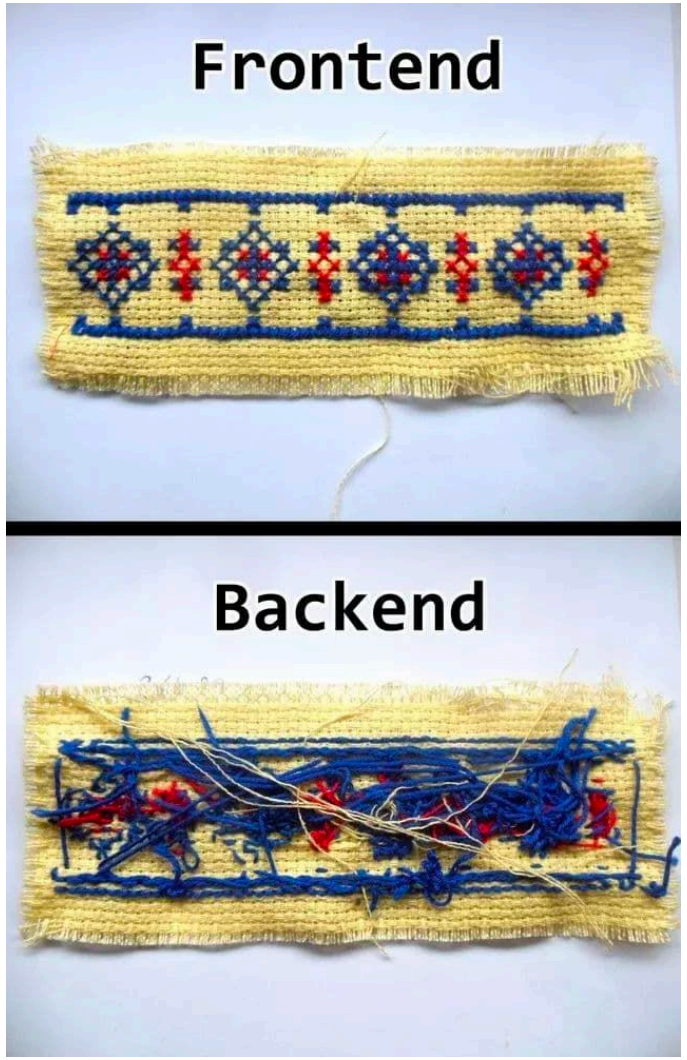

Website

Mobile Apps

Game/Simulation/Tools

Analysis

Data Modelling

Database Design

Normalization

Optimization

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CSCI 5408

Dr. Saurabh Dey

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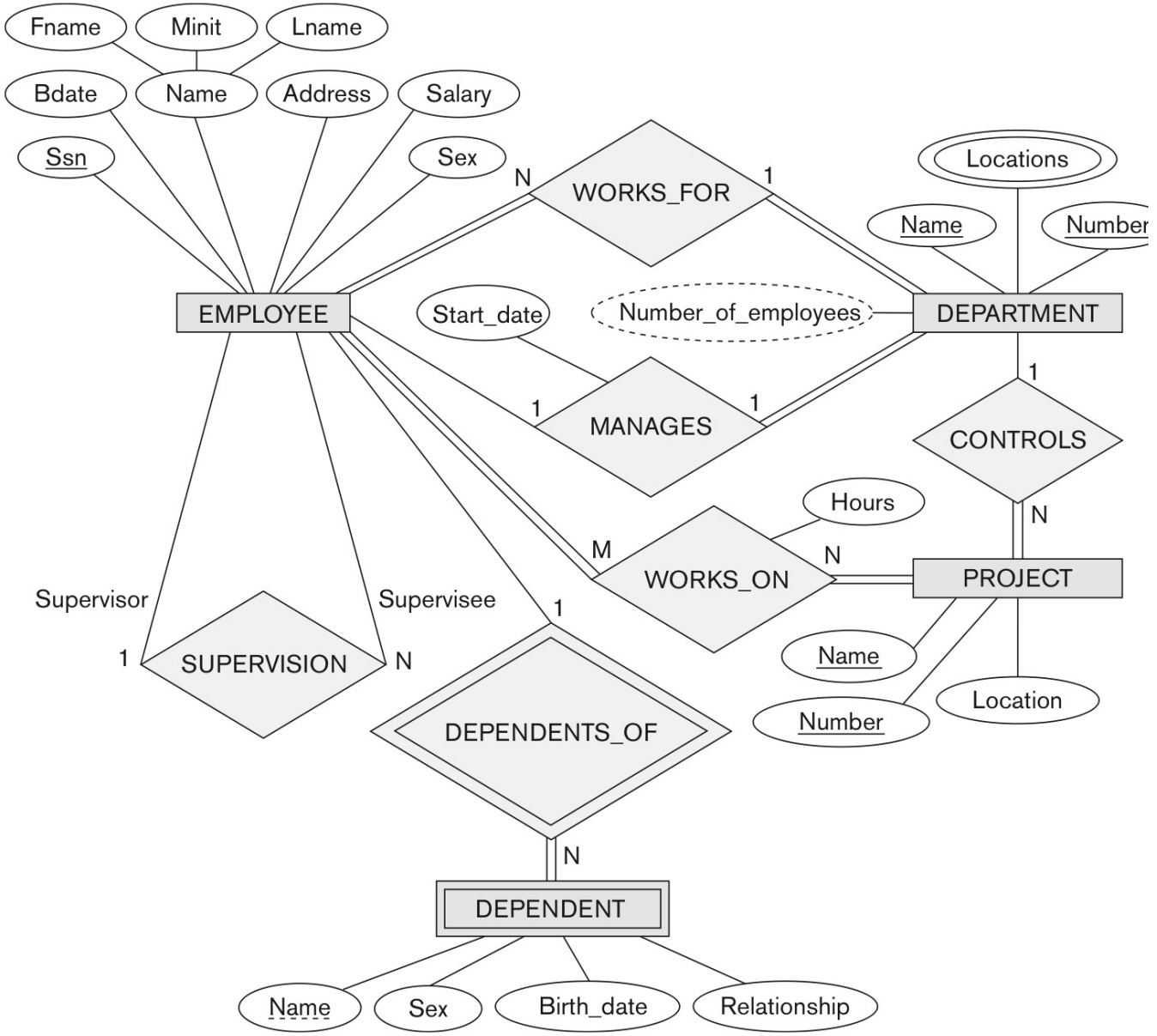
Content

1. Recap of Lecture #2
2. Data Modelling – Steps
3. Data Modelling Design & Issues
4. EERD

ER Schema Diagram

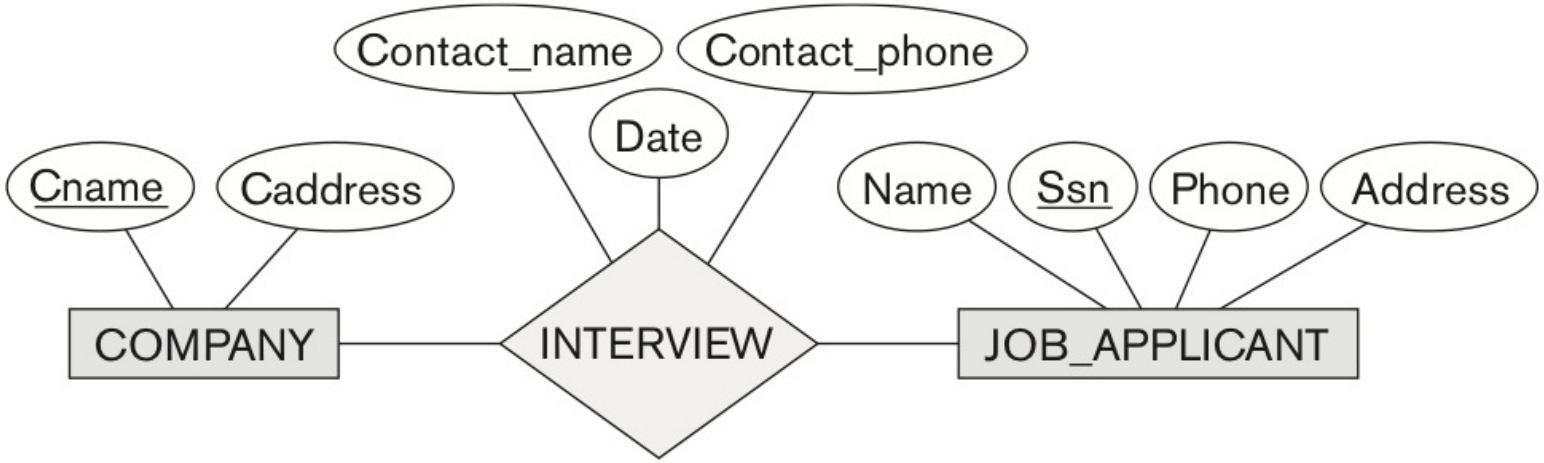
- Identify:

- Primary Key
- Weak Entity
- Total Participation
- Existence Dependency
- Partial Key
- Multivalued Attribute
- Composite Attribute
- Derived Attribute
- Partial Dependency
- Transitive Dependency



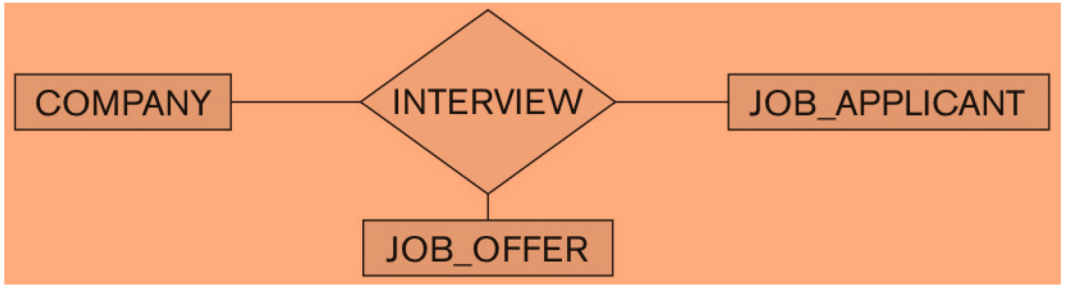
Simple Data Modelling

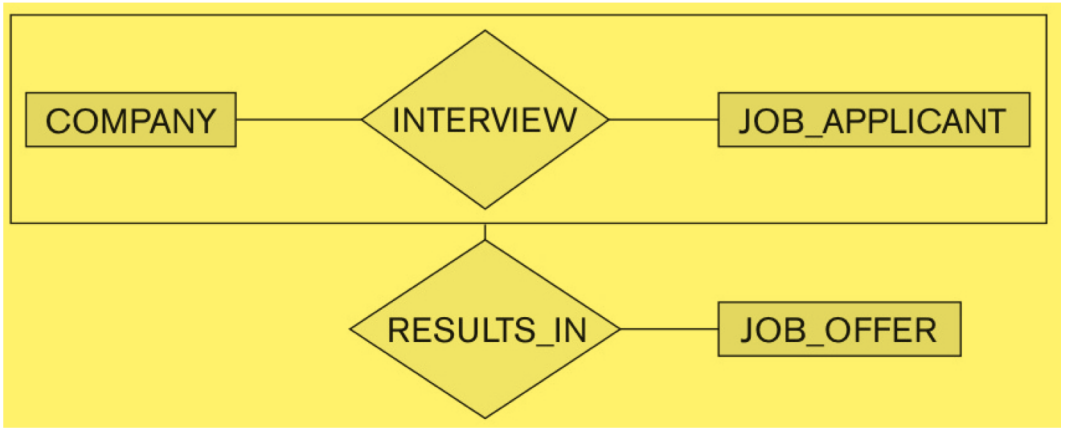
Scenario: A company interviews job applicants and provide jobs to successful candidates

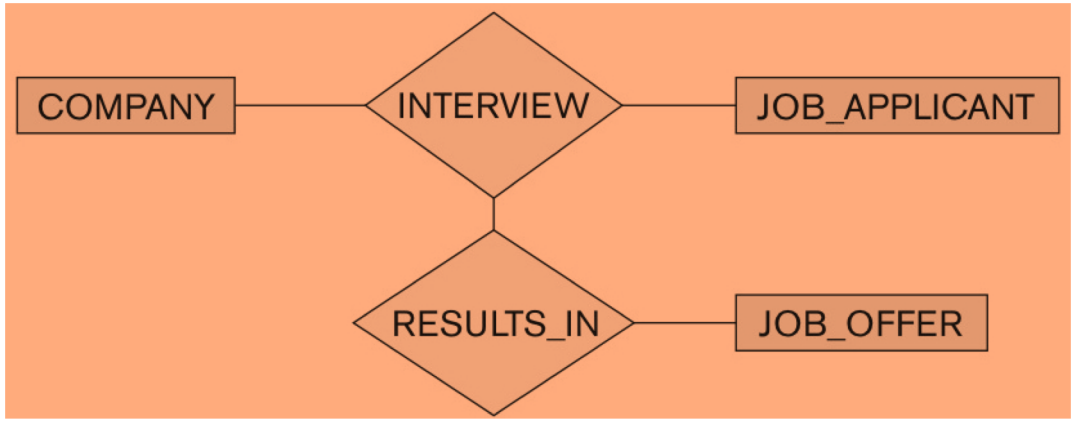


Simple Data Modelling – contd.

Scenario: A company interviews job applicants and provide jobs to successful candidates

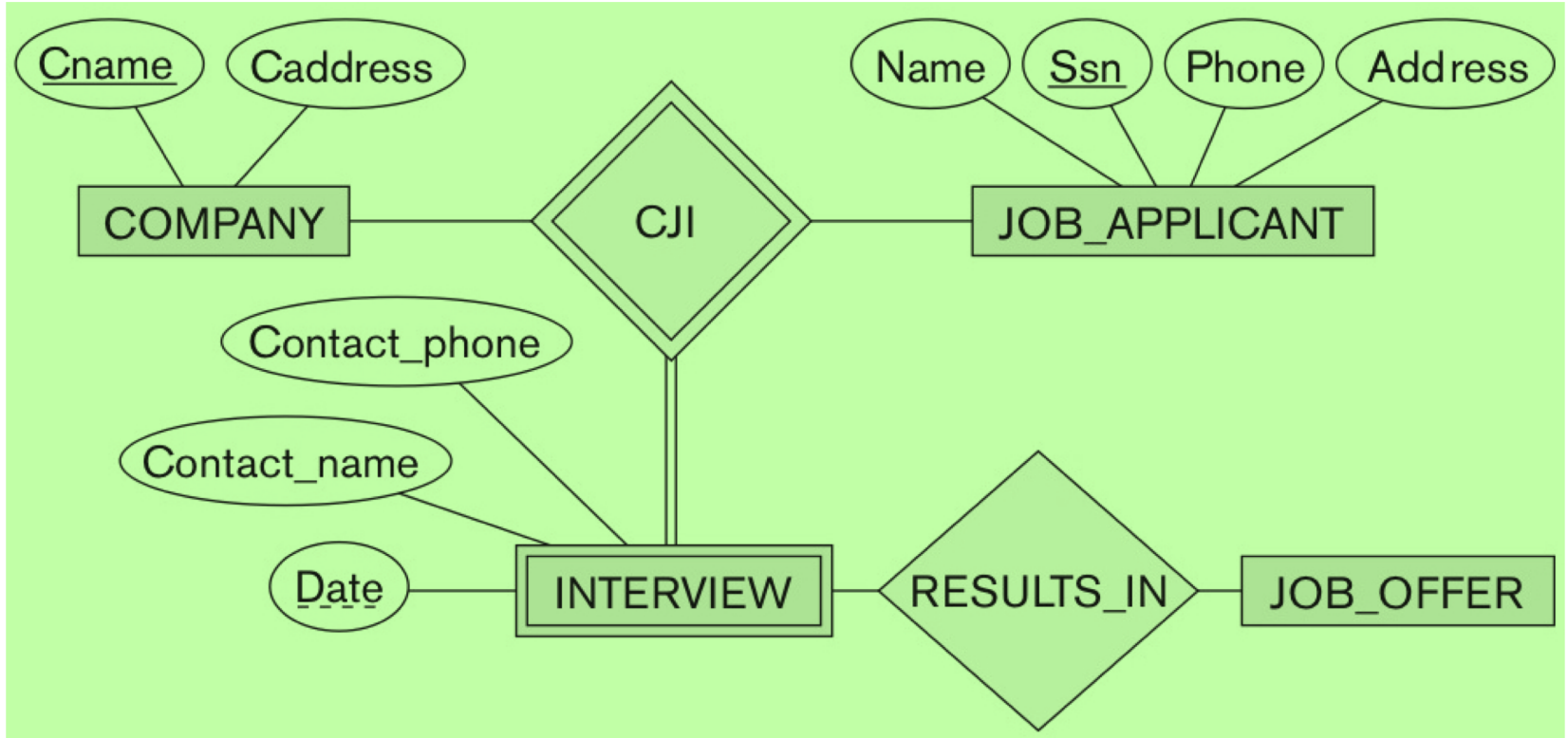






Simple Data Modelling - contd.

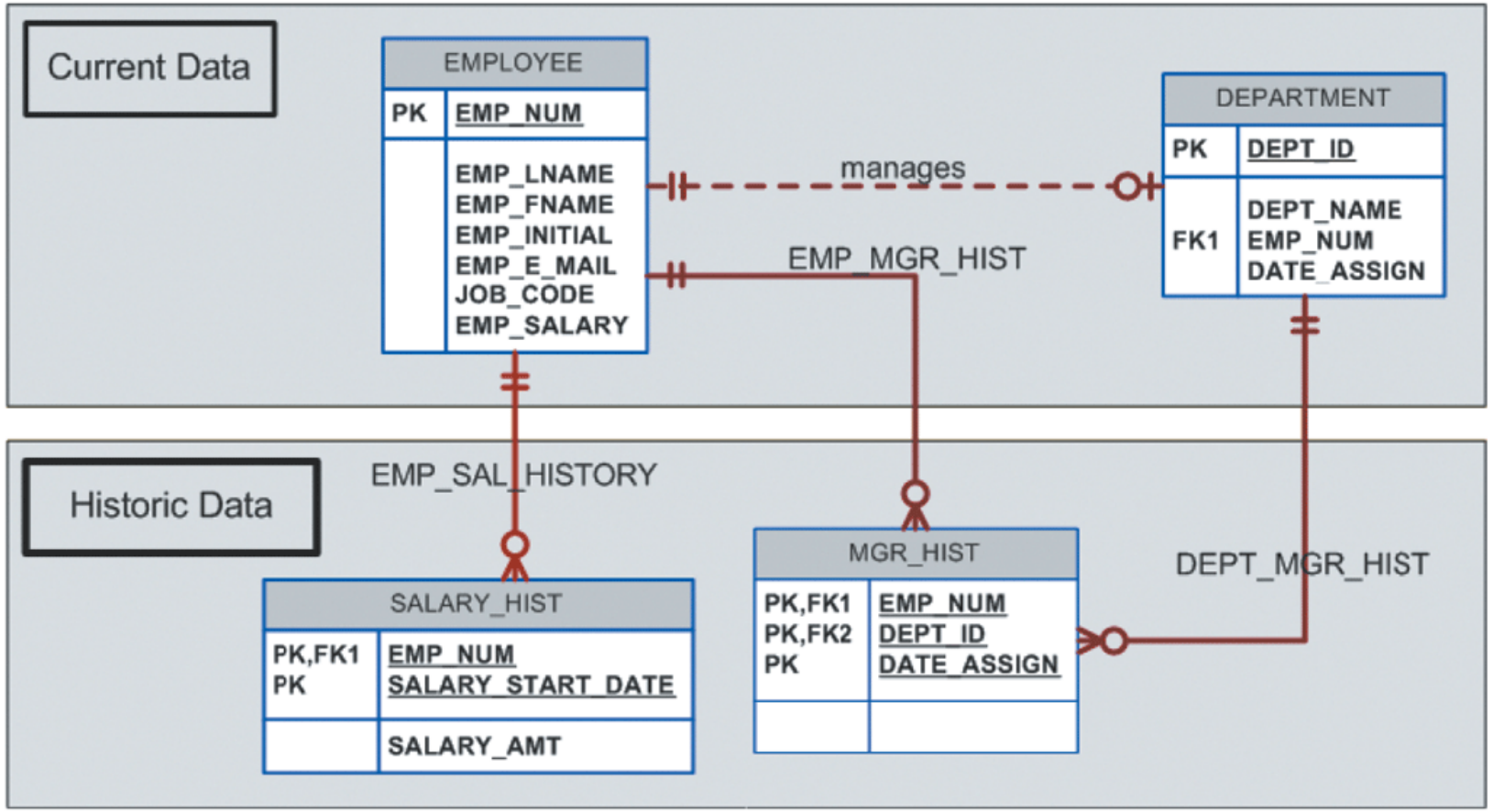
Scenario: A company interviews job applicants and provide jobs to successful candidates



Design Issues

Time-variant data: data whose values change over time and for which a history of the data changes must be retained

- Requires creating a new entity in a 1:M relationship with the original entity
- New entity contains the new value, date of the change, and any other pertinent attribute



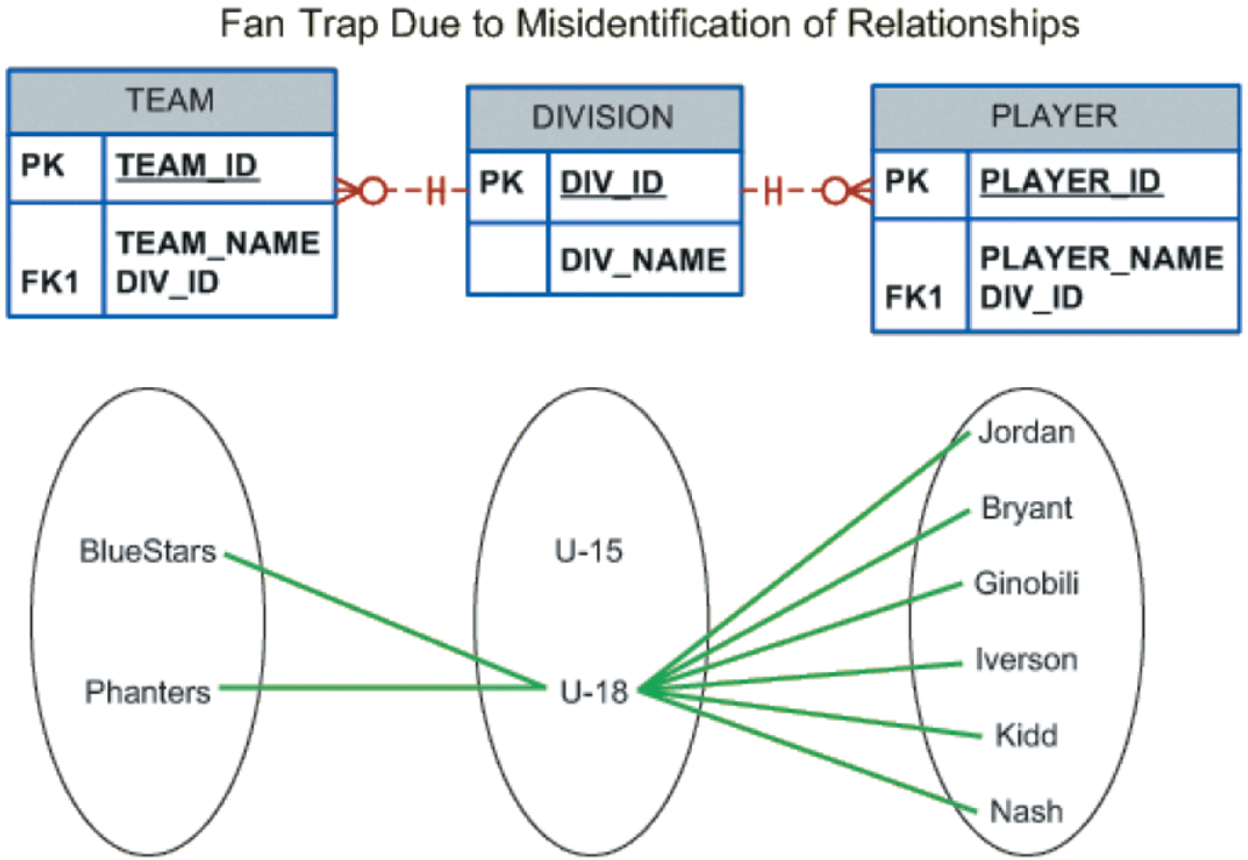
Fan Traps

Design trap: occurs when a relationship is improperly or incompletely identified

- Represented in a way not consistent with the real world

Fan trap: occurs when one entity is in two 1:M relationships to other entities

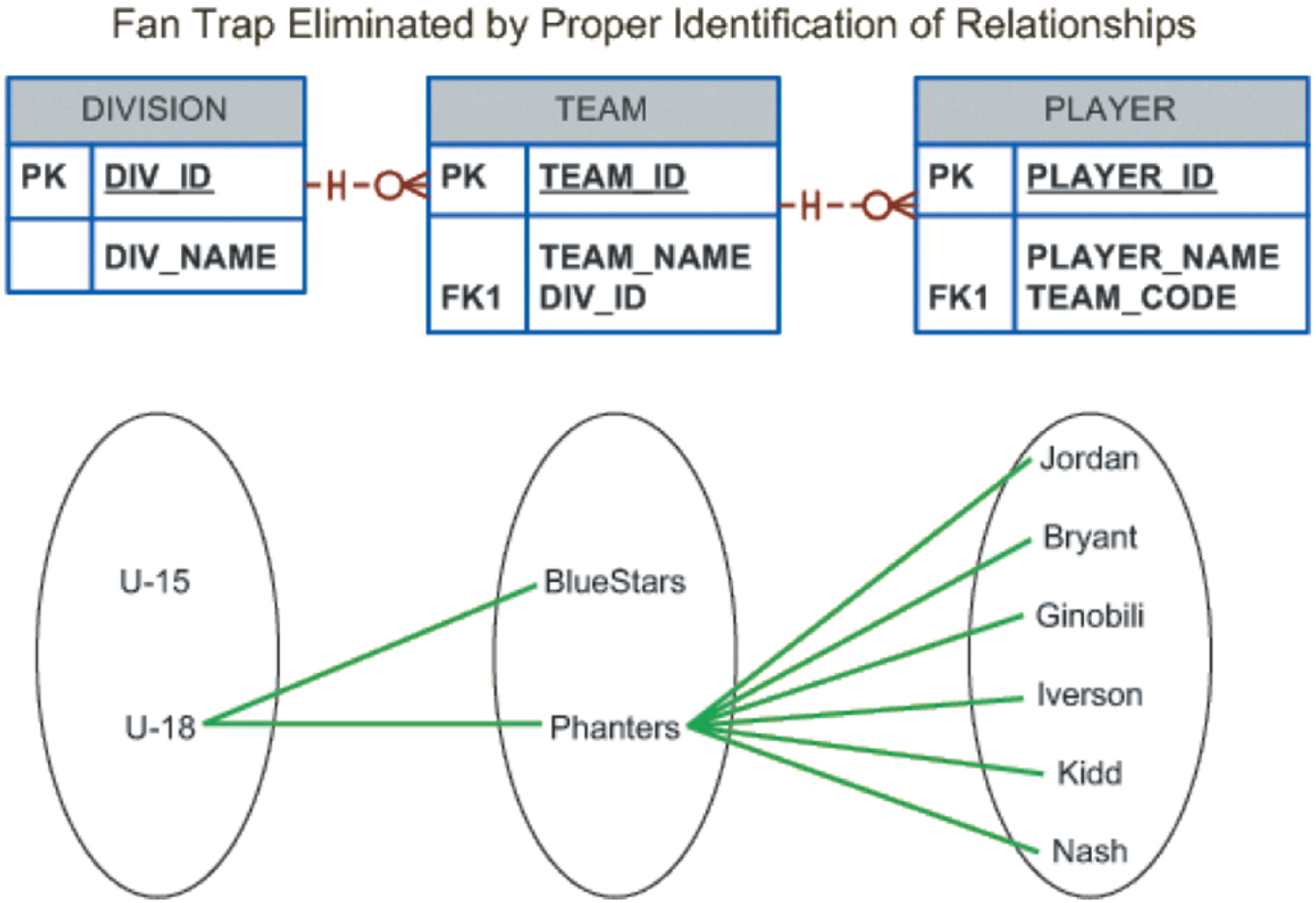
- Produces an association among other entities not expressed in the model



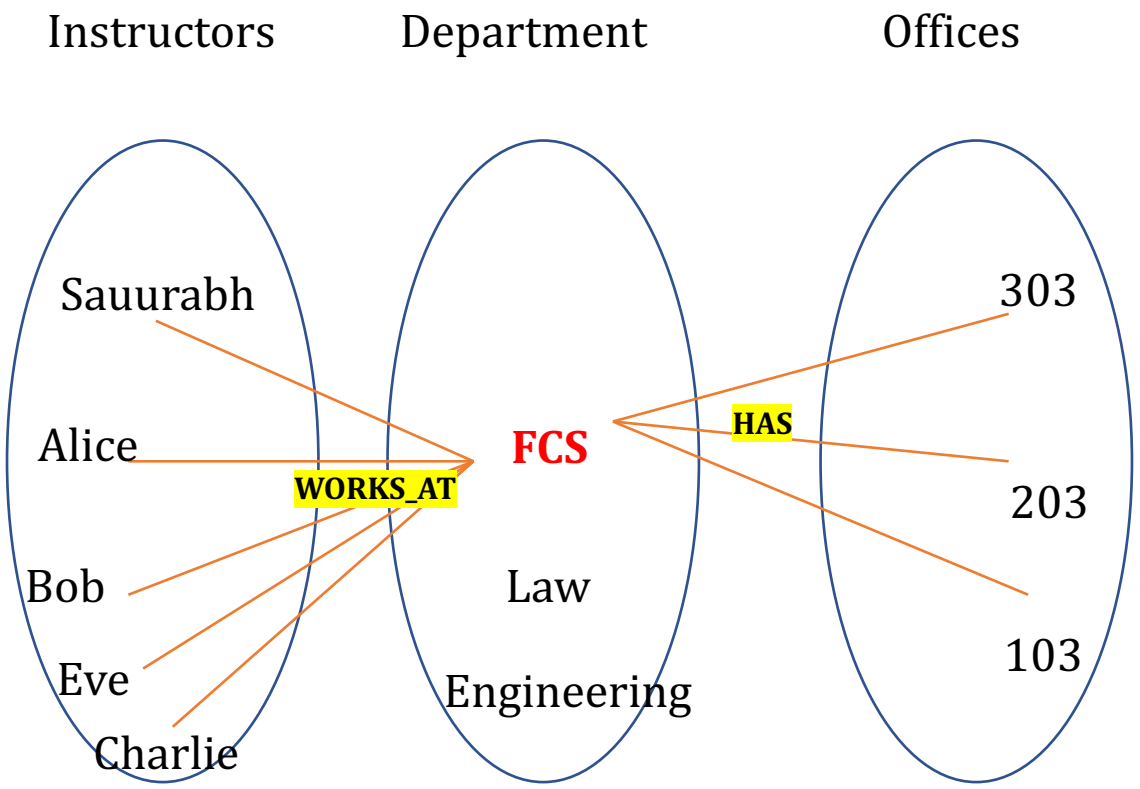
For example, assume that the JCB basketball league has many divisions. Each division has many players, and each division has many teams. G

1:M relationship between Division and Team

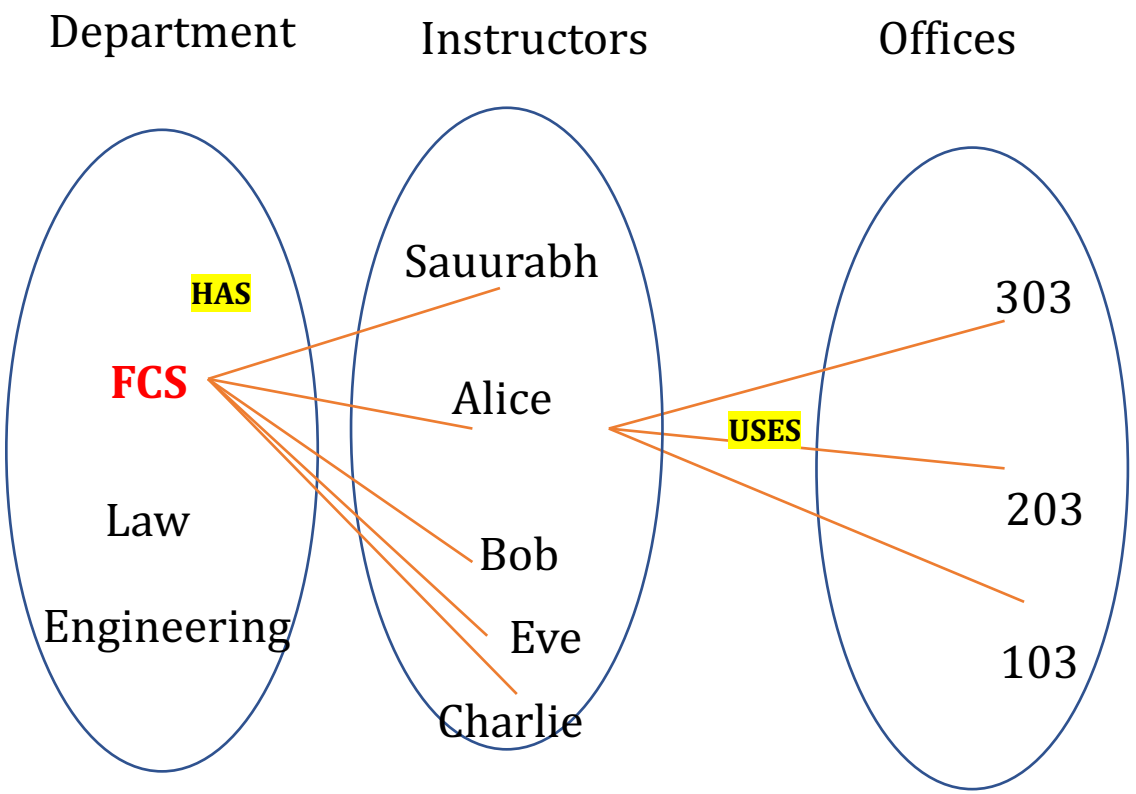
1:N relationship between Team and Player



Another Example of Fan Trap



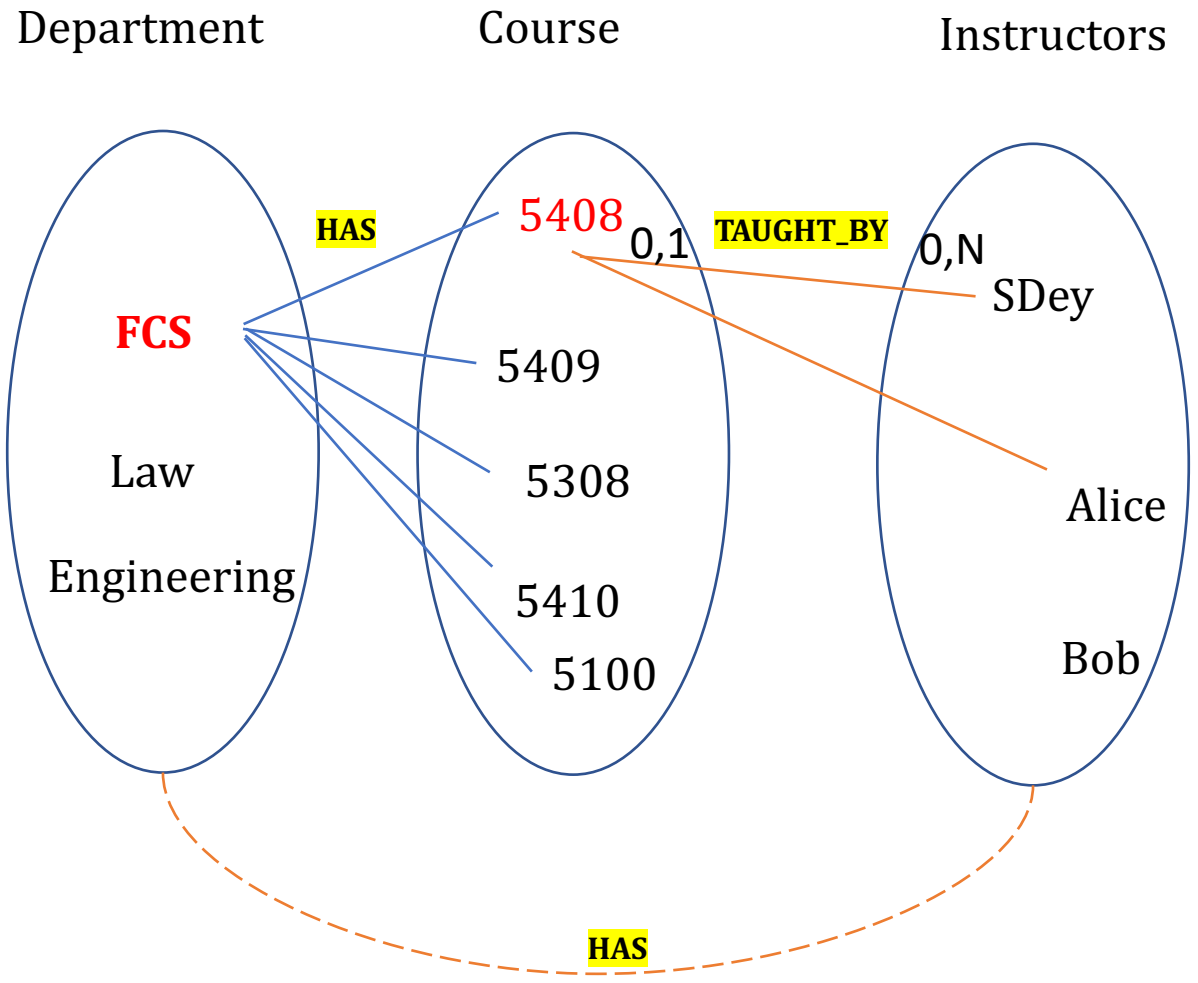
Problem



Solution

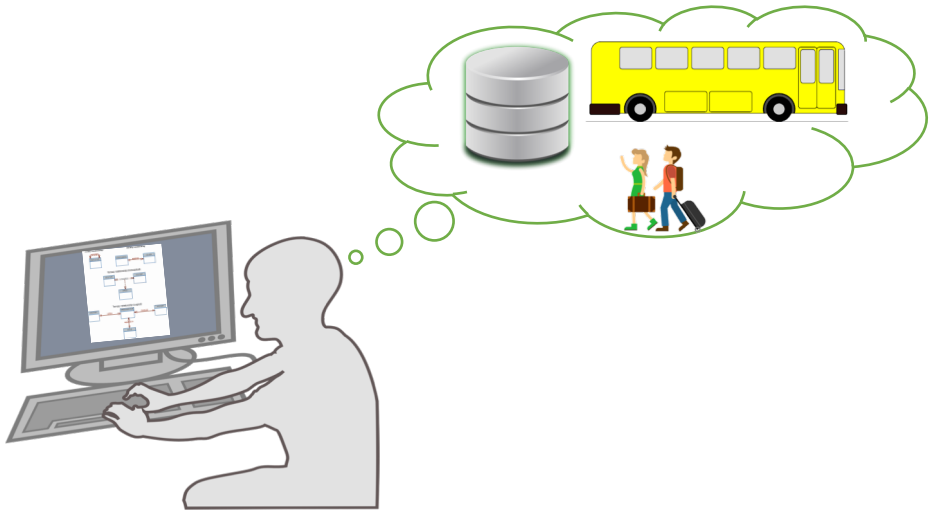
Chasm Traps

Model suggests a relationship, however, the suggested path may not exist



How to design entity-relationship diagram (ERD) from a given problem?

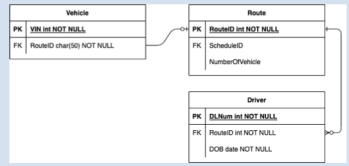
e.g. A new tourism company “HalifaxBus” wants to open office at Halifax, and asked to design their database system. They have limited budget and computational capacity. However, they want to maintain dynamic reservation system and also interested in reviewing their yearly sales record.



- What is the requirement?
- What are the entity types or sets?
- How many attributes?
- Find the unique attribute
- Is there any weak entity?
- What are possible relationships?
- Design an ERD
- Is there any Fan Trap?
- Is there any redundancy issue?
- Choose a database system (MSSQL/MySQL etc.)
- Create database and tables

Step by Step finding Solution – *HalifaxBus*

Entities	Attributes	Relationships	Build Model	Fix Design Issues

Employee
Vehicle
RepairShop
Schedule
Route
Passenger
Policy
ServiceHistory
	• E.g. **Vehicle** {VIN, MfgDate, Model, Registration, Insurance, RouteID}
	:
	:
		1 **Driver drives** 1 **Vehicle**
		
		1 **Route has** N **Vehicle**
		
		:
		:
				• **Did you capture history?**
				
				• **Are there traps?**
				  • **Fan Trap**
				  • **Chasm Trap**
				
				• **Is it flexible and extendable**

1	2	3	4	5

Conceptual Phase to create Conceptual Model

Entity Supertypes and Subtypes

- **Entity supertype**
  - Generic entity type related to one or more entity subtypes
  - Contains common characteristics

- **Entity subtype**
  - Contains unique characteristics of each entity subtype

- **Criteria to determine usage**
  - There must be different, identifiable kinds of the entity in the user's environment
  - The different kinds of instances should each have one or more attributes that are unique to that kind of instance

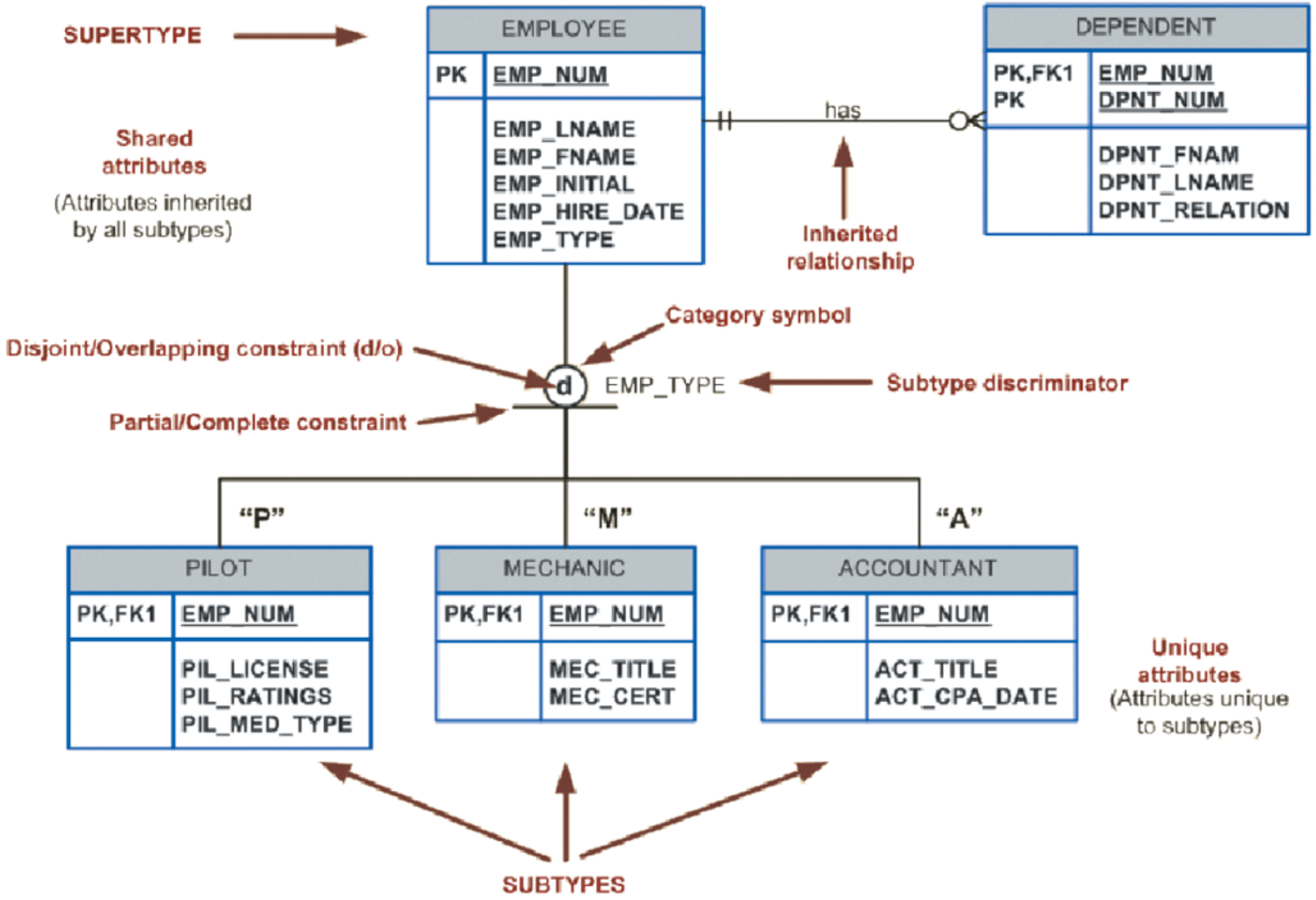
Specialization hierarchy

- Entity supertypes and subtypes are organized in a specialization hierarchy
  - Depicts arrangement of higher-level entity supertypes and lower-level entity subtypes
  - Relationships are described in terms of “is-a” relationships
  - Subtype exists within the context of a supertype
  - Every subtype has one supertype to which it is directly related
  - Supertype can have many subtypes

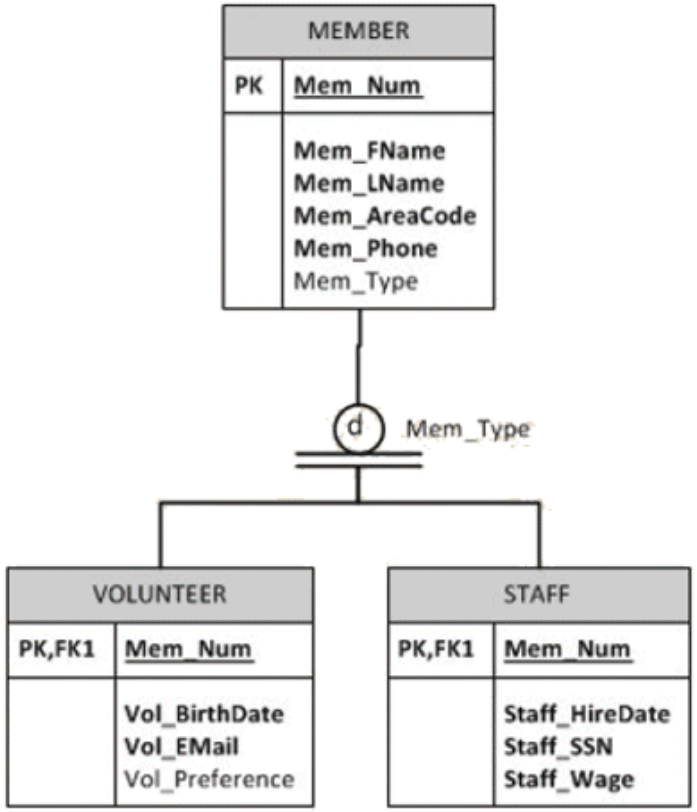
Specialization hierarchy

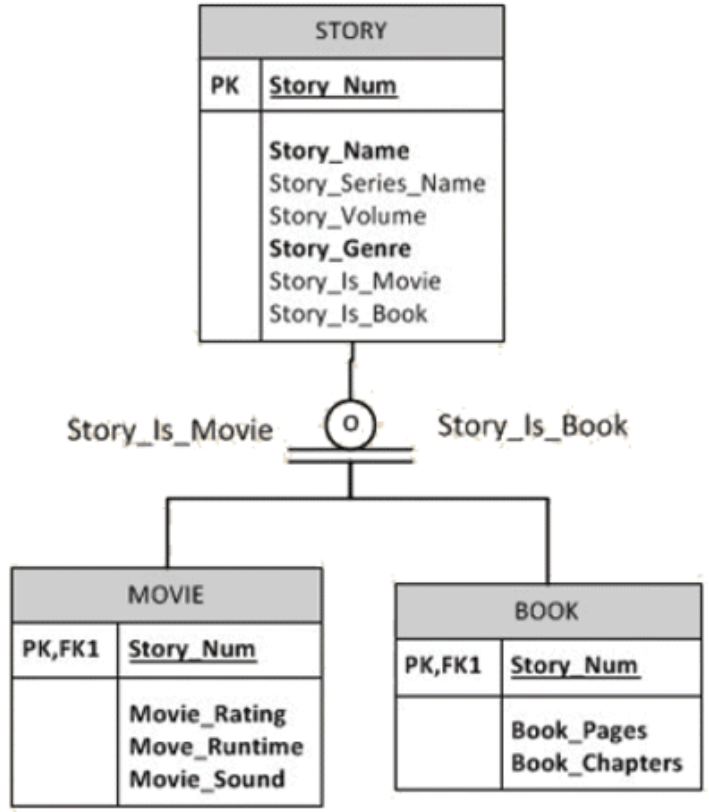
- A specialization hierarchy provides the means to:
  - Support attribute inheritance
  - Define a special supertype attribute known as the subtype discriminator
  - Define disjoint or overlapping constraints and complete or partial constraints

Specialization hierarchy



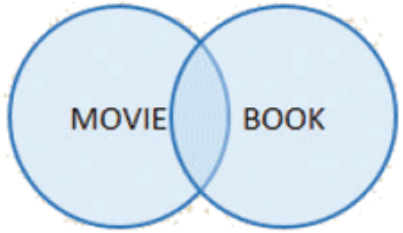
Example – overlapping/ disjoint





disjoint

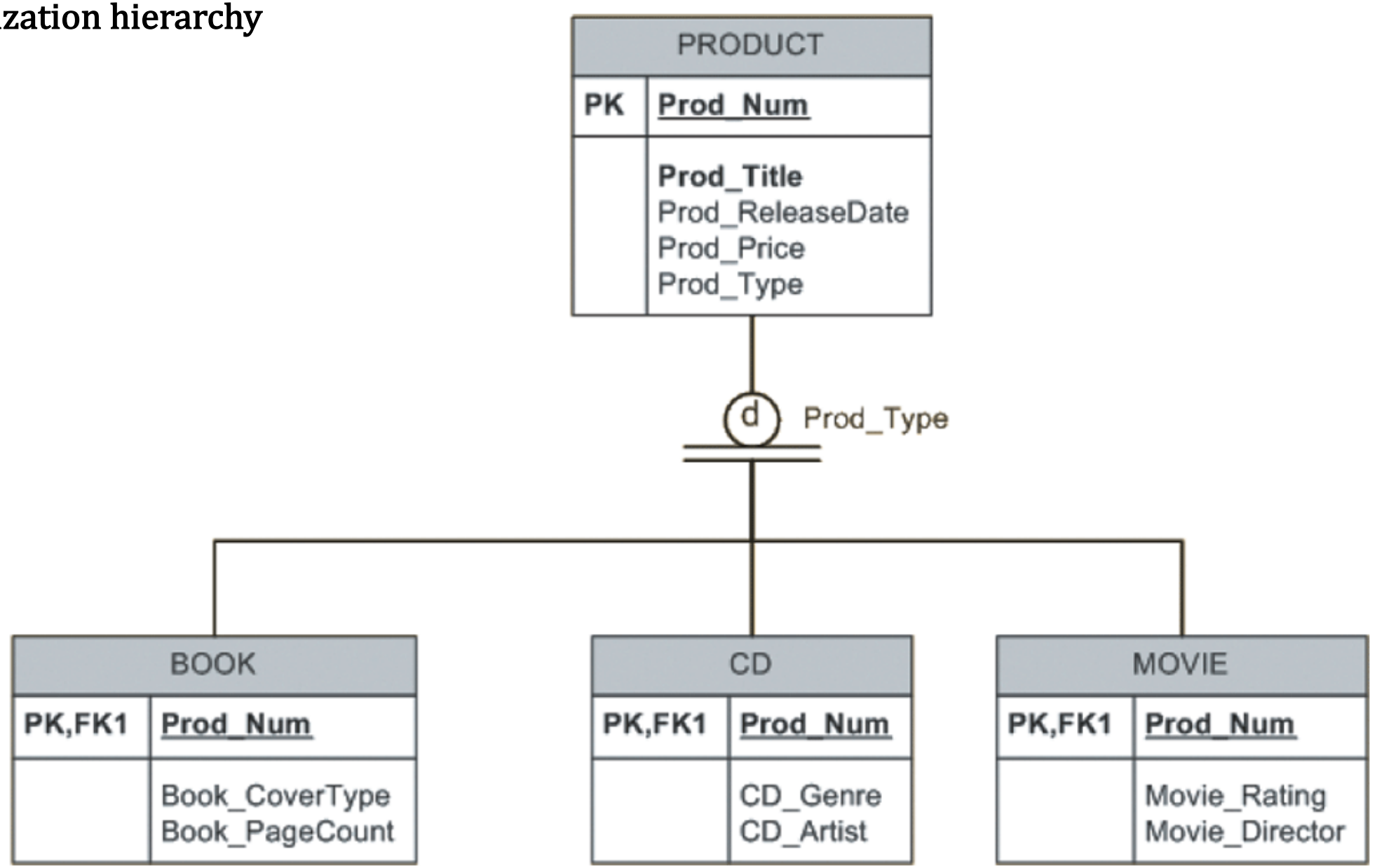
A MEMBER can be in VOLUNTEER or STAFF, but not both



overlapping

A STORY can be in MOVIE, BOOK, or both

Specialization hierarchy



End of Lecture Questions

1. Can a bad data model design cause major issues in application development?

2. Can left out entities cause data analytics problem? If Yes, is there a way to correct this?

3. Is it mandatory to consider historical data for every data modelling problem?