Module 2

Modeling Data

Object-Oriented Concepts

Objectives

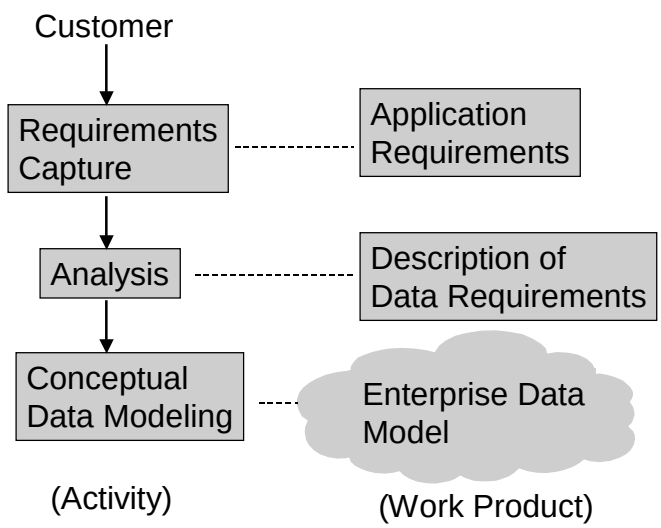
- Learn the Entity-Relationship approach to modelling data
- Reference:
  Elmasri & Navathe, 2nd edition chapter 3

Object-Oriented Concepts

Topics

- **Introduction to E-R model and notation**
- **Example E-R model constructs**

Modelling Data



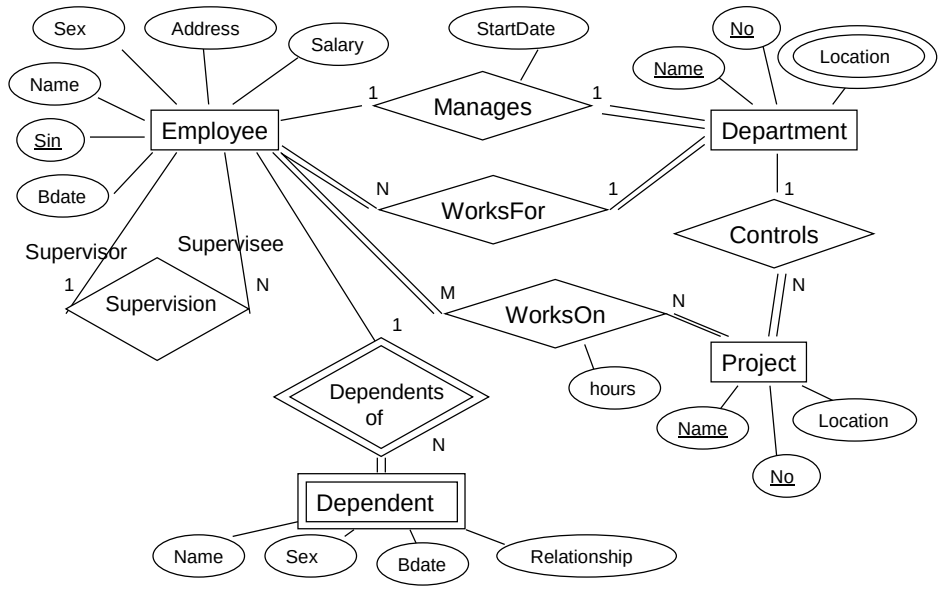
Scenarios

- A company wishes to store and access information about its employees, departments and projects.
- Departments will want to generate various reports from the stored data

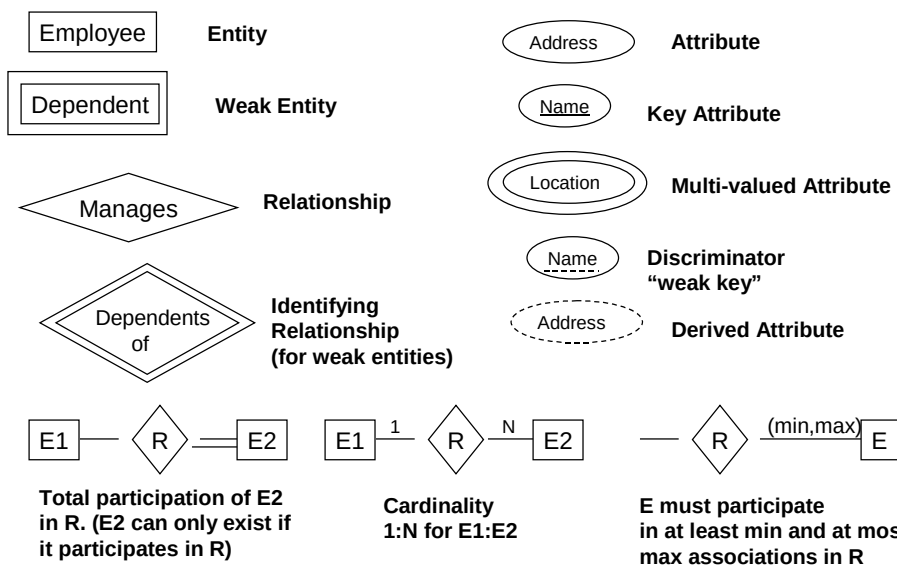
e.g. Data Description (3.2)

- Company organized into department which have unique name, unique number, manager and date manager started.
- A Department has many locations and controls projects
- Each project has a name and unique location
- Employee information includes: name, sin number, address, salary, sex, and birth date. An employee works for one department, but may work on several projects (which could be from different departments)
- Employees have a supervisor and we want to keep track of the number of hours per week they spend on each project
- For insurance purposes the company keeps track of an employees depends. It records the dependents name, sex, birthdate, and relationship to the employee

E-R diagram for Company Data (fig 3.2)



Entity-Relationship Notation



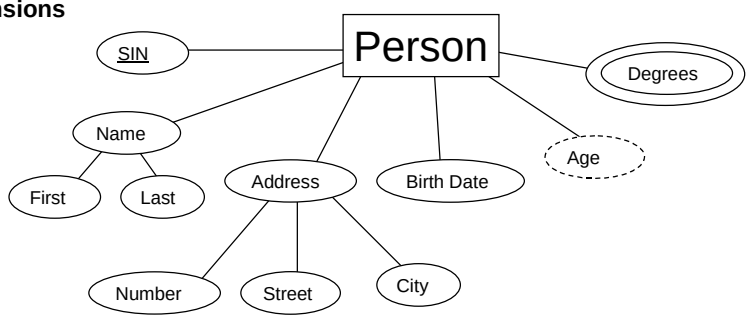
Entities and Attributes

Entity: Person
a thing with independent existence
e.g. person, company, course, job ...

Attribute: Address
Properties of entities, the things which actually hold the values

Entity describes a Type
values are called Entity Sets, or Extensions

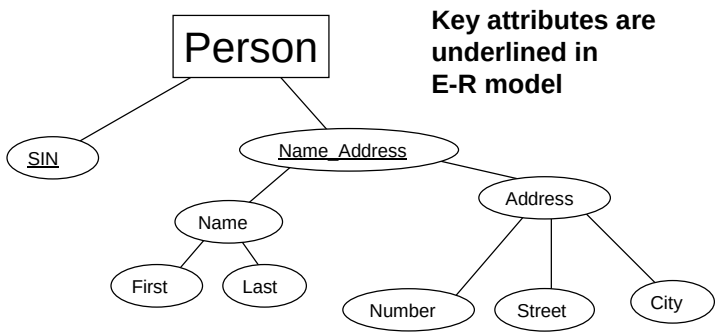
Attributes an be assigned null value



Key Attributes

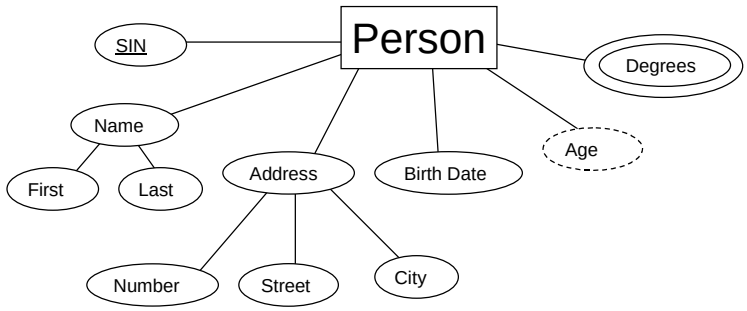
Key: Attributes whose values can distinguish different entities
(No two entity set elements can agree in their key attributes

Some data models require keys, e.g. relational model
other may not e.g. object-oriented model



Key attributes are underlined in E-R model

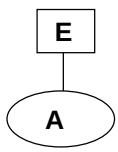
Syntactic Description of Entities and Attributes



PERSON
SIN,Name(First_Name,Last_Name),
Address(Number,Street,City),Birth_Date,{Degrees}

( ) = composite attribute
{ } = multi-values attribute

Attribute Values and Domains



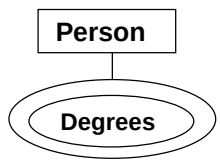
E = Entity
A = Attribute
A(e) = value of attribute A of entity type e

V = value set of A in E (Domain of A)

P(V) = powerset of V

A: E -> P(V)

Example



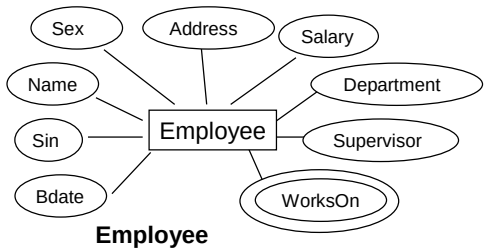
E = Person
A = Degrees
A(e) = {Bsc, Msc}

V = {Bsc, Msc, PhD}

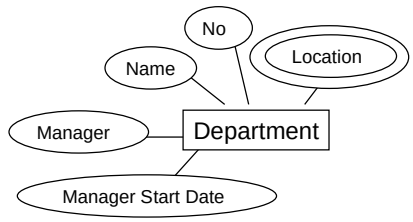
P(V) = { {} {Bsc} {Msc} {PhD} {Bsc, Msc} {Msc, PhD} {Bsc, PhD} {Bsc, Msc, PhD} }

A(e) ∈ P(V)

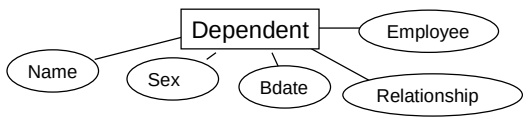
Initial Entities for Company Database (fig 3.8)



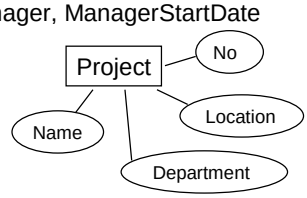
Employee
Name,SIN,Sex,Address,Salary
Bdate,Department,Supervisor,
WorksOn{Project, Hours}



Department
Name,No,{Location}
Manager, ManagerStartDate

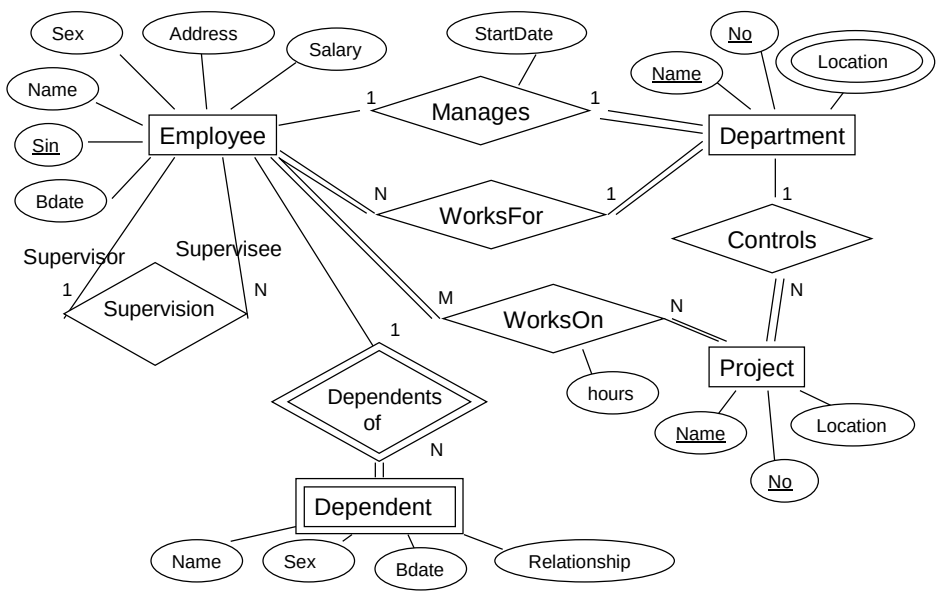


Dependent
Name,Sex,Bdate,Employee
Relationship

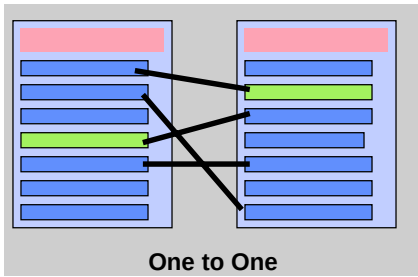


Project
Name,No,Location,Department

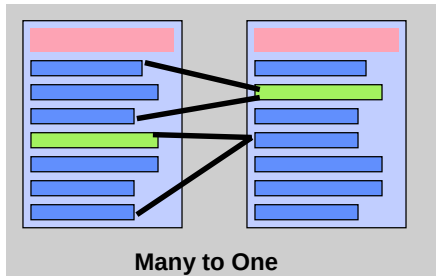
E-R diagram for Company Data (fig 3.2)



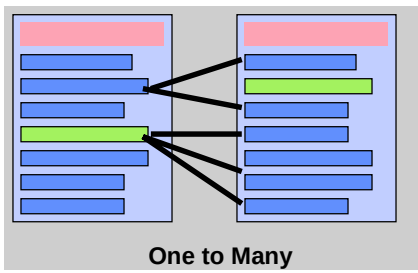
Constraints on Relationship Cardinalities



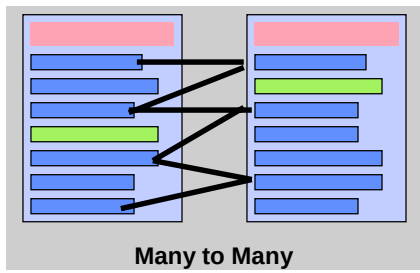
One to One



Many to One

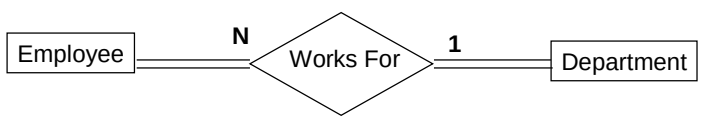


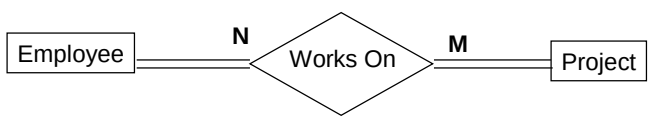
One to Many

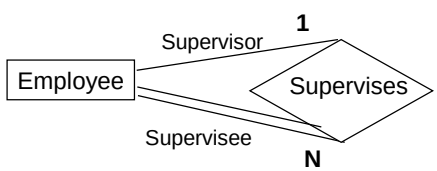


Many to Many

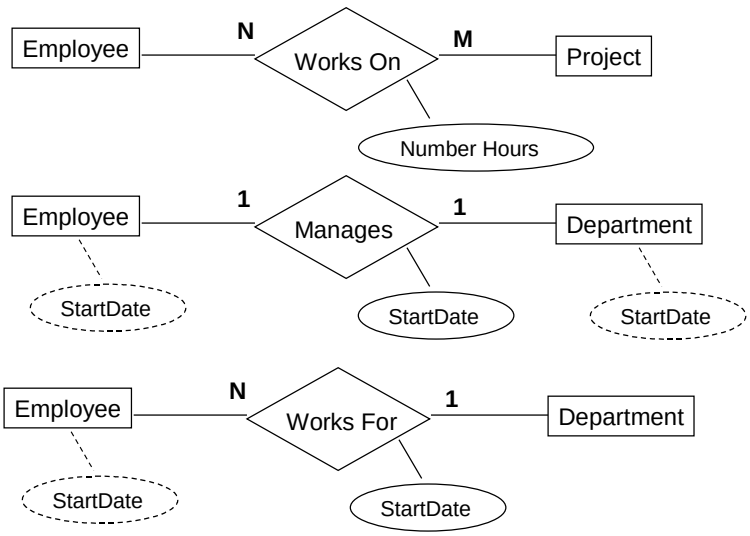
Example Relationships with Constraints



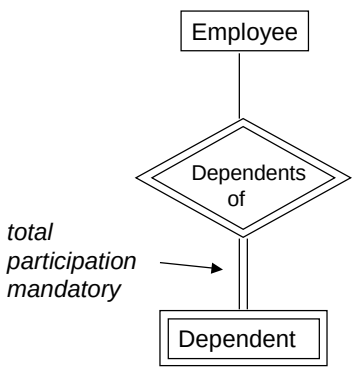




Relationships can have attributes



Weak Entities



Identifying Entity (owner)
Employee
name,SIN,address...

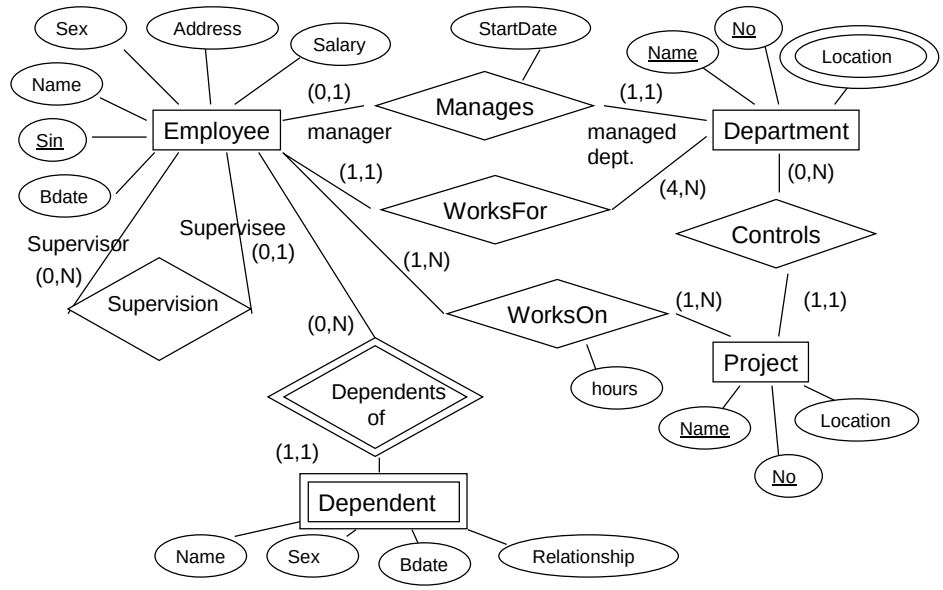
Identifying Relationship
Employee
name,SIN,address...

Weak Entity
Dependent
name,age,relationship

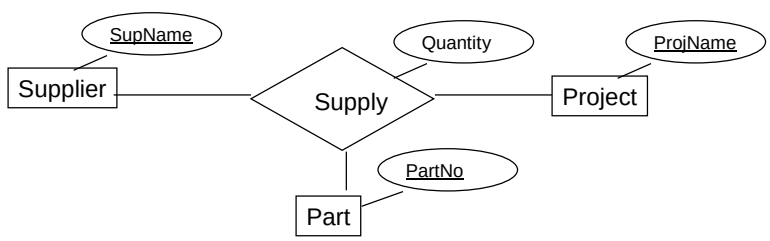
has descriminator or partial key

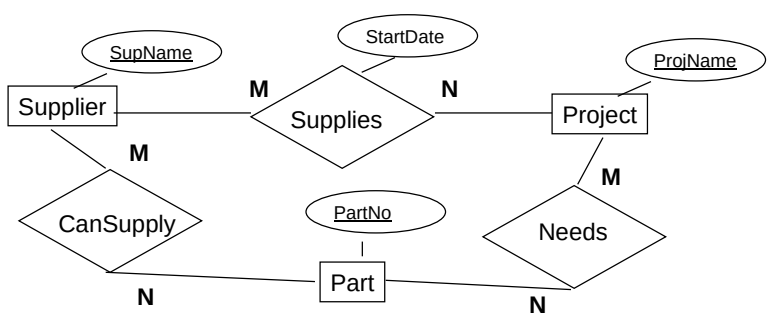
In simple cases weak entities can be handled as multivalued attributes of the owner entity

Company E-R diagram Alternative Notation (fig 3.14)

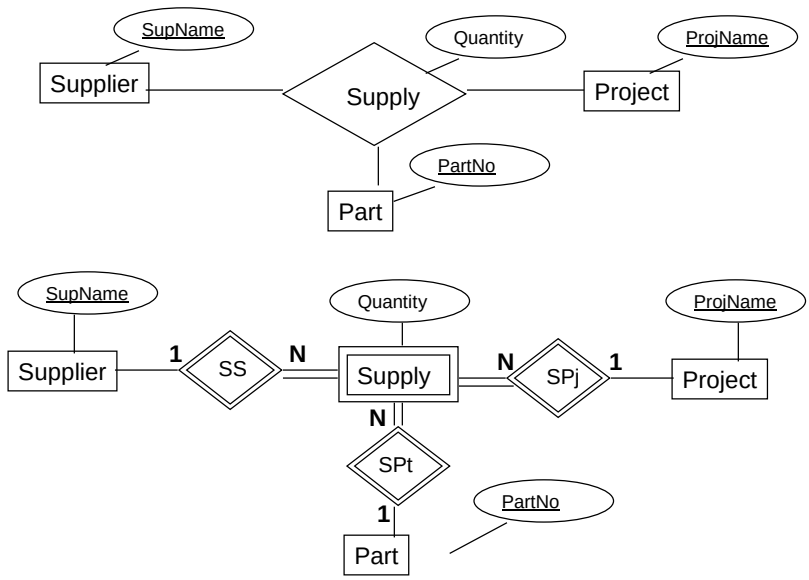


Higher Order Relationships





Equivalent Binary Relationship



Inheritance