ER – Entity Relationship Diagram

Outlines

- Basic concepts of ER diagram
- Entity and its types
- Attributes and its types
- Notations used in ER diagram
- Generalization, Specialisation
- Relationships
- Examples of ER diagram- of Banking services

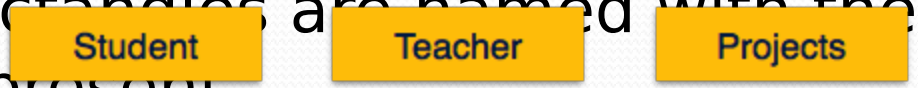
ER

- 1976 proposed by Peter Chen
- ER diagram is widely used in database design
  - Represent conceptual level of a database system
  - Describe things and their relationships in high level

Basic Concepts: Entity

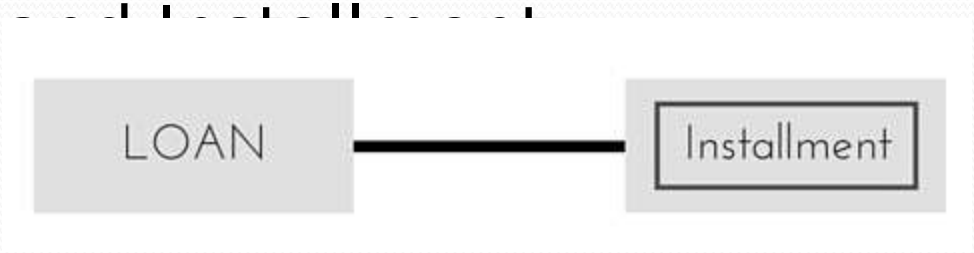
- An entity can be a real-world object, that can be easily identifiable. For example, in a school database, students, teachers, classes, and courses offered can be considered as entities. All these entities have some attributes or properties that give them their identity.

Entities are represented by means of rectangles. Rectangles are named with the entity set they represent.



Weak Entity

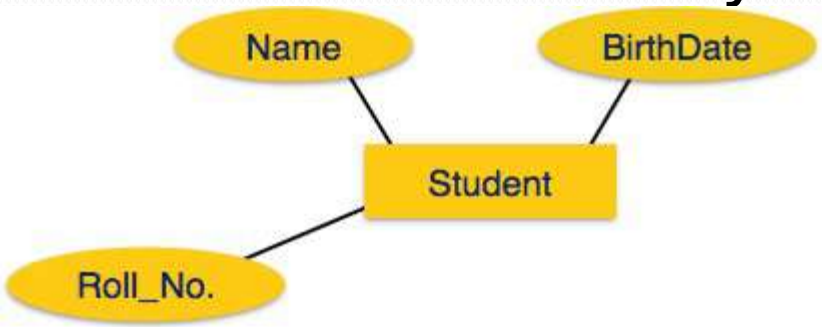
- A weak entity is one that can only exist when owned by another one. For example: a ROOM can only exist in a BUILDING. On the other hand, a TIRE might be considered as a strong entity because it also can exist without being attached to a CAR.
- Loan and Installment



Attributes

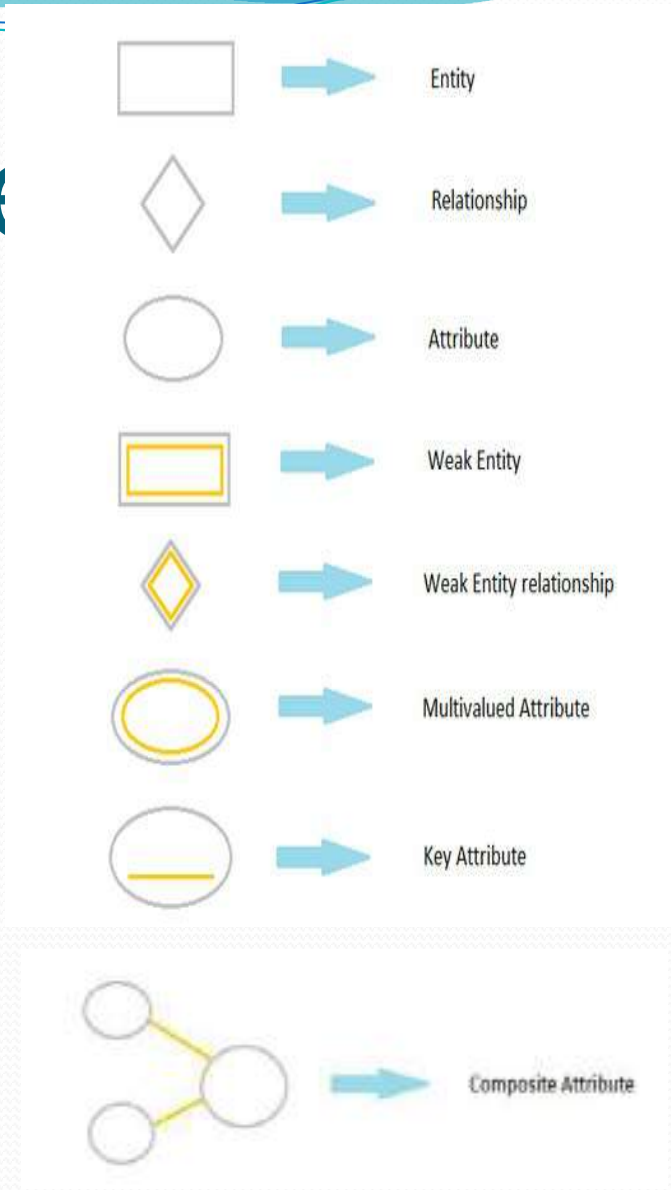
Attributes: common properties of the entities in a entity sets

Attributes are the properties of entities. Attributes are represented by means of ellipses. Every ellipse represents one attribute and is directly connected to its entity (rectangle).



Types of Attribute

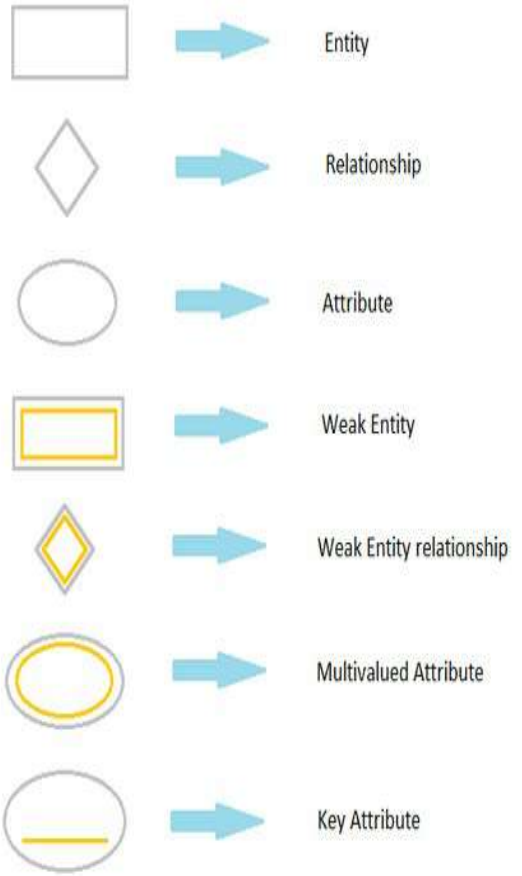
- **Simple attribute** − Simple attributes are atomic values, which cannot be divided further. For example, a student's phone number is an atomic value of 10 digits.
- **Composite attribute** − Composite attributes are made of more than one simple attribute. For example, a student's complete name may have first_name and last_name.
- **Derived attribute** − Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database. For example, average_salary in a department should not be saved directly in the database, instead it can be derived. For another example, age can be derived from data_of_birth.



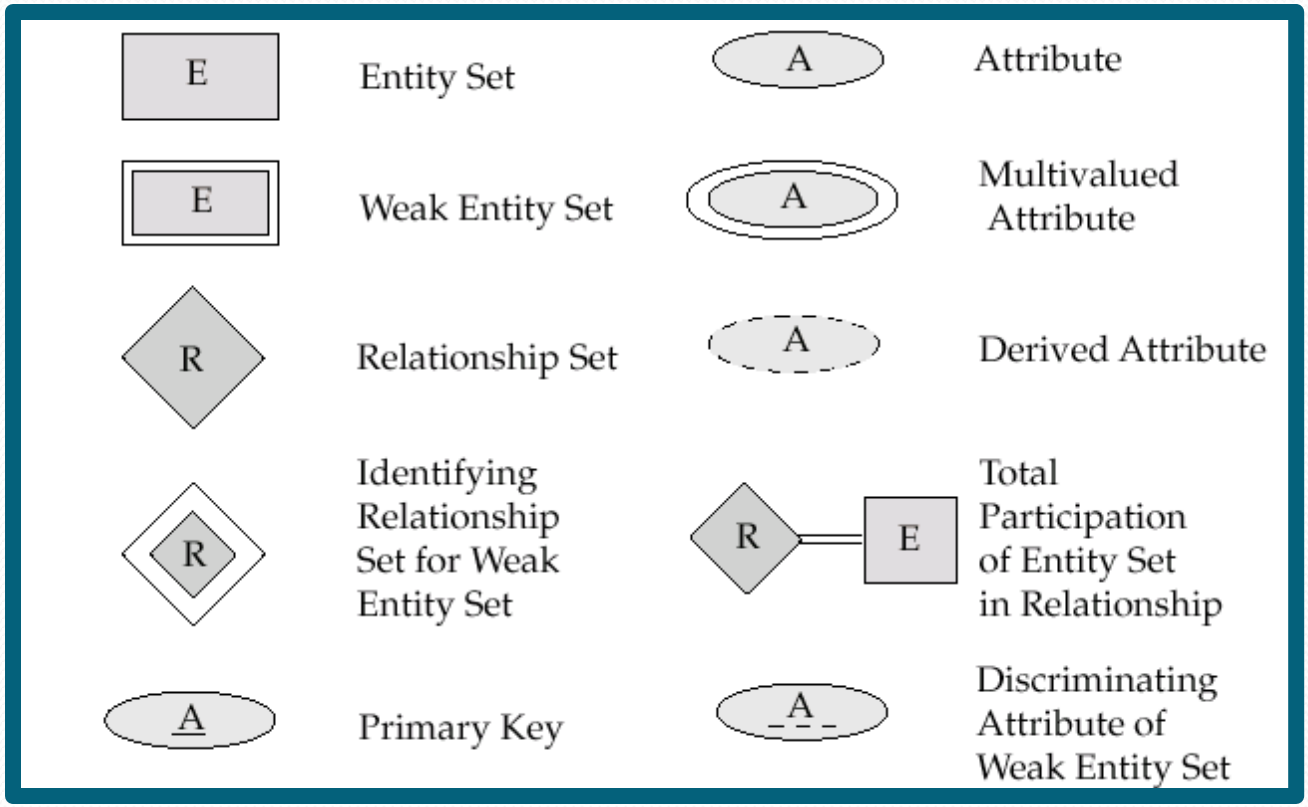
Types of Attributes

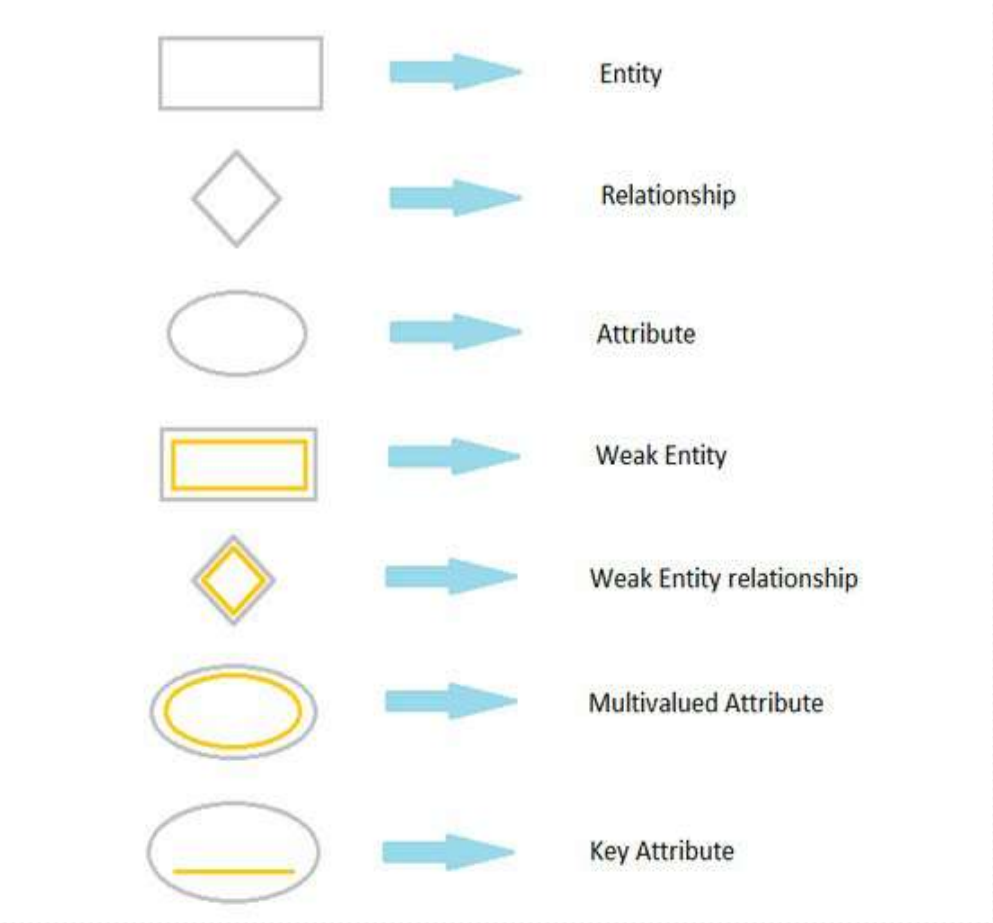
- **Single-value attribute** − Single-value attributes contain single value. For example − Social_Security_Number.

- **Multi-value attribute** − Multi-value attributes may contain more than one values. For example, a person can have more than one phone number, email_address, etc.

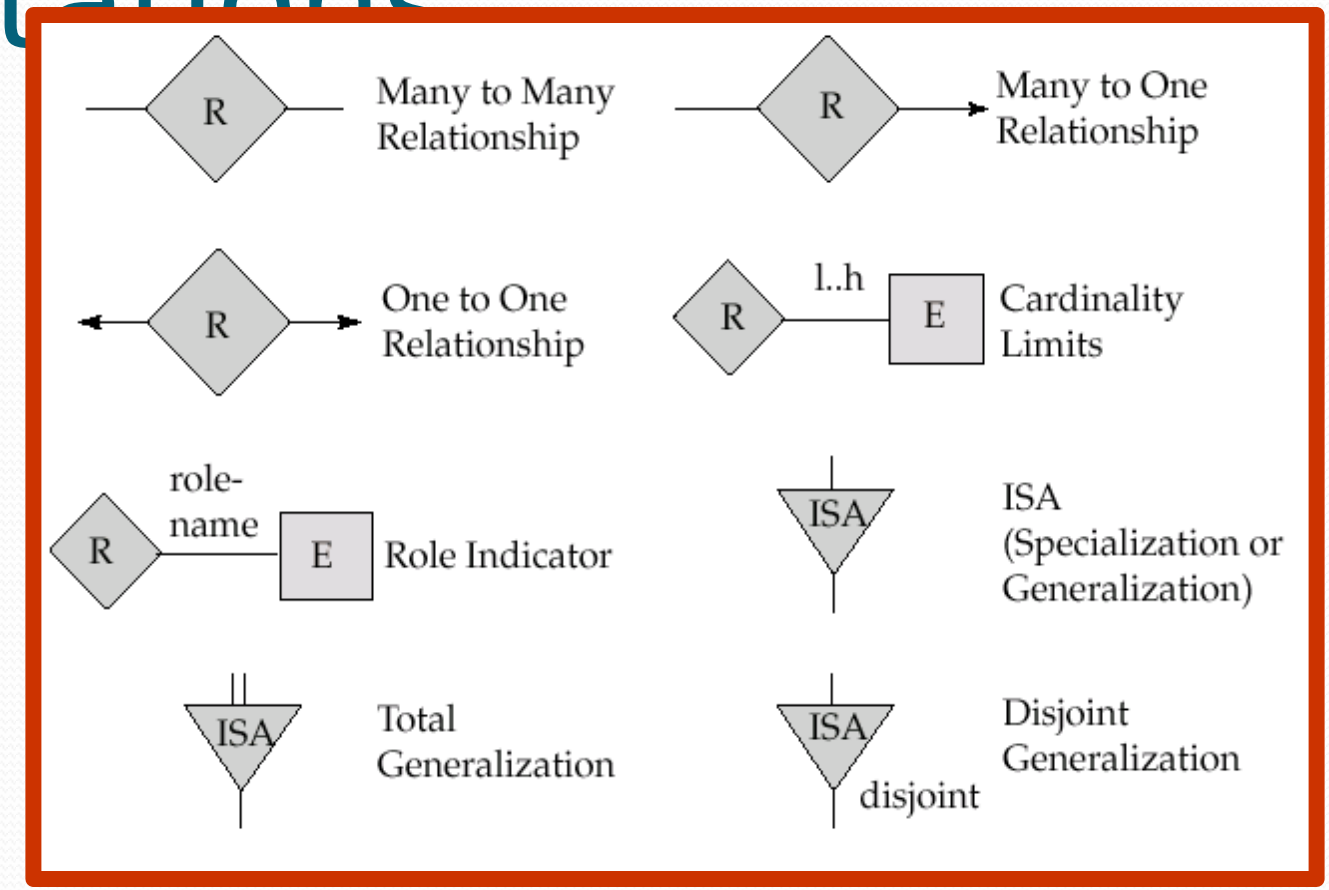


Notations

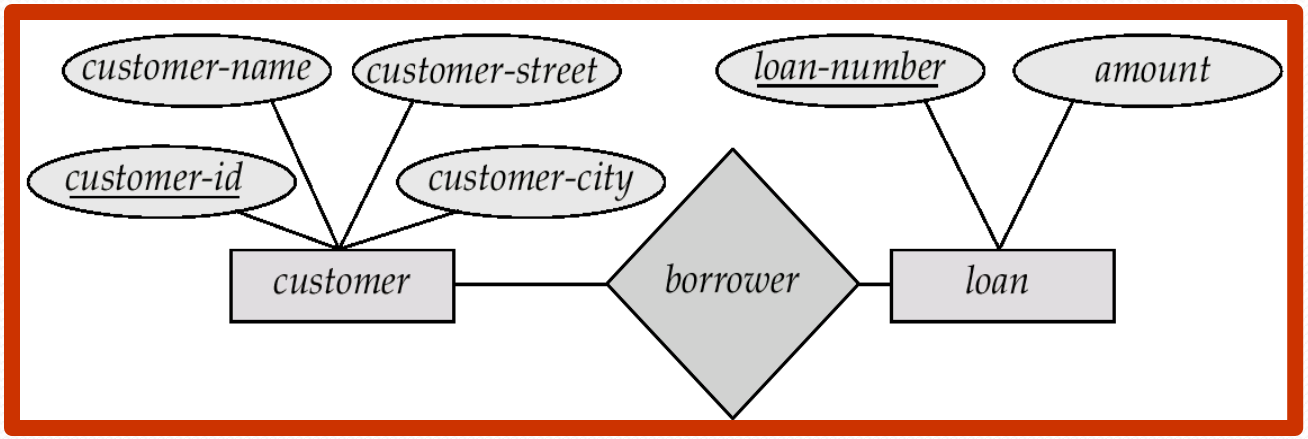

E
Entity Set
A
Attribute
E
Weak Entity Set
A
Multivalued Attribute
R
Relationship Set
A
Derived Attribute
R
Identifying Relationship Set for Weak Entity Set
R
E
Total Participation of Entity Set in Relationship
A
Primary Key
A
Discriminating Attribute of Weak Entity Set

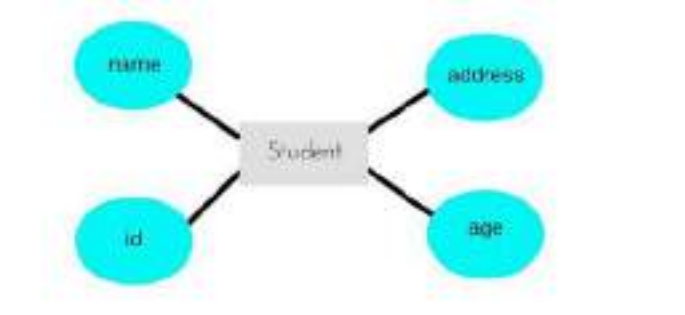

Entity
Relationship
Attribute
Weak Entity
Weak Entity relationship
Multivalued Attribute
Key Attribute

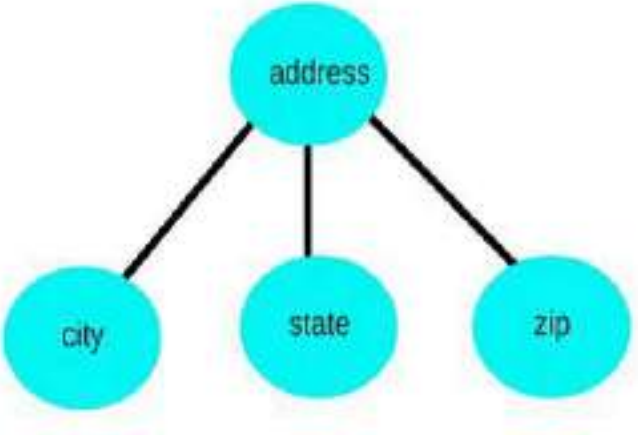
Notations

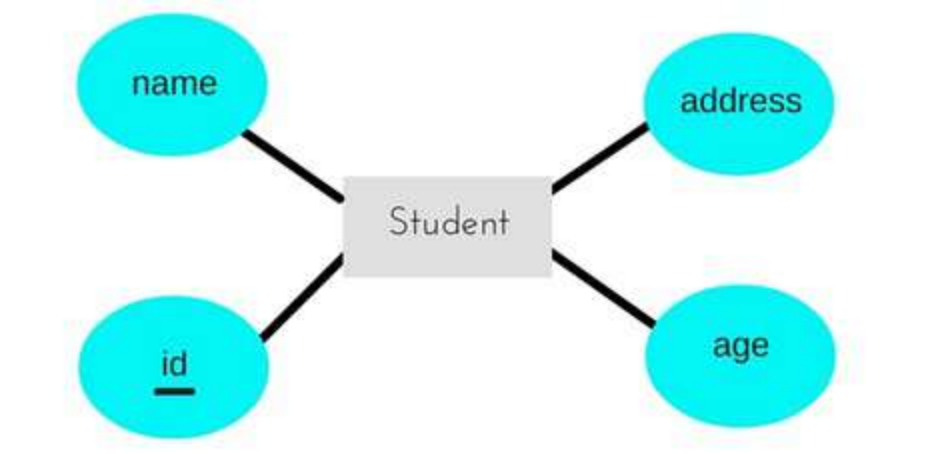

R
Many to Many Relationship
R
Many to One Relationship
R
One to One Relationship
R
l..h
E
Cardinality Limits
role-name
R
E
Role Indicator
ISA
ISA (Specialization or Generalization)
ISA
Total Generalization
ISA
disjoint
Disjoint Generalization

An Example


customer-name
customer-street
loan-number
amount
customer-id
customer-city
customer
borrower
loan


name
address
Student
id
age


address
city
state
zip


name
address
Student
id
age


Student
1
enroll
1
Course

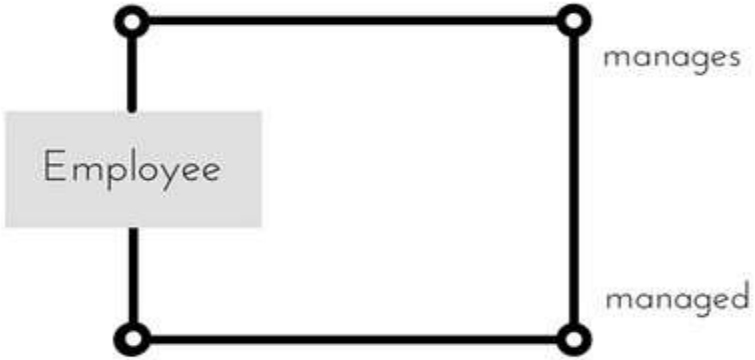

Student
N
enroll
N
Course


Student
1
enroll
N
Course


Student
N
enroll
1
Course

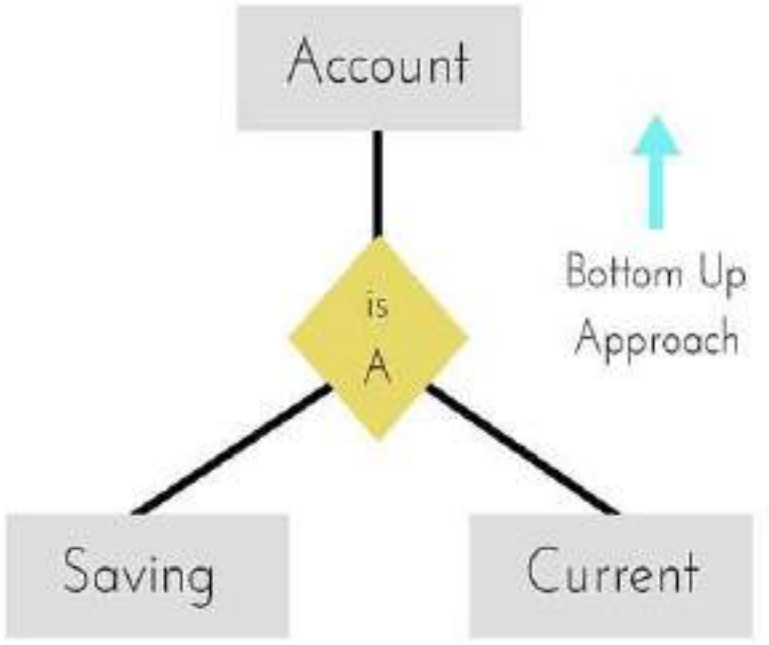
Recursive Relationship

When an Entity is related with itself it is known as **Recursive** Relationship.

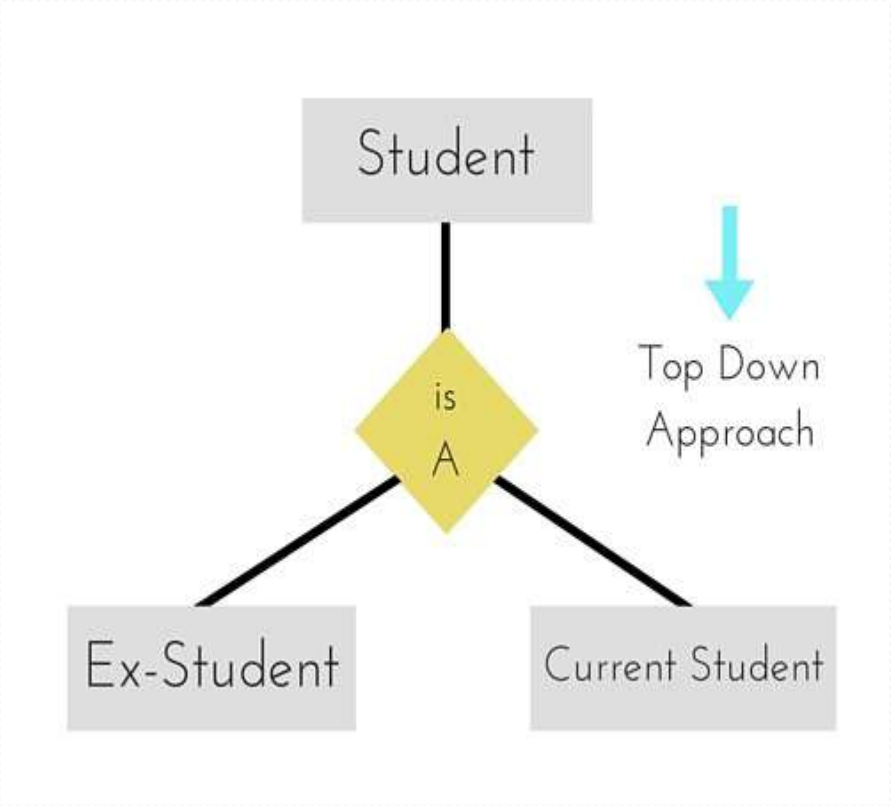


Generalization

- **Generalization** is a bottom-up approach in which two lower level entities combine to form a higher level entity. In generalization, the higher level entity can also combine with other lower level entity to make further higher level entity.

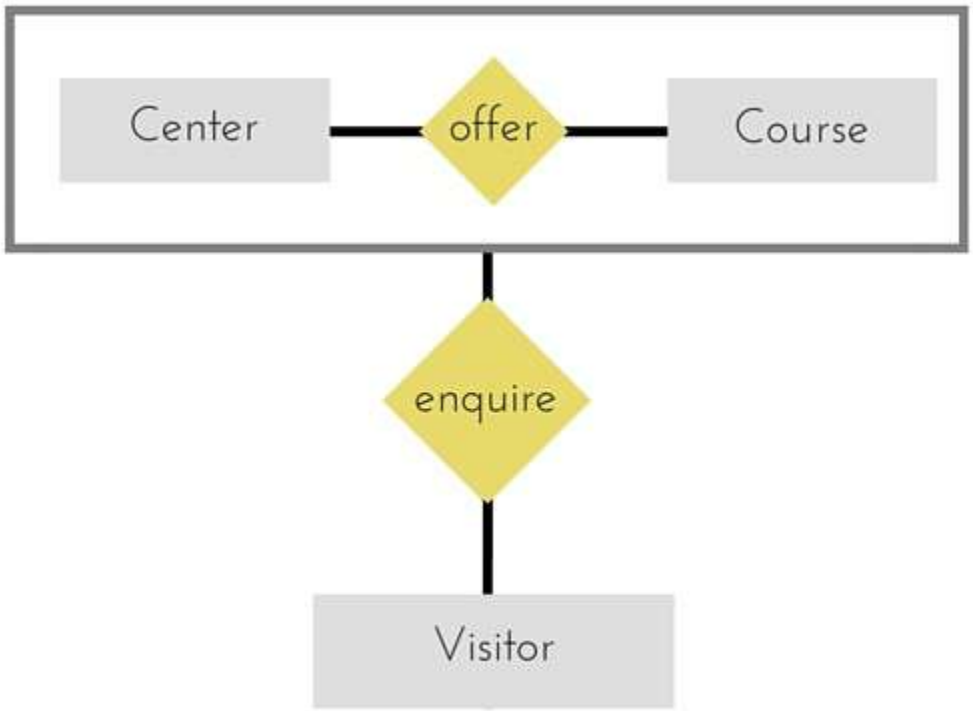


Specialization is opposite to Generalization. It is a top-down approach in which one higher level entity can be broken down into two lower level entity. In specialization, some higher level entities may not have lower-level entity sets at all.



Aggregration

- Aggregration is a process when relation between two entity is treated as a single entity. Here the relation between Center and Course, is acting as an Entity in relation with Visitor.



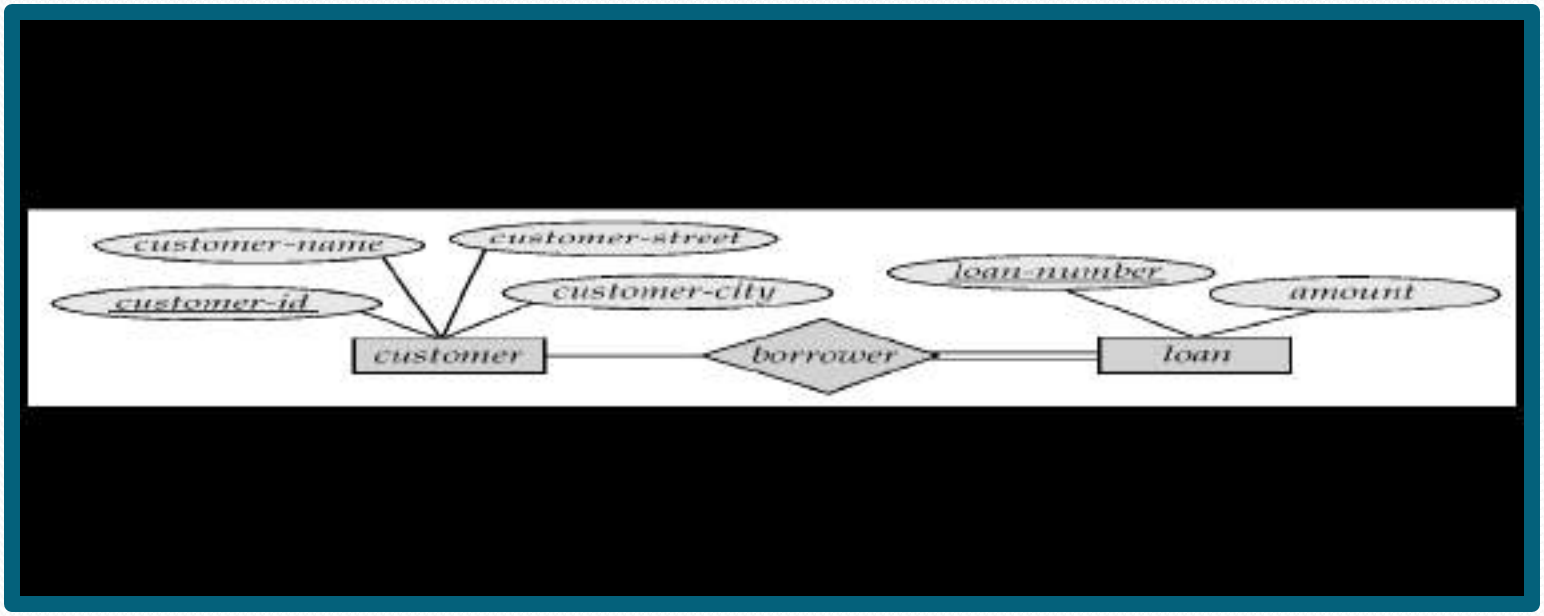
Note on Mapping Cardinality

- Both many and 1 include 0
  - Meaning some entity may not participate in the relationship

Total Participation

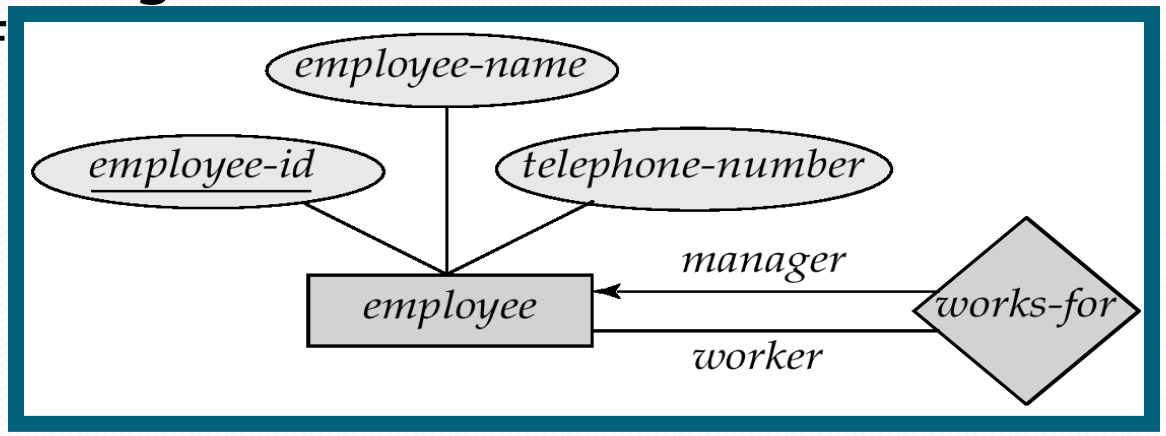
- When we require all entities to participate in the relationship (total participation), we use double lines to specify

Every loan has to have at least one customer



Self Relationship

- Sometimes entities in a entity set may relate to other entities in the same set. Thus self relationship
- Here employees mange some other employees
- The labels “manger” and “worker” are called *roles* the self



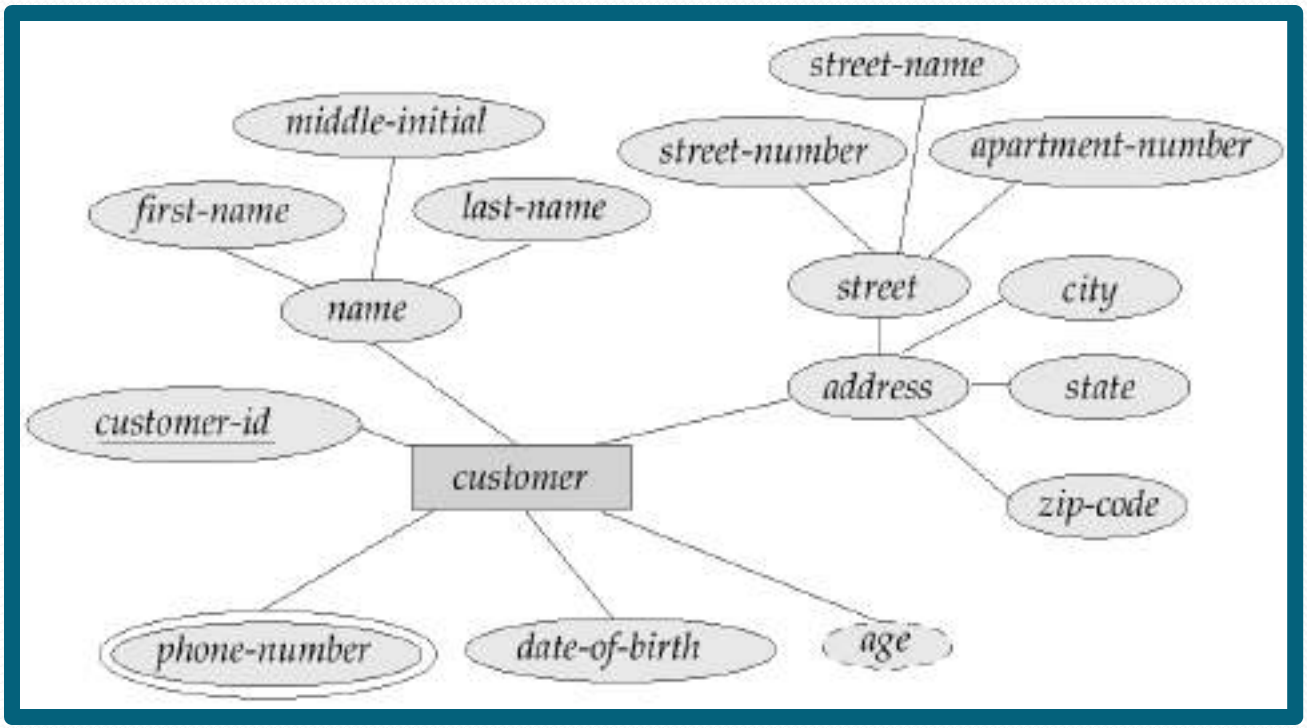
More examples on self-relationship

- People to people
  - Parent – children
  - Manager – employee
  - Husband – wife
- Word to word
  - Root – synonym

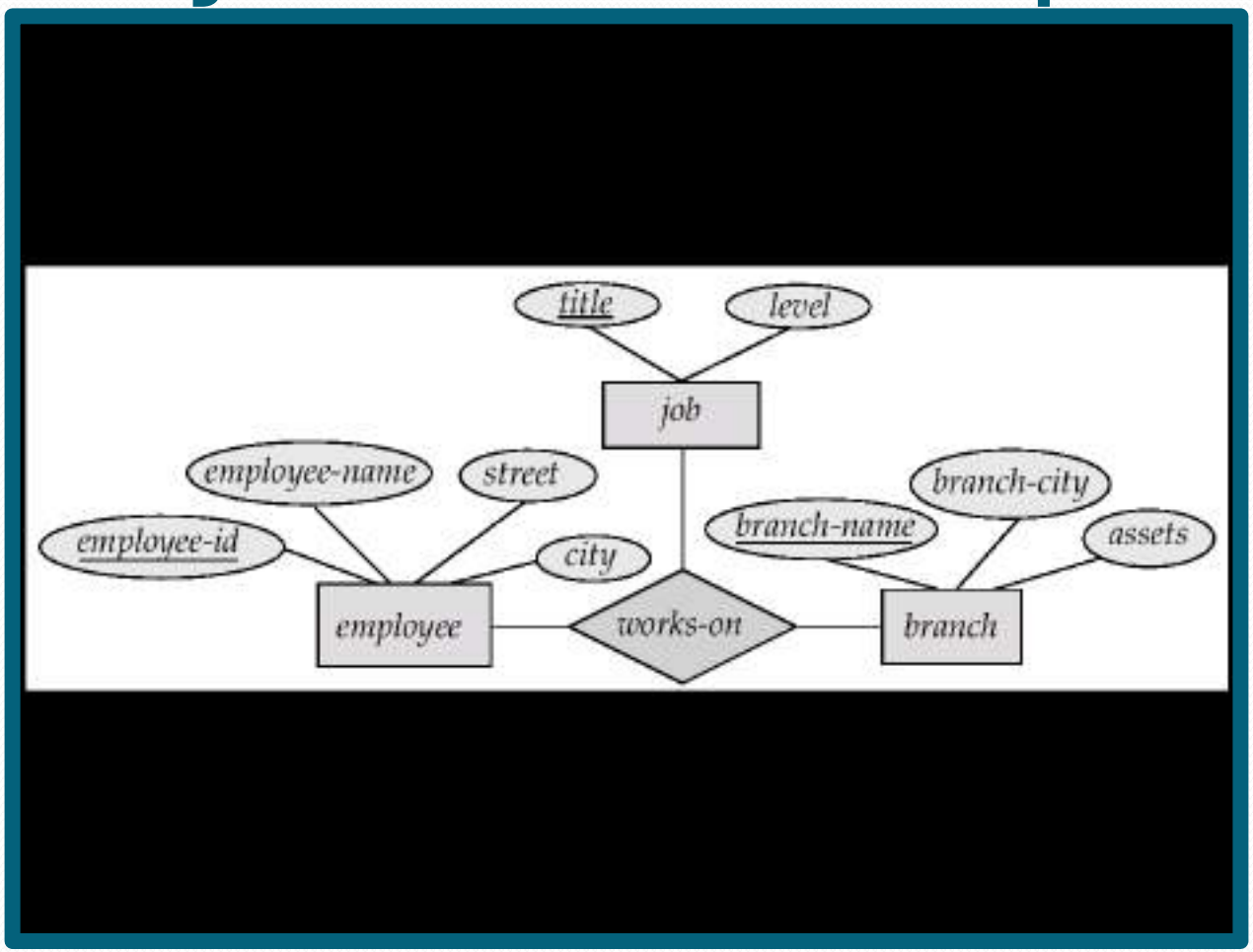
Attributes

- Both entity sets and relationships can have attributes
- Attributes may be
  - Composite
  - Multi-valued (double ellipse)
  - Derive (dashed ellipse)

Another Example



Ternary Relationship

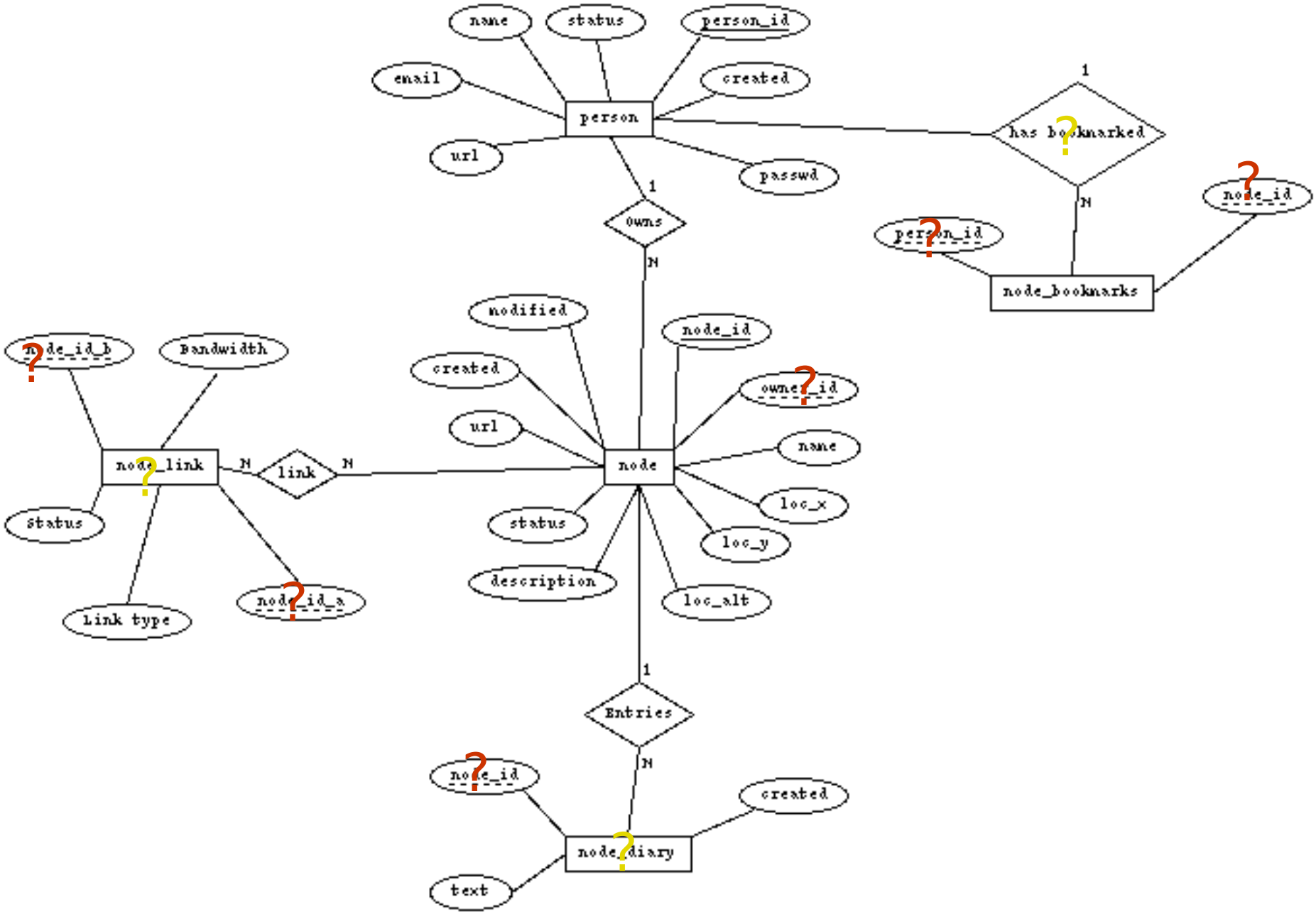


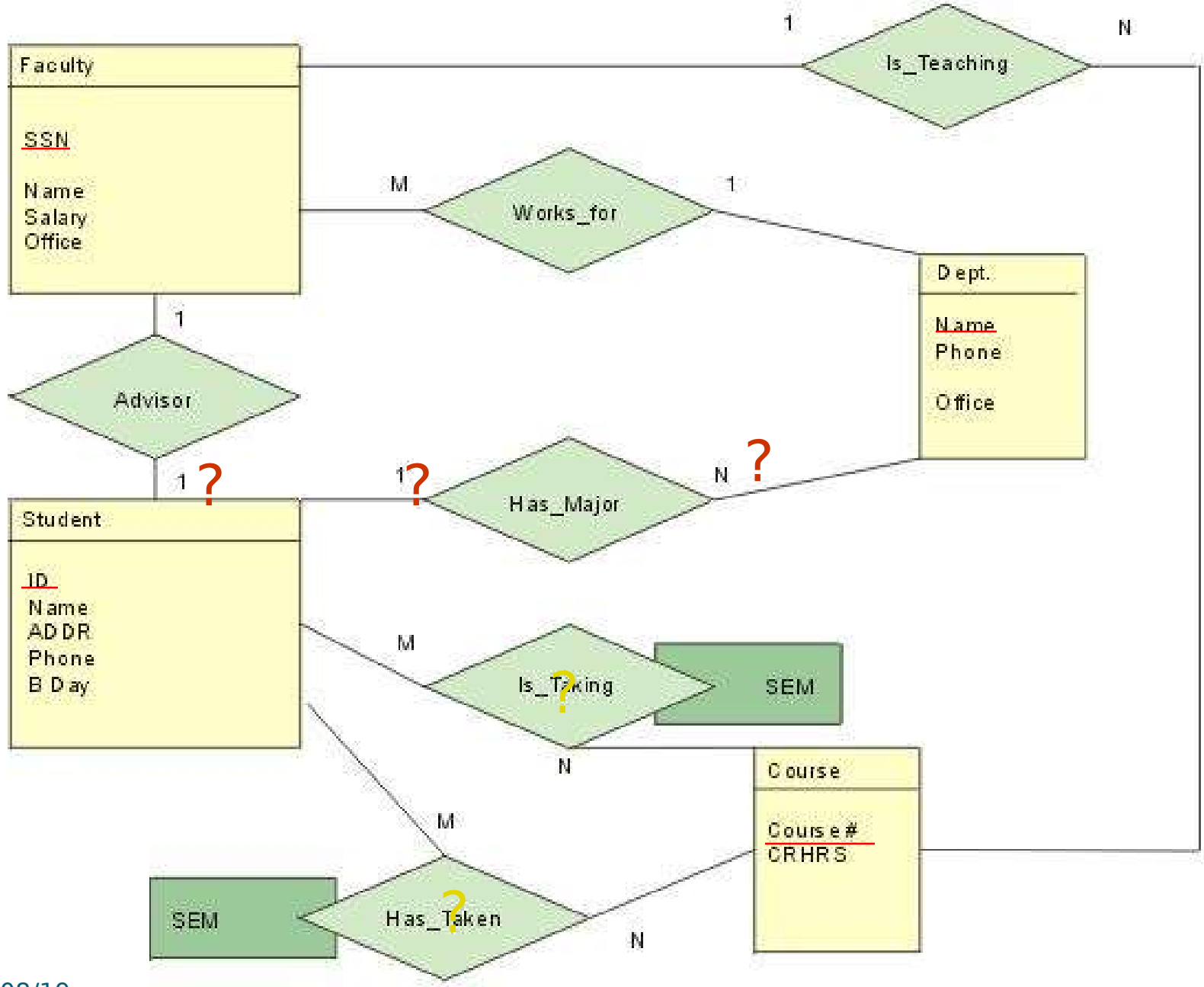
ER for Banking Enterprise

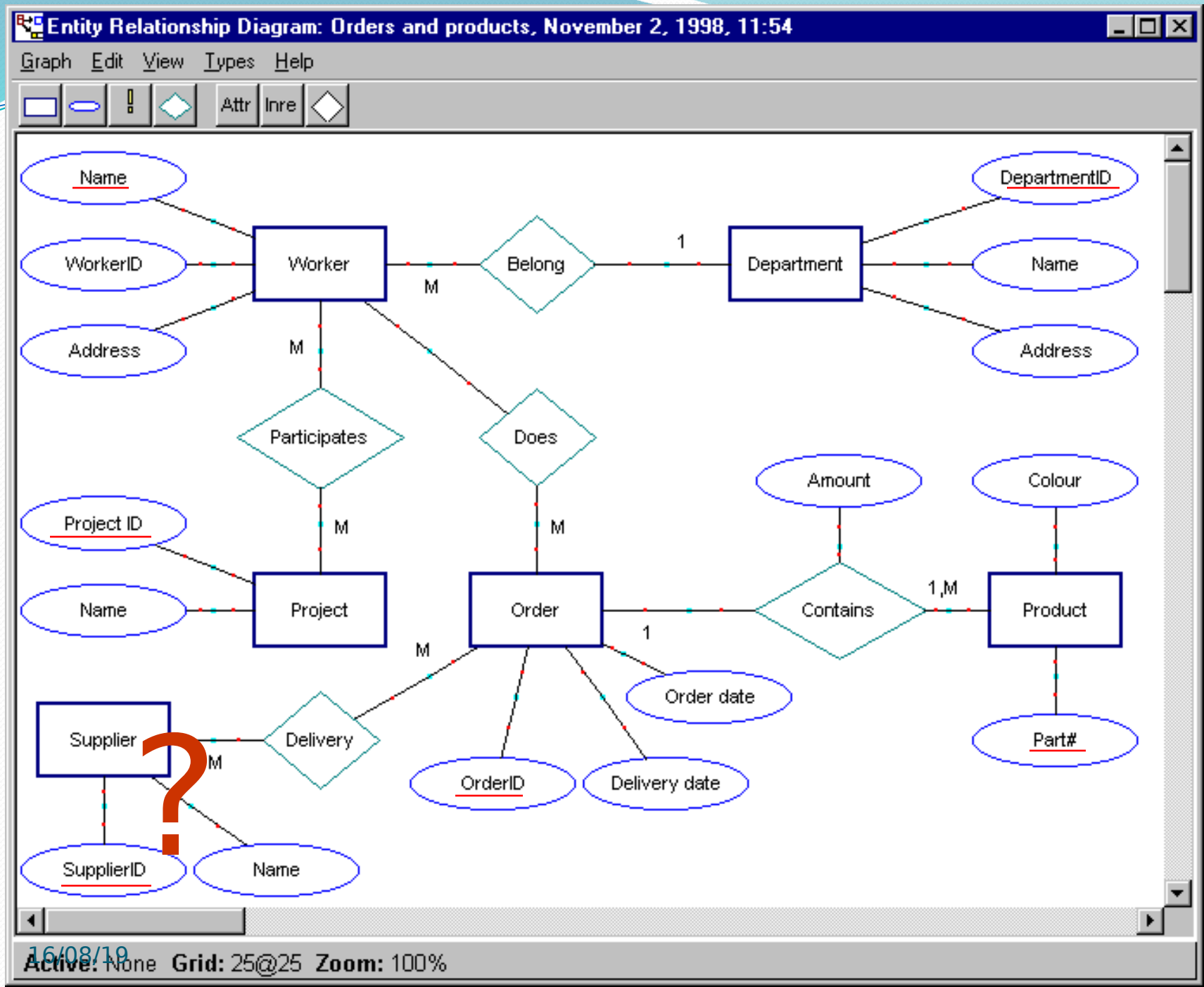
- Description handhout

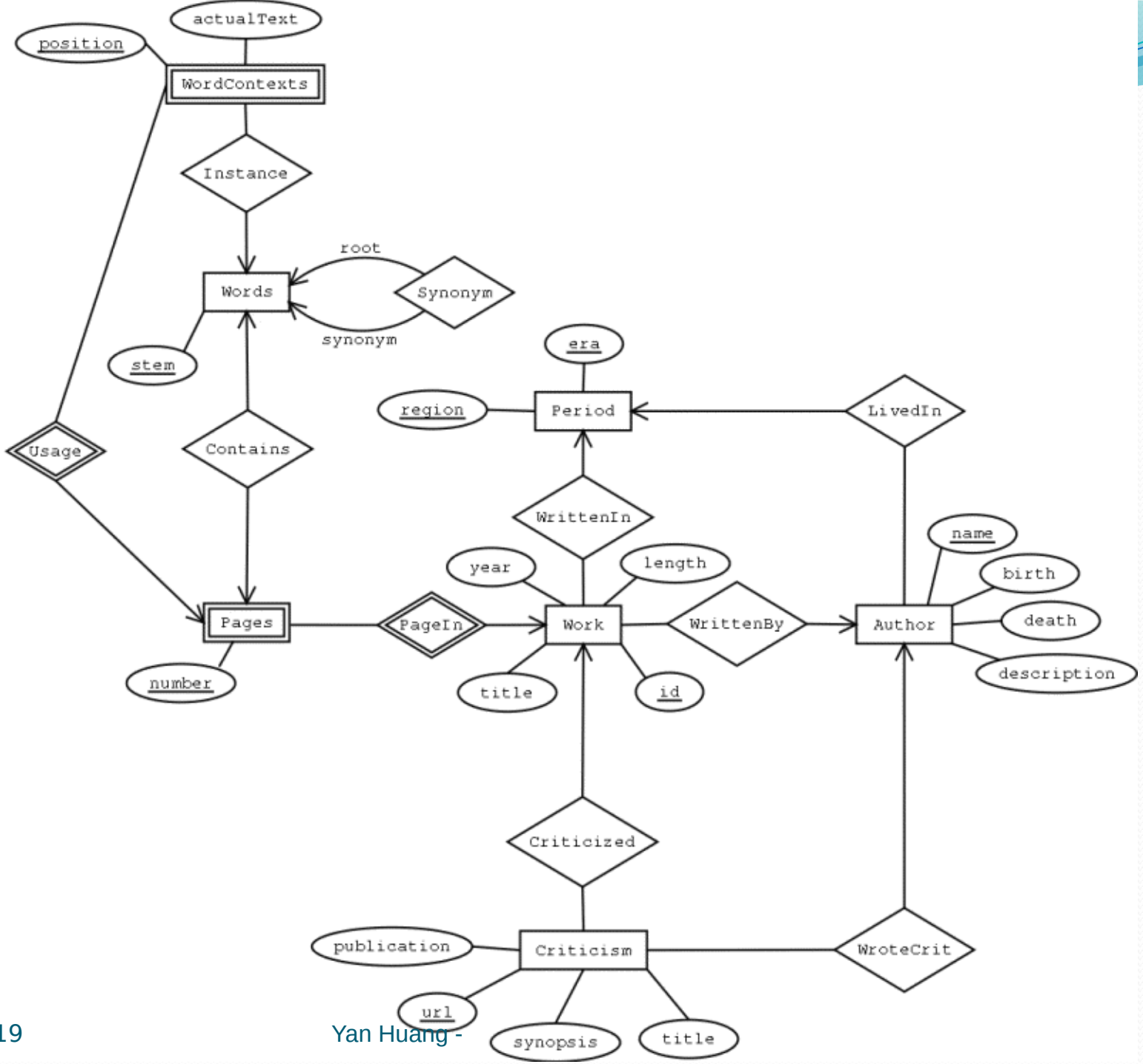
Read ER Diagrams

- Following are some ER diagrams grabbed from the web
- Read to understand/criticize


name
status
person_id
email
created
person
url
passwd
1
owns
N
1
has bookmarked
N
node_id
person_id
node_bookmarks
modified
node_id
created
owner_id
url
name
node
loc_x
status
loc_y
description
loc_alt
node_id_b
Bandwidth
node_link
N
link
N
status
Link type
node_id_a
1
Entries
N
node_id
created
node_diary
text


Faculty
SSN
Name
Salary
Office
1
N
Is_Teaching
M
1
Works_for
Dept.
Name
Phone
Office
1
Advisor
1
?
1
?
Has_Major
N
?
Student
ID
Name
ADDR
Phone
B Day
M
Is_Taking
?
SEM
N
Course
Course#
CRHRS
M
SEM
Has_Taken
?
N


Entity Relationship Diagram: Orders and products, November 2, 1998, 11:54
Graph Edit View Types Help
Attr Inre
Name
WorkerID
Address
Worker
M
Belong
1
Department
DepartmentID
Name
Address
M
Participates
Does
Project ID
Name
Project
M
M
Order
Amount
Colour
Contains
1,M
Product
M
1
Order date
Supplier
Delivery
M
OrderID
Delivery date
Part#
SupplierID
Name
Active: None Grid: 25@25 Zoom: 100%


actualText
position
WordContexts
Instance
root
Words
Synonym
synonym
stem
era
region
Period
LivedIn
Usage
Contains
WrittenIn
name
year
length
birth
Pages
PageIn
Work
WrittenBy
Author
death
number
title
id
description
Criticized
publication
Criticism
WroteCrit
url
synopsis
title

Thank You