Database Design

Lecture 9 and 10:
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 (<u>author_id</u>, author_name, author_address)**

- **publisher (<u>publisher_id</u>, name, address)**

- **books(<u>book_id</u>, book_title, *author_id, publisher_id*, price, qunatity)**

- **borrowers(<u>id</u>, firstname, lastname, phone, email, address)**

- **borrow_book (<u>id</u>, *borrower_id, book_id*, borrowing_date, return_date)**

Database: **ecommerce**

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

Database: **student Management System**

- Department(<u>dept_id</u>, dept_name, dept_location)
- Teacher(<u>teacher_id</u>, name, phone, designation, salary, city, *dept_id*)
- Student(<u>student_id</u>, name, roll, phone, cgpa, city, *dept_id*)
- Courses(<u>course_id</u>, title, credit, description, *teacher_id*)
- Enroll_course(<u>id</u>, *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
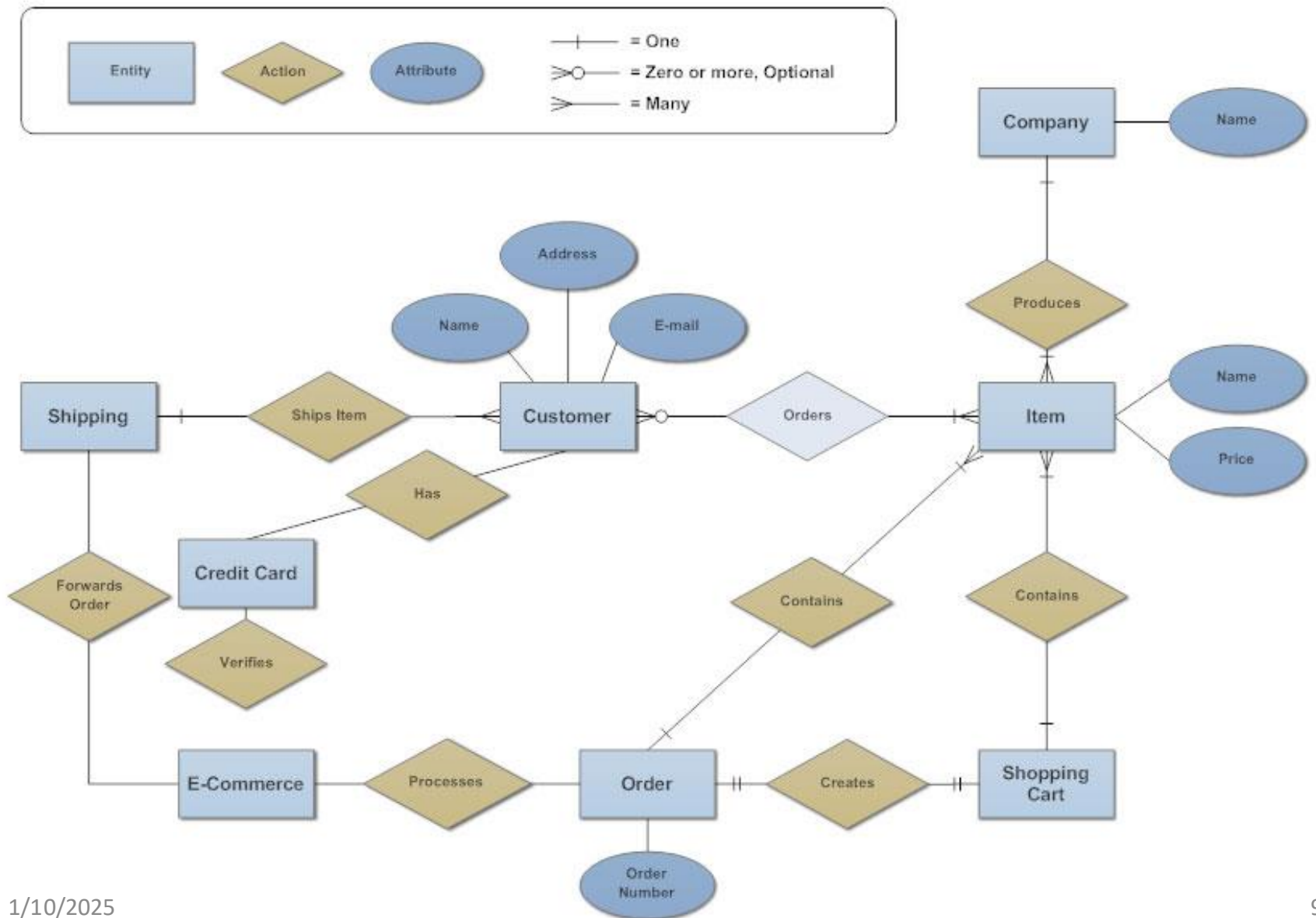
Entity Relationship Model

- **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(<u>id</u>, name, email, phone, address, dob, gender, designation, salary)
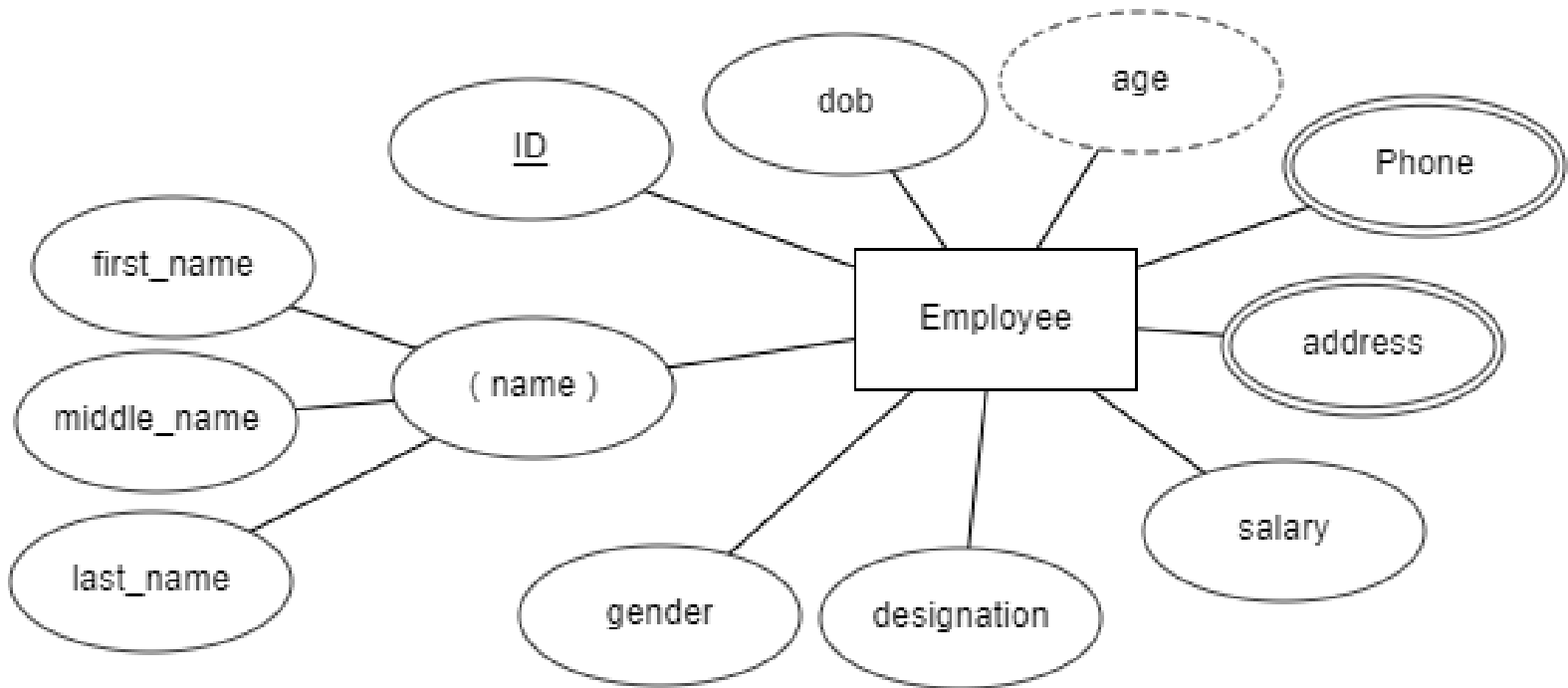
Relationships

- 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**

- Department(<u>dept_id</u>, dept_name, dept_location)
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- Student(<u>student_id</u>, name, roll, phone, cgpa, city, *dept_id*)
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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
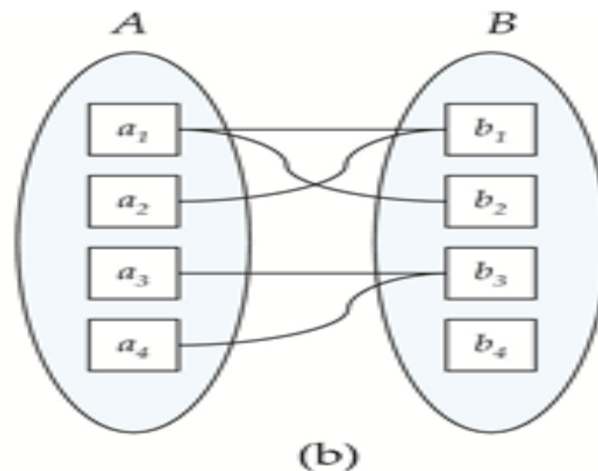

(a)
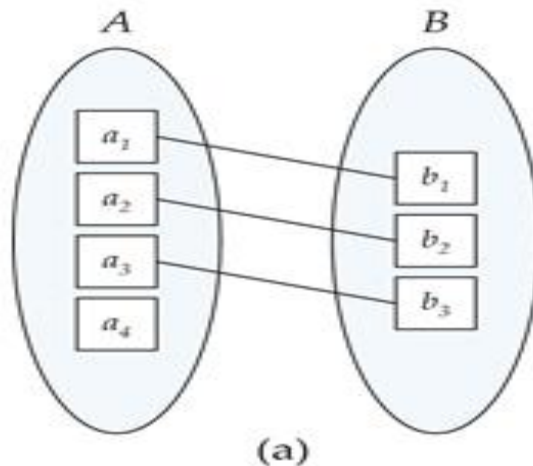
One to one

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
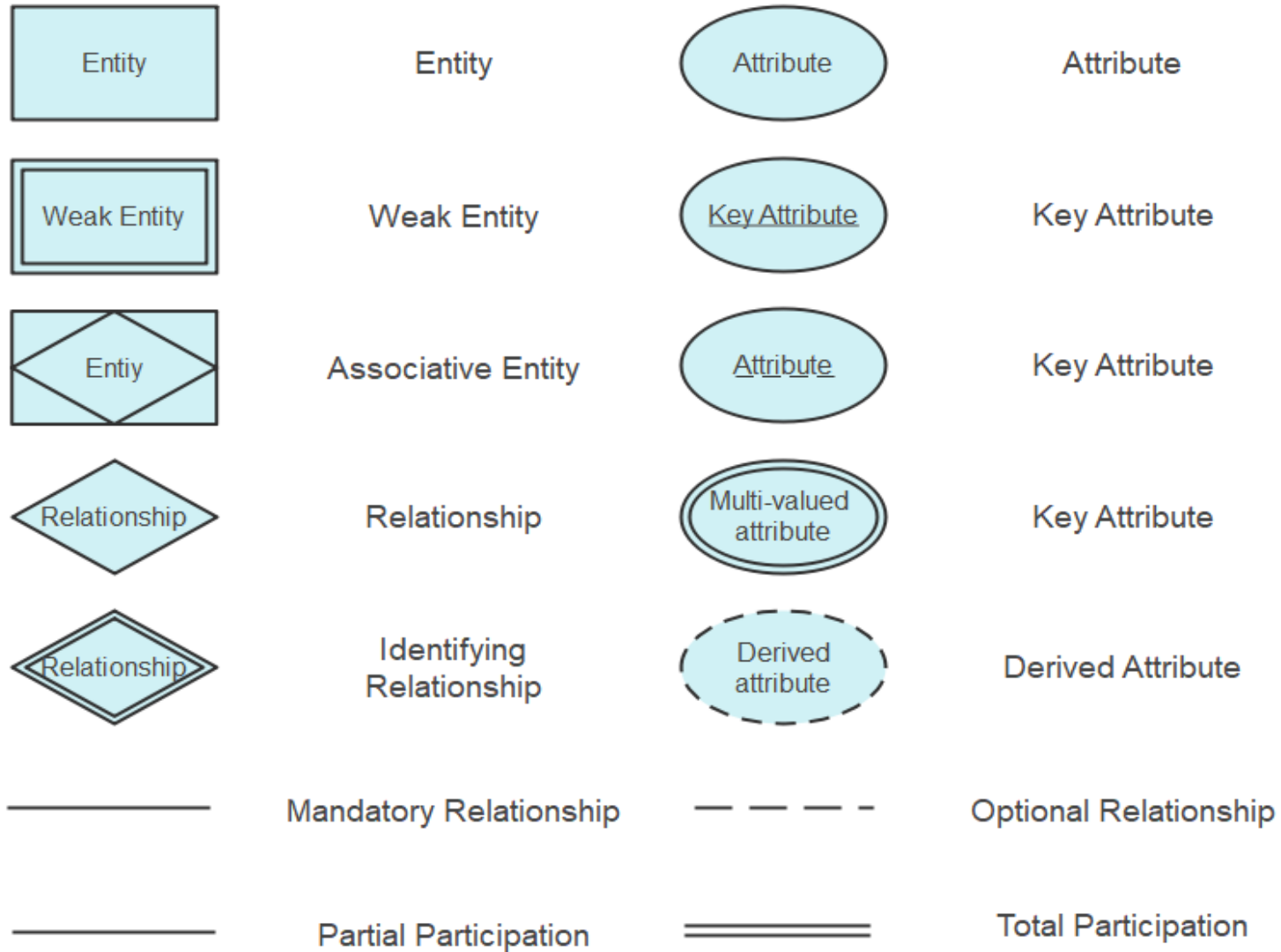
Many to Many

- One entity from A can be associated with more than one entity from B and vice versa.

- Example: employees ***works_on*** projects

(b)

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

Steps of Drawing ERD

1. Identify the Entities Required
2. Identify the Attributes and Primary key for each Entity
3. Identify the Relationship needed
4. Identify the Cardinality Ratio and Participation
5. Draw the Diagram

Requirements of a *<u>Project</u>*

- **<u>Human Resource Management System (HRMS)</u>**
  - Employee (*Works for department and works on Project*)
  - Department (Has manager, worker, project)
  - Project (employee works under)

Req.(Project HRM)-Details

- You have to develop a database for a company including some information of departments, employees and projects of the company. As mentioned that every department has many employees and each employee work for a department and each department is leading by only one manager who is also an employee. Initially a new department need not have any employee. Here, though an employee belongs a department but they can work for different projects at the same time.

EDGE training application platform

- Design a database for edge online application platform for university of barishal. Consider the following requirements:
  - Edge will offer various training programs through circular
  - There may be different training centers and any student can apply in any training module in any center when their they meet the eligibility.
  - Instructors will be assigned for any training module
  - This platform will provide a class routine for all batches
  - Student can find their result after finishing the training
  - Any notice regarding this program will be shared in this platform

Entity

- Design a database for edge online application platform for university of barishal. Consider the following requirements:
  - Edge will offer various training **programs** through **circular**
  - There may be different training **centers** and any **student** can apply in any training module in any center when their they meet the **eligibility**.
  - **Instructors** will be assign for any training module
  - This platform will provide a class **routine** for all **batches**
  - Student can find their **result/Exam** after finishing the training
  - Any **notice** regarding this program will be shared in this platform

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

Chapter 6

END OF LECTURE