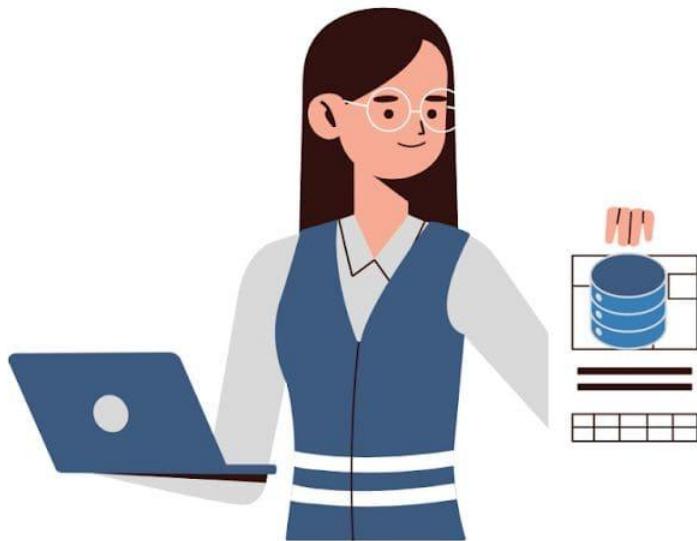


Intro to Databases



Entity Relationship Modelling (ERM)

Part II

Lecture 6

01

The Entity Relationship Model

01

The Entity Relationship Model

Relationship Strength

Relationship Strength

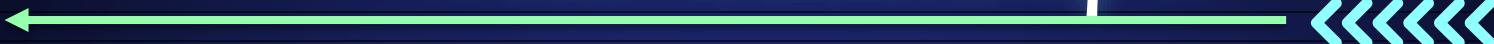


1. To implement a relationship, the **primary key** of one entity appears as a **foreign key** in the related entity.
2. Sometimes, the **foreign key** also is a **primary key** component in the related entity.

Weak Relationship

- ♣ Weak (Non-Identifying) Relationships exists if the primary key of the related entity **does not contain** a primary key component of the parent entity.
- ♣ For example, suppose the 1:M relationship between COURSE and CLASS is defined as:
 - ✿ COURSE (CRS_CODE, DEPT_CODE, CRS_DESCRIPTION, CRS_CREDIT)
 - ✿ CLASS (CLASS_CODE, CRS_CODE, CLASS_SECTION, CLASS_TIME, ROOM_CODE, PROF_NUM)
- ♣ the CLASS primary key **did not inherit** a primary key component from the COURSE entity

Weak Relationship ...



- ♣ the Crow's Foot notation depicts a weak relationship by placing a dashed line between the entities

FIGURE 4.8 A WEAK (NON-IDENTIFYING) RELATIONSHIP BETWEEN COURSE AND CLASS

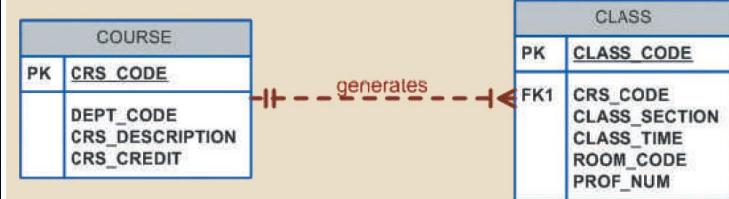


Table name: COURSE Data

CRS_CODE	DEPT_CODE	CRS_DESCRIPTION	CRS_CREDIT
ACCT-211	ACCT	Accounting I	3
ACCT-212	ACCT	Accounting II	3
CIS-220	CIS	Intro. to Microcomputing	3
CIS-420	CIS	Database Design and Implementation	4
MATH-243	MATH	Mathematics for Managers	3
QM-261	CIS	Intro. to Statistics	3
QM-362	CIS	Statistical Applications	4

Table name: CLASS

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

Strong Relationship

- ♣ A strong (identifying) relationship exists when the primary key of the related entity **contains** a primary key component of the parent entity.
- ♣ For example, suppose the 1:M relationship between COURSE and CLASS is defined as:
 - ✿ COURSE (CRS_CODE, DEPT_CODE, CRS_DESCRIPTION, CRS_CREDIT)
 - ✿ CLASS (CRS_CODE, CLASS_SECTION, CLASS_TIME, ROOM_CODE, PROF_NUM)
- ♣ the CLASS primary key **inherit** a primary key component from the COURSE entity.

Strong Relationship ...

♣ the Crow's Foot notation depicts a Strong Relationship by placing a solid line between the entities

FIGURE 4.9 A STRONG (IDENTIFYING) RELATIONSHIP BETWEEN COURSE AND CLASS

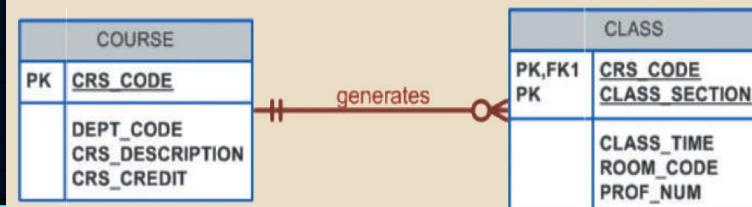


Table name: COURSE Database

CRS_CODE	DEPT_CODE	CRS_DESCRIPTION	CRS_CREDIT
ACCT-211	ACCT	Accounting I	3
ACCT-212	ACCT	Accounting II	3
CIS-220	CIS	Intro. to Microcomputing	3
CIS-420	CIS	Database Design and Implementation	4
MATH-243	MATH	Mathematics for Managers	3
QM-261	CIS	Intro. to Statistics	3
QM-362	CIS	Statistical Applications	4

Table name: CLASS

CRS_CODE	CLASS_SECTION	CLASS_TIME	ROOM_CODE	PROF_NUM
ACCT-211	1	MWF 8:00-8:50 a.m.	BUS311	105
ACCT-211	2	MWF 9:00-9:50 a.m.	BUS200	105
ACCT-211	3	TTh 2:30-3:45 p.m.	BUS252	342
ACCT-212	1	MWF 10:00-10:50 a.m.	BUS311	301
ACCT-212	2	Th 6:00-8:40 p.m.	BUS252	301
CIS-220	1	MWF 9:00-9:50 a.m.	KLR209	228
CIS-220	2	MWF 9:00-9:50 a.m.	KLR211	114
CIS-220	3	MWF 10:00-10:50 a.m.	KLR209	228
CIS-420	1	W 6:00-8:40 p.m.	KLR209	162
MATH-243	1	Th 6:00-8:40 p.m.	DRE155	325
QM-261	1	MWF 8:00-8:50 a.m.	KLR200	114
QM-261	2	TTh 1:00-2:15 p.m.	KLR200	114
QM-362	1	MWF 11:00-11:50 a.m.	KLR200	162
QM-362	2	TTh 2:30-3:45 p.m.	KLR200	162

01

The Entity Relationship Model

Weak Entities

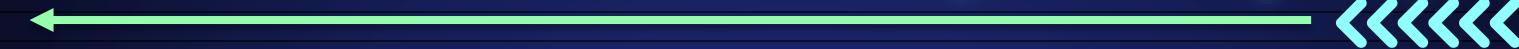
Weak Entities



♣ weak entity is one that meets two conditions:

- ✿ The entity is **existence-dependent**; it cannot exist without the entity with which it has a relationship.
- ✿ The entity has a **primary key** that is **partially** or **totally derived** from the parent entity in the relationship.

Weak Entities (Example)



- ♣ a company insurance policy insures an employee and any dependents.
 - ✿ an EMPLOYEE might or might not have a DEPENDENT, but the DEPENDENT must be associated with an EMPLOYEE.
 - ✿ Moreover, the DEPENDENT cannot exist without the EMPLOYEE.
- ♣ DEPENDENT is the weak entity in the relationship “EMPLOYEE has DEPENDENT.”

Figure 4.12 A Weak Entity in a Strong Relationship

Table name: EMPLOYEE

EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_DOB	EMP_HIREDATE
1001	Callifante	Jeanine	J	12-Mar-64	25-May-97
1002	Smithson	William	K	23-Nov-70	28-May-97
1003	Washington	Herman	H	15-Aug-68	28-May-97
1004	Chen	Lydia	B	23-Mar-74	15-Oct-98
1005	Johnson	Melanie		28-Sep-66	20-Dec-98
1006	Ortega	Jorge	G	12-Jul-79	05-Jan-02
1007	O'Donnell	Peter	D	10-Jun-71	23-Jun-02
1008	Brzinski	Barbara	A	12-Feb-70	01-Nov-03

Database name: Ch04_ShortCo

Table name: DEPENDENT

EMP_NUM	DEP_NUM	DEP_FNAME	DEP_DOB
1001	1	Annelise	05-Dec-97
1001	2	Jorge	30-Sep-02
1003	1	Suzanne	25-Jan-04
1006	1	Carlos	25-May-01
1008	1	Michael	19-Feb-95
1008	2	George	27-Jun-98
1008	3	Katherine	18-Aug-03

Figure 4.11 A Weak Entity in an ERD

Chen Model



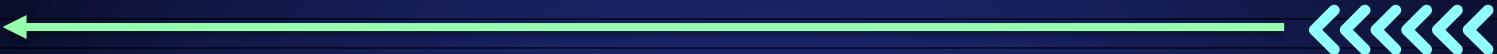
EMP_NUM
EMP_LNAME
EMP_FNAME
EMP_INITIAL
EMP_DOB
EMP_HIREDATE

EMP_NUM
DEP_NUM
DEP_FNAME
DEP_DOB

Crow's Foot Model



Weak Entities



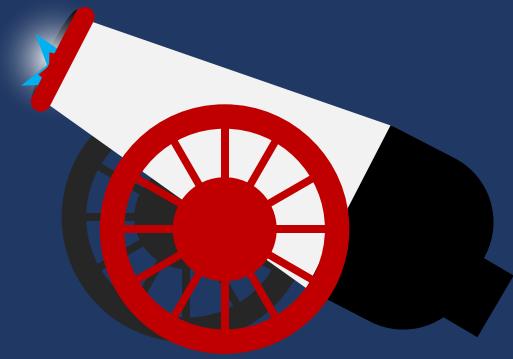
♣ A strong relationship indicates that the related entity is weak. (**Why or True and False**)

- ✿ the related entity is existence-dependent,
- ✿ and the PK of the related entity contains a PK component of the parent entity.
- ✿ Example:

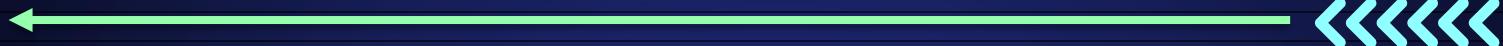
EMPLOYEE (EMP_NUM, EMP_LNAME, EMP_FNAME, EMP_INITIAL,
EMP_DOB, EMP_HIREDATE)

DEPENDENT (EMP_NUM, DEP_NUM, DEP_FNAME, DEP_DOB)

Quiz



Question



1. Is CLASS entity in Figure 4.8 is classified as weak?

Explain your answer

2. If not what is the updates needed to change it to week entity?

01

The Entity Relationship Model

Relationship Participation

Relationship Participation



- ♣ Participation in an entity relationship is either optional or mandatory.

Optional participation

♣ means that one entity occurrence does not require a

corresponding entity occurrence in a particular relationship.

- ✿ For example, in the “COURSE generates CLASS” relationship, an entity occurrence (row) in the COURSE table does not necessarily require the existence of a corresponding entity occurrence in the CLASS table.

Optional participation

- ♣ In Crow's Foot notation, an optional relationship is shown by drawing a small circle (0) on the side of the optional entity.
- ♣ The existence of an optional entity indicates that its minimum cardinality is 0.

Mandatory participation

- ♣ means that one entity occurrence **require** a corresponding entity occurrence in a particular relationship.
- ♣ mandatory participation is depicted graphically, as a **small hash mark** across the relationship line (no optionality symbol)
- ♣ mandatory relationship indicates that the **minimum cardinality** is at **least 1** for the mandatory entity

Mandatory participation

Table 4.3 shows the various connectivity and participation combinations that are supported by the Crow's Foot notation.

CROW'S FOOT SYMBOLS

SYMBOL	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.

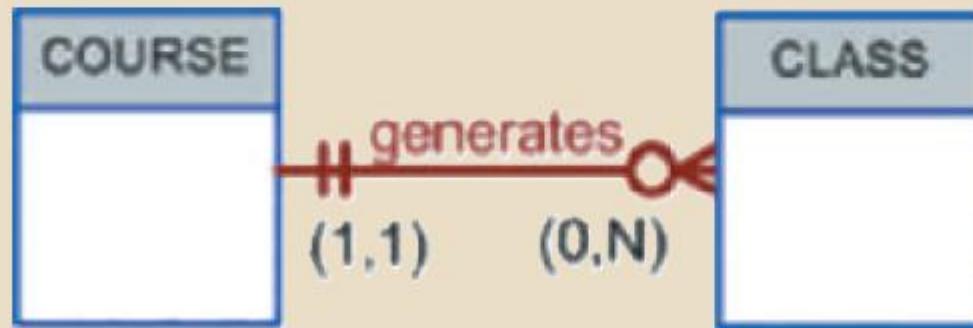
Examples

.12 AN OPTIONAL CLASS ENTITY IN THE RELATIONSHIP “PROFESSOR TEACHES CLASS”



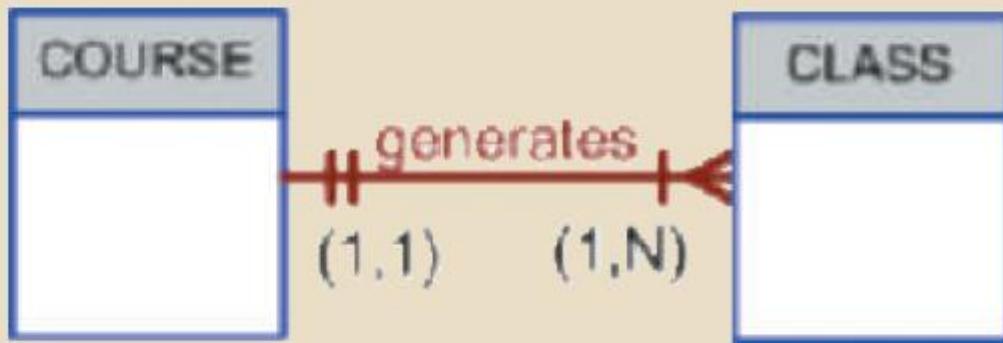
Examples

CLASS IS OPTIONAL TO COURSE



Examples

COURSE AND CLASS IN A MANDATORY RELATIONSHIP



01

The Entity Relationship Model

Relationship Degree

Relationship Degree



♣ A relationship degree indicates the number of entities or participants associated with a relationship.

- ✿ unary relationship exists when an association is maintained within a single entity.
- ✿ binary relationship exists when two entities are associated.
- ✿ ternary relationship exists when three entities are associated.

FIGURE 4.15 THREE TYPES OF RELATIONSHIP DEGREE

Unary relationship



Binary relationship



Ternary relationship (Conceptual)

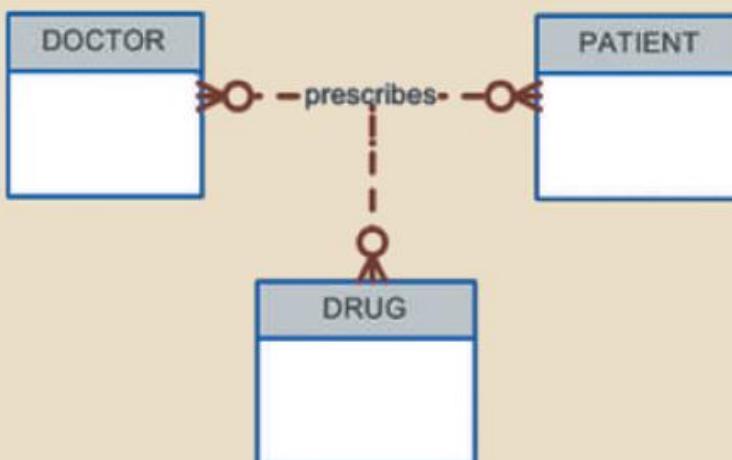


Figure 4.17 The Implementation of a Ternary Relationship

Database name: Ch04_Clinic

Table name: DRUG

DRUG_CODE	DRUG_NAME	DRUG_PRICE
AF15	Afgapan-15	25.00
AF25	Afgapan-25	35.00
DRO	Droalene Chloride	111.89
DRZ	Druzochalar Cryptoleene	18.99
KO15	Koliabar Oxyhexalene	65.75
OLE	Oleander-Drizapan	123.95
TRYP	Tryptolac Heptadimetric	79.45

Table name: PATIENT

PAT_NUM	PAT_TITLE	PAT_LNAME	PAT_FNAME	PAT_INITIAL	PAT_DOB	PAT_AREACODE	PAT_PHONE
100	Mr.	Kolmycz	George	D	15-Jun-1942	615	324-5456
101	Ms.	Lewis	Rhonda	G	19-Mar-2005	615	324-4472
102	Mr.	Vandam	Rhett		14-Nov-1958	901	675-8993
103	Ms.	Jones	Anne	M	16-Oct-1974	615	898-3456
104	Mr.	Lange	John	P	08-Nov-1971	901	504-4430
105	Mr.	Williams	Robert	D	14-Mar-1975	615	890-3220
106	Mrs.	Smith	Jeanine	K	12-Feb-2003	615	324-7883
107	Mr.	Diante	Jorge	D	21-Aug-1974	615	890-4567
108	Mr.	Wiesenbach	Paul	R	14-Feb-1966	615	897-4358
109	Mr.	Smith	George	K	18-Jun-1961	901	504-3339
110	Mrs.	Genkazi	Leighla	W	19-May-1970	901	569-0093
111	Mr.	Washington	Rupert	E	03-Jan-1966	615	890-4925
112	Mr.	Johnson	Edward	E	14-May-1961	615	898-4387
113	Ms.	Smythe	Melanie	P	15-Sep-1970	615	324-9006
114	Ms.	Brandon	Marie	G	02-Nov-1932	901	882-0845
115	Mrs.	Saranda	Hermine	R	25-Jul-1972	615	324-5505
116	Mr.	Smith	George	A	08-Nov-1965	615	890-2984

Table name: DOCTOR

DOC_ID	DOC_LNAME	DOC_FNAME	DOC_INITIAL	DOC_SPECIALTY
29827	Sanchez	Julio	J	Dermatology
32445	Jorgensen	Annelise	G	Neurology
33456	Korenski	Anatoly	A	Urology
33989	LeGrande	George		Pediatrics
34409	Washington	Dennis	F	Orthopaedics
36221	McPherson	Katye	H	Dermatology
36712	Dreifag	Herman	G	Psychiatry
38995	Minh	Tran		Neurology
40004	Chin	Ming	D	Orthopaedics
40028	Feinstein	Denise	L	Gynecology

Table name: PRESCRIPTION

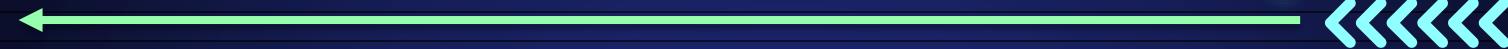
DOC_ID	PAT_NUM	DRUG_CODE	PRES_DOSAGE	PRES_DATE
32445	102	DRZ	2 tablets every four hours -- 50 tablets total	12-Nov-22
32445	113	OLE	1 teaspoon with each meal -- 250 ml total	14-Nov-22
34409	101	KO15	1 tablet every six hours -- 30 tablets total	14-Nov-22
36221	109	DRO	2 tablets with every meal -- 60 tablets total	14-Nov-22
38995	107	KO15	1 tablet every six hours -- 30 tablets total	14-Nov-22

01

The Entity Relationship Model

Recursive Relationships

Recursive Relationships

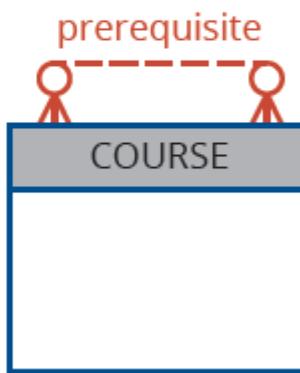


♣ a recursive relationship is one in which a relationship can exist between occurrences of the same entity set.

♣ Naturally, such a condition is found within a unary relationship.

Recursive Relationships

Figure 4.18 An ER Representation of Recursive Relationships



01

The Entity Relationship Model

Associative (Composite) Entities

Associative (Composite) Entities



♣ The ER model uses the associative entity (composite or bridge entity,) to represent an M:N relationship between two or more entities.

♣ is in a 1:M relationship with the parent entities and is composed of the primary key attributes of each parent entity.

♣ Can have additional attributes of its own.

FIGURE 4.23 CONVERTING THE M:N RELATIONSHIP INTO TWO 1:M RELATIONSHIPS

Table name: STUDENT

STU_NUM	STU_LNAME
321452	Bowser
324257	Smithson

Database name: Ch04_CollegeTry

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

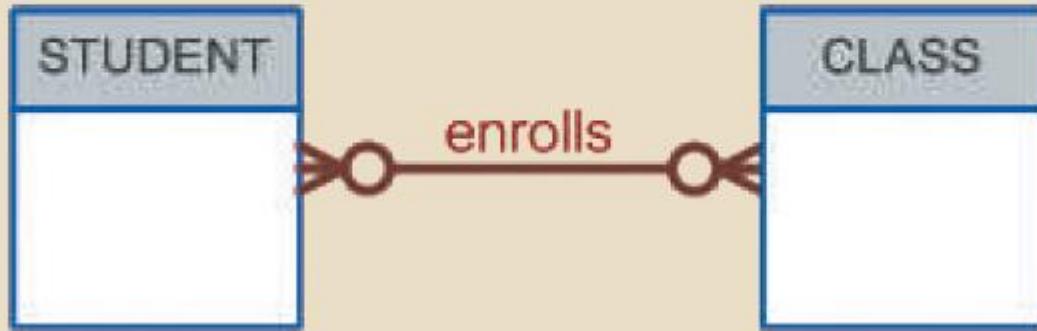
Table name: CLASS

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

Note the following points

- ♣ A class may exist (at least at the start of registration) even though it contains no students.

THE M:N RELATIONSHIP BETWEEN STUDENT AND CLASS



Note the following points...

- Because the M:N relationship between STUDENT and CLASS is decomposed into two 1:M relationships through ENROLL, the optionalities must be transferred to ENROLL

FIGURE 4.25 A COMPOSITE ENTITY IN AN ERD

