University of Central Florida
CGS 2545
Database Concepts

DEPARTMENT OF ELECTRICAL ENGINEERING & COMPUTER SCIENCE
COMPUTER SCIENCE DIVISION

Data Models

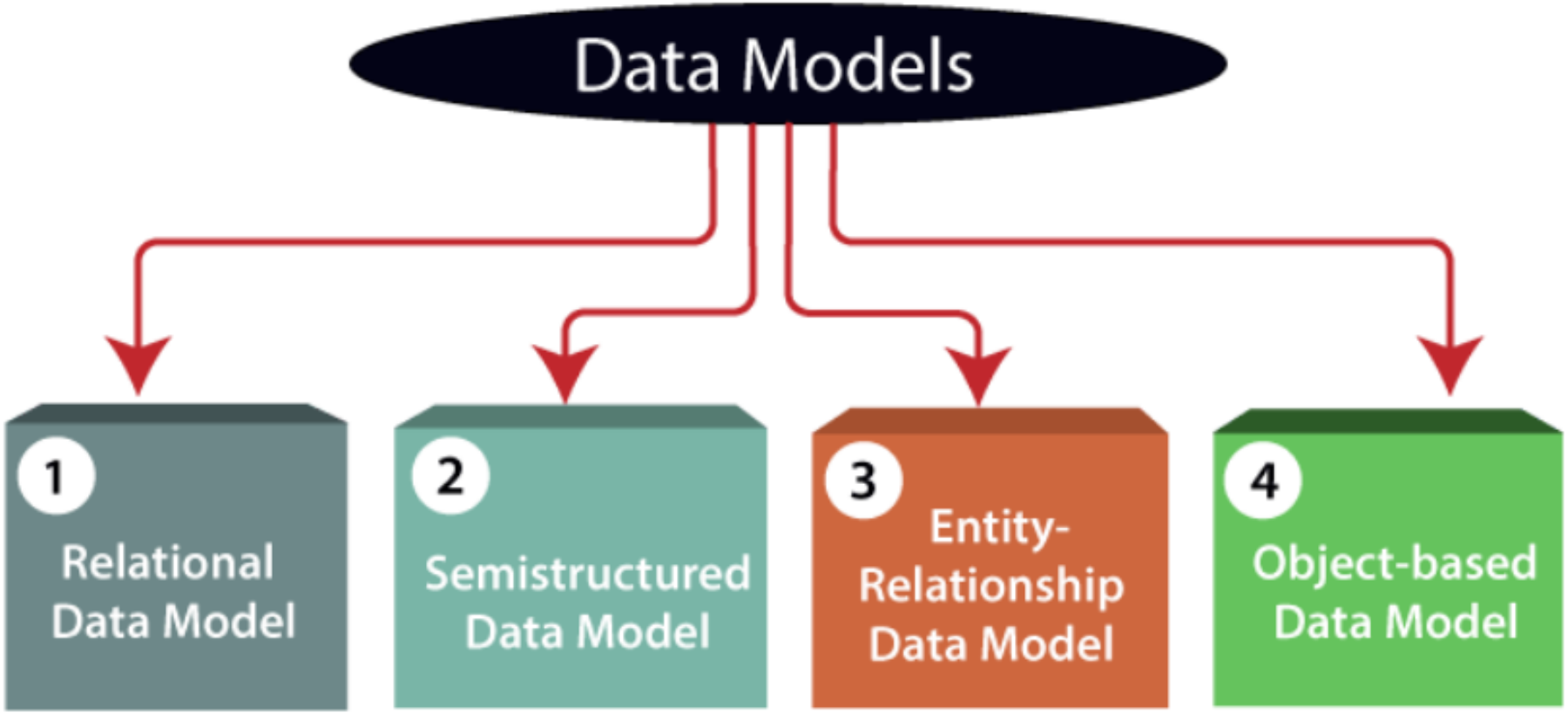
Data Models

- Data models
  - define how the logical structure of a database is modeled.
  - are fundamental entities to introduce abstraction in a DBMS.
  - define how data is connected to each other and how they are processed and stored inside the system.
- The very first data model could be flat data-models, where all the data used are to be kept in the same plane.
- Earlier data models were not so scientific, hence they were prone to introduce lots of duplication and update anomalies.

Data Models

- A data model is the modeling of the
  - data description
  - data semantics
  - consistency constraints
- Provides the conceptual tools for describing the design of a database at each level of data abstraction.
- There are four data models used for understanding the structure of the database
  - Entity-relationship data model
  - Relational data model
  - Semi structured data model
  - Object-based data model

Data Models

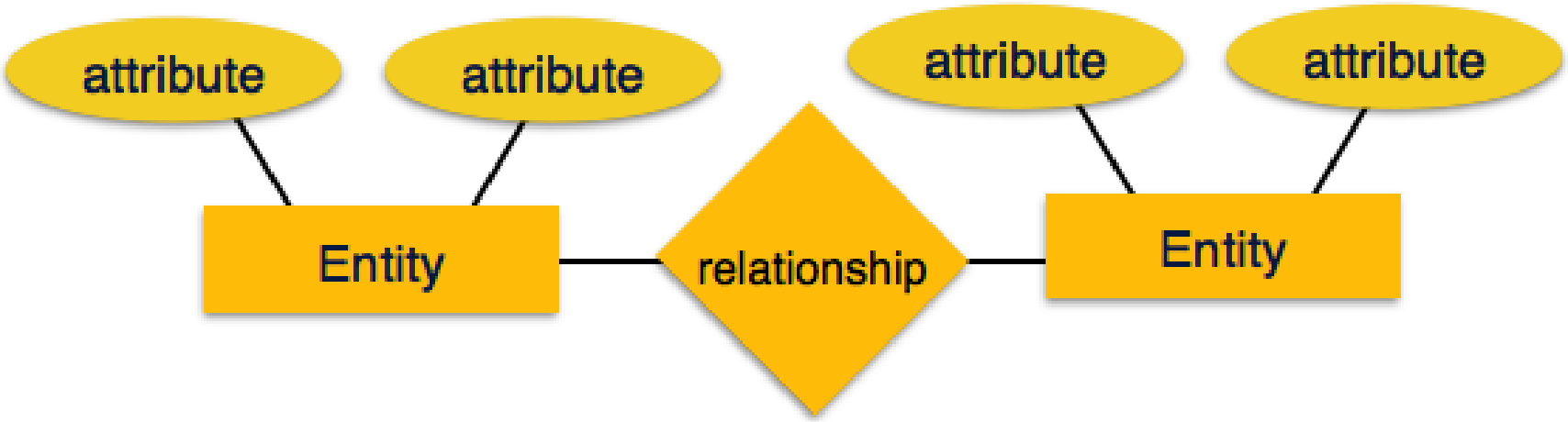

Data Models
1
Relational Data Model
2
Semistructured Data Model
3
Entity-Relationship Data Model
4
Object-based Data Model

Data Models

- Entity-Relationship (ER) Model
  - is based on the notion of real-world entities and relationships among them.
  - while formulating real-world scenario into the database model, the ER Model creates
    - entity set
    - relationship set
    - general attributes
    - constraints
  - ER Model is best used for the conceptual design of a database

Data Models

- ER Model is based on
  - **Entities** and their *attributes*
  - **Relationships** among entities



Data Models

- Entity-Relationship (ER) Model
  - **Entity**
    - An entity in an ER Model is a real-world entity having properties called **attributes**.
    - Every **attribute** is defined by its set of values called **domain**.
    - For example, in a school database, a student is considered as an entity.
      - Student has various attributes like
        - » name
        - » age
        - » class
        - » etc…

Data Models

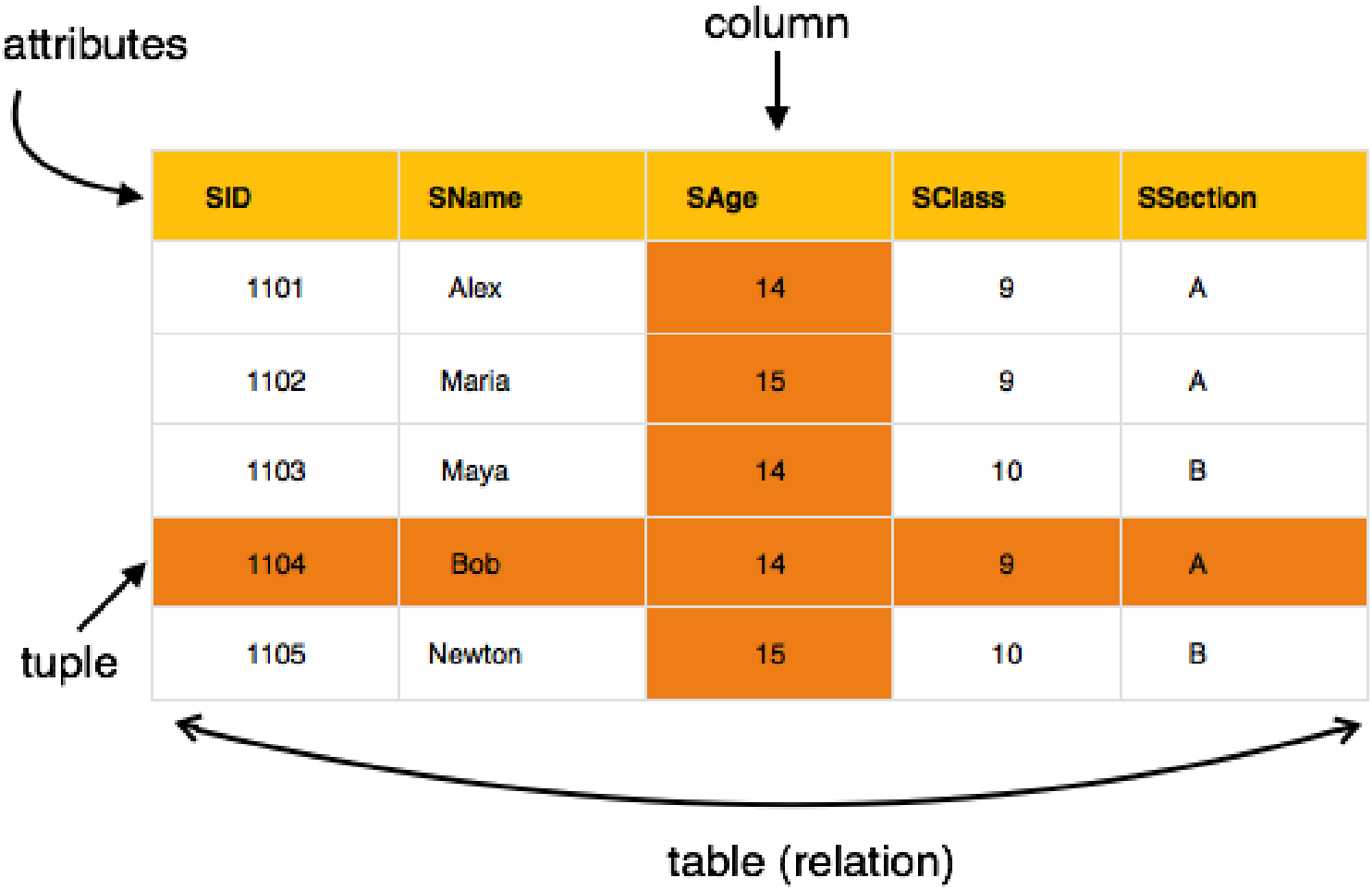
- Entity-Relationship (ER) Model
  - **Relationship**
    - The logical association among entities is called ***relationship***.
    - Relationships are mapped with entities in various ways.
    - Mapping cardinalities define the number of association between two entities.
    - Mapping cardinalities
      - one to one
      - one to many
      - many to one
      - many to many

Data Models

- Relational Model
  - The most popular data model in DBMS is the Relational Model.
  - It is more scientific a model than others.
  - This model is based on first-order predicate logic and defines a table as an **n-ary relation**

Data Models

- Relational Model



SID	SName	SAge	SClass	SSection
1101	Alex	14	9	A
1102	Maria	15	9	A
1103	Maya	14	10	B
1104	Bob	14	9	A
1105	Newton	15	10	B

Data Models

- Relational Model
  - The main highlights of this model are −
    - Data is stored in tables called **relations**.
    - Relations can be normalized.
    - In normalized relations, values saved are atomic values.
    - Each row in a relation contains a unique value.
    - Each column in a relation contains values from a same domain.

Data Models

- Semi structured data model
  - Allows the data specifications at places where the individual data items of the same type may have different attributes sets
  - The Extensible Markup Language, also known as XML, is widely used for representing the semistructured data
  - XML is important because of its application in data exchange

Data Models

- Object-based data model
  - An extension of the ER model with notions of functions, encapsulation, and object identity
  - This model supports a rich type system that includes structured and collection types
  - In 1980s, various database systems following the object-oriented approach were developed
  - The objects are nothing but the data carrying its properties