Database Design

Lecture 15:
Basic of DB Design

Contents

- Entity Relationship Diagram (ERD)
- ***Entity***
- ***Attributes***
- ***Relationships (Degree/Types)***
- ***Constraints***
  - ***Mapping Cardinalities/Relationship Types***
  - ***Participation***
  - Keys
- ***Steps of Drawing ERD***

Database: **library management system**

- **authors (author_id, author_name, author_address)**
- **publisher (publisher_id, name, address)**
- **books(book_id, book_title, *author_id, publisher_id*, price, qunatity)**
- **borrowers(id, firstname, lastname, phone, email, address)**
- **borrow_book (id, *borrower_id, book_id*, borrowing_date, return_date)**

Database: **ecommerce**

- **Company(company_id, name, contact, address)**
- **Customer(cust_id, name, phone, city)**
- **Product(pro_id, name, description, unit_price, quantity, *comp_id*)**
- **Order(order_id, *cust_id, pro_id*, order_date, total_price)**

Database: **student Management System**

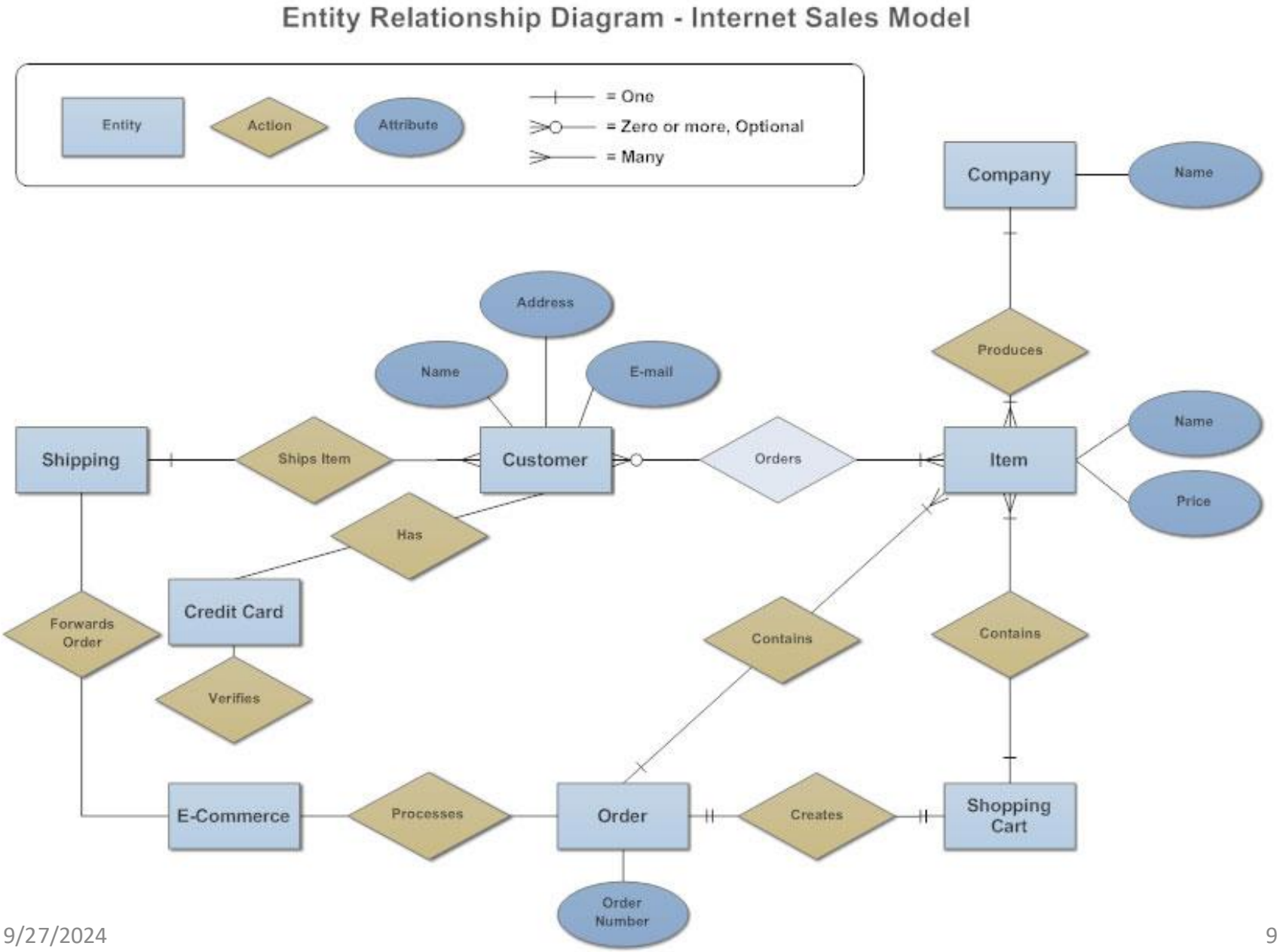
- Department(dept_id, dept_name, dept_location)
- Teacher(teacher_id, name, phone, designation, salary, city, *dept_id*)
- Student(student_id, name, roll, phone, cgpa, city, *dept_id*)
- Courses(course_id, title, credit, description, *teacher_id*)
- Enroll_course(id, *course_id, student_id*, enroll_date)

Creating Database

- You have to design a database system for **Blood Bank Management** where the system will maintain the list of donors and recipients. It will keep blood history those are available in inventory. Anyone can send request for asking any blood.

Creating Database

- You have to design a database system for **Blood Bank Management** that requires tables for managing donors, blood inventory, recipients, and requests.
  - The **Donors** table should store details like donor ID, name, blood type, contact information, and donation history.
  - The **Blood Inventory** table tracks blood units with fields for blood type, available units, and expiry dates.
  - A **Recipients** table records recipient information, such as name, blood type, contact details, and hospital affiliation.
  - A **Blood Requests** table manages requests with fields for recipient ID, requested blood type, units needed, request status, and request date.


Entity Relationship Diagram - Internet Sales Model
Entity
Action
Attribute
= One
= Zero or more, Optional
= Many
Company
Name
Produces
Address
Name
E-mail
Shipping
Ships Item
Customer
Orders
Item
Name
Price
Has
Credit Card
Forwards Order
Verifies
Contains
Contains
E-Commerce
Processes
Order
Creates
Shopping Cart
Order Number

Entity Relationship Model

- **Entity**:
  - An **entity** is an object that exists and is distinguishable from other objects.
  - Example: specific person, company, event, plant
- **Relationships**:
  - Correlations/Association among entities
  - Example: *employee **works_for** company, Instructor **teaches** students*

Attributes

- An entity is represented by a set of attributes
- **Descriptive properties** possessed by all members of an entity set
- Types
  - Simple
  - Single Valued
  - Multi valued
  - Composite
  - Stored
  - Derived
  - ***Complex [Composite-multi valued]***
  - *Simple-single valued, simple-multivalued, single derived, single-composite*

Attributes Details

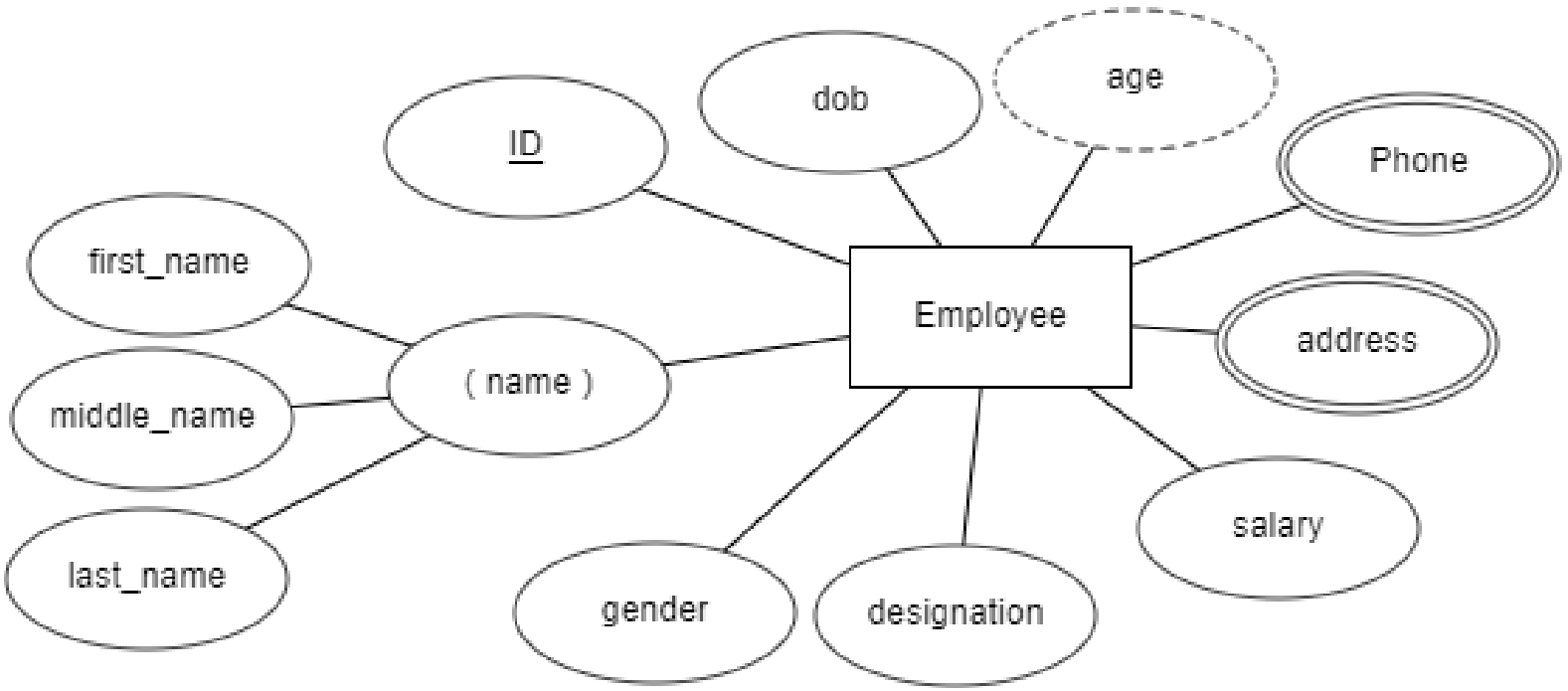
- Simple
  - Simple attributes are atomic values, which cannot be divided further
  - Example: Person(**id**, name, **phone**, address, age, dob, **email**)
- Single Valued
  - It holds only one value
  - Example: Person(**id**, name, phone, address, age, **dob**, email)
- **Multi-valued**
  - It may contain more than one values
    Example: phone, email

Attributes Details

- **Derived**
  - Which can be derived from another attribute or set of attributes
  - Example: age→dob
- **Composite**
  - Composite attributes are made of more than one simple attribute
  - Example: full name→firstname, lastname
- ***Complex [Composite multi-valued]***
  - Combination of composite and multi-valued attributes
  - Example: Address
  - Present address (post code, district , country)
  - Permanent address (Same pattern)
- *Simple-single valued, simple-multivalued, single derived, single-composite*

Representing Attributes with Entities

Employees(*id, name, email, phone, address, dob, gender, designation, salary*)



Relationships

- Degree
  - Unary (1 Degree): CR ***inform*** Students
  - Binary (2 Degree): instructor ***teaches*** Student
  - Ternary (Three/More degree): instructor, Room, Students (***Teaches***)
- Types/ ***Mapping Cardinalities Constraints***
  - One to One
  - One to Many/ Many to One
  - Many to Many
  - Recursive Relationship
- Attributes for Relationship: *Employee works for department (**Start Date**)*

Database: **student Management System**

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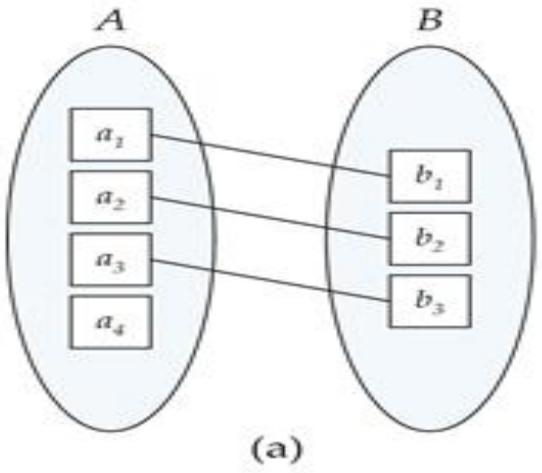
One to One

- One entity from entity set A can be associated with at most one entity of entity set B and vice versa.
- Example: Employee ***manages*** department



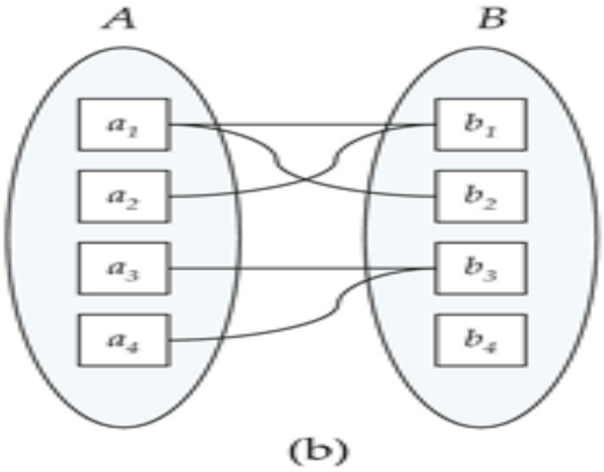
One to one

One to Many

- One entity from entity set A can be associated with more than one entities of entity set B however an entity from entity set B, can be associated with at most one entity.
- Example: Department ***Controls*** projects

Many to Many

- One entity from A can be associated with more than one entity from B and vice versa.
- Example: employees ***works_on*** projects

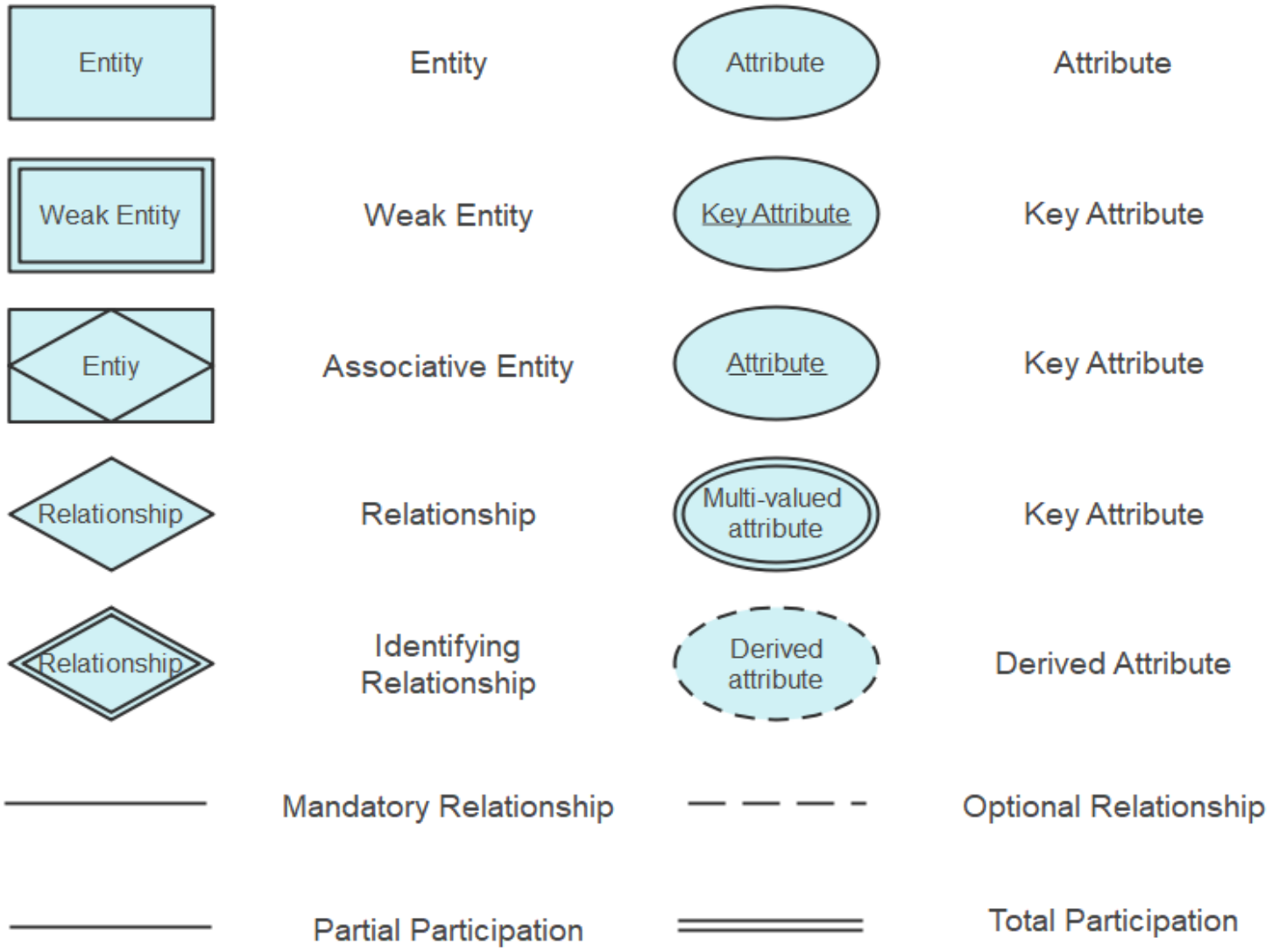


Many to many

Symbols

- **Rectangle:** Represents Entity sets.
- **Ellipses**: Attributes
- **Diamonds:** Relationship Set
- **Lines:** They link attributes to Entity Sets and Entity sets to Relationship Set
- **Double Ellipses:** Multivalued Attributes
- **Dashed Ellipses:** Derived Attributes
- **Double Rectangles:** Weak Entity Sets
- **Double Lines:** Total participation of an entity in a relationship set
- **Relationships**: 1-1, 1-N, M-N

- ***Suggested Notation: Chen ERD, UML Notation, Min-Max Notation***
- Reference: https://www.edrawsoft.com/er-diagram-symbols.html


Entity
Entity
Attribute
Attribute
Weak Entity
Weak Entity
Key Attribute
Key Attribute
Entiy
Associative Entity
Attribute
Key Attribute
Relationship
Relationship
Multi-valued attribute
Key Attribute
Relationship
Identifying Relationship
Derived attribute
Derived Attribute
Mandatory Relationship
Optional Relationship
Partial Participation
Total Participation

Reference for ERD diagram notation: https://www.edrawsoft.com/er-diagram-symbols.html

Chapter 6

END OF LECTURE