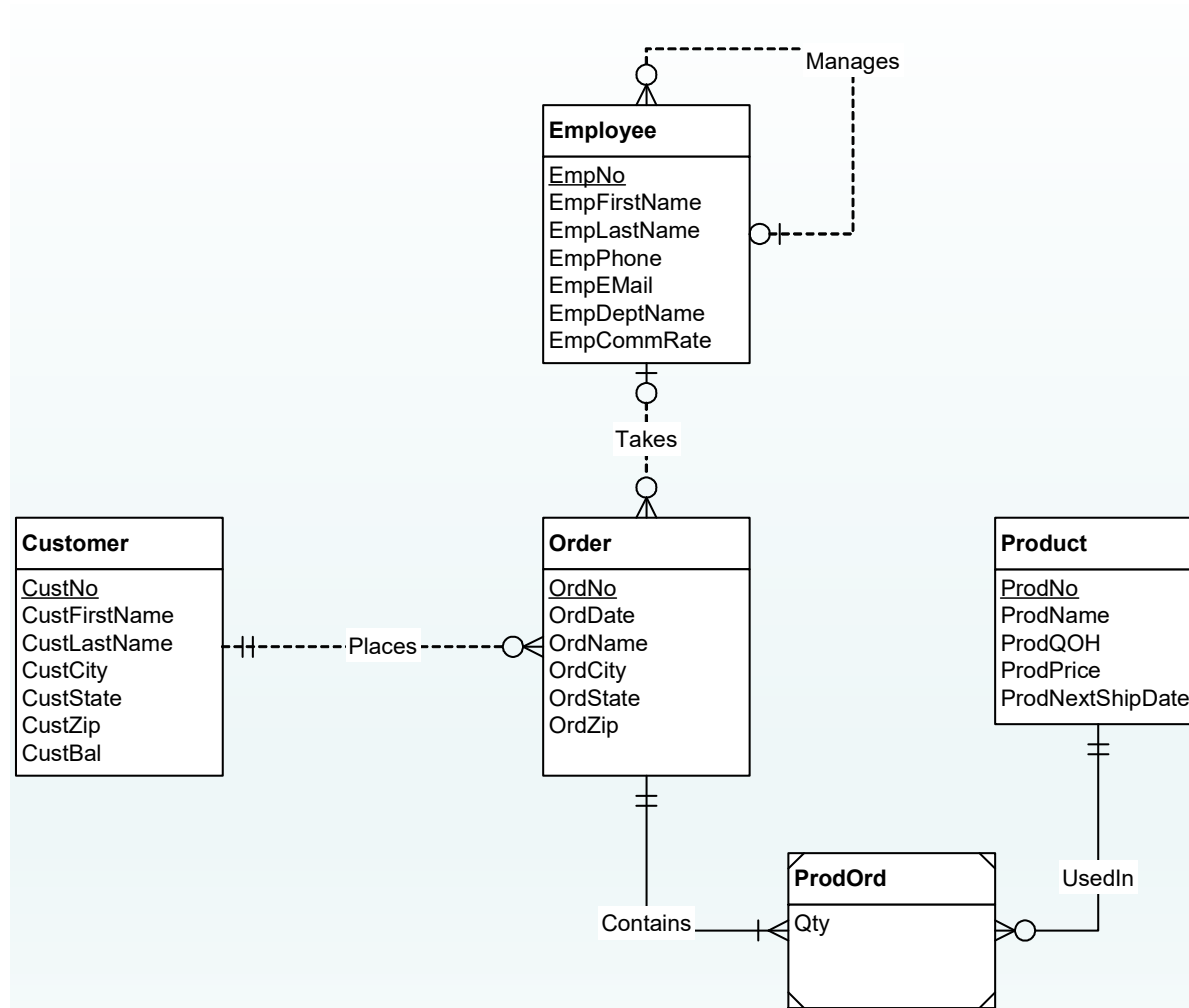


Diagram Error Problem

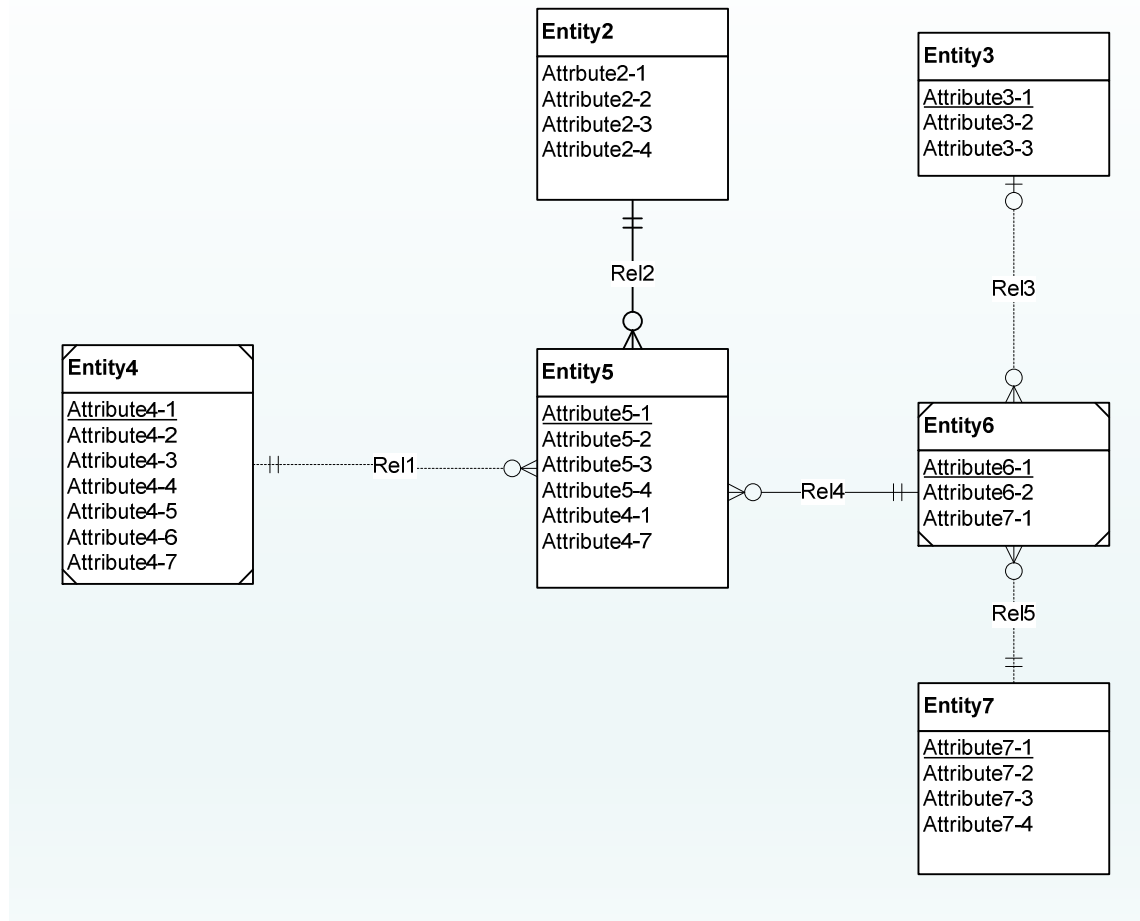
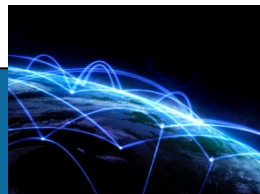
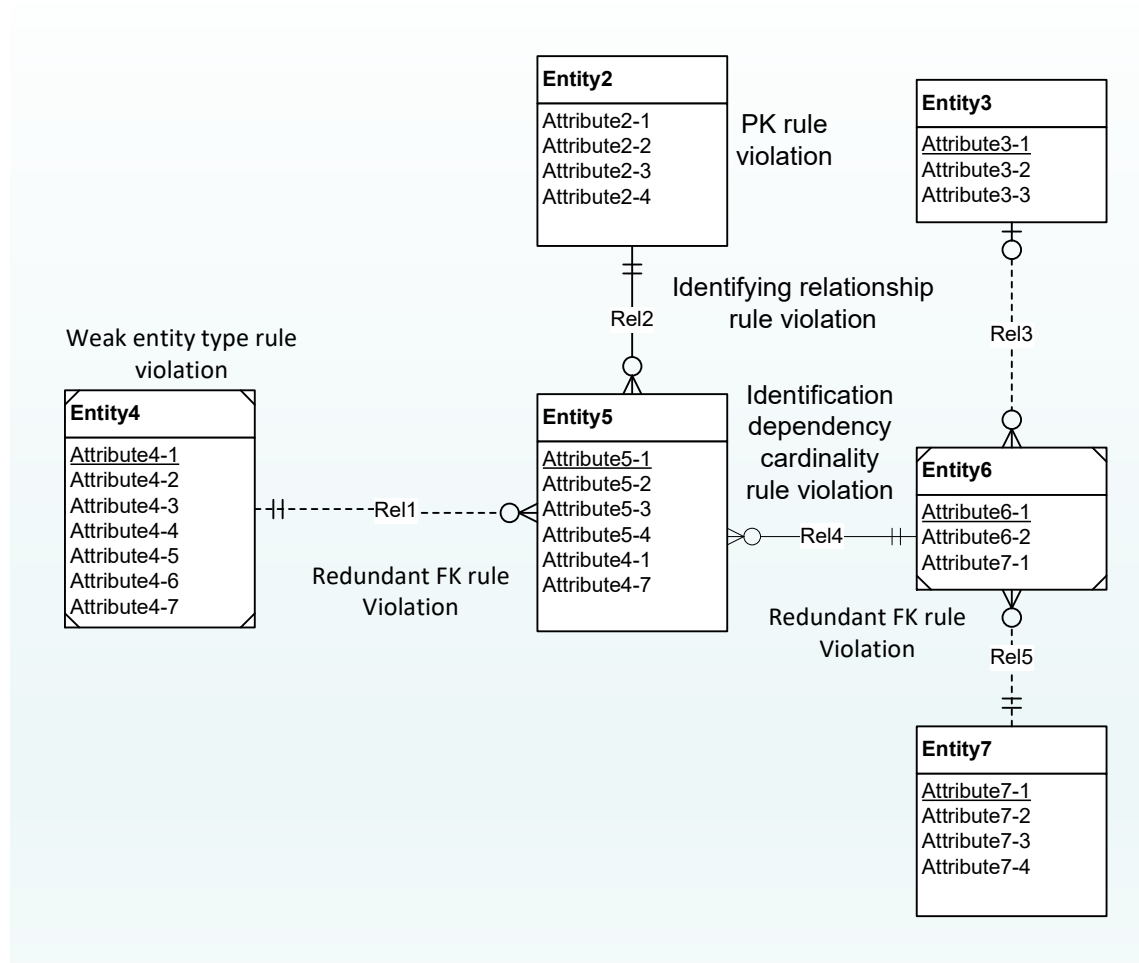


Diagram Error Problem Solution



Summary

- Work problems to gain confidence with the Crow's Foot notation
- Identify and resolve diagram errors to avoid errors in business data modeling problems
- Use the ER Assistant for drawing and detection of notational errors
- Use Visual Paradigm for experience with a feature rich product
- Use notation precisely in business data modeling problems

37

