

# Chapter 5

## Understanding Entity Relationship Diagrams

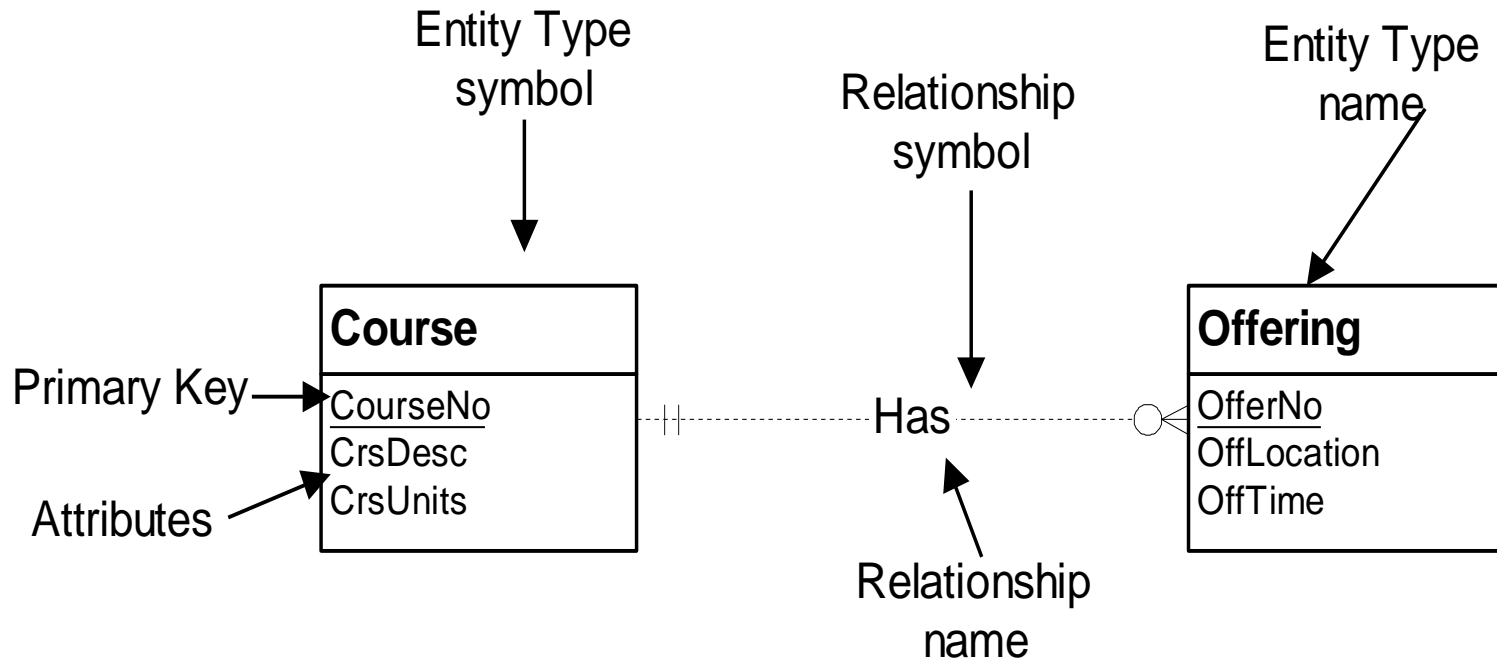
# Outline

- Notation basics
- Understanding relationships
- Generalization hierarchies
- Diagram rules
- Alternative notations

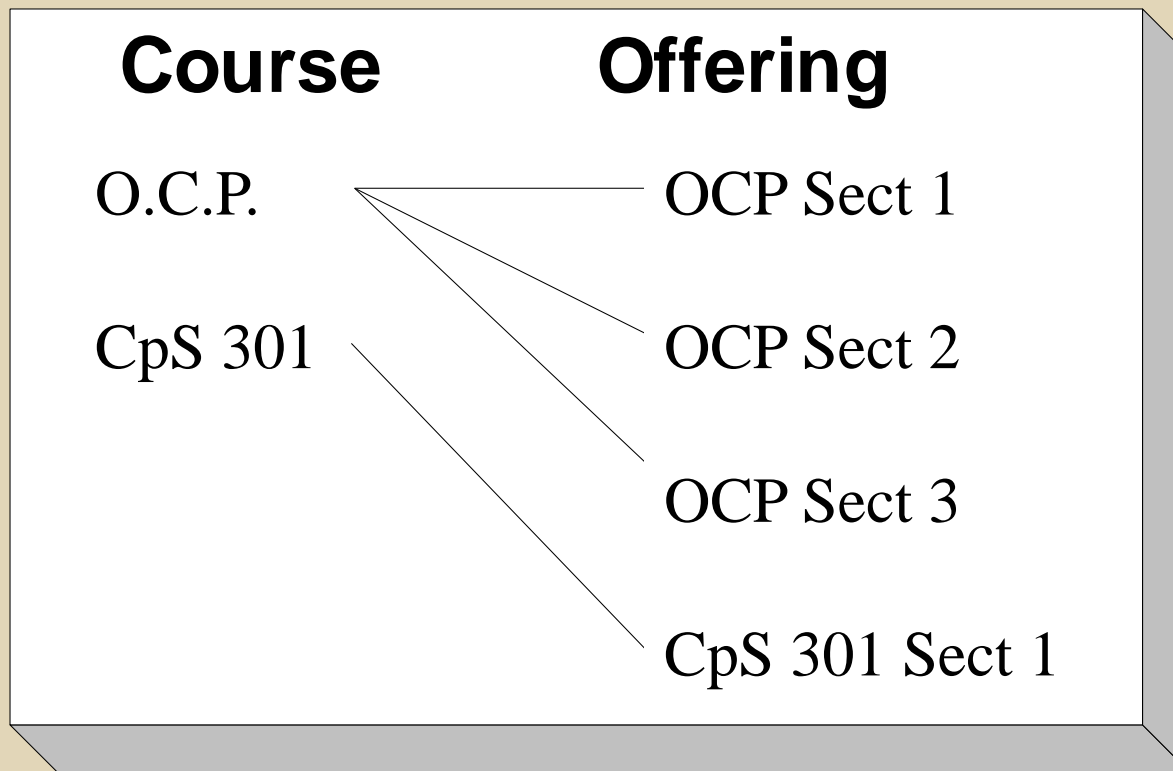
# Why E-R Diagrams?

- Semi-standard graphical notation for database designs
- More expressive than relational model
- Can be easily converted to relational schema

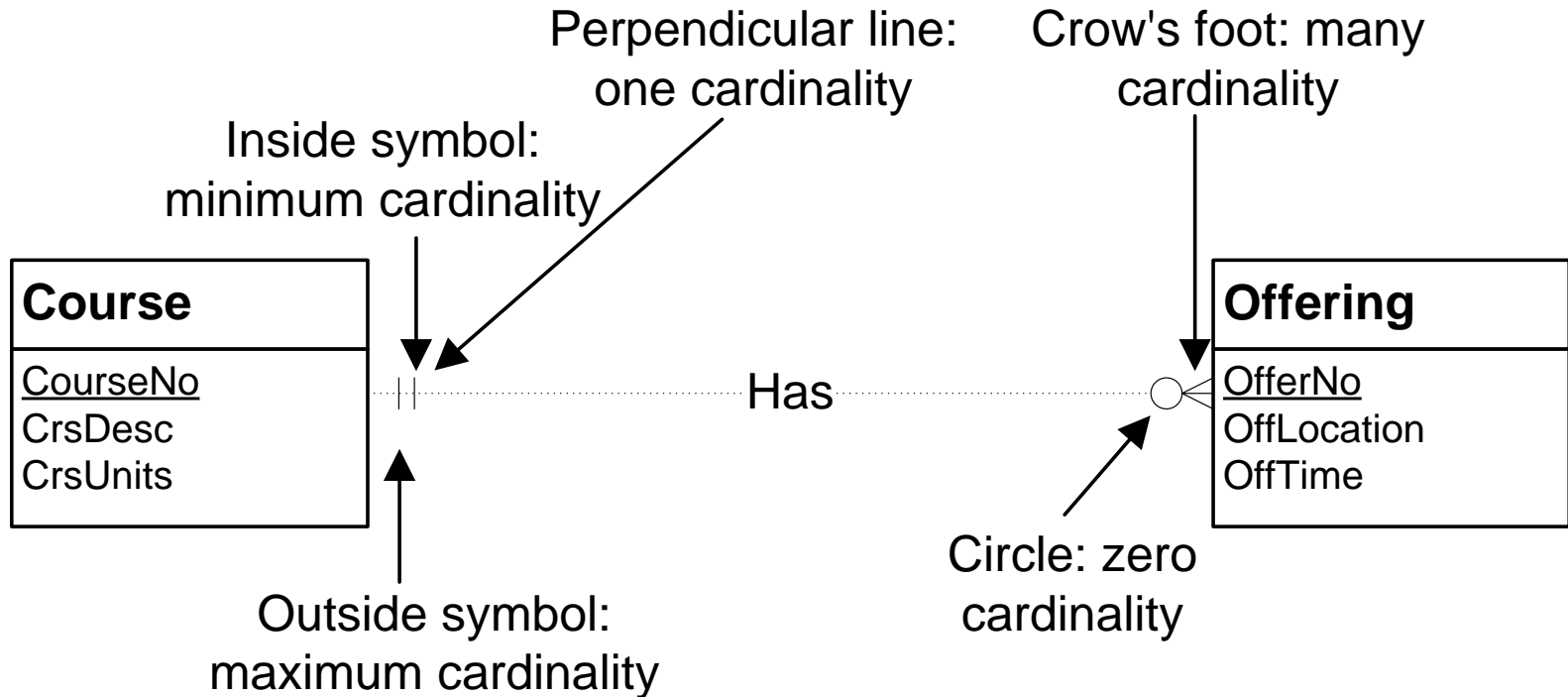
# Basic Symbols



# Cardinalities



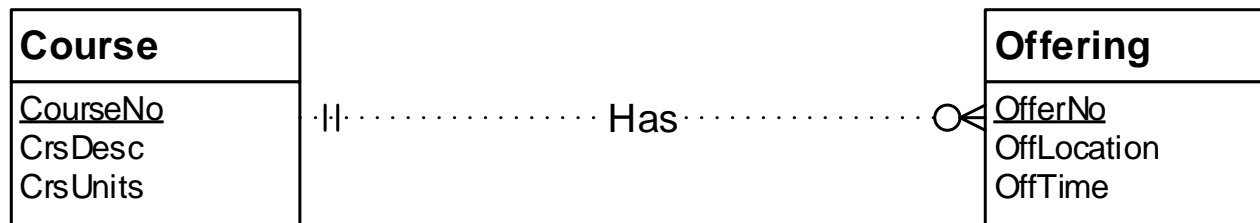
# Cardinality Notation



# Reading Relationships

"A Course has zero or more Offerings"

"An Offering has one and only one Course"

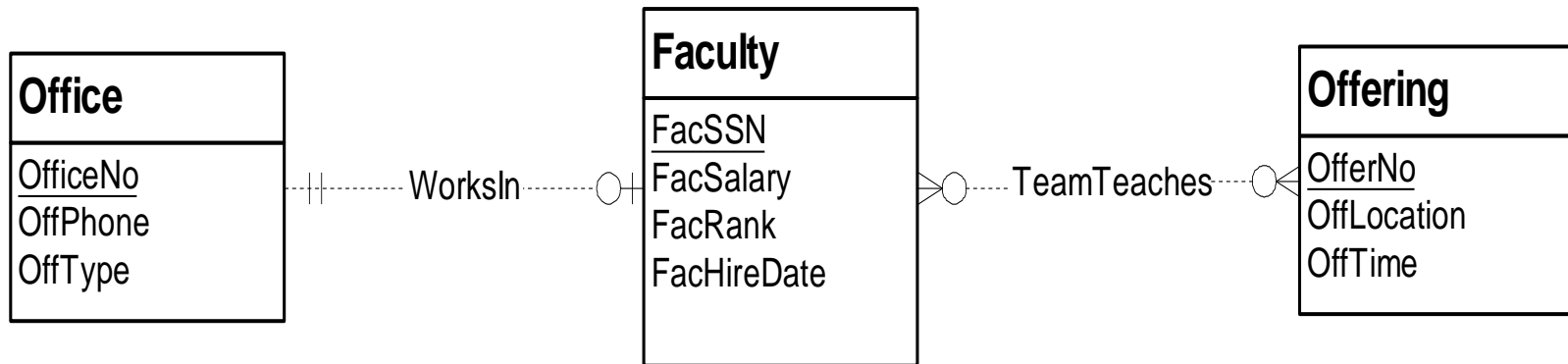


# Classification of Cardinalities

- **Minimum cardinality**
  - 1 : Mandatory
    - Existence dependency: Entity cannot exist unless related entity exists
  - 0 : Optional
- **Maximum cardinality**
  - 1-1
  - 1-M
  - M-N



# More Relationship Examples



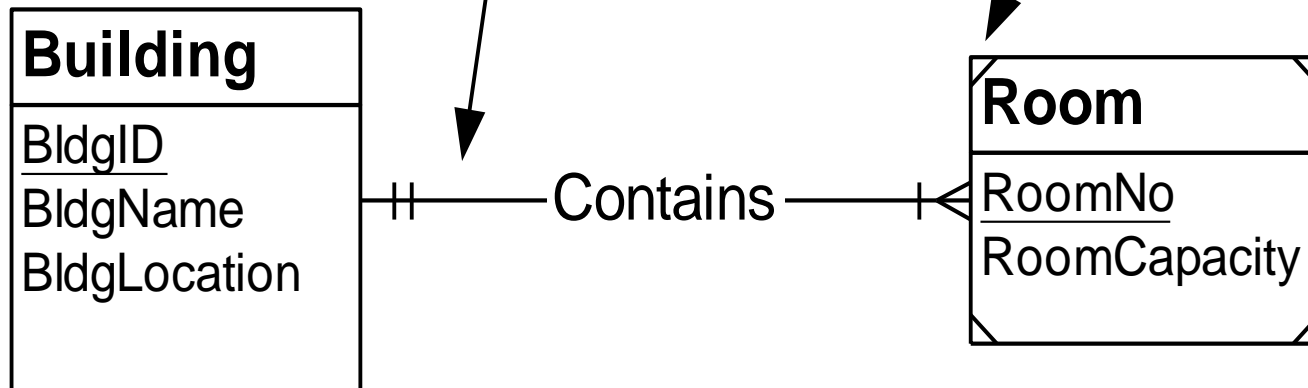
# Understanding Relationships

- Identification dependency
- M-N relationships with attributes
- Self identifying relationships
- M-way relationships
- Equivalence between M-N and 1-M relationships

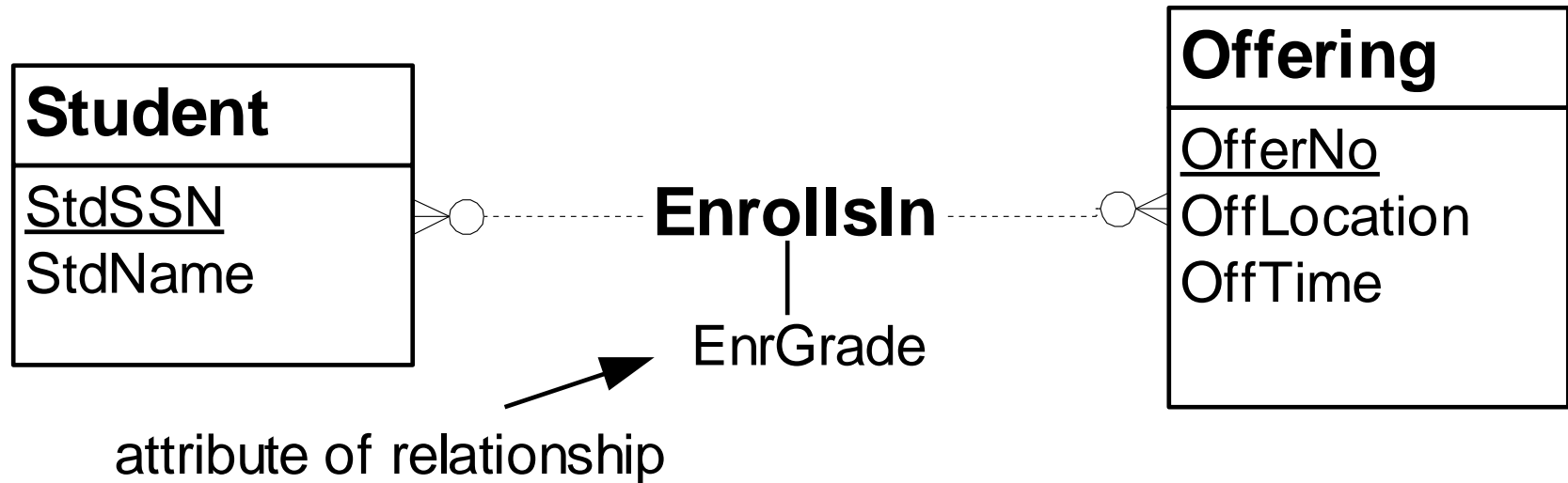
# Identification Dependency

Identification Dependency Symbols:

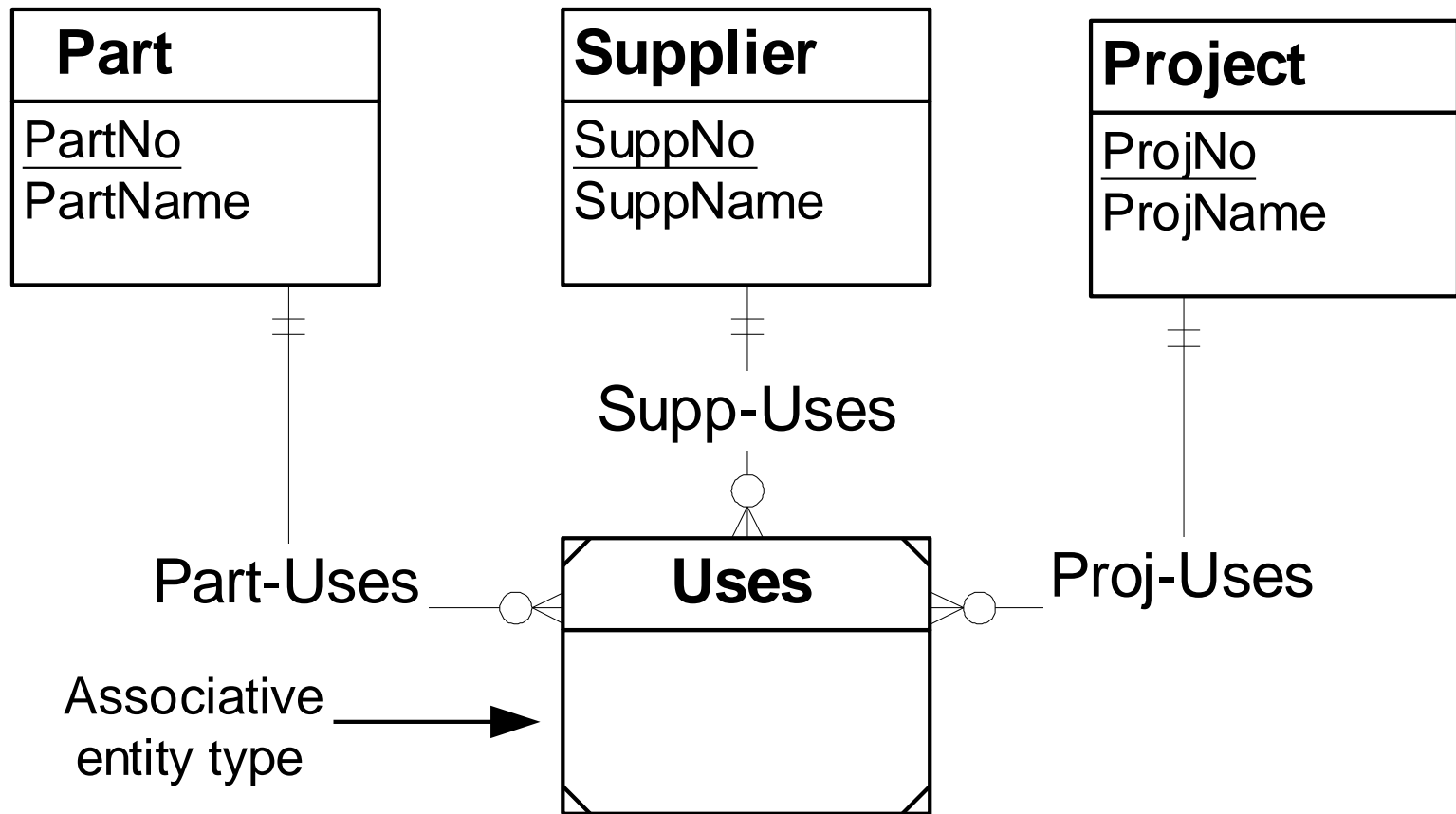
- Solid relationship line for identifying relationships
- Diagonal lines in the corners denote weak entities.



# M-N Relationships with Attributes



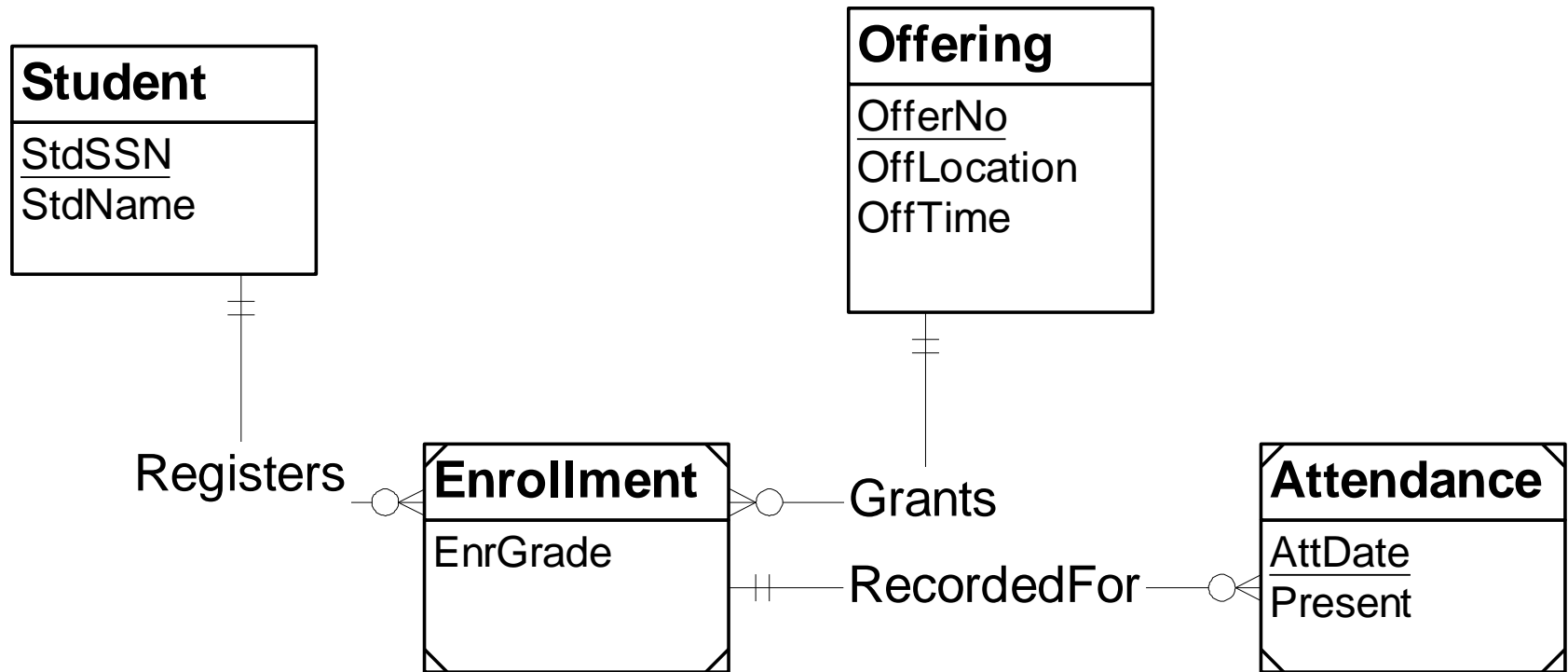
# Associative Entity Types for M-way Relationships



# Relationship Equivalence

- Replace M-N relationship
  - Associative entity type
  - Two identifying 1-M relationships
- M-N relationship versus associative entity type
  - Largely preference
  - Associative entity type is more flexible in some situations

# Associative Entity Type Example



# Validating ERD's

- ERD diagrams can have errors



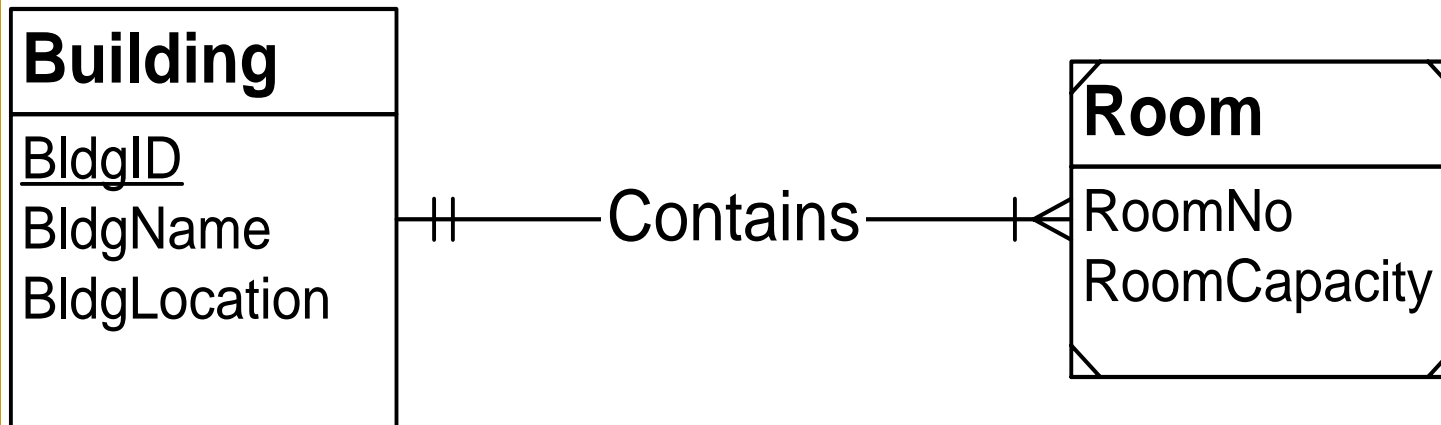
# Primary Key Rule Issue

- Primary key rule is simple in most cases
- For some weak entities, the PK rule is subtle
  - Weak entity with only one 1-M identifying relationship
  - Weak entity 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.



# Identification Dependency Rules

- Weak entity rule: weak entities 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 in all identifying relationships

# Summary

- Data modeling is an important skill
- Crow's Foot ERD notation is widely used
- Use notation precisely
- Use the diagram rules to ensure structural consistency and completeness
- Understanding the ERD notation is a prerequisite to applying the notation on business problems