Database Systems and Web (15B11CI312)

Database Systems and Web

Lecture 3

Contents to be covered

- Entity-Relationship (E-R) Model
- Entity and Its Attributes
- Types of Attributes
- Domain of Attributes
- Entity types and Entity sets
- Classification of Constraints
- Keys

Entity-Relationship (E-R) Model

- The ER Model of data is the most widely as conceptual level data model.
- *f* Data model to describe the database system at the requirements collection stage.
- Defines high level description.
- Very easy to understand.

Entity-Relationship (E-R) Model

Main concept of ER model:

Diagrammatic notation of Entities, attributes of entities and relationships between entities.

Entity-Relationship (E-R) Diagram

A detailed, logical representation of the entities, associations and data elements for an organization or business. Diagrammatic notation associated with the ER model, known as ER diagrams.

Entity

ƒ**Entity :** An entity may be an object with a physical or conceptual existence.

For example :

particular person, car, house, company etc.

In the context of University database, an individual student, faculty member, a class room and a course are entities.

An Entity is denoted by rectangle with entity name

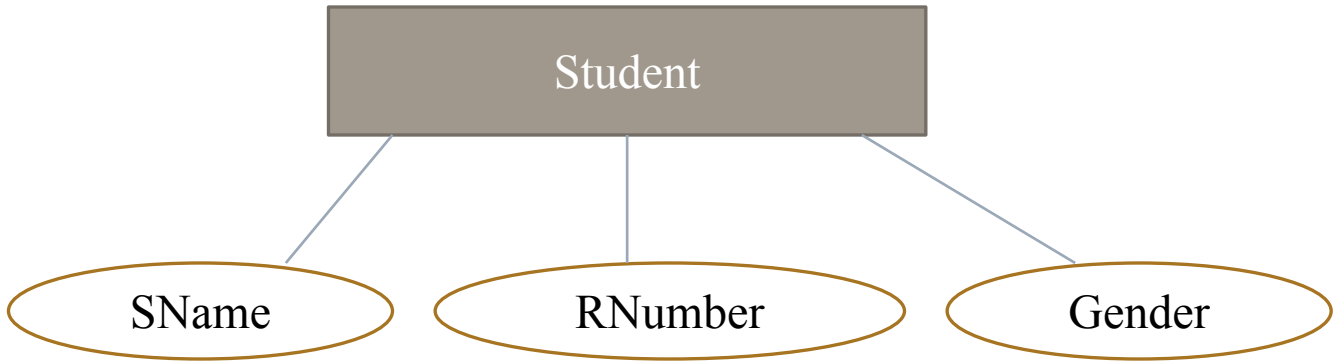
Attributes

Each entity is described by a set of attributes/properties.

For example : Attributes of student entity

- SName – name of the student.
- RNumber – the roll number of the student.
- Gender – the gender of the student etc.

Attribute are denoted by ellipse



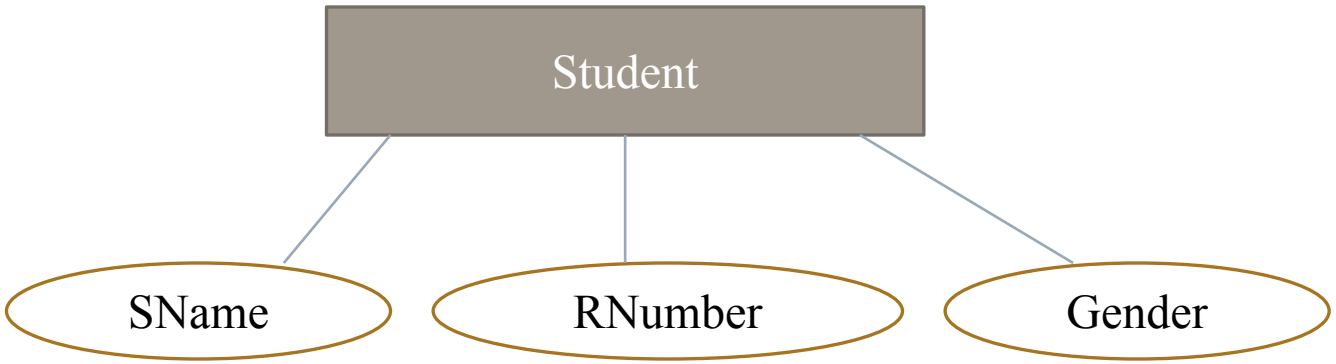
Types of Attributes

Simple Attributes

- ƒ An attribute having atomic or indivisible values.

For example: RNumber

Gender

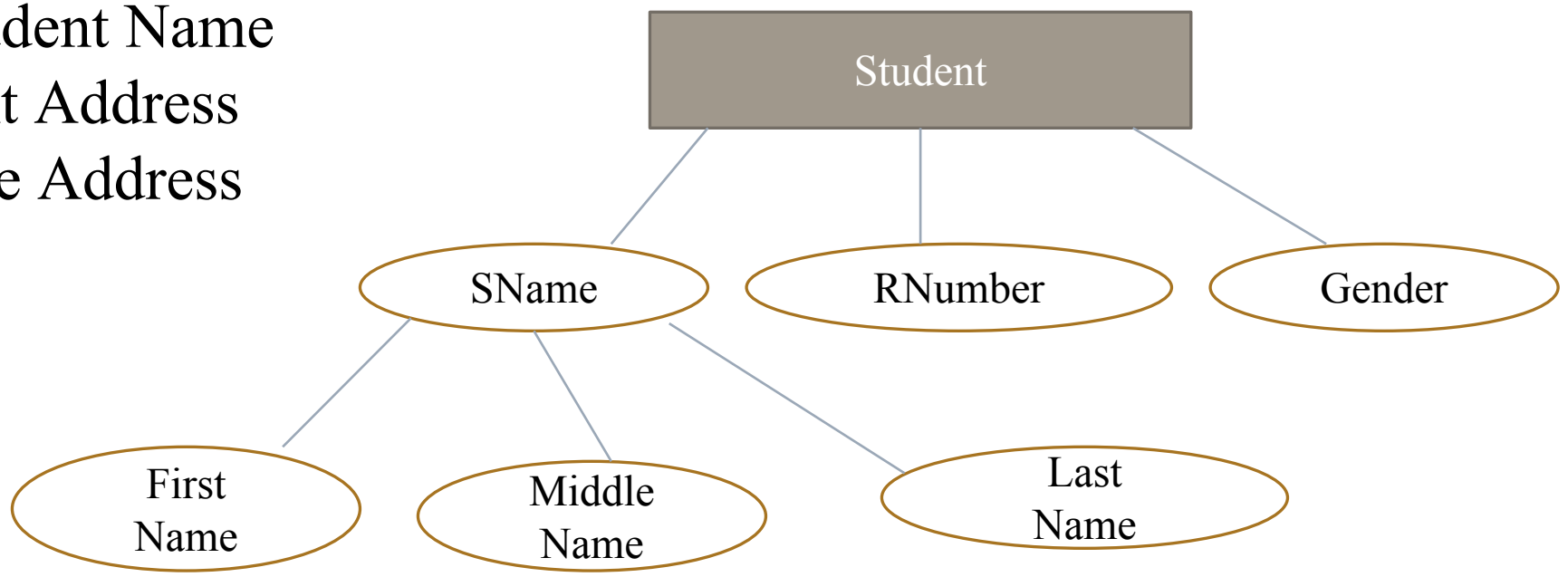


Types of Attributes

Composite Attributes

- Attributes having several components in the value.

For Example: Student Name
Student Address
College Address



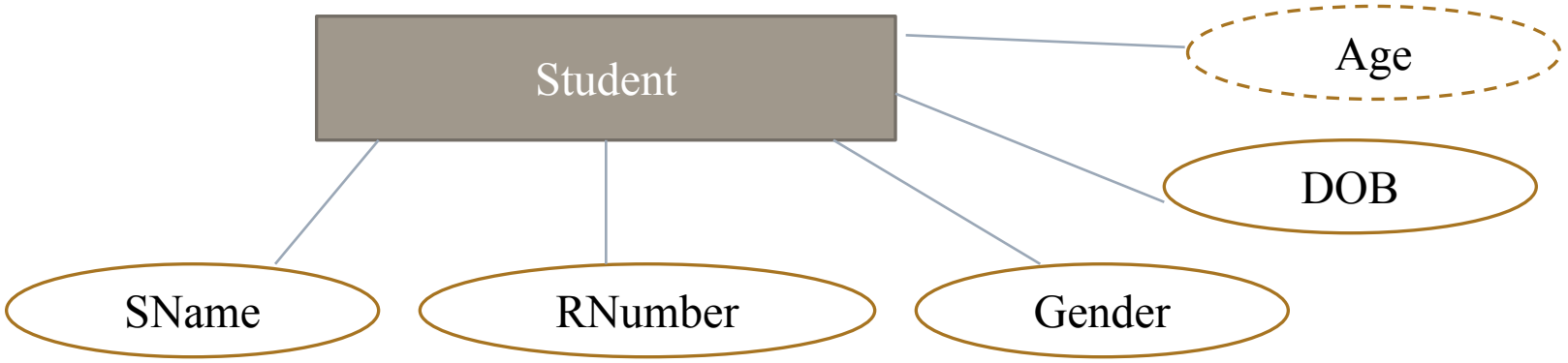
Composite Attribute is represented as a tree like structure

Types of Attributes

Derived Attributes

The value of an attribute is dependents on some other attribute.

example: Age depends on DateOf Birth, so age can be a derived attribute.



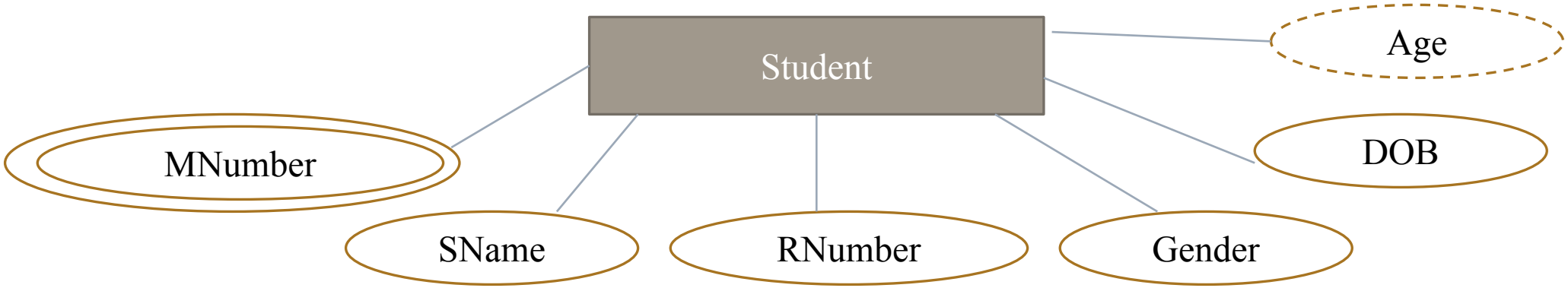
Derived attributes are represented by dashed ellipse

Types of Attributes

Multi-valued

f Attribute having a set of values rather than a single value.

For Example : Courses Enrolled attribute for student
Mobile Number attribute for student
Previous Degree attribute for student.



Domains of Attributes

- Each attribute takes values from a set called its domain

  For Example: StudentAge – {17,18, …, 55}

  HomeAddress – character strings of length 35

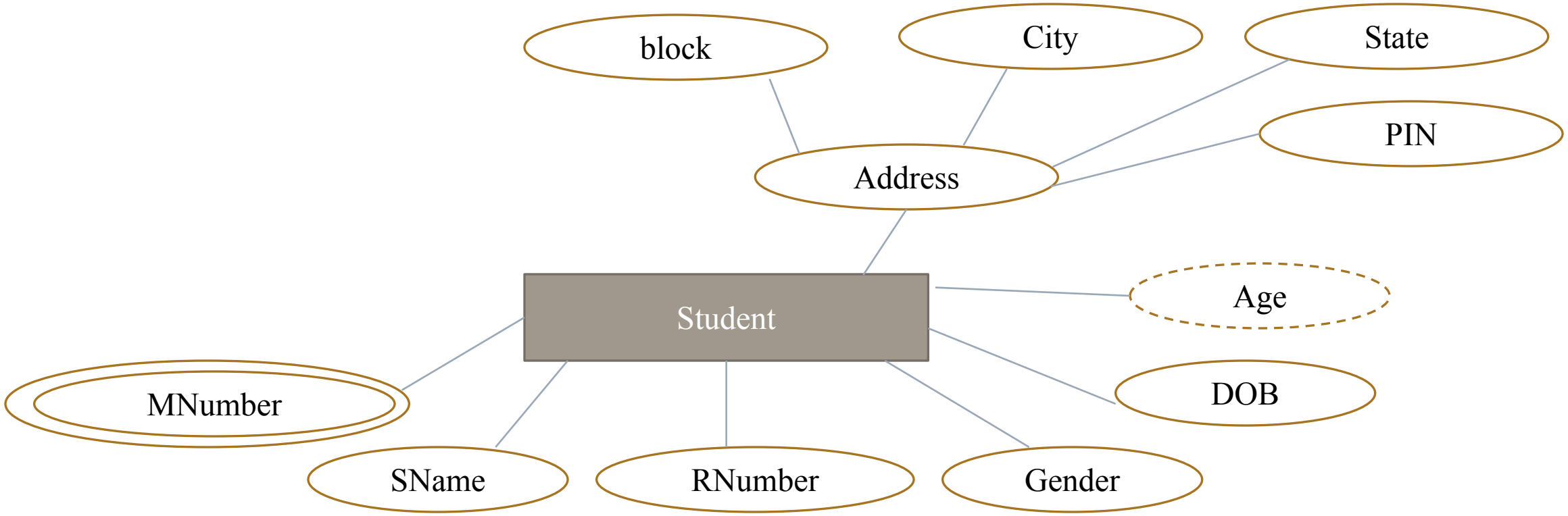
- Domain of composite attributes –

  cross product of domains of component attributes

- Domain of multi-valued attributes –

  set of subsets of values from the basic domain

E-R Diagram With Composite, Multivalued, and Derived Attributes



Classification of Constraints

1. Keys
2. Single-value constraints
3. Multi-valued constraints
4. Mapping Cardinalities and Participation Constraints

Entity Type and Entity Sets

An entity type defines a collection (or set) of entities that have the same attributes. Each entity type in the database is described by its name and attributes.

The collection of all entities of a particular entity type in the database at any point in time is called an entity set.

Key Attributes

Key – an attribute or a collection of attributes whose value(s) uniquely identify an entity in the entity set.

For Example:

- Enrollment Number- Key for Student entity set
- EmpID - Key for Faculty entity set

Key Attributes

A key for an entity set may have more than one attribute.
For Example :

HostelName, RoomNo - Key for Student entity set
(assuming that each student gets to stay in a single room)

An entity set may have more than one key.
For Example :

Enrollment number, aadhar card number, voter id number

Keys can be determined only from the meaning of the attributes in the entity type and Determined by the designers

Keys

Super Key – An attribute or a combination of attribute that is used to identify the records uniquely is known as Super Key.

A table can have many Super Keys.

En_Number	Aadhar_ID	Name	CGPA	Address

Example of Super Key for given schema

1 En_Number

2 Aadhar_ID

3 En_Number, Name

4 Aadhar_ID, Name

5 En_Number, Address

6 Name, Address

7 Name, Address, CGPA

……

So on as any combination which can identify the records uniquely will be a Super Key.

Keys

Candidate Key – It can be defined as minimal Super Key or irreducible Super Key

En_Number	Aadhar_ID	Name	CGPA	Address

For example

En_Number : is a Candidate Key
Aadhar_ID : is a Candidate Key
Name, Address : is a Candidate Key

Combination of “Name and Address” can identify the record uniquely, but neither Name nor Address can be used to identify the records uniquely as it might be possible that we have two employees with similar name or two employees from the same house.

En_Number,Aadhar_ID: is not a Candidate Key
En_Number,Name: is not a Candidate Key

Keys

Primary Key – A Candidate Key that is used for unique identification of each row in a table is known as Primary Key. A Primary Key can consist of one or more attributes of a table.

Several candidate keys may exist, one of the candidate keys is selected to be the **primary key**. Database designer can use one of the Candidate Key as a Primary Key.

En_Number	Aadhar_ID	Name	CGPA	Address

For Example

1. En_Number
2. Aadhar_ID
3.Name,Address

Note:. In this example we have “En_Number”, “Aadhar_ID” and “Name, Address” as Candidate Key. A good database designer will consider “En_Number” or “Aadhar_ID” Key as a Primary Key as the other key is the combination of more than one attribute.

Keys

Alternate Key – Alternate Key can be any of the Candidate Keys except for the Primary Key.

For example :

- Suppose database designer has consider “En_Number” as primary key , Then remaining Candidate Keys “Aadhar_ID” and “Name, Address” will treat as Alternate Key

En_Number	Aadhar_ID	Name	CGPA	Address

Composite Key – There may be no single attribute which can be treat as key, in this case we use multiple attributes to create a Primary Key then that Primary Key is called Composite Key (also called a Compound Key or Concatenated Key).

For Example :

- Assume “En_Number” and “Aadhar_ID” are not the part of given schema . In this case we will use “Name, Address” as a Primary Key and then it will be our Composite Key.

Keys

Foreign Key – A foreign key is an attribute or combination of attribute in one base table that points to the candidate key (generally it is the primary key) of another table. The purpose of the foreign key is to ensure **referential integrity** of the data i.e. only values that are supposed to appear in the database are permitted.

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Keys

For Example – Consider given two tables i.e. Student Table and Department Table where RNumber and Dept are Primary Keys.

Now the "Branch" attribute of Student Table (dependent or child table) can be defined as the Foreign Key as it can reference to the "Dept" attribute of the Departments table (the referenced or parent table).

A Foreign Key value must match an existing value in the parent table or be NULL.

A Foreign Key must primary key of unique key in parent table.

RNumber	Sname	CGPA	Branch
1	A	7	CSE
2	B	8	ECE
3	C	6	CSE
4	D	9	BT

Dept	HOD
CSE	X
ECE	Y
BT	Z

Primary Keys in E/R Diagrams

Every entity set must have a primary key

Denoted by the underline attribute