Database Principles: Fundamentals of Design, Implementation, and Management Tenth Edition

Chapter 7 Data Modeling with Entity Relationship Diagrams

Objectives

- In this chapter, students will learn:
 - The main characteristics of entity relationship components
 - How relationships between entities are defined, refined, and incorporated into the database design process
 - How ERD components affect database design and implementation
 - That real-world database design often requires the reconciliation of conflicting goals

The Entity Relationship Model (ERM)

- ER model forms the basis of an ER diagram
- ERD represents conceptual database as viewed by end user
- ERDs depict database's main components:
 - Entities
 - Attributes
 - Relationships

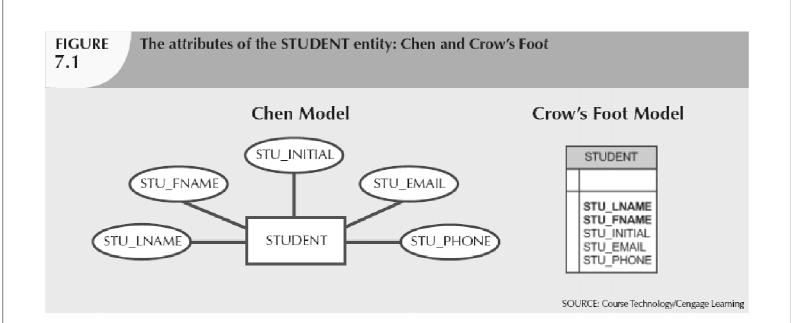
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Entities

- Refers to entity set and not to single entity occurrence
- Corresponds to table and not to row in relational environment
- In Chen and Crow's Foot models, entity is represented by rectangle with entity's name
- The entity name, a noun, is written in capital letters

Attributes

- Characteristics of entities
- Chen notation: attributes represented by ovals connected to entity rectangle with a line
 - Each oval contains the name of attribute it represents
- Crow's Foot notation: attributes written in attribute box below entity rectangle



Attributes (cont'd.)

- Required attribute: must have a value
- Optional attribute: may be left empty
- Domain: set of possible values for an attribute
 Attributes may share a domain
- Identifiers: one or more attributes that uniquely identify each entity instance
- Composite identifier: primary key composed of more than one attribute

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FIGURE 7.2

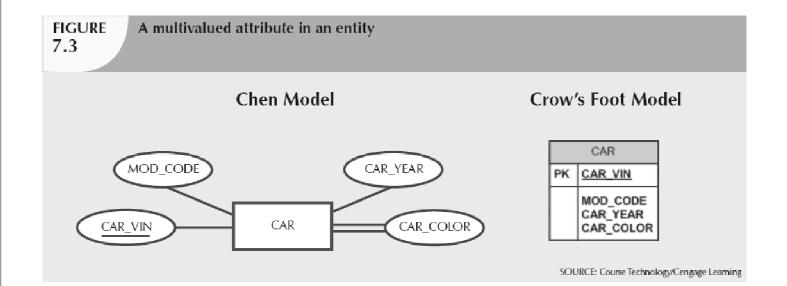
The CLASS table (entity) components and contents

Database name: Ch07_TinyCollege

CLASS_CODE	CRS_CODE	CLASS_SECTION	CLASS_TIME	ROOM_CODE	PROF_NUM
10012	ACCT-211	1	MA/F 8:00-8:50 a.m.	BUS311	105
10013	ACCT-211	2	MAVE 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	M/VF 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	MAVE 9:00-9:50 a.m.	KLR209	228
10018	CIS-220	2	MAVE 9:00-9:50 a.m.	KLR211	114
10019	CIS-220	3	MAVE 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	MAVE 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

Attributes (cont'd.)

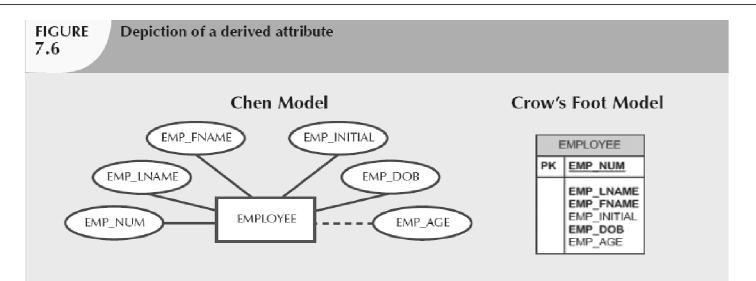
- Composite attribute can be subdivided
- Simple attribute cannot be subdivided
- Single-value attribute can have only a single value
- Multivalued attributes can have many values



Attributes (cont'd.)

- M:N relationships and multivalued attributes should not be implemented
 - Create several new attributes for each of the original multivalued attributes' components
 - Create new entity composed of original multivalued attributes' components
- Derived attribute: value may be calculated from other attributes
 - Need not be physically stored within database

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SOURCE: Course Technology/Cengage Learning

TABLE

7.2 Adva

Advantages and Disadvantages of Storing Derived Attributes

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

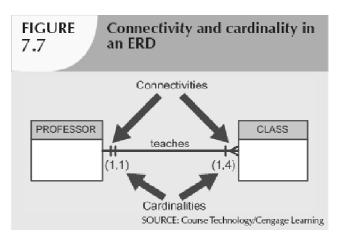
Relationships

- Association between entities
- Participants are entities that participate in a relationship
- Relationships between entities always operate in both directions
- Relationship can be classified as 1:M
- Relationship classification is difficult to establish if only one side of the relationship is known

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Connectivity and Cardinality

- Connectivity
 - Describes the relationship classification
- Cardinality
 - Expresses minimum and maximum number of entity occurrences associated with one occurrence of related entity
- Established by very concise statements known as business rules



Existence Dependence

- Existence dependence
 - Entity exists in database only when it is associated with another related entity occurrence
- Existence independence
 - Entity can exist apart from one or more related entities
 - Sometimes such an entity is referred to as a strong or regular entity

Relationship Strength

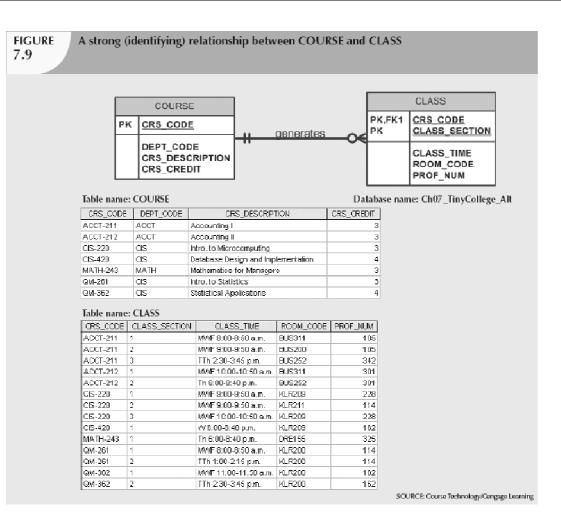
- Weak (non-identifying) relationships
 - Exists if PK of related entity does not contain PK component of parent entity
- Strong (identifying) relationships

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 Exists when PK of related entity contains PK component of parent entity

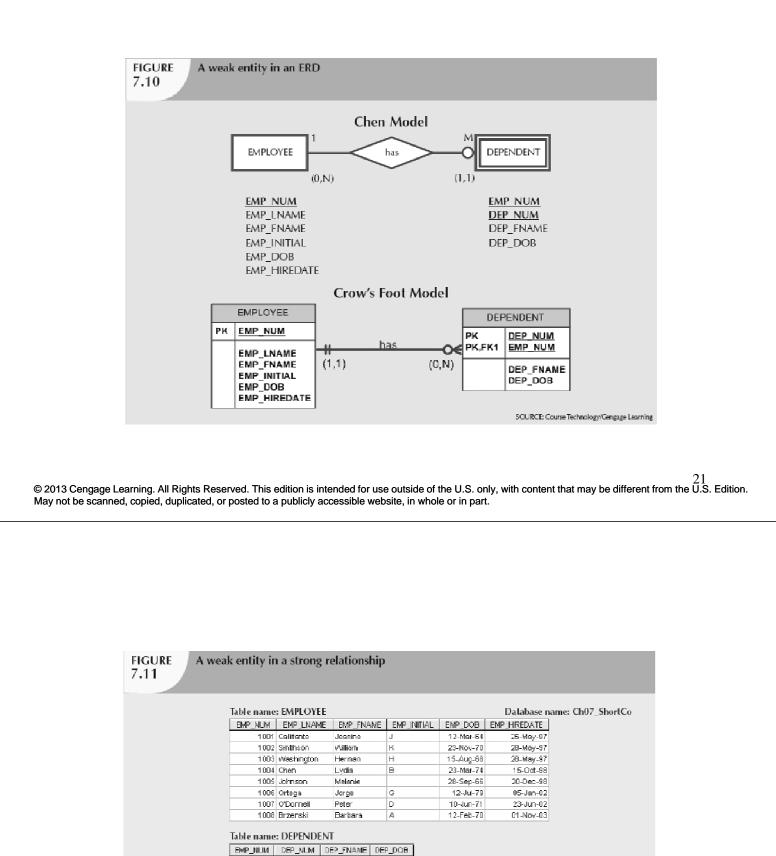
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FIGURE A weak (n 7.8	on-identifyi	ng) relationship between CC	URSE and	CLASS
7.10				
PK <u>CRS</u> DEP CRS	COURSE <u>CODE</u> T_CODE _DESCRIPTIC _CREDIT			CLASS LASS_CODE RS_CODE LASS_SECTION LASS_TIME DOM_CODE ROF_NUM
Table name	: COURSE		Dat	tabase name: Ch07 TinyCollege
CRS_CODE	DEPT_CODE	CRS_DESCRPTION	CRS_CREDIT	- , ,
ACCT-211	ACCT	Accounting I	3	
ACCT-212	ACCT	Accounting II	З	
CIS-220	as	htro. to Microcomputing	3	
CIS-420	as	Database Design and Implementation	4	
CIS-420 MATH-243	OS NATH	Database Design and Inplementation Mathematics for Managers	4	
MATH-243 QM-261	NATH CIS	Mathematics for Managers Intro. to Statistics	3	
MATH-243	MATH	Mathematics for Managers	3	
MATH-243 QM-261	NATH CIS CIS	Mathematics for Managers Intro. to Statistics	3	
MATH-243 QM-261 QM-362 Table name	NATH CIS CIS CLASS	Mathematics for Managars Intro. Io Statistics Statistical Applications	3 3 4	PROF NUM
MATH-243 QM-261 QM-362 Table name	MATH GS GS CLASS DE CRS_CODE	Mathematics for Managers Intro. to Statistics	3 3 4	PROF_NUM 105
MATH-243 QM-261 QM-382 Table name CLASS_CO	MATH OS OS CLASS DE CRS_CODE	Mathematics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MAY 8 00-8:50 a.m.	3 3 4 ROOM_CODE	
MATH-243 QM-261 QM-362 Table name (LASS_CO 10012	MATH CIS CIS CLASS DE CRS_CODE ACCT-211	Mathematics for Managers htro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MVF 8 00-850 a.m. 2 MVF 8 00-850 a.m.	3 3 4 ROOM_CODE BU5311	105
MATH-243 QM-261 QM-362 Table name QLASS_D0 10012 10013	MATH CIS CIS CLASS DE CRS_CODE ACCT-211 ACCT-211	Mathematics for Managers htro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MVF 8 00-8:50 a.m. 2 MVF 9 00-8:50 a.m. 3 TTh 2:30-3:45 p.m.	3 3 4 ROOM_CODE BUS311 BUS200 BUS252	105
MATH-243 QM-261 QM-362 Table name QLASS_D0 10012 10013 10014	MATH CIS CIS CLASS DE CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-212	Mathematics for Managers htro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MVF 8 00-650 a.m. 2 MVF 8 00-850 a.m. 3 TTh 2:30-3:45 p.n.	3 3 4 BU5311 BU5200 BU5252 BU5252 BU5252	105 105 342
MATH-243 QM-261 QM-362 Table name QLASS_DO 10012 10013 10014 10015	MATH CIS CIS CLASS DE CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-212	Mathematics for Managers htro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MAVE 8 00-8:50 a.m. 2 MAVE 900-8:50 a.m. 3 TTh 2:30-3:45 p.m. 1 MAVE 10:00:10:50 a.m. 2 Th 6:00-8:40 p.m. 1 MAVE 900-8:50 a.m.	3 3 4 BU5311 BU5200 BU5252 bBU5311	105 105 342 301 301 228
MATH-243 QM-261 QM-362 Table name CLASS_CO 10012 10013 10014 10015 10016	MATH GS CS CLASS DE CRS_CODE ACCT-211 ACCT-211 ACCT-212 ACCT-212	Mathemetics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MAVE 900-8:50 a.m. 2 MAVE 900-8:50 a.m. 3 TTh 2:30-3:45 p.n. 1 MAVE 10:00-10:50 a.m. 2 Th 6:00-6:40 p.m.	3 3 4 BU5311 BU5200 BU5252 BU5252 BU5252	105 105 342 301 301
MATH-243 QM-261 QM-362 Table name QLASS_DO 10012 10013 10014 10015 10016 10016 10018 10018	NATH CIS CIS CLASS DE CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-212 CIS-220 CIS-220 CIS-220	Mathematics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MVF 900-850 a.m. 2 MVF 900-850 a.m. 3 TTh 2:30-345 p.m. 1 MVF 10:00-10 50 a.m. 2 Th 6:00-6:40 p.m. 1 MVF 900-850 a.m. 2 TN 6:00-8:00 a.m. 3 MVF 900-8:50 a.m. 3 MVF 900-8:50 a.m.	3 3 4 ROOM_DODE BUS311 BUS320 BUS311 BUS22 BUS311 BUS22 KLR209 KLR211 KLR209	105 105 342 301 228 114 228
MATH-243 QM-261 QM-362 Table name (LASS_CO 10012 10013 10014 10015 10016 10016 10017 10018 10019 10020	NATH CIS CIS CECLASS DE CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-211 ACCT-211 ACCT-212 CIS-220 CIS-220 CIS-220 CIS-220 CIS-220 CIS-220	Mathematics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MAVE 900-850 am 3 TTh 2:30-3:45 p.in. 1 MAVE 900-8:50 am 3 TTh 2:30-3:45 p.in. 1 MAVE 900-8:50 am 2 Th 6:00-8:40 p.in. 1 MAVE 900-8:50 am 3 MAVE 900-8:50 am 3 MAVE 900-8:50 am 1 MAVE 900-8:50 am 3 MAVE 900-8:50 am 1 MAVE 900-8:50 am 1 MAVE 900-8:50 am 1 MAVE 900-8:50 am	3 3 4 ROOM_DODE BUS311 BUS252 BUS311 BUS252 KLR208 KLR209 KLR209 KLR209	105 105 342 301 228 114 228 162
MATH-243 QM-261 QM-362 Table name (LASS_CO 10012 10013 10014 10015 10016 10017 10016 10017 10018 10019 10020 10020	MATH CIS CIS CE CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-212 CIS-220 CIS-220 CIS-220 CIS-220 CIS-220 CIS-220 CIS-420 QM-261	Mathemetics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MAVE 900-8:50 a.m. 2 MAVE 900-8:50 a.m. 3 TTh 2:30-3:45 p.m. 1 MAVE 900-8:50 a.m. 2 Th 2:30-3:45 p.m. 1 MAVE 900-8:50 a.m. 2 Th 6:00-8:40 p.m. 1 MAVE 900-8:50 a.m. 3 MAVE 900-8:50 a.m. 1 MAVE 900-8:50 a.m. 1 MAVE 900-8:50 a.m. 1 MAVE 900-8:50 a.m.	3 3 4 ROOM_DODE BU5311 BU5200 BU5311 BU5252 kLR208 KLR209 KLR209 KLR209 KLR209 KLR200	105 105 342 301 228 114 228 162 114
MATH-243 GM-261 GM-362 Table name (LASS_CO 10012 10013 10014 10015 10016 10017 10018 10019 10020 10020 10021	MATH GIS CIS CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-212 CIS-220	Mathematics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MAVE 8 00-8:50 a.m. 2 MAVE 8 00-8:50 a.m. 3 TTh 2:30-3:45 p.m. 1 MAVE 900-8:50 a.m. 2 TTh 2:30-3:45 p.m. 1 MAVE 10:00-10:50 a.m. 2 Th 6:00-8:40 p.m. 1 MAVE 900-8:50 a.m. 2 MAVE 900-8:50 a.m. 3 MAVE 900-9:50 a.m. 1 MAVE 900-9:50 a.m. 2 MAVE 900-9:50 a.m. 3 MAVE 900-8:50 a.m. 2 TTH 2:00-10:50 a.m. 2 MAVE 900-8:50 a.m.	3 3 4 ROOM_DODE BU5311 BU5200 BU5311 BU5252 KLR209 KLR209 KLR209 KLR209 KLR209 KLR209 KLR200 KLR200 KLR200	105 105 342 301 228 114 228 162 114 114
MATH-243 GM-261 GM-362 Table name (LASS_D0 10012 10013 10014 10015 10016 10017 10018 10019 10020 10020 10022 10022	NATH CIS CIS CLASS DE CRS_CODE ACCT-211 ACCT-211 ACCT-212 CIS-220 CIS-	Mathematics for Managers Intro. Io Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MVF 800-850 a.m. 2 MVF 800-850 a.m. 3 TTh 2:30-3:45 p.m. 1 MVF 10:00-10:50 a.m. 2 Th 6:00-8:40 p.m. 1 MVF 9:00-8:50 a.m. 2 TM 6:00-4:0 p.m. 1 MVF 9:00-8:50 a.m. 3 MVF 9:00-8:50 a.m. 1 VY 8:00-8:04 p.m. 1 VY 8:00-8:04 p.m. 1 MVF 9:00-8:50 a.m. 2 TTh 1:00-2:15 p.m. 1 MVF 8:00-8:50 a.m.	3 3 4 ROOM_DODE BU5311 BU520 BU5311 BU522 BU5311 BU522 KLR209 KLR209 KLR209 KLR200 KLR200 KLR200 A KLR200 K	105 105 342 301 301 228 114 228 162 114 114 114
MATH-243 GM-261 GM-362 Table name CLASS_D0 10012 10013 10014 10015 10016 10017 10018 10019 10020 10020 10021 10022	MATH GIS CIS CRS_CODE ACCT-211 ACCT-211 ACCT-211 ACCT-212 CIS-220	Mathematics for Managers Intro. to Statistics Statistical Applications CLASS_SECTION CLASS_TIME 1 MVF 800-850 a.m. 2 MVF 800-850 a.m. 3 TTh 2:30-345 p.n. 1 MVF 900-850 a.m. 2 Th 6:00-8:40 p.m. 1 MVF 900-8:50 a.m. 2 TN F 900-8:50 a.m. 3 MVF 900-8:50 a.m. 1 MVF 900-8:50 a.m. 3 MVF 900-8:50 a.m. 1 Y 800-8:50 a.m. 1 MVF 900-8:50 a.m. 2 TTh 1:00-2:15 p.n. 1 MVF 11:00-1:150 a.r. 2 TTh 1:20-3:45 p.m.	3 3 4 ROOM_DODE BU5311 BU5200 BU5311 BU5252 KLR209 KLR209 KLR209 KLR209 KLR209 KLR209 KLR200 KLR200 KLR200	105 105 342 301 228 114 228 162 114 114



Weak Entities

- Weak entity meets two conditions
 - Existence-dependent
 - Primary key partially or totally derived from parent entity in relationship
- Database designer determines whether an entity is weak based on business rules



05-Dcc-97

30-Sep-02

25-Jan-04

25-Mey-01

19-Feb-95

27-Jun-98

18-Aug-03

SOURCE: Course Technology/Gengage Learning

1001

1001

1003

1006

1008

1008

1008

1 Annelise

1 Suzanne

z Jorge

1 Carlos

1 Michael

2 George

3 Katherine

Relationship Participation

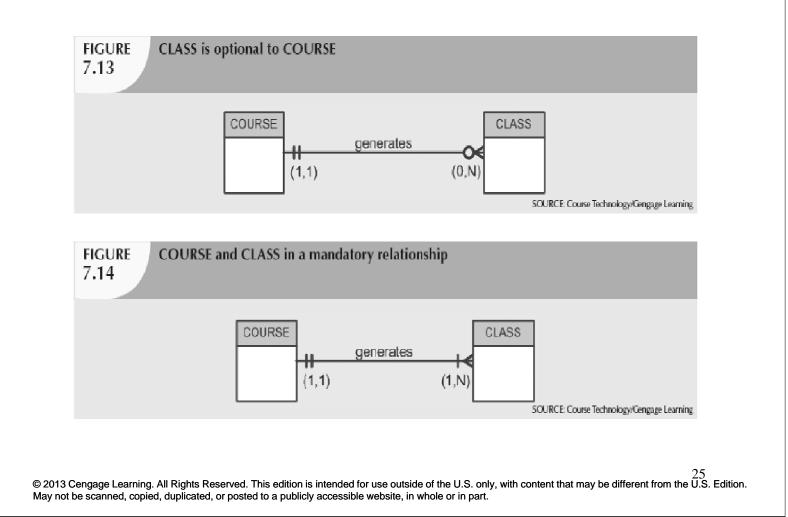
- Optional participation
 - One entity occurrence does not require corresponding entity occurrence in particular relationship
- Mandatory participation
 - One entity occurrence requires corresponding entity occurrence in particular relationship

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TABLE 7.3

Crow's Foot Symbols

CROW'S FOOT SYMBOLS	CARDINALITY	COMMENT
Œ	(0,N)	Zero or many; the "many" side is optional.
l€	(1,N)	One or many; the "many" side is mandatory.
11	(1,1)	One and only one; the "1" side is mandatory.
Ю	(0,1)	Zero or one; the "1" side is optional.



Relationship Degree

- Indicates number of entities or participants associated with a relationship
- Unary relationship
 - Association is maintained within single entity
- Binary relationship
 - Two entities are associated
- Ternary relationship
 - Three entities are associated

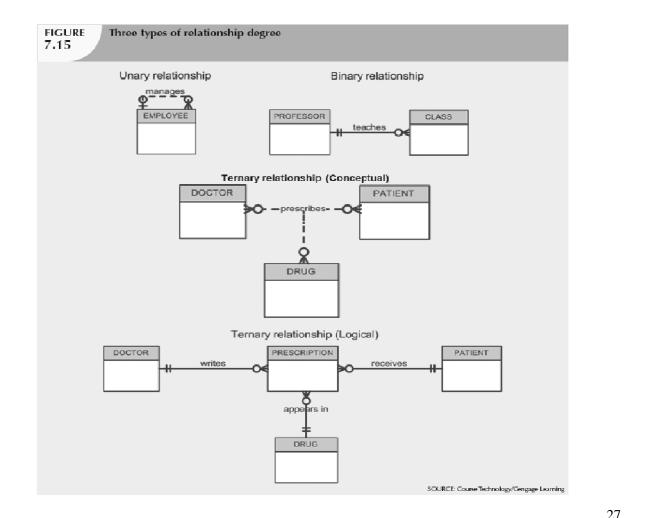


FIGURE 7.16

The implementation of a ternary relationship

Table name: DRUG

DRUC_CODE	DRUG_NAME	DRUG_PRICE
AP15	Afgopon-15	25.00
AF2S	Afgapan-25	35.00
DRO	Drosiene Chiorida	111.89
DRZ	Druzocholar Cryptolene	18.99
K015	Kolisbar Oxyhexalane	85.75
OLE	Oleander-Drizapan	123.95
TRYP	Tryptolec Heptadimetric	79.45

Table name: PATIENT

PAT_NUM	PAT_TITLE	PAT_UNAME	PAT_FNANE	PAT_NITAL	PAT_D08	PAT_AREACODE	RAT_PHONE
100	Wr.	Kolmycz	George	D	15-Jun-1942	615	324-5455
101	Ma.	Lovria	Föhemde	0	19-Mar-2005	615	324-4472
102	Wr.	Yandari	Rinett		14-Nov-1958	901	675-8993
103	MB.	JONES	Anne	М	16-00-1974	615	898-3455
10.9	Wr.	Lange	John	p	08-Nov-1971	901	504-4430
105	Mr.	v¥lisms:	Robert	D	14-Mar-1975	615	890-3220
108	Mrs.	Snih	Jeanine	К	12-Feb-2003	615	324-7883
107	Mr.	Diarrie	Jorge	D	21-Aug-1974	615	890-4587
108	Wr.	Wesenbach	Paul	R	14-Feb-1985	615	897-4358
109	Wr.	Snih	Ceorge	К	18-Jun-1981	901	504-3339
110	Mrs.	Ganicazi	Leighla	M	19-May-1970	901	569-0093
111	Mr.	Washington	Rugert	E	03-Jen-1965	615	890-4925
112	Mr.	Johnson	Echward	E	14-May-1961	615	696-4367
113	MB.	Sinythe	Melanie	P	15-Sep-1970	615	324-9006
114	Ms.	Brandon	Marie	0	02.Nov-1932	901	862-0845
115	Mrs.	Saranda	Hermine	R	25-Jt4-1972	615	324-5505
118	MF.	Smith	George	6	084Nov-1965	615	890-2984

Table name: DOCTOR

0.000 JD	DOC_UNAME	DOC_FNAME	DOC_NITAL	DOC_SPECIALTY
29827	Sanchez	Julio	J	Demistology
32945	Jorgensen	Amelia	G	Neurology
33456	Korenski	Anaboly	A.	Urology
33989	LeGrande	George		Pediabrics
34409	Washington	Dennis	F	Orthopaedics
36221	McPherson	Katye	н	Dermstology
36712	Dreifag	Hennen	G	Psychistry
38995	Nith	Tran		Neurology
40004	Chin	Ming	B	Orthopaedics
40028	Feinstein	Denise	L	Gynecology

Table name: PRESCRIPTION

DOC_D	PAT_NUM	DRUG_CODE	PRES_DOGAGE	PRES_DATE
32445	102	DRZ	2 tablets every four hours – 50 tablets total	12-No+-12
32445	113	OLE	1 tes spoon with each meal 250 miltotal	14-Nov-12
34409	101	8015	1 tablet every six hours 30 tablets total	14-Nox-12
38221	109	DRO	2 tablets with every meal 60 tablets total	14-Nov-12
38995	107	KO15	1 tablet every six hours 30 tablets total	14-Nov-12

SOURCE: Course Technology/Gengage Learning

Database name: Ch07_Clinic

Recursive Relationships

- Relationship can exist between occurrences of the same entity set
 - Naturally found within unary relationship

FIGURE Another 7.19	unary relationship: "PA	ART contains P	ART″		
Table na	ne: PART_V1			Database name:	CH07_PartCo
PART_CO	E PART_DESCRIPTION	PART_IN_STOCK	PART_UNITS_NEEDED	PART_OF_PART	
AA21-6	2.5 cm. washer, 1.0 mm. rin	432	4	C-130	
AB-121	Cotter pin, copper	1034	2	C-130	
C-130	Rotor assembly	36			
E129	2.5 cm. steel shank	128	1	C-130	
X10	10.25 cm. rotor blade	345	4	C-130	
X34AVV	2.5 cm. hex nut	879	2	C-130	

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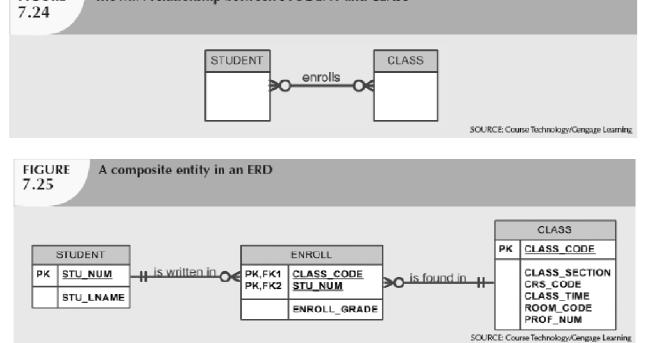
FIGURE Imple	ementation of the M:	N recursive	relations	hip "PART co	ontains PART″
7.20				•	
	Table name:	COMPONEN	Т		Database name: Ch07_PartCo
	COMP_CODE	PART_CODE	COMP_PART	IS_NEEDED	
	C-130	AA21-6		4	
	C-130	AD-121		2	
	C-130	E1 29		1	
	C-131A2	E1 29		1	
	C.130	X10		4	
	C-131A2	X10		1	
	C-130	X34AW		2	
	C-131A2	X34AW		2	
	Table name:	PART			
	PART_CODE	PART_DES	CRIPTION	PART_IN_STOCK	
	AA21-6	2.5 cm. washer	, 1.0 mm. rim	433	2
	AB-121	Cotter pin, copp	er	1034	1
	C-130	Rotor assembly		36	3
	E129	2.5 cm. steel sh	ank	120	3
	X10	10.25 cm. retor l	blade	34	5
	X34AVY	2.5 cm, hex nut		873	3

FIGURE 7.22	Implementation of th	ne 1:M red	cursive rela	tionship "EMI	PLOYEE manages EMPLOYEE"
		Table name	: EMPLOYEE	V2	Database name: Ch07_PartCo
		EMP_CODE	-	EMP MANAGER	
			vVaddell	102	
		102	Orincona		
		103	Jones	102	
		104	Reballoh	102	
		105	Robertson	102	
		106	Deltona	102	
					SOURCE: Course Technology/Cengage Learning

Associative (Composite) Entities

- Also known as bridge entities
- Used to implement M:N relationships
- Composed of primary keys of each of the entities to be connected
- May also contain additional attributes that play no role in connective process

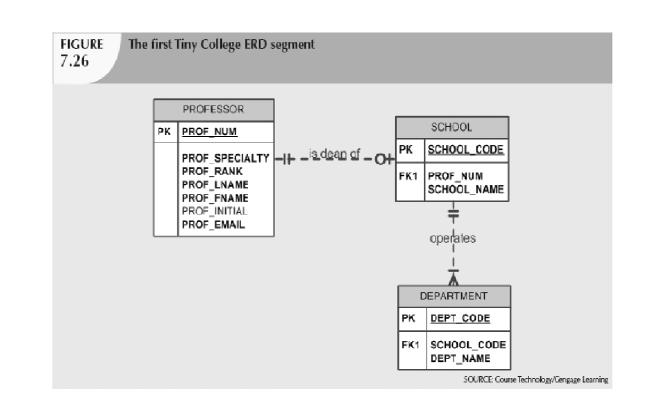
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Image Learning. All Rights Reserved. This edition is intended for use outside of the U.S. only, with content that may be different from the		Table name: ENROLL	
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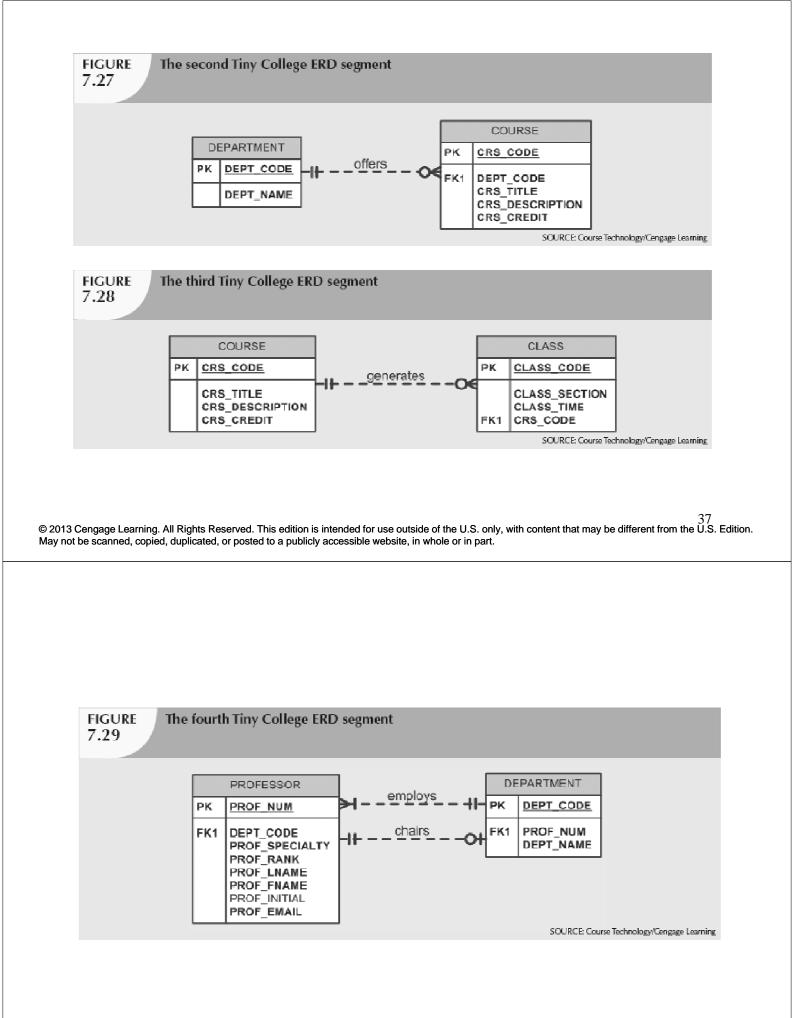


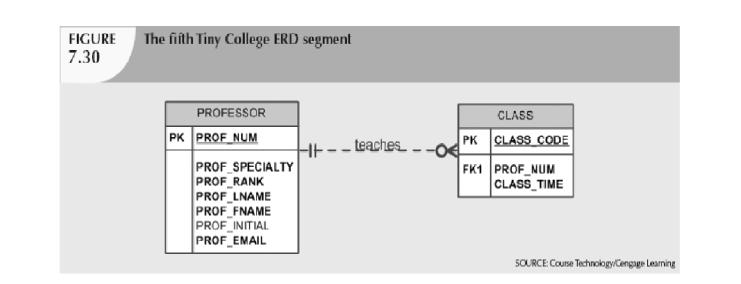
Developing an ER Diagram

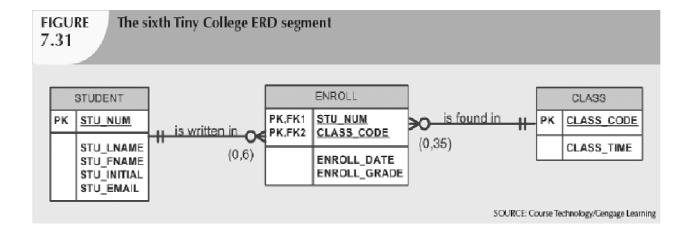
- Database design is an iterative process
 - Create detailed narrative of organization's description of operations
 - Identify business rules based on description of operations
 - Identify main entities and relationships from business rules
 - Develop initial ERD
 - Identify attributes and primary keys that adequately describe entities

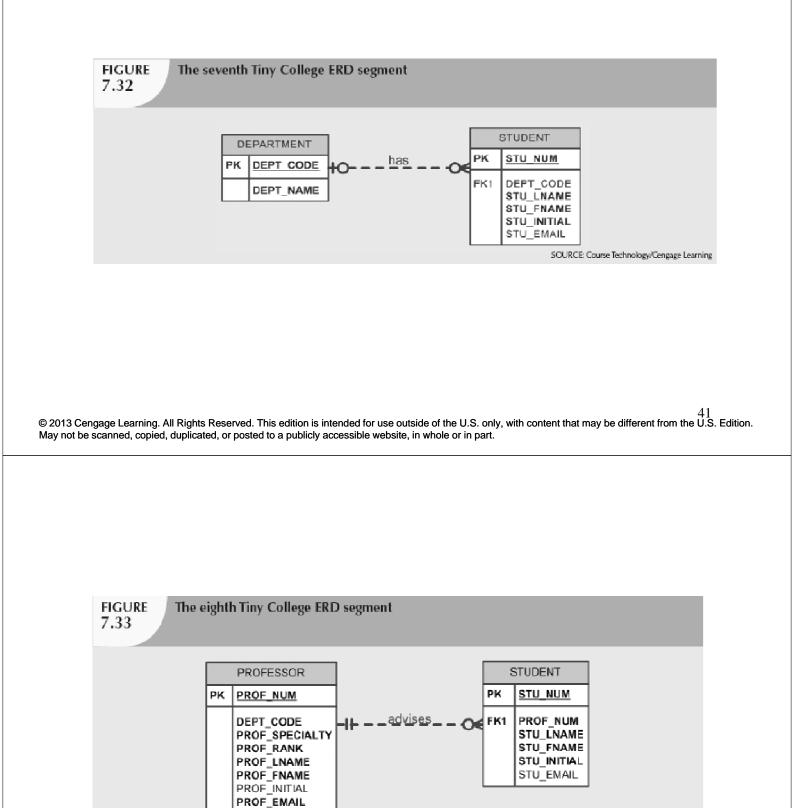
- Revise and review ERD



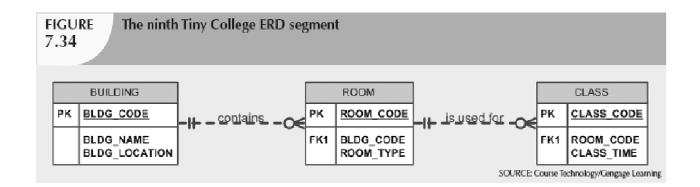








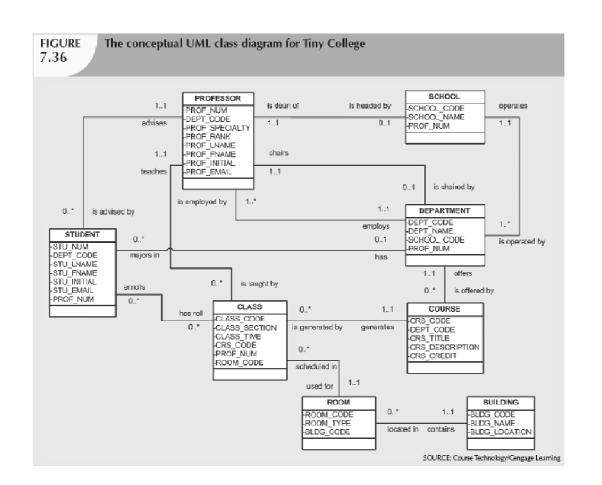
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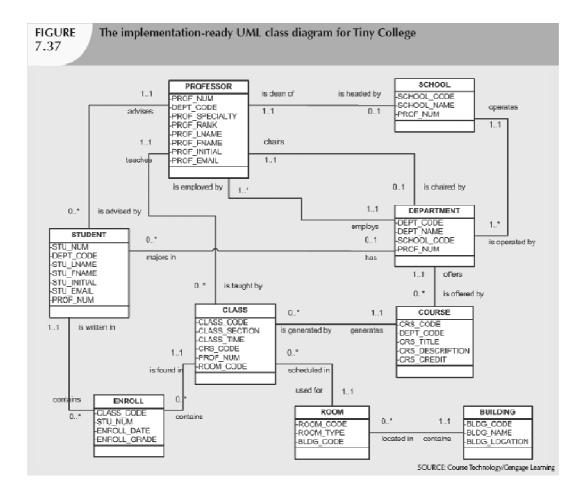


TABLE

Components of the ERM

7.4			
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
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	y that implements the M:N relationship	"STUDENT enrolls in CLASS."	





Database Design Challenges: Conflicting Goals

- Database designers must make design compromises
 - Conflicting goals: design standards, processing speed, information requirements
- Important to meet logical requirements and design conventions
- Design is of little value unless it delivers all specified query and reporting requirements
- Some design and implementation problems do not yield "clean" solutions

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Summary

- Entity relationship (ER) model
 - Uses ERD to represent conceptual database as viewed by end user
 - ERM's main components:
 - Entities
 - Relationships
 - Attributes
 - Includes connectivity and cardinality notations

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Summary (cont'd.)

- Connectivities and cardinalities are based on business rules
- M:N relationship is valid at conceptual level
 Must be mapped to a set of 1:M relationships
- ERDs may be based on many different ERMs
- UML class diagrams are used to represent the static data structures in a data model
- Database designers are often forced to make design compromises