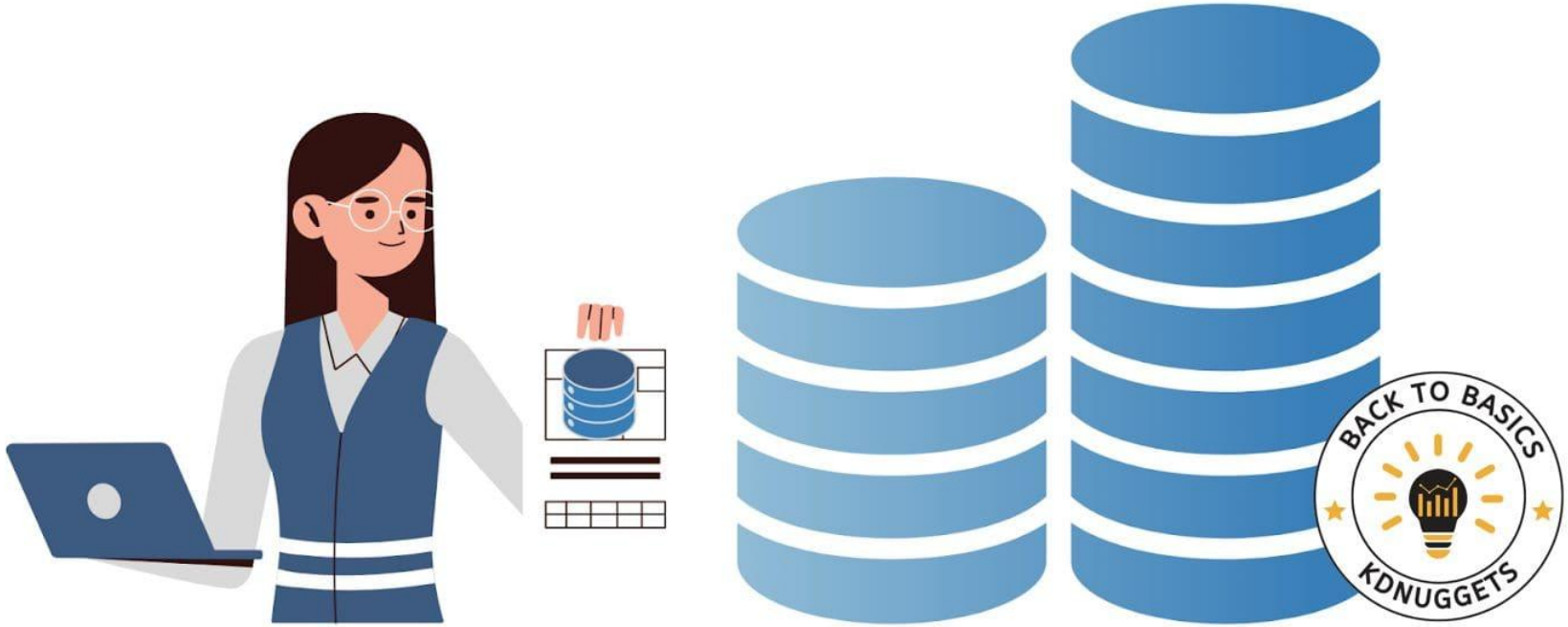
Intro to Databases



Entity Relationship Modelling (ER)

Lecture 5

01

The Entity Relationship Model

01

The Entity Relationship Model

Entities

Entities

1. an *entity* in the ERM corresponds to a table—not to a row—in the relational environment.
2. In the Chen, Crow's Foot, and UML notations, an entity is represented by a rectangle that contains the entity's name.
3. The entity name, a noun, is usually written in all capital letters

01

The Entity Relationship Model

Attributes

Attributes

1. Attributes are characteristics of entities.
    a. For example, the STUDENT entity includes the attributes STU_LNAME, STU_FNAME, and STU_INITIAL
2. In Chen, attributes are represented by ovals and are connected to the entity rectangle with a line
3. the Crow's Foot, the attributes are written in the attribute box below the entity rectangle.

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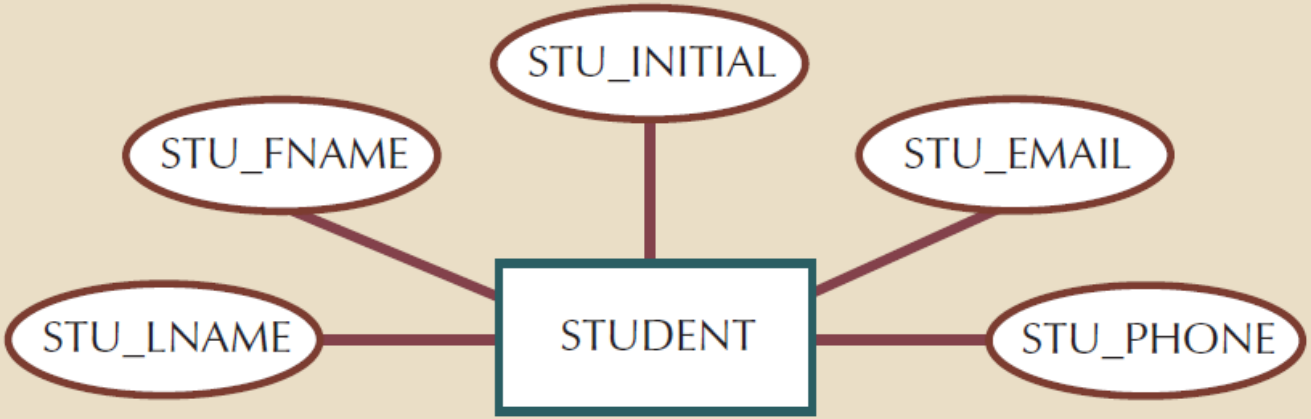
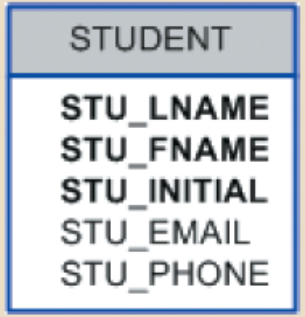
Entities

.1 THE ATTRIBUTES OF THE STUDENT ENTITY: CHEN AND CROW'S FOOT

Chen Model



Crow's Foot Model



Important notes on Attributes

1. Required and Optional Attributes
   a. A required attribute is an attribute that must have a value; in other words, it cannot be left empty
   b. An optional attribute is an attribute that does not require a value; therefore, it can be left empty.
2. Domain: is the set of possible values for a given attribute.

Important notes on Attributes

3. Identifiers (Primary Keys)
    a. The ERM uses identifiers—one or more attributes that uniquely identify each entity instance.
    b. Identifiers are underlined in the ERD.
    c. Key attributes are also underlined in a relational schema,
        i. For example, a CAR entity may be represented by CAR (**CAR_VIN**, MOD_CODE, CAR_YEAR, CAR_COLOR)

Important notes on Attributes

4. Composite Identifiers
    a. Ideally, an entity identifier is composed of only a single attribute.
    b. a primary key composed of more than one attribute.

THE CLASS TABLE (ENTITY) COMPONENTS AND CONTENTS

Database name: Ch04_TinyCollege

CLASS_CODE	CRS_CODE	CLASS_SECTION	CLASS_TIME	ROOM_CODE	PROF_NUM
10012	ACCT-211	1	MWF 8:00-8:50 a.m.	BUS311	105
10013	ACCT-211	2	MWF 9:00-9:50 a.m.	BUS200	105
10014	ACCT-211	3	TTh 2:30-3:45 p.m.	BUS252	342
10015	ACCT-212	1	MWF 10:00-10:50 a.m.	BUS311	301
10016	ACCT-212	2	Th 6:00-8:40 p.m.	BUS252	301
10017	CIS-220	1	MWF 9:00-9:50 a.m.	KLR209	228
10018	CIS-220	2	MWF 9:00-9:50 a.m.	KLR211	114
10019	CIS-220	3	MWF 10:00-10:50 a.m.	KLR209	228
10020	CIS-420	1	W 6:00-8:40 p.m.	KLR209	162
10021	QM-261	1	MWF 8:00-8:50 a.m.	KLR200	114
10022	QM-261	2	TTh 1:00-2:15 p.m.	KLR200	114
10023	QM-362	1	MWF 11:00-11:50 a.m.	KLR200	162
10024	QM-362	2	TTh 2:30-3:45 p.m.	KLR200	162
10025	MATH-243	1	Th 6:00-8:40 p.m.	DRE155	325

Important notes on Attributes

4. Composite Identifiers ....
    c. If the CLASS_CODE used as the primary key,
        i. CLASS (**CLASS_CODE**, CRS_CODE, CLASS_SECTION, CLASS_TIME, ROOM_CODE, PROF_NUM)
    d. If the composite primary key is the combination of CRS_CODE and CLASS_SECTION,
        i. CLASS (**CRS_CODE, CLASS_SECTION**, CLASS_TIME, ROOM_CODE, PROF_NUM)

Important notes on Attributes

5. Composite and Simple Attributes

a. Composite attribute: is an attribute that can be further subdivided to yield additional attributes (e.g. Address attribute)

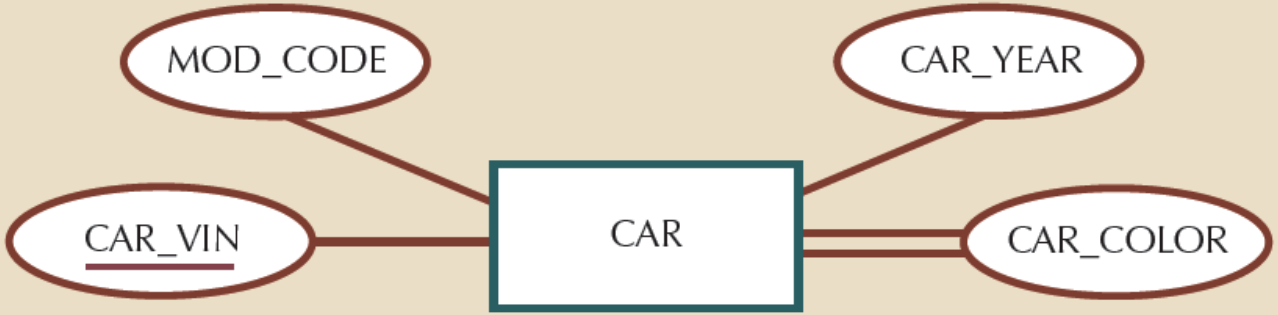
b. Simple attribute: is an attribute that cannot be subdivided (e.g. age, sex attributes)

Important notes on Attributes

6. Single-Valued Attributes and Multivalued Attributes
    a. Single-valued attribute is an attribute that can have only a single value.(e.g. SSN attribute for person)
    b. Multivalued attributes are attributes that can have many values.
        i. e.g. household may have several different phones
        ii. a car's color may be subdivided into many colors for the roof, body, and trim
    c. In the Chen ERM, multivalued attributes are shown by a double line connecting the attribute to the entity.
    d. The Crow's Foot notation does not identify multivalued attributes.

4.3 A MULTIVALUED ATTRIBUTE IN AN ENTITY

Chen Model



Crow's Foot Model

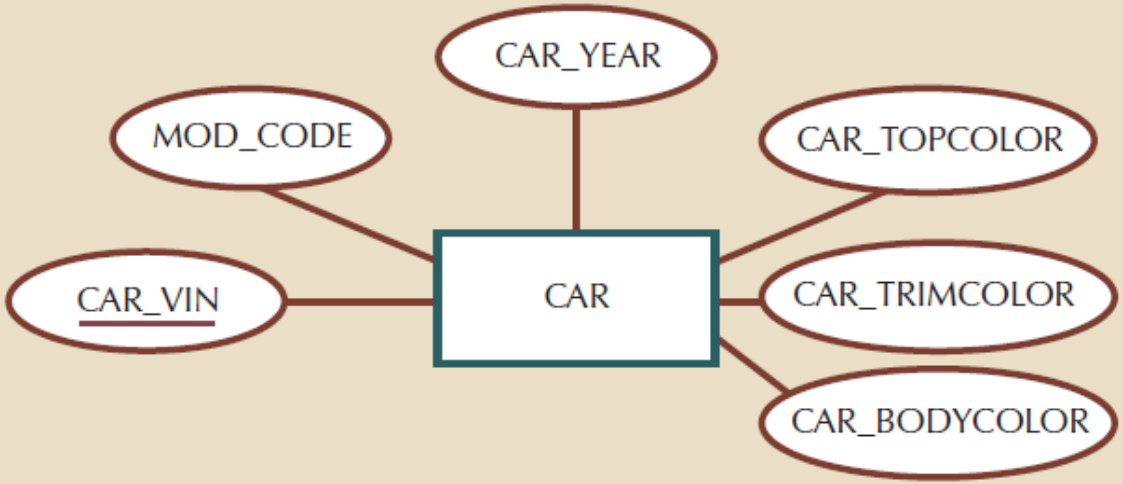
CAR	
PK	CAR_VIN
	MOD_CODE CAR_YEAR CAR_COLOR

Important notes on Attributes

7. Implementing Multivalued Attributes: you should not implement them in the RDBMS
    a. Within the original entity, create several new attributes, one for each component of the original multivalued attribute

E 4.4 SPLITTING THE MULTIVALUED ATTRIBUTE INTO NEW ATTRIBUTES

Chen Model



Crow's Foot Model

CAR	
PK	CAR_VIN
	MOD_CODE CAR_YEAR CAR_TOPCOLOR CAR_TRIMCOLOR CAR_BODYCOLOR

Important notes on Attributes

b. Create a new entity composed of the original multivalued attribute's components. This new entity allows the designer to define color for different sections of the car (see Table 4.1). Then, this new CAR_COLOR entity is related to the original CAR entity in a 1:M relationship.

TABLE 4.1

COMPONENTS OF THE MULTIVALUED ATTRIBUTE

SECTION	COLOR
Top	White
Body	Blue
Trim	Gold
Interior	Blue

RE 4.5 A NEW ENTITY SET COMPOSED OF A MULTIVALUED ATTRIBUTE'S COMPONENTS

01

The Entity Relationship Model

Relationships

Relationships

- The entities that participate in a relationship are also known as participants
- The relationship name is an active or passive verb; for example:
  a. a STUDENT takes a CLASS, a PROFESSOR teaches a CLASS, a DEPARTMENT employs a PROFESSOR, a DIVISION is managed by an EMPLOYEE, and an AIRCRAFT is flown by a CREW.

Relationships

- Relationships always operate in both directions.
  - A CUSTOMER may generate many INVOICEs.
  - Each INVOICE is generated by one CUSTOMER

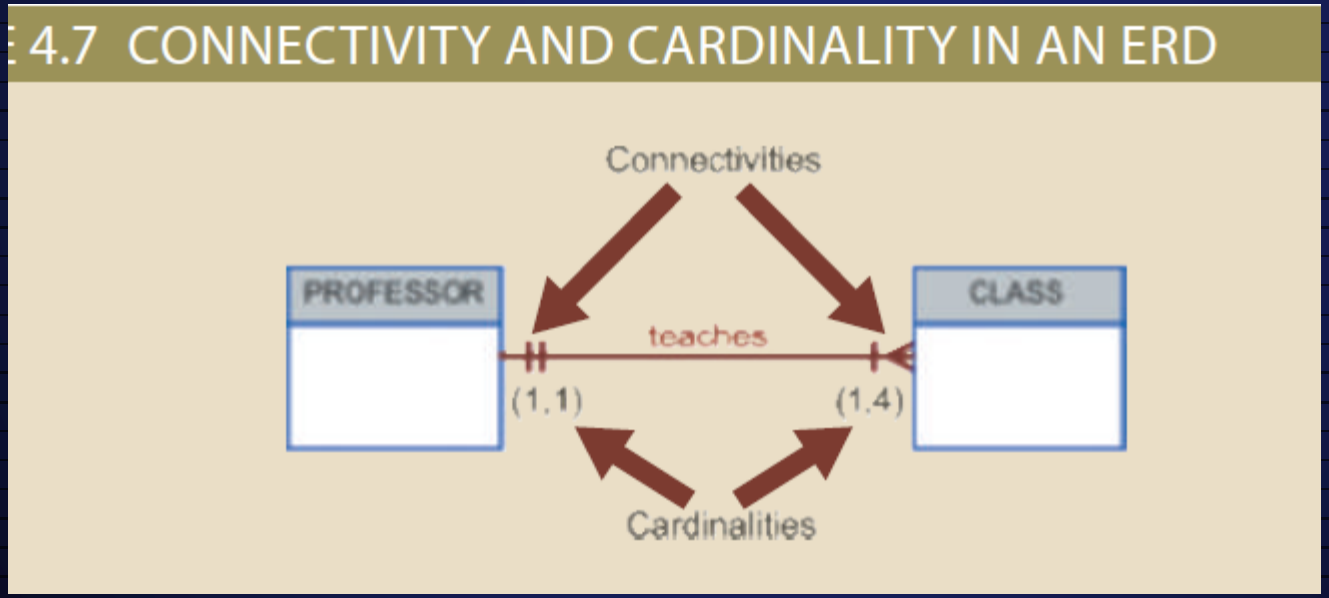
01

The Entity Relationship Model

Connectivity and Cardinality

Connectivity and Cardinality

- **Connectivity:** is used to describe the relationship classification.
- **Cardinality** expresses the minimum and maximum number of entity occurrences associated with one occurrence of the related entity.



Connectivity and Cardinality

- The cardinality (1,4) indicates that each professor teaches up to four classes,
  - which means that the PROFESSOR table's primary key value occurs at least once and no more than four times as foreign key values in the CLASS table.
- If the cardinality had been written as (1,N), there would be no upper limit to the number of classes a professor might teach.
- Similarly, the cardinality (1,1) indicates that each class is taught by one
- and only one professor.
  - That is, each CLASS entity occurrence is associated with one and only one entity occurrence in PROFESSOR.