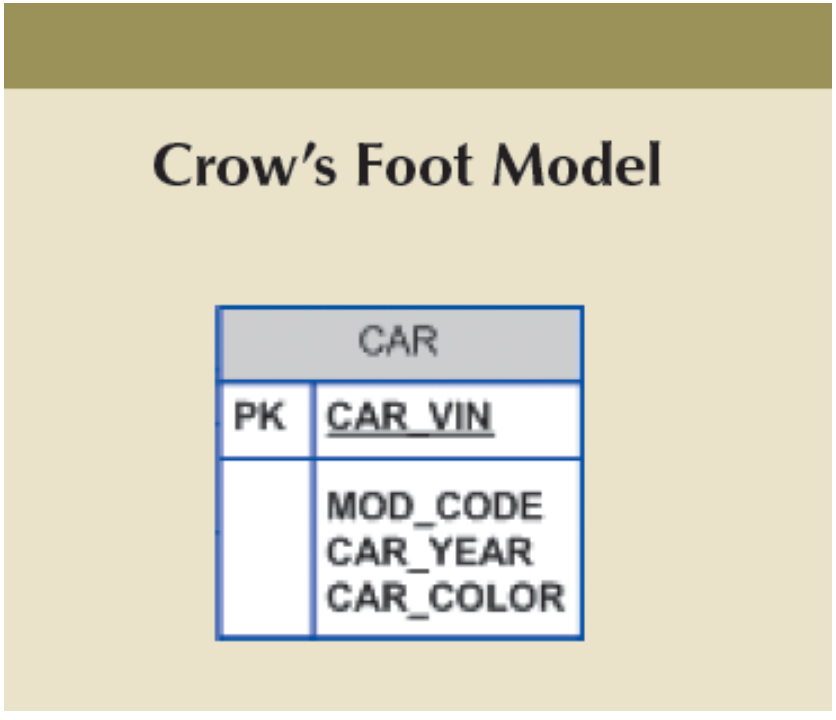
Chen's Type Guidance

Table 1
Correspondence between English sentence structures and ERD constructs

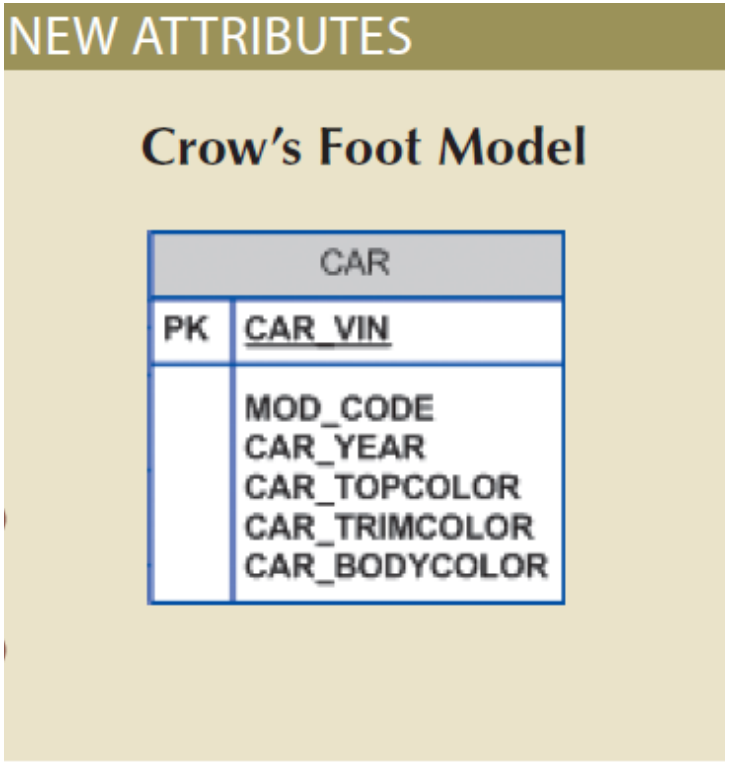
English grammar structure	ERD structure
Common noun	Entity type (candidate)
Proper noun	Entity (candidate)
Transitive verb	Relationship type (candidate)
Intransitive verb	Attribute type (candidate)
Adjective	Attribute for entity
Adverb	Attribute for relationship
Gerund (a noun converted from a verb)	An entity type converted from a relationship type
Clause	A high-level entity type which hides a detailed ERD

r otherwise

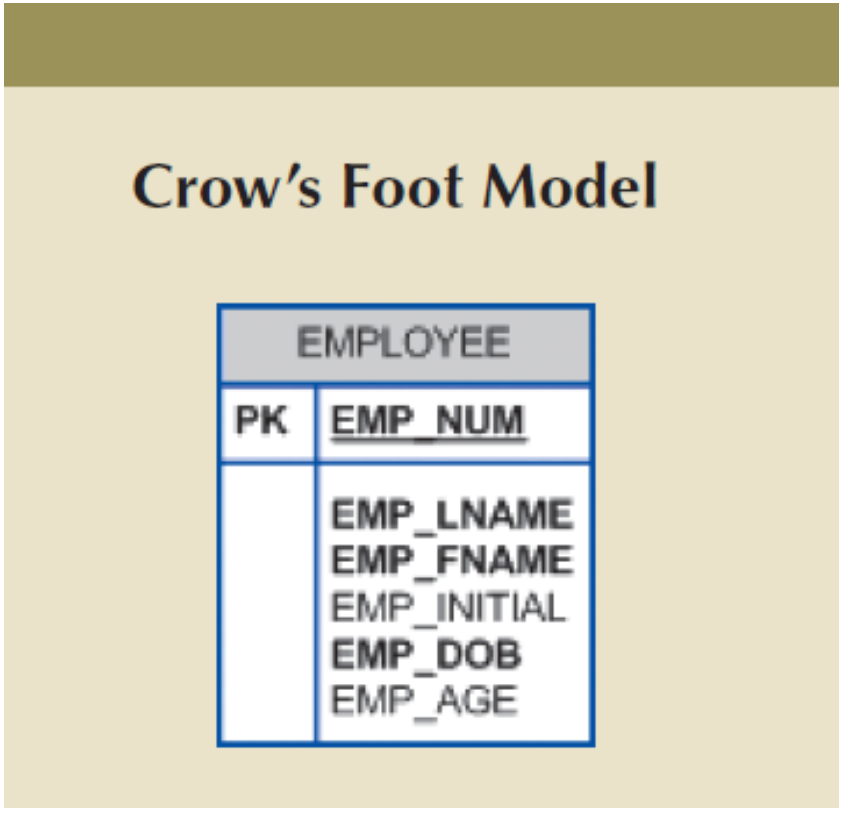
A Multivalued Attribute in an Entity



Splitting the Multivalued Attributes into New Attributes



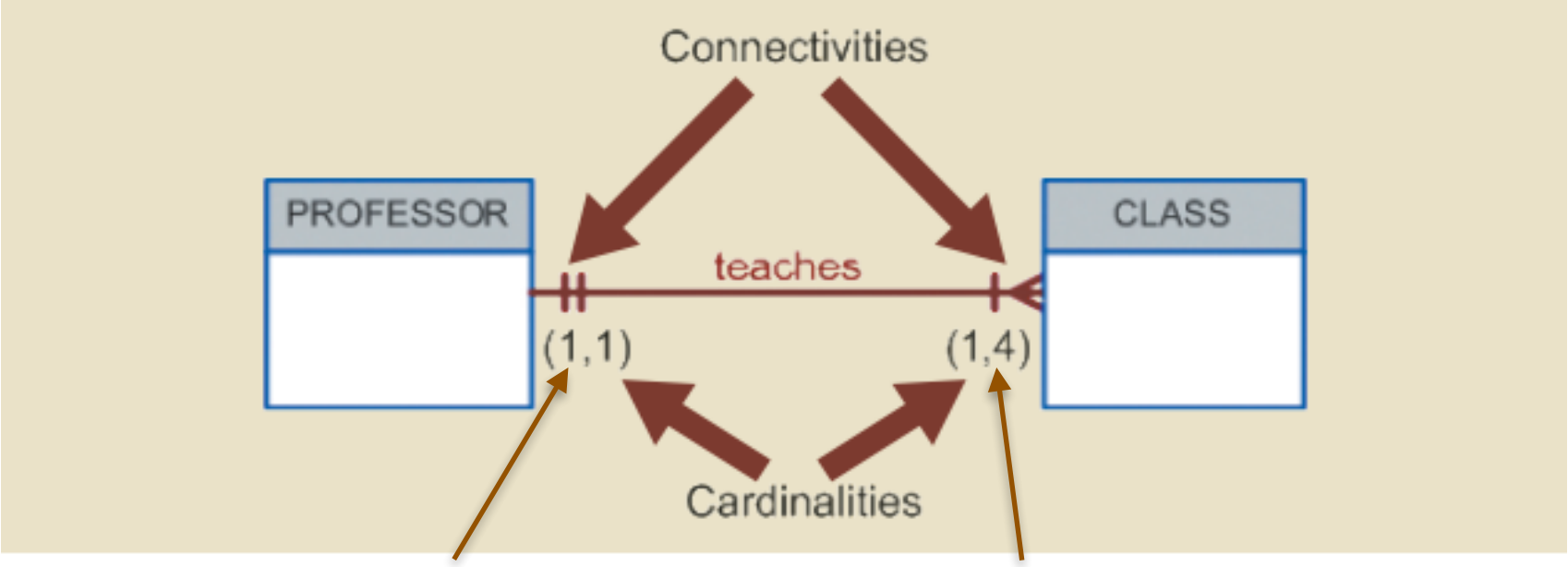
Depiction of a Derived Attribute



Advantages & Disadvantages of Storing Derived Attributes

	DERIVED ATTRIBUTE	
	STORED	**NOT STORED**
Advantage	Saves CPU processing cycles Saves data access time Data value is readily available Can be used to keep track of historical data	Saves storage space Computation always yields current value
Disadvantage	Requires constant maintenance to ensure derived value is current, especially if any values used in the calculation change	Uses CPU processing cycles Increases data access time Adds coding complexity to queries

Connectivity & Cardinality in an ERD

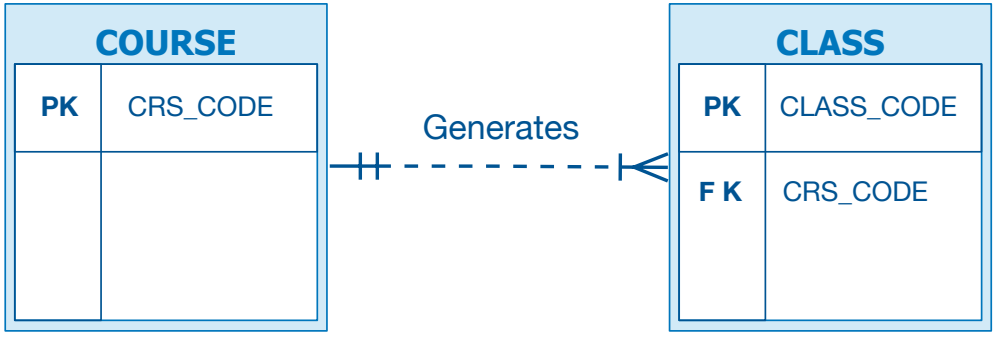


A class is taught by exactly 1 PROFESSOR

A PROFESSOR teaches between 1 and 4 classes

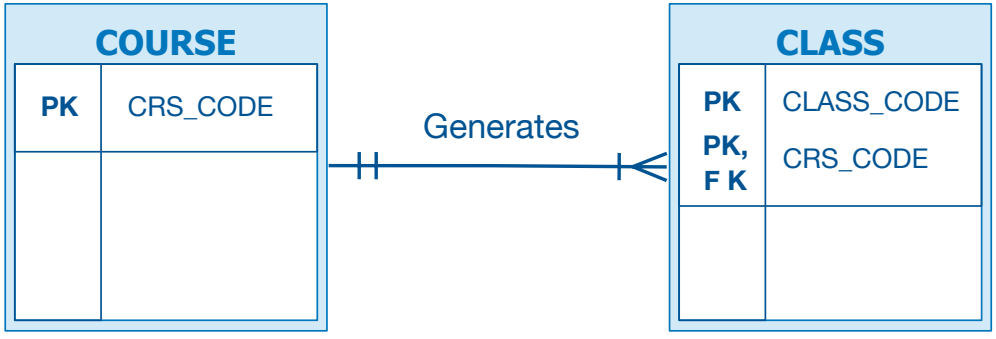
Weak, non-identifying relationship

These exist if the PK of the related entity does not contain a PK component of the parent entity.
The PK of the parent appears as a FK in the child.



Strong, identifying relationship

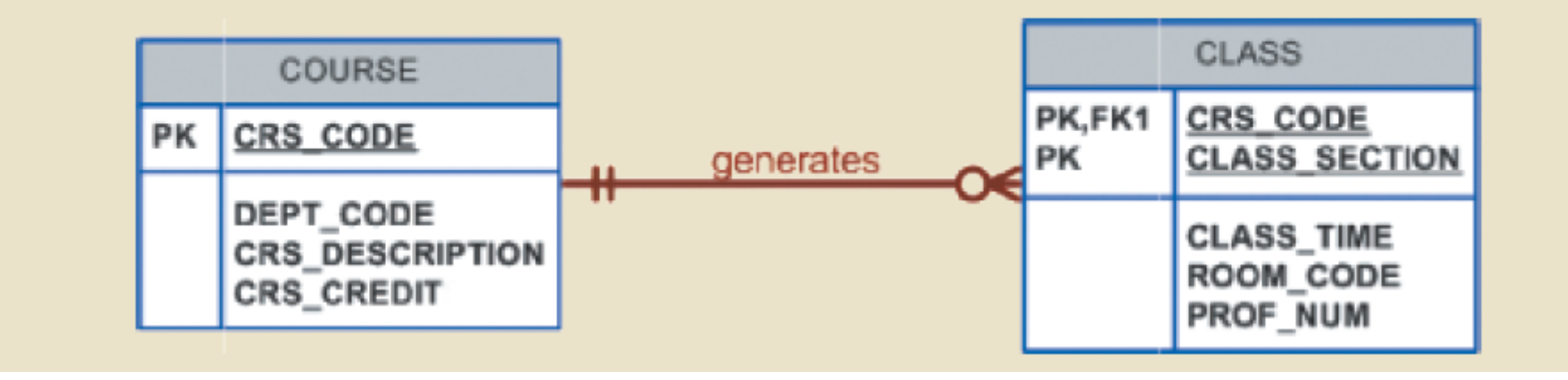
These exist when the PK of the related entity contains a PK component of the parent entity.



Relationship Strength

Determines the order in which tables are created.

If COURSE generates CLASS, we must create the COURSE table first since creating the CLASS table first would result in its FK referring to a non-existent COURSE table.

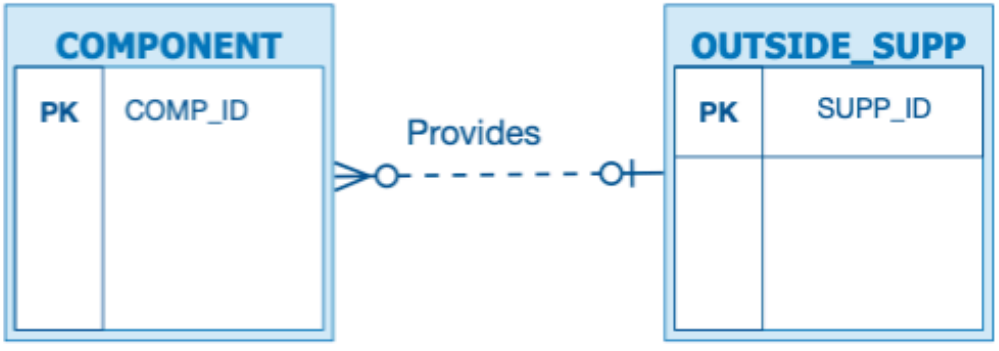


Strong entities

An entity that can exist apart from all of its related entities

OUTSIDE_SUPPLIER is a Strong Entity

It is existence-independent.
Here, not all components come from an outside supplier.



Weak entities

1) Are existence-dependent; they cannot exist without one of the entities it has a relationship with, and

2) Their primary key is partially or totally derived from the "parent" entity in a relationship

In other words, an entity is existence-dependent if it has a mandatory foreign key

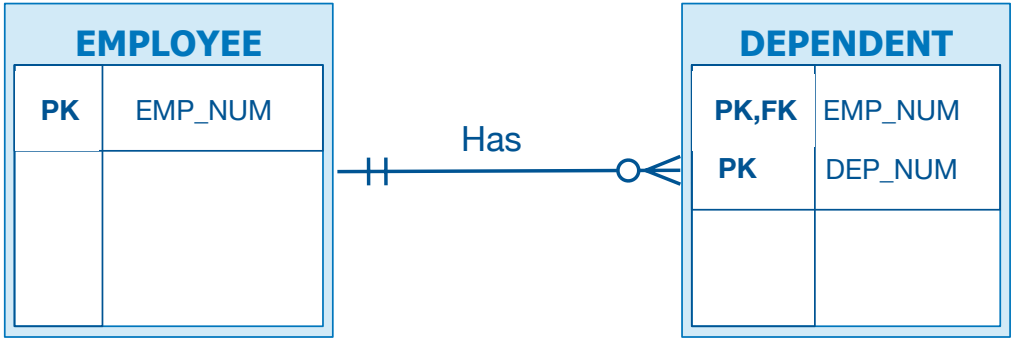
A Weak Entity in an ERD

DEPENDENT is a Weak Entity

1) is existence-dependent
2) has a PK that is partially or totally derived from the parent entity in the relationship.

In a strong relationship

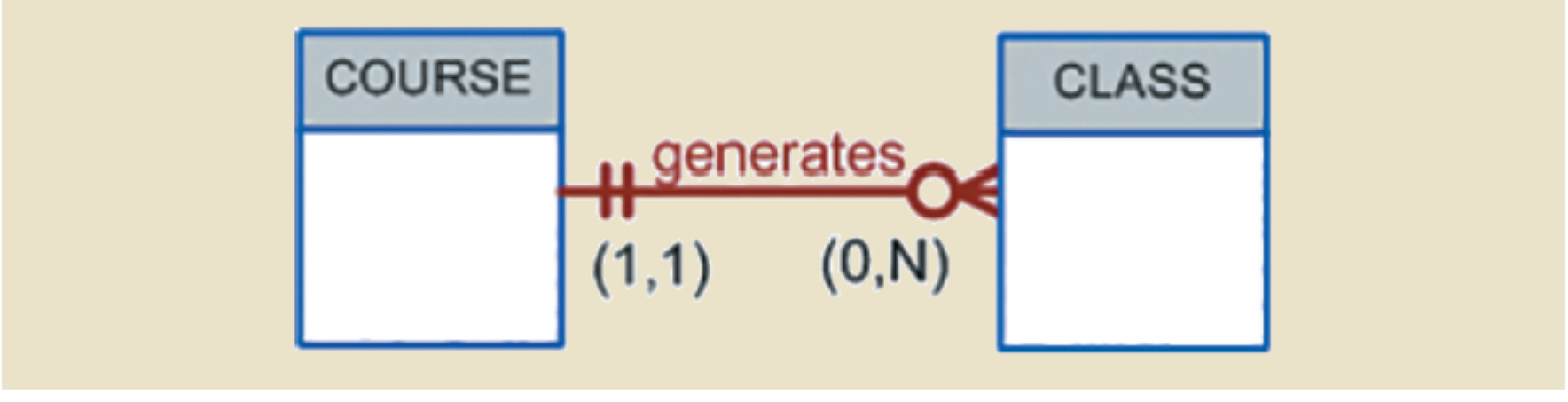
The PK of the related entity contains a PK component of the parent entity.



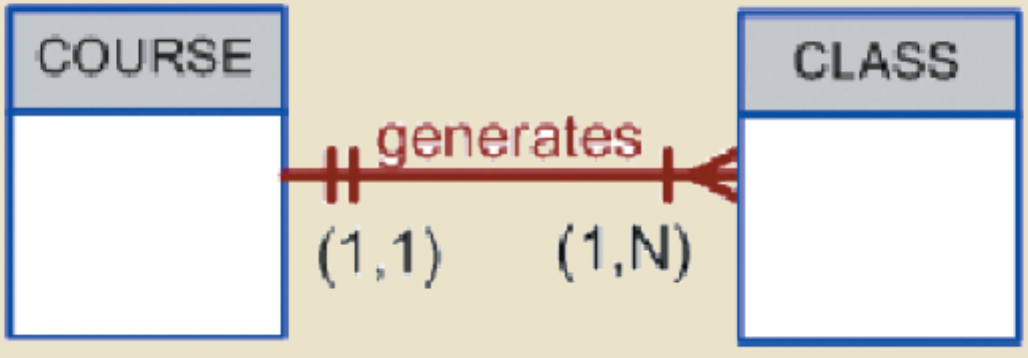
Crow's Foot Symbols

CROW'S FOOT SYMBOLS	CARDINALITY	COMMENT
	(0,N)	Zero or many; the "many" side is optional.
	(1,N)	One or many; the "many" side is mandatory.
	(1,1)	One and only one; the "1" side is mandatory.
	(0,1)	Zero or one; the "1" side is optional.

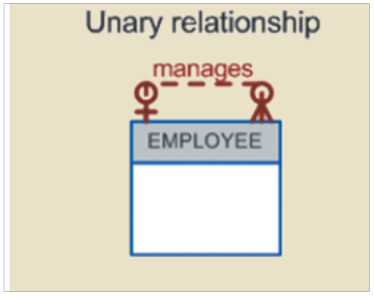
CLASS is Optional to COURSE

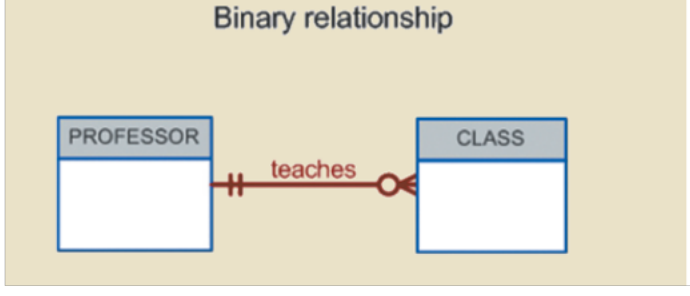


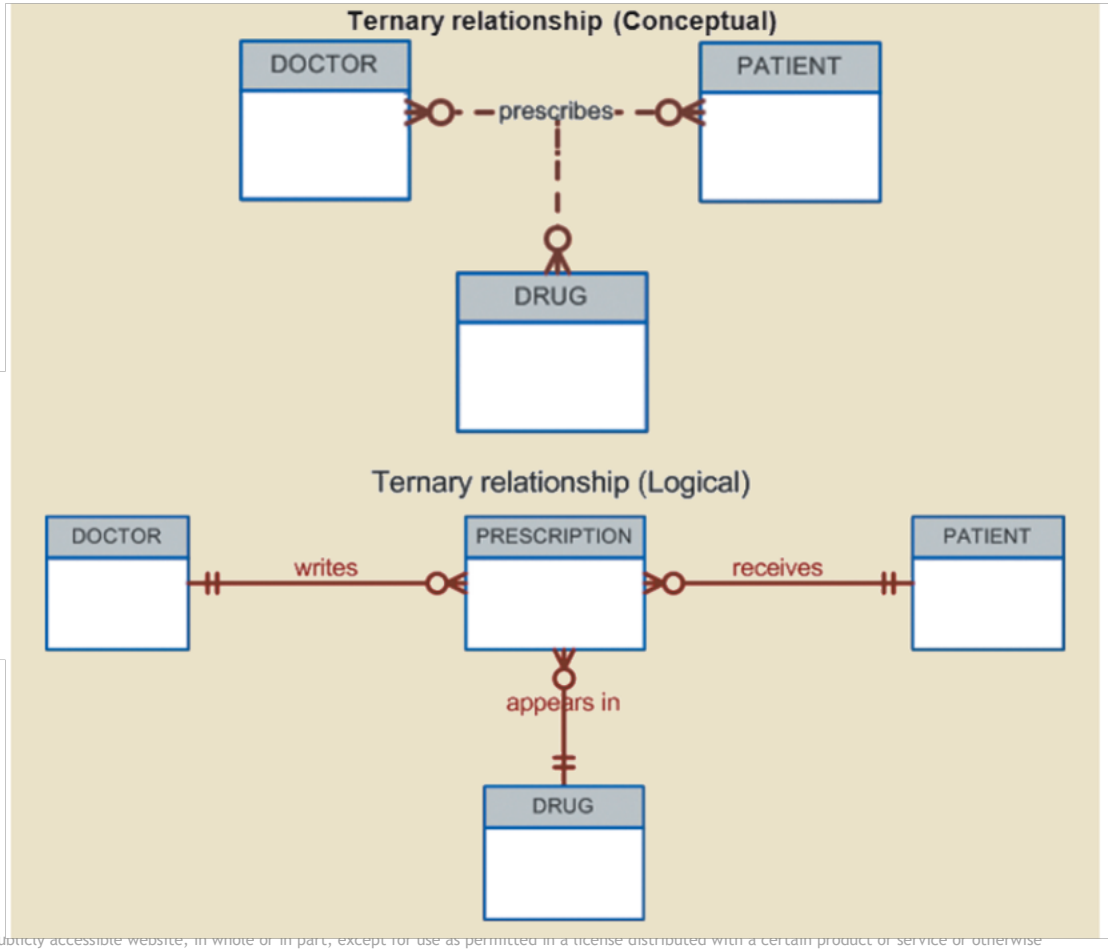
COURSE & CLASS in a Mandatory Relationship



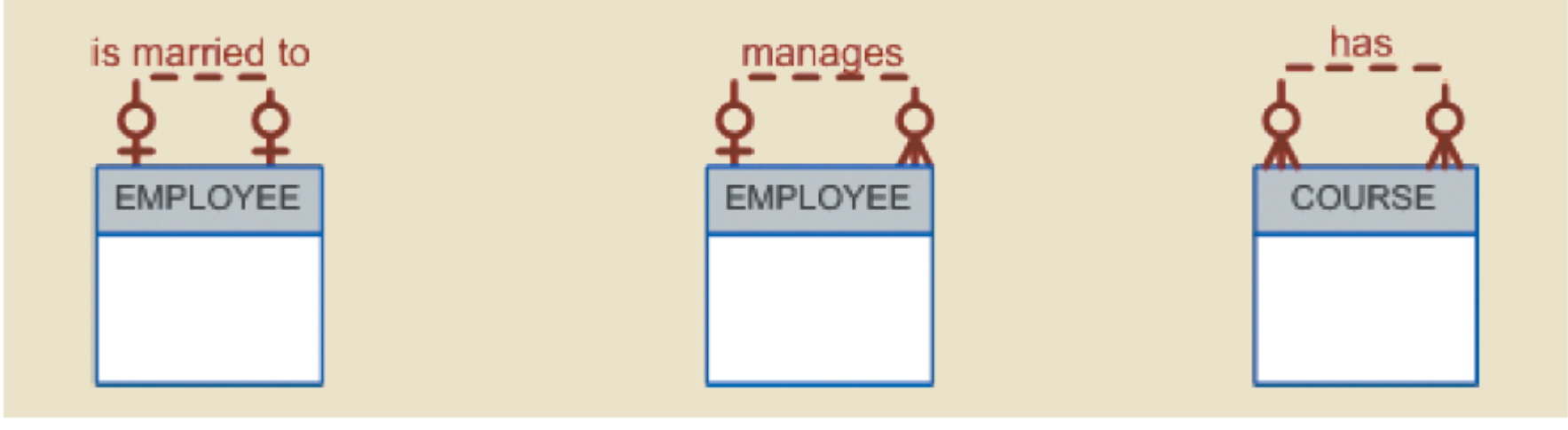
Three Types of Relationship Degree







Recursive Relationships



Converting the M:N Relationship into Two 1:M Relationships

Table name: STUDENT

Database name: Ch04_CollegeTry

STU_NUM	STU_LNAME
321452	Bowser
324257	Smithson

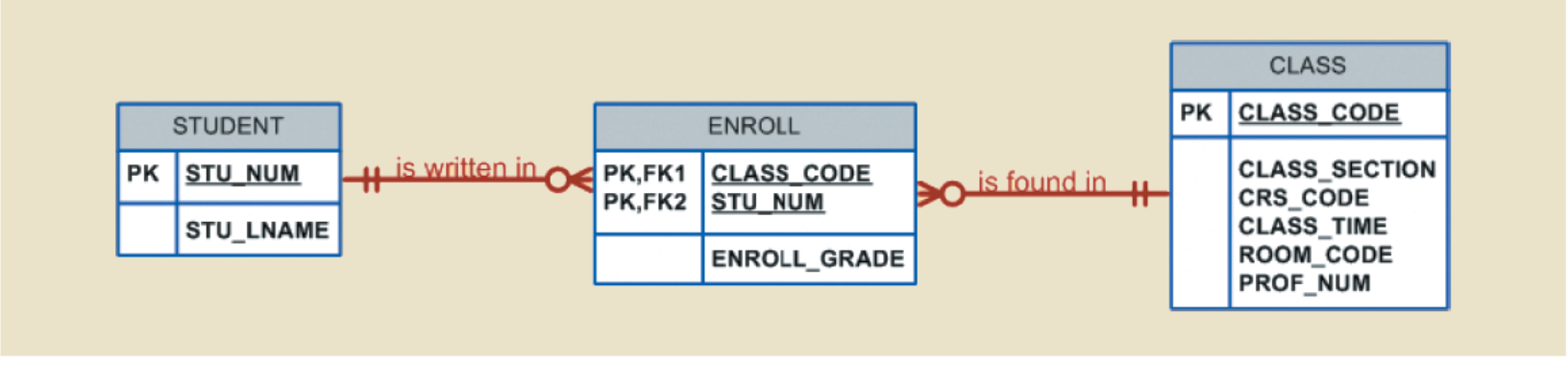
Table name: ENROLL

CLASS_CODE	STU_NUM	ENROLL_GRADE
10014	321452	C
10014	324257	B
10018	321452	A
10018	324257	B
10021	321452	C
10021	324257	C

Table name: CLASS

CLASS_CODE	CRS_CODE	CLASS_SECTION	CLASS_TIME	ROOM_CODE	PROF_NUM
10014	ACCT-211	3	TTh 2:30-3:45 p.m.	BUS252	342
10018	CIS-220	2	MWF 9:00-9:50 a.m.	KLR211	114
10021	QM-261	1	MWF 8:00-8:50 a.m.	KLR200	114

Composite Entity in an ERD



Basketball Team DB

The local city youth league needs a database system to help track children that sign up to play soccer. Data needs to be kept on each team & the children that will be playing on each team & their parents. Also, data needs to be kept on the coaches for each team.

<u>Entities required:</u> Team, Player, Coach, & Parent.

<u>Attributes required:</u>

Team: Team ID number, Team name, & Team colors.
Player: Player ID number, Player first name, Player last name, & Player age.
Coach: Coach ID number, Coach first name, Coach last name, & Coach home phone number.
Parent: Parent ID number, Parent last name, Parent first name, Home phone number, & Home Address (Street, City, State, & ZIP Code).

<u>Relationships required:</u>

Team is related to Player.
Team is related to Coach.
Player is related to Parent.

Basketball Team DB Relationships

1. A Team may or may not have a Player.
2. A Player must have a Team.
3. A Team may have many Players.
4. A Player has only one Team.
5. A Team may or may not have a Coach.
6. A Coach must have a Team.
7. A Team may have many Coaches.
8. A Coach has only one Team.
9. A Player must have a Parent.
10. A Parent must have a Player.
11. A Player may have many Parents.
12. A Parent may have many Players.

The First Tiny College ERD Segment

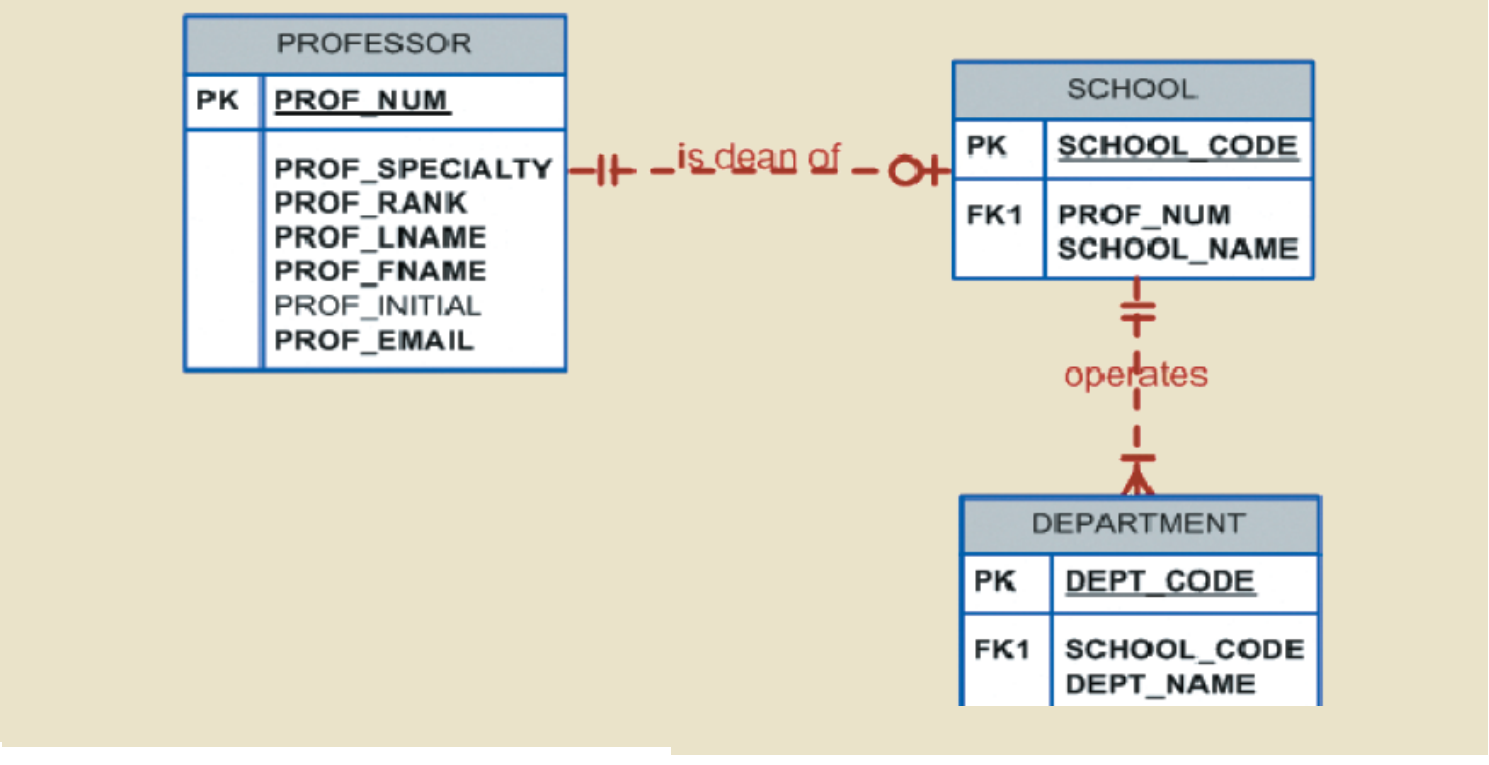


Figure 4.27 - The Second Tiny College ERD Segment

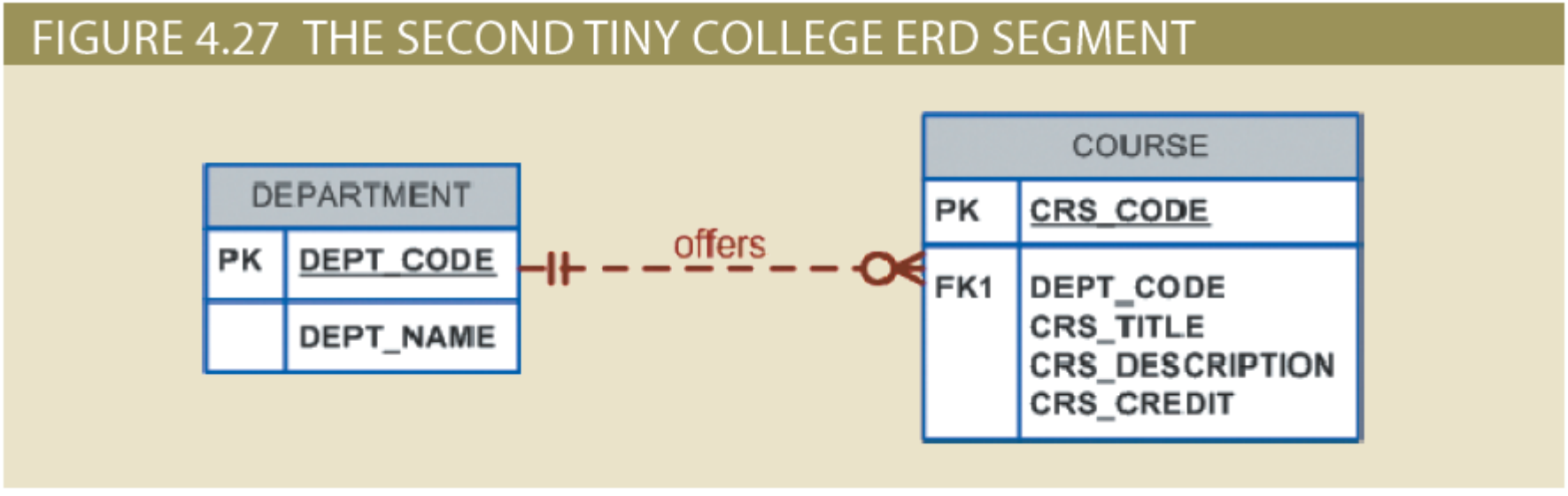


Figure 4.28 - The Third Tiny College ERD Segmen

FIGURE 4.28 THE THIRD TINY COLLEGE ERD SEGMENT

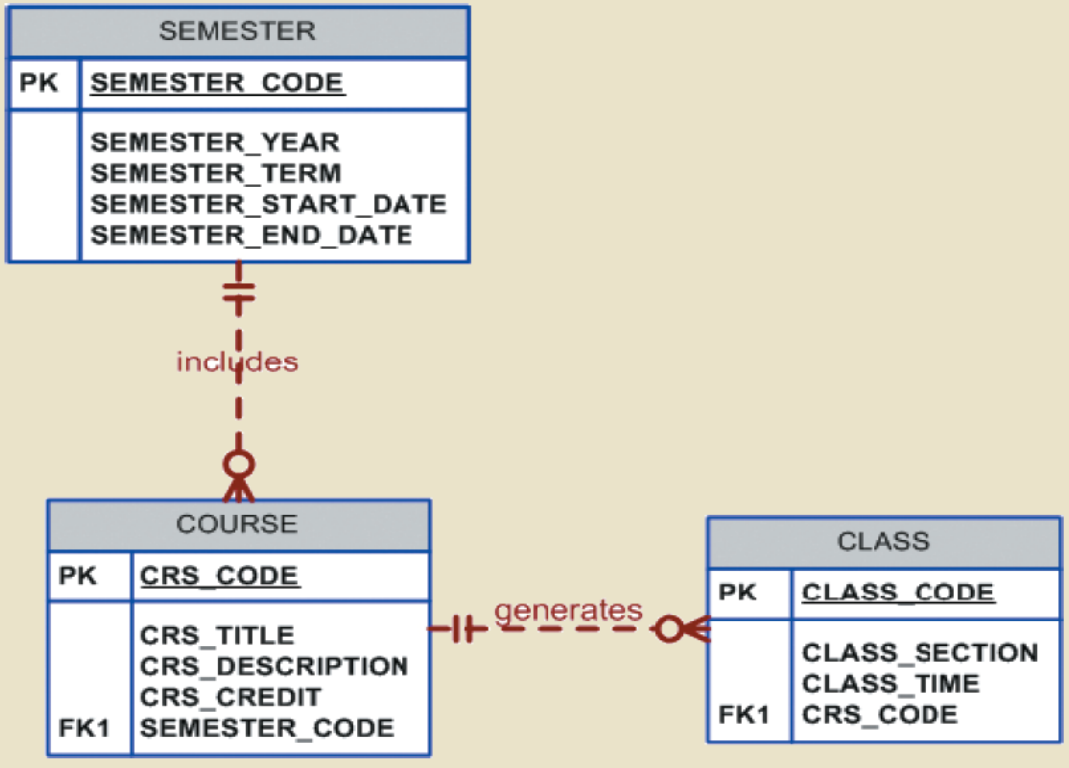


Figure 4.29 - The Fourth Tiny College ERD Segment

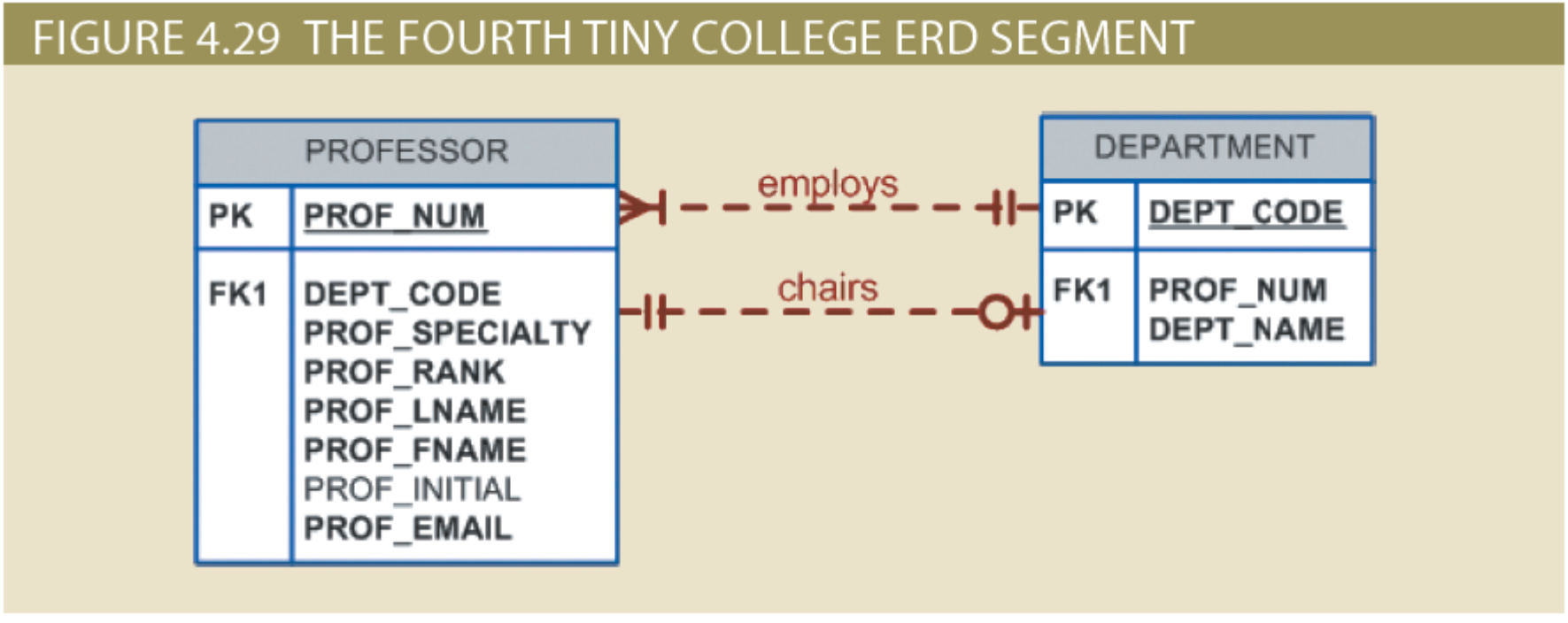


Figure 4.30 - The Fifth Tiny College ERD Segment

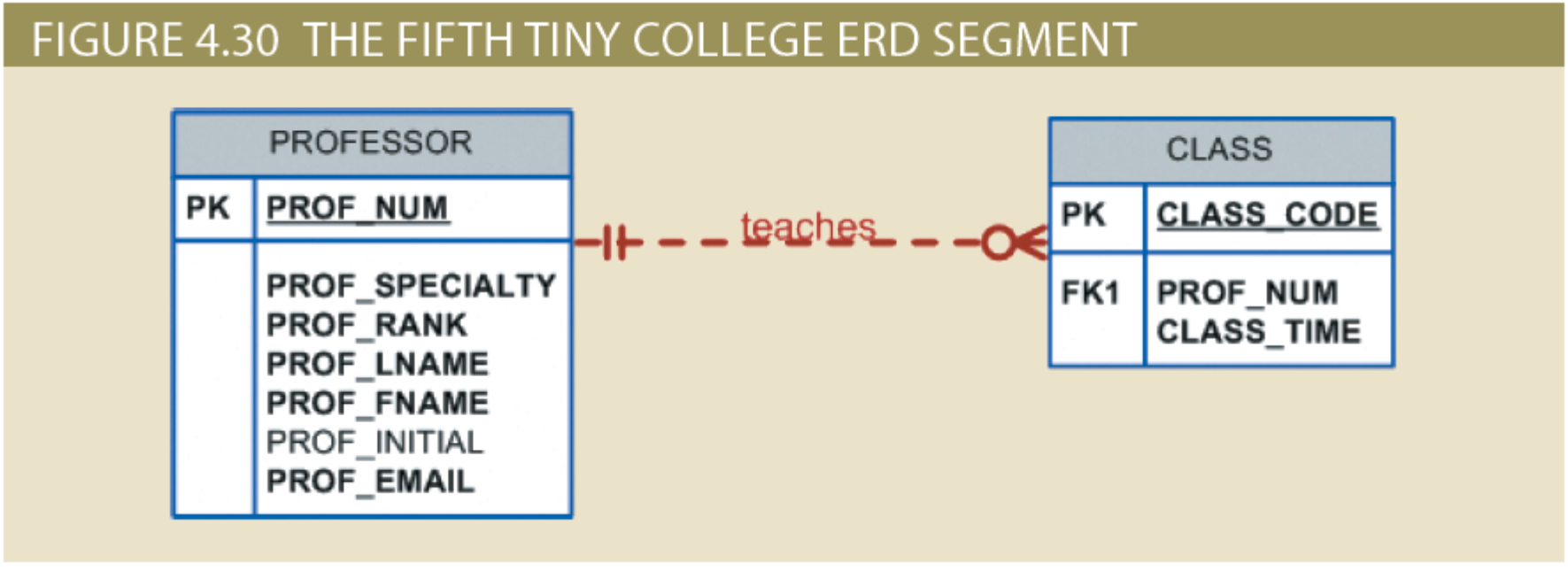


Figure 4.31 - The Sixth Tiny College ERD Segment

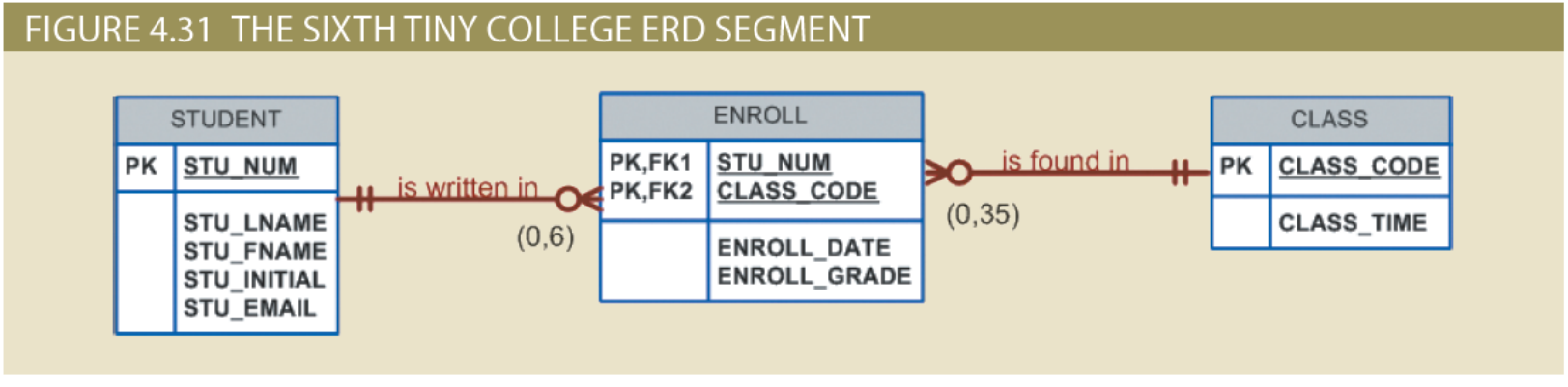


Figure 4.32 - The Seventh Tiny College ERD Segment

FIGURE 4.32 THE SEVENTH TINY COLLEGE ERD SEGMENT

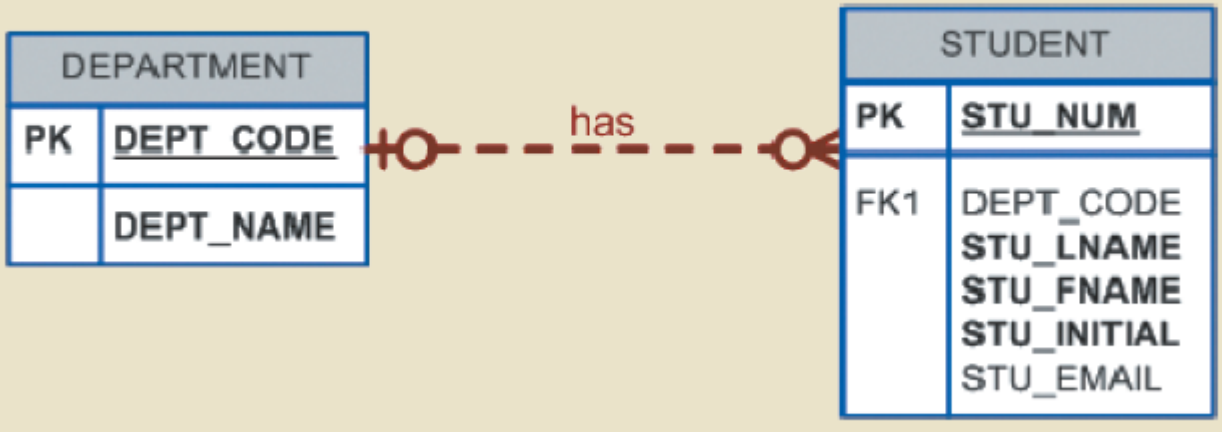


Figure 4.33 - The Eighth Tiny College ERD Segment

FIGURE 4.33 THE EIGHT TINY COLLEGE ERD SEGMENT

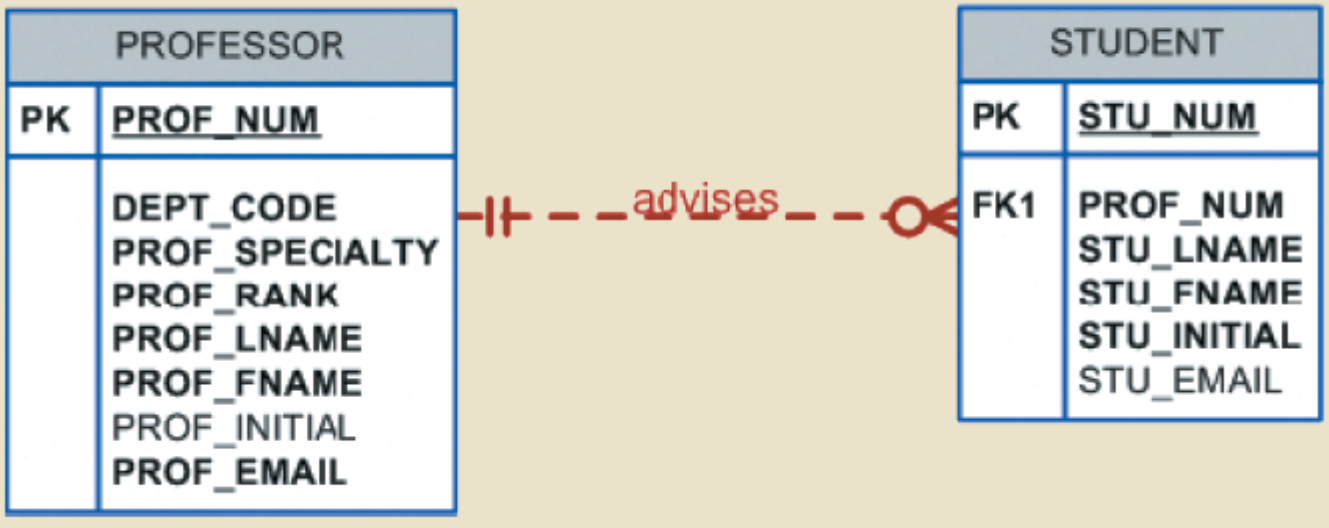


Figure 4.34 - The Ninth Tiny College ERD Segment

FIGURE 4.34 THE NINTH TINY COLLEGE ERD SEGMENT

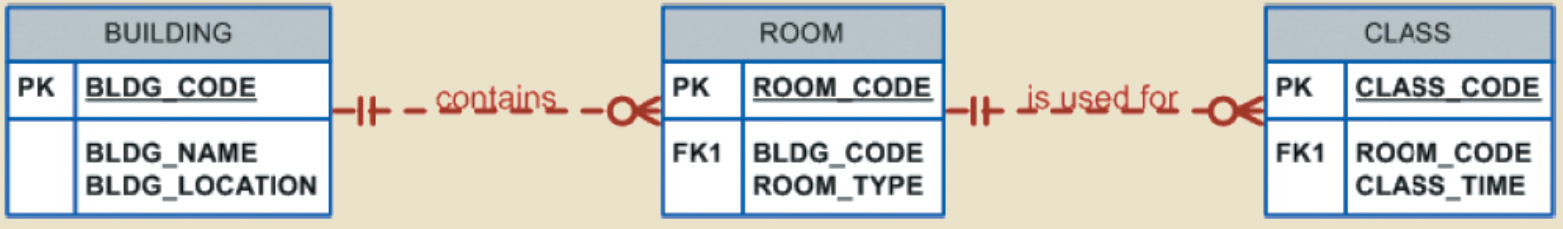


Table 4.4 - Components of the ERM

TABLE 4.4

COMPONENTS OF THE ERM

ENTITY	RELATIONSHIP	CONNECTIVITY	ENTITY
SCHOOL	operates	1:M	DEPARTMENT
DEPARTMENT	has	1:M	STUDENT
DEPARTMENT	employs	1:M	PROFESSOR
DEPARTMENT	offers	1:M	COURSE
COURSE	generates	1:M	CLASS
SEMESTER	includes	1:M	CLASS
PROFESSOR	is dean of	1:1	SCHOOL
PROFESSOR	chairs	1:1	DEPARTMENT
PROFESSOR	teaches	1:M	CLASS
PROFESSOR	advises	1:M	STUDENT
STUDENT	enrolls in	M:N	CLASS
BUILDING	contains	1:M	ROOM
ROOM	is used for	1:M	CLASS

Note: ENROLL is the composite entity that implements the M:N relationship "STUDENT enrolls in CLASS."

Database Design Challenges: Conflicting Goals

Database design must conform to design st&ards

Need for high processing speed may limit the number & complexity of logically desirable relationships

Need for maximum information generation may lead to loss of clean design structures & high transaction speed

Figure 4.38 - Various Implementations of the 1:1 Recursive Relationship