

Slide Set 5: ER Relationships

Relationship Strength

❖ Existence dependence

- ◆ Child Entity existence dependent on existence of related Parent Entity
- ◆ Existence-independent entities can exist apart from related entities
- ◆ EMPLOYEE claims DEPENDENT

❖ Weak (Non-Identifying) Relationship

- ◆ Entity is existence-independent of other entities
- ◆ PK of Child doesn't contain PK component of Parent Entity

❖ Strong (Identifying) Relationship

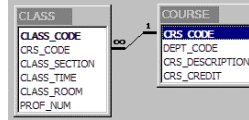
- ◆ Child entity is existence-dependent on parent
- ◆ PK of Child Entity contains PK component of Parent Entity
- ◆ Usually occurs utilizing a composite key for primary key

Copyright © 2004 R.M. Laurie 1

Weak or Strong Relationships?

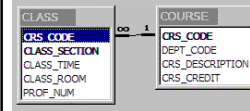
COURSE : Table				
CRS_CODE	DEPT_CODE	CRS_DESCRIPTION	CRS_CREDIT	
ACCT-210	ACCT	Accounting I	3	
ACCT-212	ACCT	Accounting II	3	
CIS-220	CIS	Intro. to Microcomputing	3	
CIS-420	CIS	Database Design and Implementation	4	
MATH-243	MATH	Differential Equations	3	
QM-261	CIS	Intro. to Statistics	3	
QM-362	CIS	Statistical Applications	4	
			0	*

Weak Relationship



CLASS : Table					
CLASS_CODE	CRS_CODE	CLASS_SECTION	CLASS_TIME	CLASS_ROOM	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	220
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	220
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
					0
					*

Strong Relationship

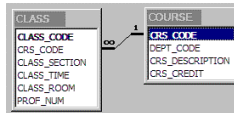


Copyright © 2004 R.M. Laurie 2

Weak or Strong Relationships?

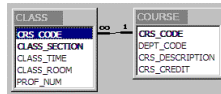
Weak (Non-Identifying) Relationship

COURSE(CRS_CODE, DEPT_CODE, CRS_CREDIT, CRS_DESCRIPTION)
 CLASS(CLASS_CODE, CRS_CODE, CLASS_TIME, CLASS_SECTION,
 CLASS_ROOM, PROF_NUM)



Strong (Identifying) Relationship

COURSE(CRS_CODE, DEPT_CODE, CRS_CREDIT, CRS_DESCRIPTION)
 CLASS(CRS_CODE, CLASS_SECTION, CLASS_TIME, CLASS_SECTION,
 CLASS_ROOM, PROF_NUM)



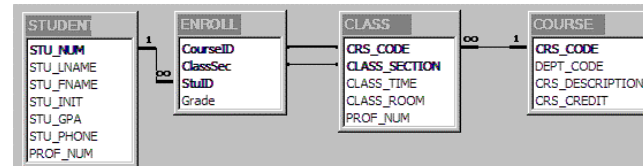
Note: CLASS Table utilizes **composite key** for primary key

Copyright © 2004 R.M. Laurie 3

Primary Keys in Strong Relationship

Strong Relationship

- ❖ COURSE(CRS_CODE, DEPT_CODE, CRS_CREDIT, CRS_DESCRIPTION)
- ❖ CLASS(CRS_CODE, CLASS_SECTION, CLASS_TIME, CLASS_SECTION, CLASS_ROOM, PROF_NUM)
- ❖ ENROLL(CourseID, ClassSec, StuID, Grade)
- ❖ STUDENT(STU_NUM, STU_LNAME, STU_FNAME, STU_INIT, STU_GPA, STU_PHONE, PROF_NUM)



Copyright © 2004 R.M. Laurie 4

Slide Set 5: ER Relationships

Strong Relationships = Weak Entities

❖ Strong (identifying) Relationship

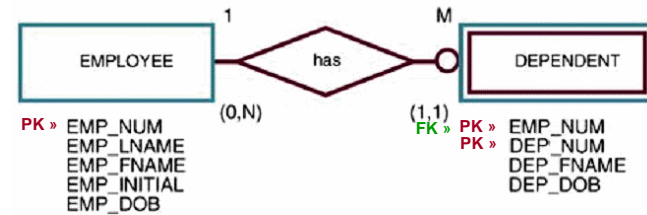
- ◆ PK of Child Entity contains PK component of Parent Entity
- ◆ Usually occurs utilizing a composite key for primary key

❖ Weak Entity

- ◆ ERD Symbol used to implement Strong Relationship
- ◆ Symbolized by Double Rectangle
- ◆ Existence-dependent
- ◆ Has a primary key that is partially or totally derived from the parent entity in the relationship
- ◆ Weak entity (child) inherits all or part of its primary key from its strong counterpart (parent)

Copyright © 2004 R.M. Laurie 5

Conceptual Model: ERD Weak Entity

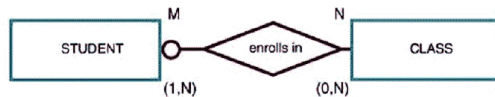


❖ EMPLOYEE(EMP_NUM, EMP_LNAME, EMP_FNAME, EMP_INITIAL, EMP_DOB)

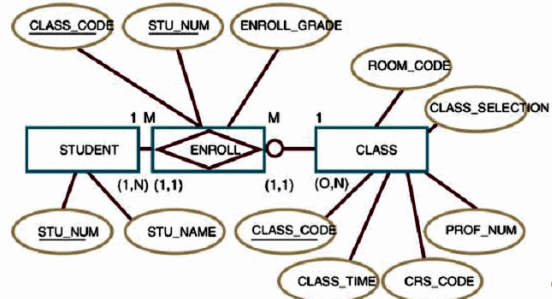
❖ DEPENDENT(EMP_NUM, DEP_NUM, DEP_FNAME, DEP_DOB)

Copyright © 2004 R.M. Laurie 6

Conceptual Model: ERD Composite Entity



What do you do with the M:N Relationship Between STUDENT and CLASS?



Copyright © 2004 R.M. Laurie 7

Relational Model: M:N Decomposition

Table name: STUDENT

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

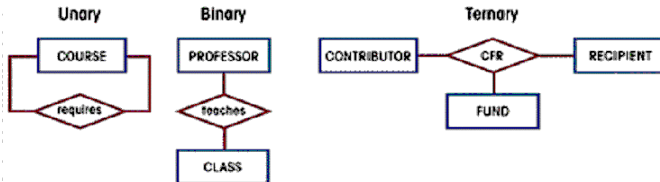
CLASS_CODE	CRS_CODE	CLASS_SECTION	CLASS_TIME	CLASS_ROOM	PROF_NUM
10014	ACCT-211	3	TTh 2:30-3:45 p.m.	BUS252	342
10018	CIS-220	2	M/W/F 9:00-9:50 a.m.	KLR211	114
10021	QM-261	1	M/W/F 8:00-8:50 a.m.	KLR200	114

Copyright © 2004 R.M. Laurie 8

Slide Set 5: ER Relationships

Conceptual Relationship Degree

- ❖ A relationship's **degree** indicates the number of associated entities or participants.
 - ◆ A **unary (recursive) relationship** exists when an association is maintained within a single entity. Course has prerequisite course.
 - ◆ A **binary relationship** exists when two entities are associated. The most common.
 - ◆ A **ternary relationship** exists when three entities are associated. Usually decomposed to binary with composite entity.

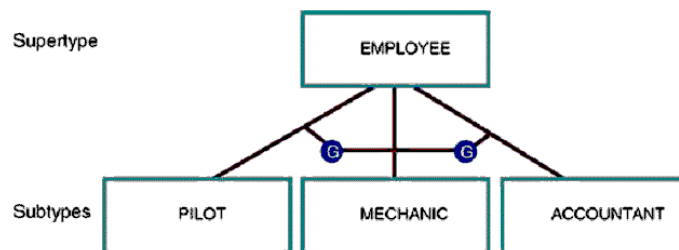


ERD Supertypes and Subtypes

- ❖ **Generalization Hierarchy** depicts the parent-child relationship.
- ❖ The **supertype** contains the shared attributes, while the **subtype** contains the unique attributes.
- ❖ A subtype entity **inherits** its attributes and its relationships from the supertype entity.
- ❖ The supertype entity is usually related to several unique and **disjoint** (nonoverlapping) subtype entities (**G**).
- ❖ The supertype and its subtype(s) maintain a 1:1 relationship.

Copyright © 2004 R.M. Laurie 10

ERD Disjoint Subtypes (G)



Subtype entities **inherit** their attributes and relationships from the supertype entity. Subtype entities with no common attributes are called **disjoint** subtypes symbolized by **(G)**.

Copyright © 2004 R.M. Laurie 11

Disjoint Subtype Table (G)

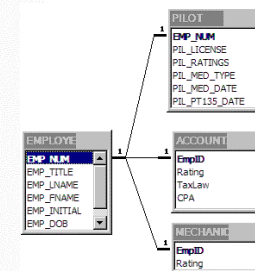
EMPLOYEE/PILOT Supertype/Subtype Relationship

Table name: EMPLOYEE (the supertype)

EMP_NUM	EMP_LNAME	EMP_HIRE_DATE
100	Kolmycz	Friday, March 15, 1985
101	Lewis	Friday, April 25, 1986
102	Vandam	Thursday, December 20, 1990
103	Jones	Sunday, August 28, 1994
104	Lange	Thursday, October 20, 1994
105	Williams	Tuesday, November 08, 1994
106	Duzak	Tuesday, January 05, 1999
107	Dianje	Saturday, July 02, 1994
108	Wesensbach	Wednesday, November 18, 1992
109	Travis	Friday, April 14, 1989
110	Genkazi	Tuesday, December 01, 1998

Table name: PILOT (the subtype)

EMP_NUM	PILOT_LICENSE	PILOT_RATINGS	PILOT_MED_TYPE
101	ATP	SEL/MEL/Instr/CFII	1
104	ATP	SEL/MEL/Instr	1
105	COM	SEL/MEL/Instr/CFI	2
106	COM	SEL/MEL/Instr	2
109	COM	SEL/MEL/SES/Instr/CFII	1

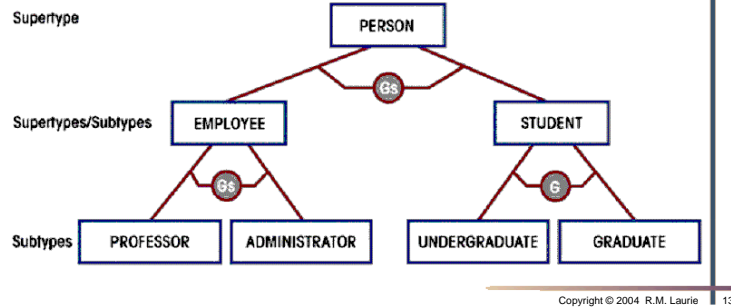


Copyright © 2004 R.M. Laurie 12

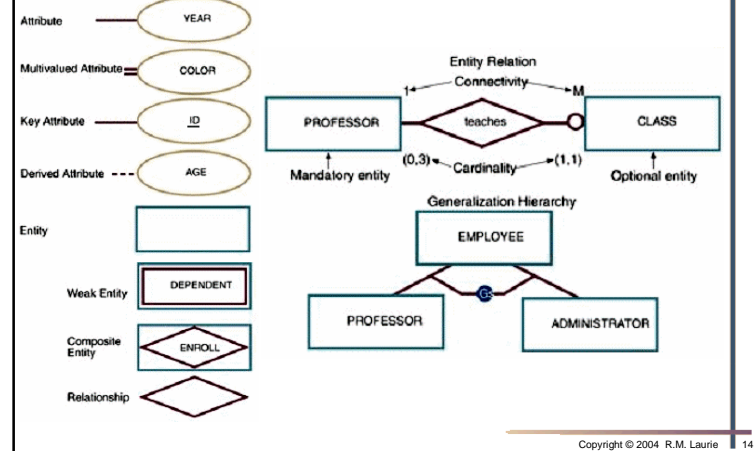
Slide Set 5: ER Relationships

ERD Overlapping Subtypes (Gs)

- ❖ A Professor can also be an administrator
- ❖ A person can be both an Employee and Student



ERD Component Summary



Developing an ER Diagram

- ❖ Iterative Process
 - ◆ Step1: General narrative of organizational operations developed
 - ◆ Step2: Basic E-R Model graphically depicted and reviewed
 - ◆ Step3: Modifications made to incorporate newly discovered E-R components
- ❖ Repeat process until designers and users agree E-R Diagram complete

Copyright © 2004 R.M. Laurie 15

Challenge of Database Design

- ❖ It is very important to have the entities, attributes, and relationships clearly identified and well-defined -- and this is not an easy task!!
- ❖ The more you do -- in terms of thinking and modeling -- in this part of the process, the less money and time are needed later on (for re-work)!!
- ❖ Additional concerns
 - ◆ Security
 - ◆ Performance
 - ◆ Shared access
 - ◆ Integrity

Copyright © 2004 R.M. Laurie 16