

DATABASE SYSTEMS

Presented by Prof. Elisha T. O. Omulo

WEEK 2 AGENDA

The Relational Database Model

Related terminology- relation, table, schema

External schema

Conceptual schema

Internal schema

Course Textbook: Carlos Coronel, Steven Morris, Peter Rob and Keeley Crockett Database Principles: Fundamentals of Design, Implementation, and Management, 14th Edition, 2022, ISBN-13978-0357673034.

The Relational Database Model: Related terminology

(Source: THOMAS M. CONNOLLY, CAROLYN E. BEGG (2021). Database Systems: A Practical Approach to Design, Implementation, and Management. Published by Pearson (July 14th 2021). ISBN-13: 9780137517053)

Relation: Is a named table with columns and rows

Attribute: Is a named column of a relation

Domain: A set of allowed values for one or more attributes

Tuple: A row of a relation

Degree of a relation: the number of attributes it contains

Cardinality of a relation: the number of rows it contains

Relational database: A collection of normalized relations

Field: a single column on a table

Record: a single row on a table

Table: an implementation of a relation.

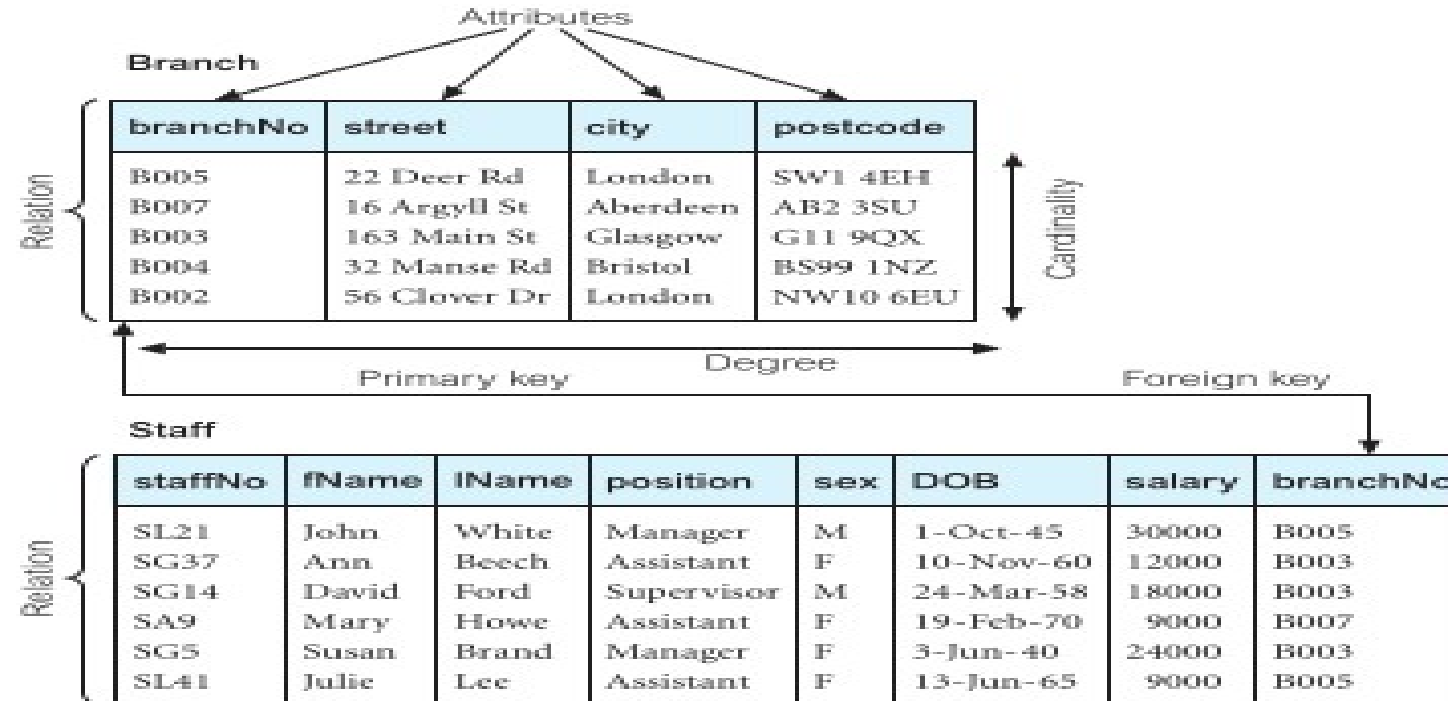
Schema: structure of a database

Task: Investigate other database models.

The Relational Database Model: Related terminology

(Source: THOMAS M. CONNOLLY, CAROLYN E. BEGG (2021). Database Systems: A Practical Approach to Design, Implementation, and Management. Published by Pearson (July 14th 2021). ISBN-13: 9780137517053)

Relation: Attribute: Domain: Tuple: Degree of a relation: Cardinality of a relation: Relational database: Field: Record: Table: Schema:



Task: Where are the tables here? Are relations named?

The Relational Database Model: Related terminology

(Source: THOMAS M. CONNOLLY, CAROLYN E. BEGG (2021). Database Systems: A Practical Approach to Design, Implementation, and Management. Published by Pearson (July 14th 2021). ISBN-13: 9780137517053)

Relation: Attribute: Domain: Tuple: Degree of a relation: Cardinality of a relation: Relational database: Field: Record: Table: Schema:

Attribute	Domain Name	Meaning	Domain Definition
branchNo	BranchNumbers	The set of all possible branch numbers	character: size 4, range B001–B999
street	StreetNames	The set of all street names in Britain	character: size 25
city	CityNames	The set of all city names in Britain	character: size 15
postcode	Postcodes	The set of all postcodes in Britain	character: size 8
sex	Sex	The sex of a person	character: size 1, value M or F
DOB	DatesOfBirth	Possible values of staff birth dates	date, range from 1-Jan-20, format dd-mmm-yy
salary	Salaries	Possible values of staff salaries	monetary: 7 digits, range 6000.00–40000.00

Task: Can a domain have only one value?

The Relational Database Model: Related terminology

(Source: THOMAS M. CONNOLLY, CAROLYN E. BEGG (2021). Database Systems: A Practical Approach to Design, Implementation, and Management. Published by Pearson (July 14th 2021). ISBN-13: 9780137517053)

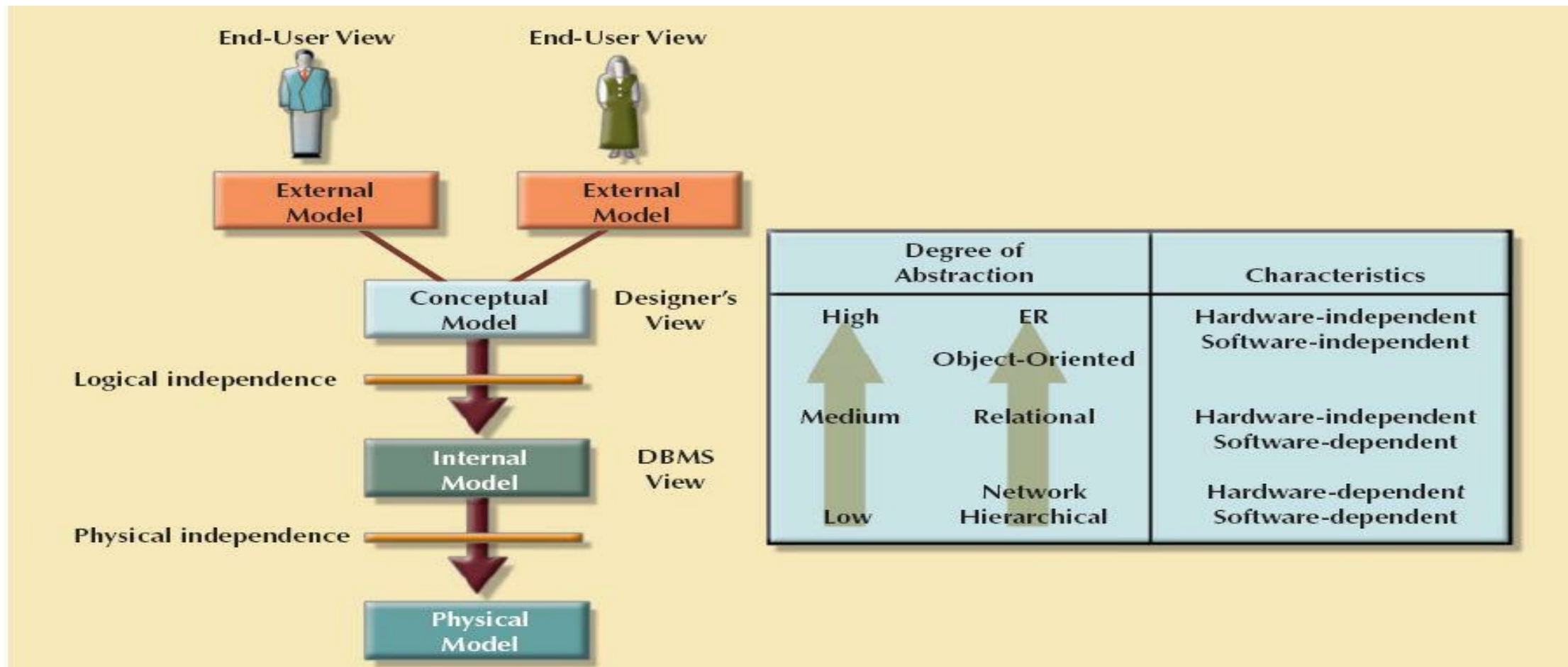
Relation: Attribute: Domain: Tuple: Degree of a relation: Cardinality of a relation: Relational database: Field: Record: Table: Schema:

EXAMPLE OF A RELATIONAL SCHEMA

Branch	(branchNo, street, city, postcode)
Staff	(staffNo, fName, lName, position, sex, DOB, salary, branchNo)
PropertyForRent	(propertyNo, street, city, postcode, type, rooms, rent, ownerNo, staffNo, branchNo)
Client	(clientNo, fName, lName, telNo, prefType, maxRent)
PrivateOwner	(ownerNo, fName, lName, address, telNo)
Viewing	(clientNo, propertyNo, viewDate, comment)
Registration	(clientNo, branchNo, staffNo, dateJoined)

Task: Draw a diagrammatic version of the schema. Name the entities.

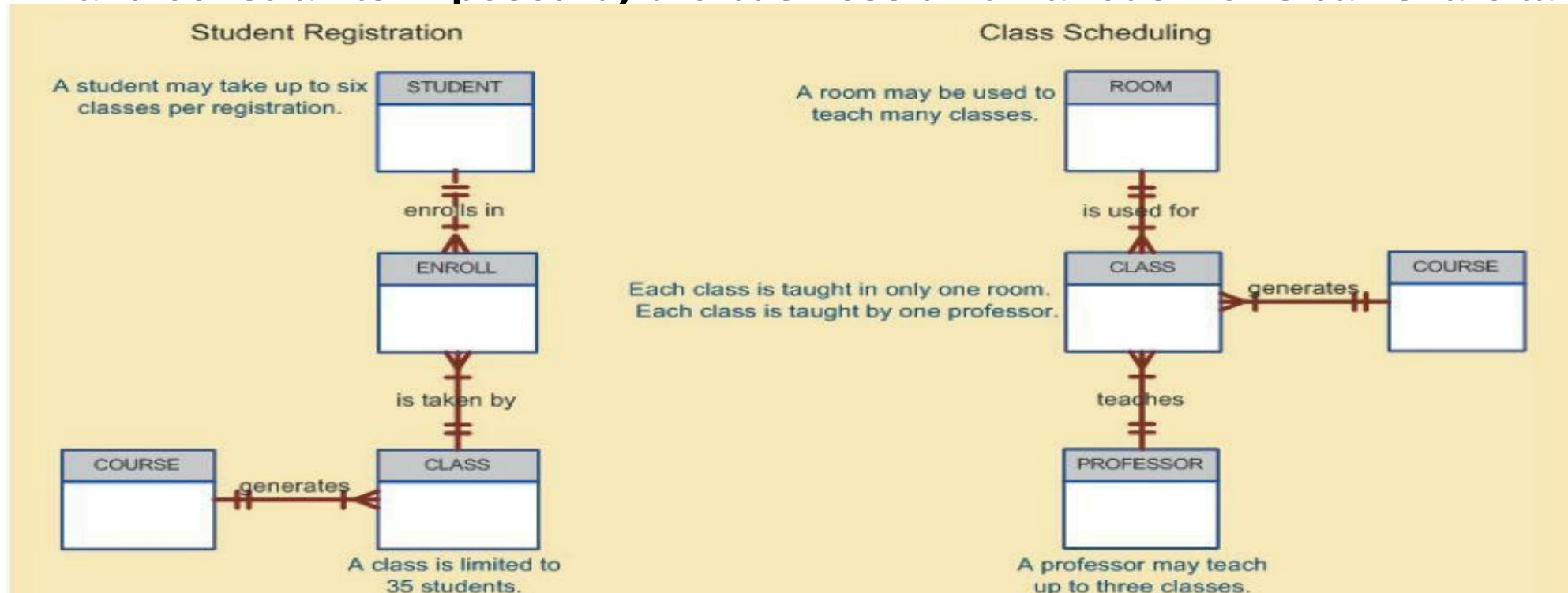
The External, Conceptual and Internal schema (Course Text)



The External, Conceptual and Internal schema (Course Text)

External Schema- specific views in which the external users view the system.

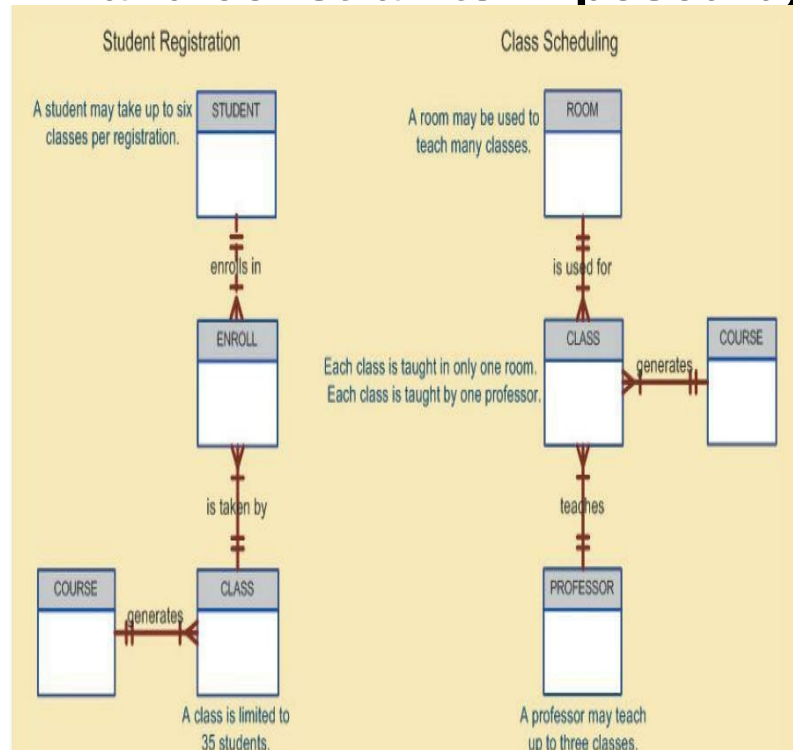
- Each external schema includes the appropriate entities, relationships, processes, and constraints imposed by the business unit. Various views can share tables.



The External, Conceptual and Internal schema (Course Text)

External Schema- specific views in which the external users view the system.

- Each external schema includes the appropriate entities, relationships, processes, and constraints imposed by the business unit. Various views can share tables.

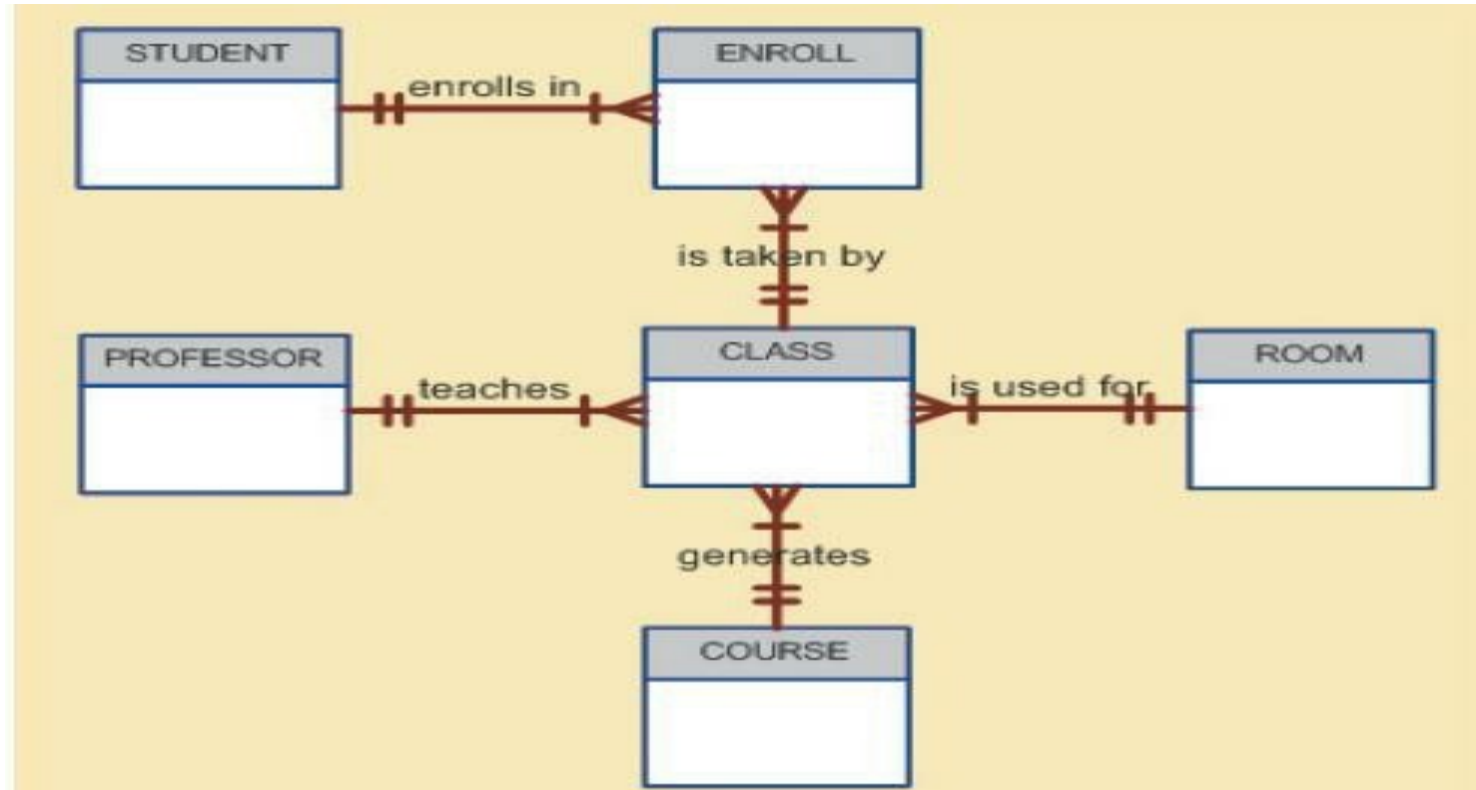


Advantages:

- easy to identify specific data needs for operations of each business unit.
- designer's job easy is by providing feedback about the model's adequacy.
- the model can be checked to ensure that it supports all processes as defined by their external models, as well as all operational requirements and constraints.
- helps to ensure security constraints in the database design, as each business unit works with only a subset of data.
- It makes application program development much simpler.

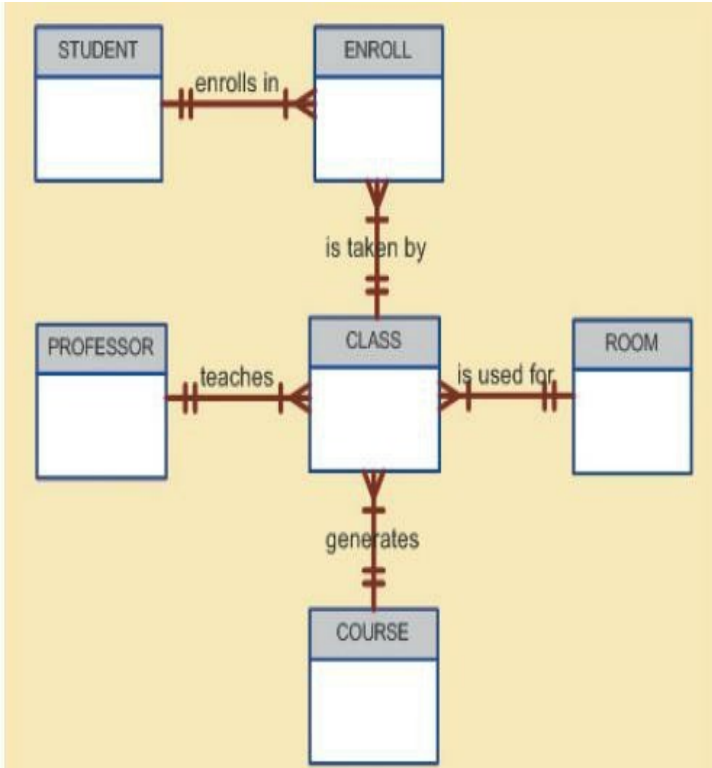
The External, Conceptual and Internal schema (Course Text)

Conceptual Schema- a global view of the entire database by the entire organization



The External, Conceptual and Internal schema (Course Text)

Conceptual Schema- a global view of the entire database by the entire organization



- Also called the conceptual model.
- It integrates all external views (entities, relationships, constraints, and processes) into a single global view of the data in the enterprise
- Used to identify and give high-level description of the main data objects
- The most widely used conceptual model is the ER model (ERD)
- The ERD is used to graphically represent the conceptual schema.

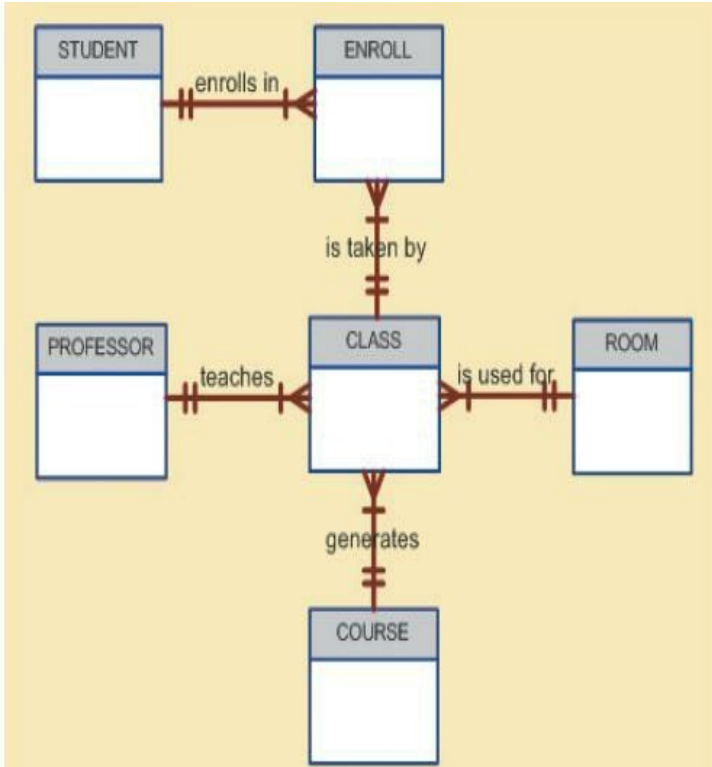
Advantages

- a bird's-eye (macro level) view of the data environment that is relatively easy to understand.
- it is independent of both software and hardware, and will not be affected by changes in either the hardware or the DBMS software.
- the term logical design refers to the task of creating a conceptual data model that could be implemented in any DBMS.

Task: Summarize the nature and role of the conceptual schema.

The External, Conceptual and Internal schema (Course Text)

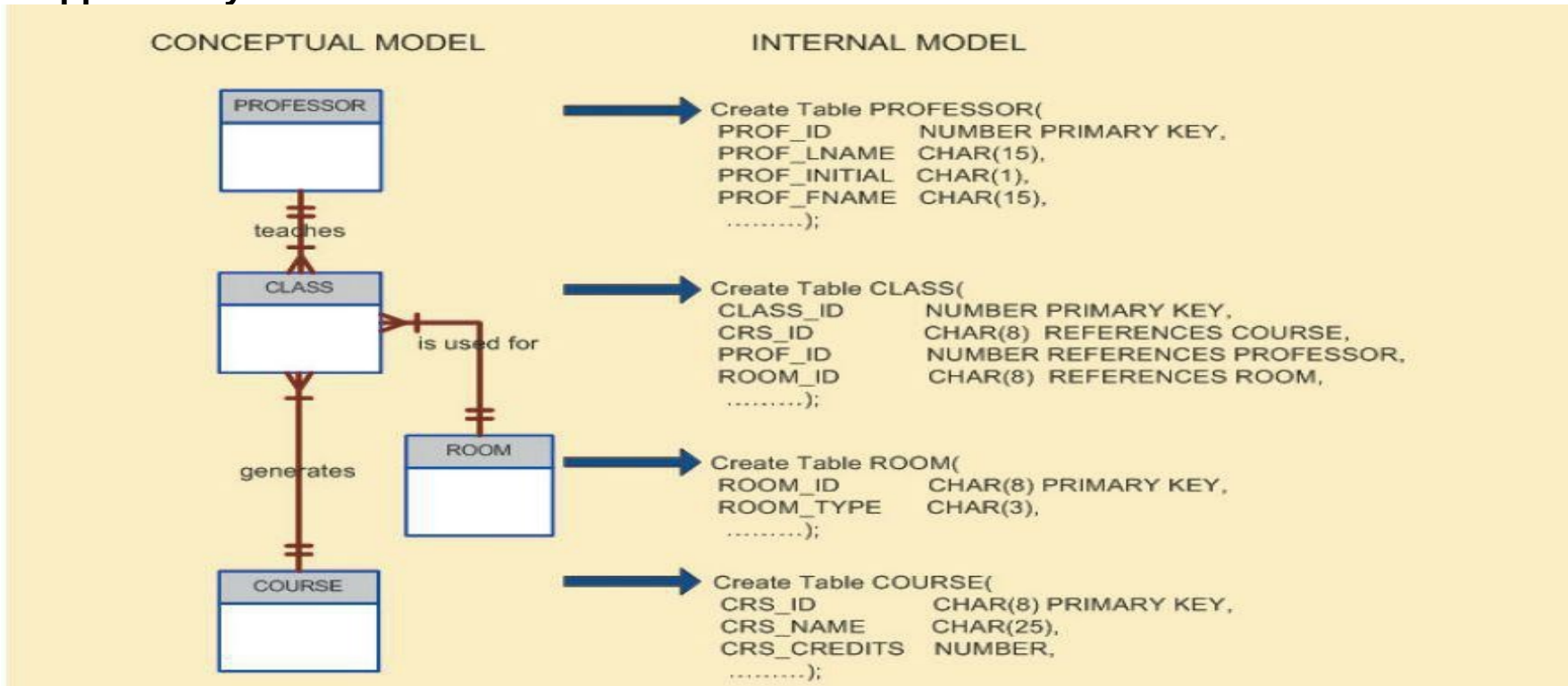
Internal Schema- gives a specific representation of an internal model, using the database constructs supported by the selected database.



- Due to the focus on the relational model, a relational database is used to implement the internal model.
- the internal schema maps the conceptual model to the relational model constructs.
- the entities in the conceptual model are mapped to tables in the relational model.
- The internal schema is expressed using SQL, the standard language for relational databases.
- For this example the internal model is implemented by creating the tables PROFESSOR, COURSE, CLASS, STUDENT, ENROLL, and ROOM.

The External, Conceptual and Internal schema (Course Text)

Internal Schema- gives a specific representation of an internal model, using the database constructs supported by the selected database.



The External, Conceptual and Internal schema (Course Text)

Summary table for Schemas

MODEL	DEGREE OF ABSTRACTION	FOCUS	INDEPENDENT OF
External	High ↑ ↓ Low	End-user views	Hardware and software
Conceptual		Global view of data (database model independent)	Hardware and software
Internal		Specific database model	Hardware
Physical		Storage and access methods	Neither hardware nor software

- A data model is an abstraction of a complex real-world data environment.
- The basic data-modeling components are entities, attributes, relationships, and constraints.
- Business rules are used to identify and define the basic modeling components within a specific real-world environment.
- Data-modeling- data views (global vs. local) and the level of data abstraction.
- The American National Standards Institute Standards Planning and Requirements Committee (ANSI/SPARC) describes three levels of data abstraction: external, conceptual, and internal.
- The fourth and lowest level of data abstraction, called the physical level, is concerned exclusively with physical storage methods.

Week 2 Exercises

- 1) Discuss related terms.
- 2) Explain the differences between external, conceptual, and internal schemas.
- 3) Give the reasons for the three-schema architecture for databases.

Week 2 Session References

- [Course Text] Carlos Coronel, Steven Morris, Peter Rob and Keeley Crockett Database Principles: Fundamentals of Design, Implementation, and Management, 14th Edition, 2022, ISBN-13978-0357673034.
- Thomas M. Connolly, Carolyn E. Begg (2021). Database Systems: A Practical Approach to Design, Implementation, and Management. Published by Pearson (July 14th 2021). ISBN-13: 9780137517053

Thank You

