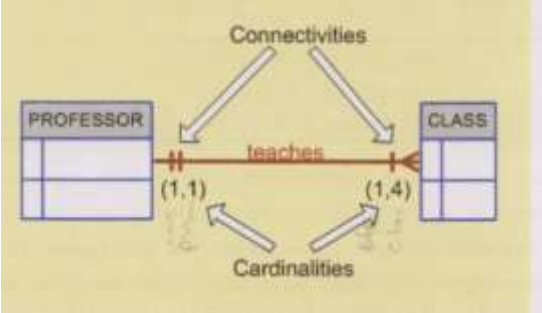
Connectivity and Cardinality

The term **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 in the ERD, cardinality is indicated by placing the appropriate numbers beside the entities, using the format(x, y).The first value represents the minimum number of associated entities, while the second value represents the maximum number of associated entities as in following figure



EXISTANCE DEPENDENCE

An entity is said to be **existence –dependent** if it can exist in the database only when it is associated with another related entity occurrence. In implementation terms, an entity is existence –dependent if it has a mandatory foreign key _that is, a foreign key attribute that can not be null.

If an entity can exist a part from one or more related entities, it is said to be **existence_ independent** .(some times designers refer to such an entity as a strong or regular entity) for example, suppose that the XYZ corporation uses parts to produce its products. farther, suppose that some of those parts are produced in _house and other parts are bought from vendors. In that scenario , it is quite possible for a PART to exist independently from a VENDOR in the relationship "PART is supplied by VENDOR ",because at least some of the parts are not supplied by a vendor . therefore ,PART is existence _independent from VENDOR

RELATIONSHIP STRENGTH

The concept of relationship strength is based on how the primary key of a related entity is defined.

Weak (non-identifying) relationships

A weak relationship ,also known as a non- identifying relationship, exist if the PK of the related entity does not contain a PK component of the parent entity . by default ,relationships are established by having the PK of the parents entity appear as an FK on the related entity. for example, suppose that COURSCE and CLASS entities are defined as

COURSE(**CRS-CODE,**DEPT_CODE,CRS_DESCRIPTION, CRS_CREDIT).

CLASS(**CLASS-CODE**,CRS_CODE,CLASS_SECTION, CLASS_TIME,ROOM_CODE, PROF_NAME).

In this case, a weak relationship exist between COURSE and CLASS because the CLASS_CODE is the CLASS entity's PK, while the CRS_CODE in CLASS is only an FK .

In this example, the CLASS PK did not inherit the PK component from the COURSE entity as figure bellow.

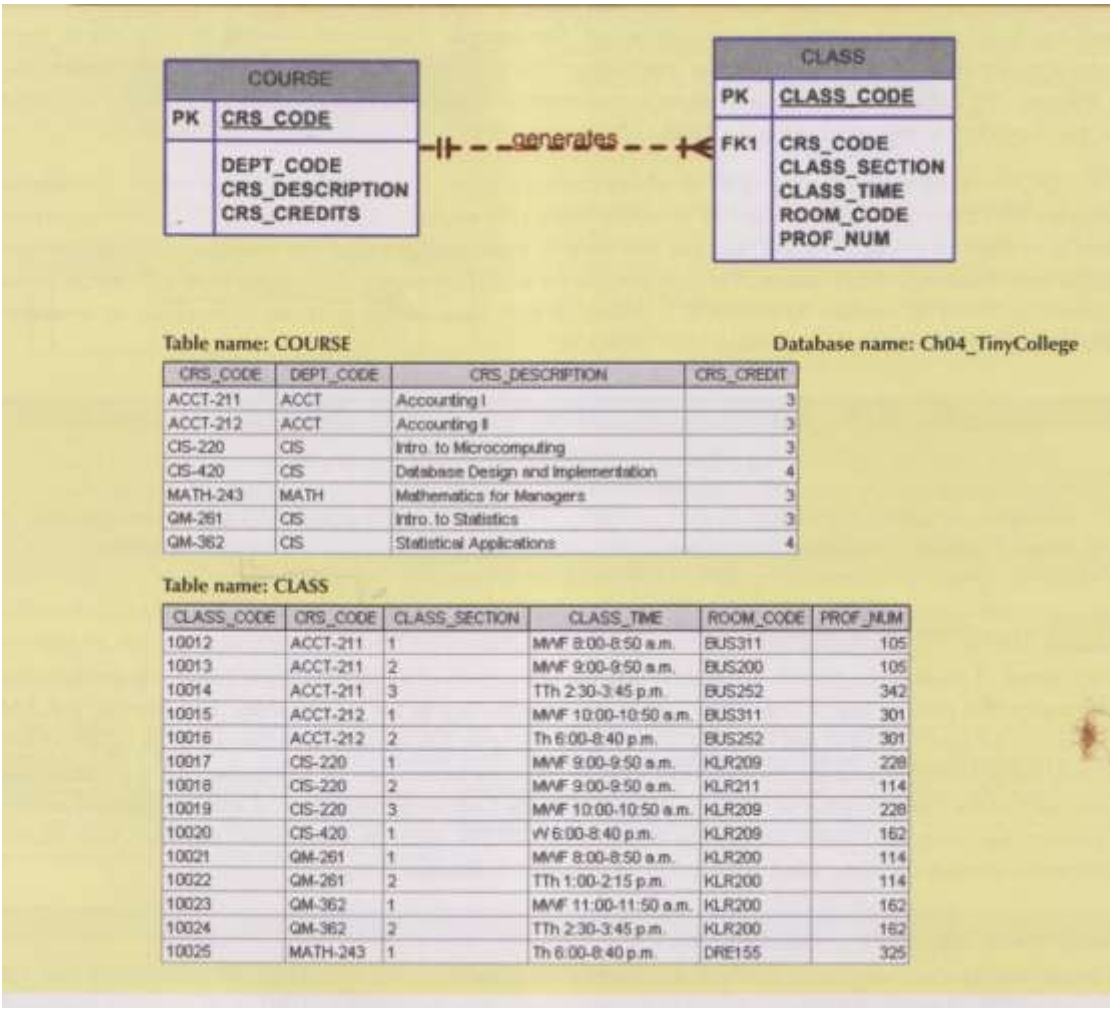


Table name: COURSE Database name: Ch04_TinyCollege

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
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

Strong (identifying) relationships

A strong relationship, also known as an identifying relationship, exists when the PK of the related entity contains a PK component of the parent entity. For example, the definitions of the COURSE and CLASS entities

COURSE(**CRS-CODE,**DEPT_CODE,CRS_DESCRIPTION, CRS_CERDIT)

CLASS(**CRS-CODE,CLASS-SECTION**,CIASS_TIME, ROOM_CODE, PROF_NUM)

Indicate that a strong relationship exists between COURSE and CLASS, because the CLASS entity's composite PK is composed of CRS_CODE + CLASS_SECTION. (Note that the CRS_CODE in CLASS is also the FK to the COURSE entity). As in figure bellow:

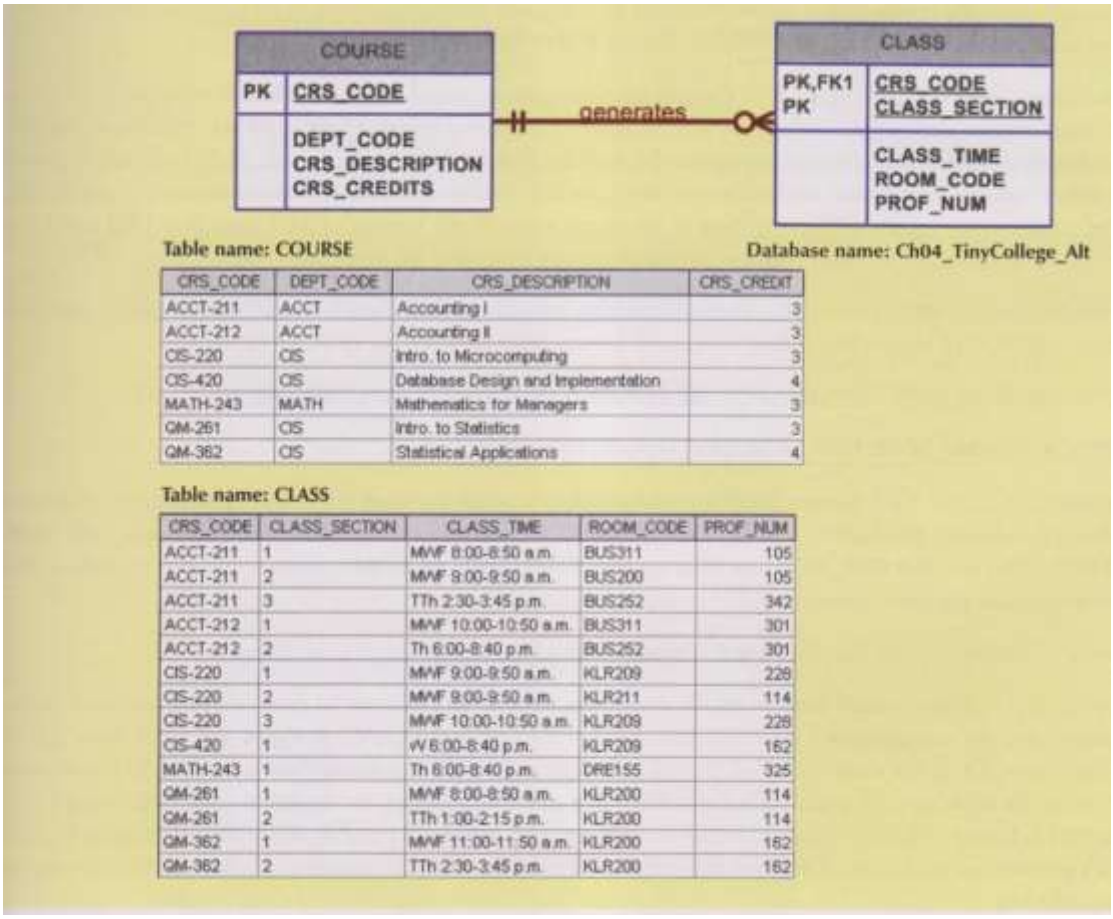


Table name: COURSE Database name: Ch04_TinyCollege_Alt

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

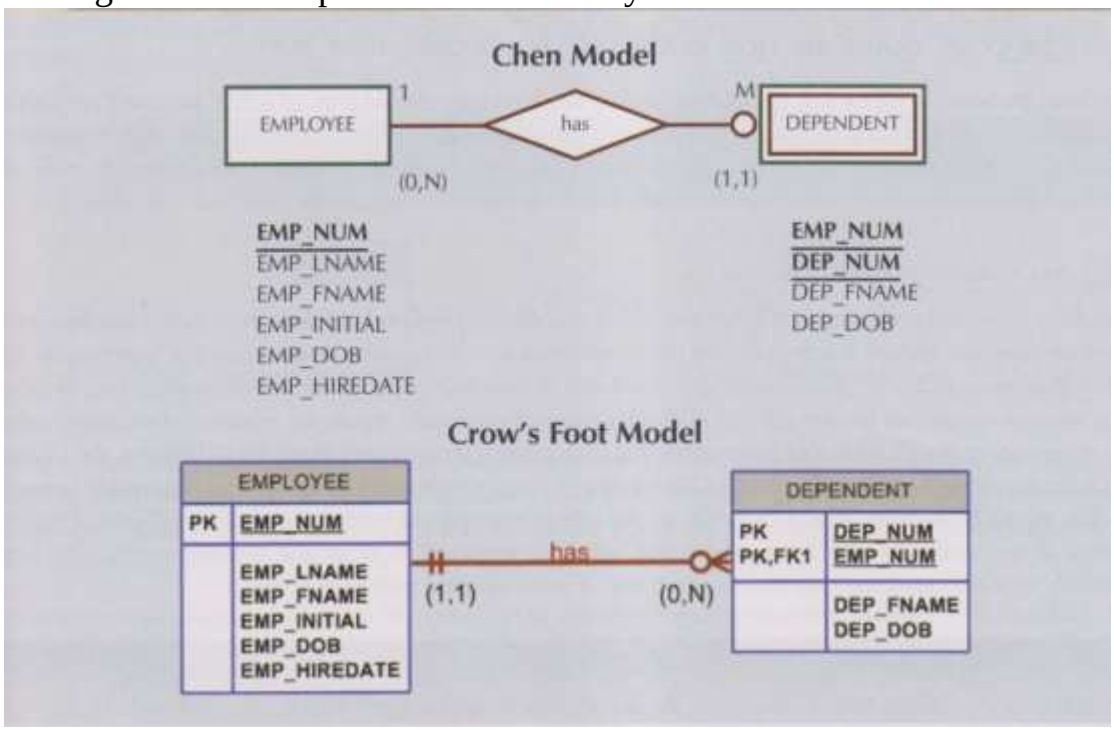
Weak Entities

A weak entity is one that meets two conditions:

1- the entity is existence _ dependent ; that is ,it can not exist without the entity with which it has a relationship.

2- the entity has a primary key that is partially or totally derived from the parent entity in the relationship.

The figure bellow explain that weak entity



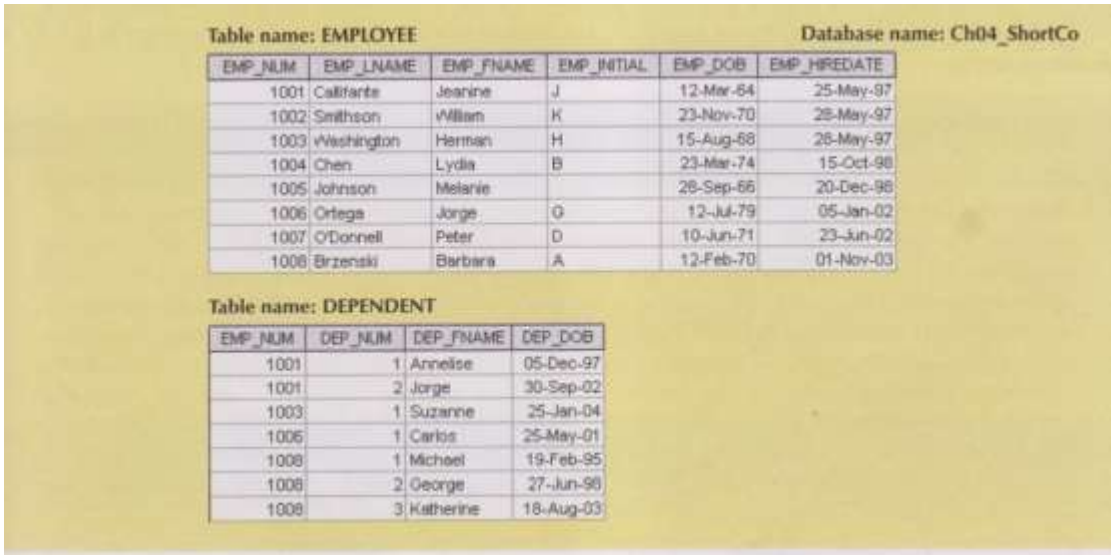


Table name: EMPLOYEE — Database name: Ch04_ShortCo

EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_DOB	EMP_HIREDATE
1001	Califante	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	Brzenski	Barbara	A	12-Feb-70	01-Nov-03

Table name: DEPENDENT

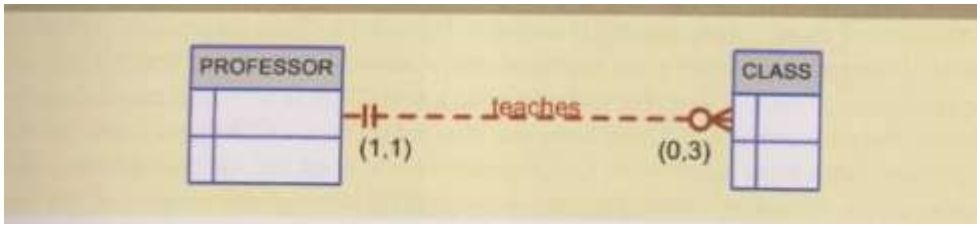
EMP_NUM	DEP_NUM	DEP_FNAME	DEP_DOB
1001	1	Annelise	05-Dec-97
1001	2	Jorge	30-Sep-02
1003	1	Suzanne	25-Jan-04
1006	1	Carlos	25-May-01
1008	1	Michael	19-Feb-95
1008	2	George	27-Jun-98
1008	3	Katherine	18-Aug-03

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, you noted that at last some courses do not generate a class.

Existence of an optional entity indicates that the minimum cardinality is 0 for the optional entity, as illustrated in figure



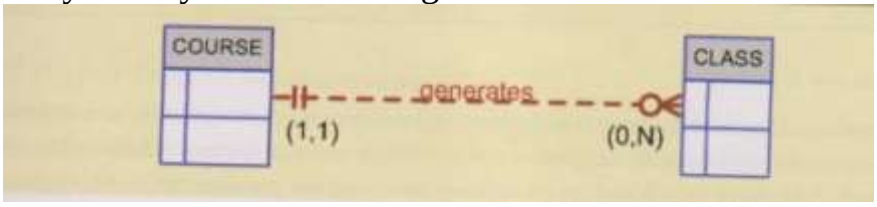
Mandatory participation means that one entity occurrence requires a corresponding entity occurrence in a particular relationship. the existence of a mandatory relationship indicates that the minimum cardinality is 1 for the mandatory entity.

It is important to understand that the semantics of a problem might determined the type of participation in a relationship for example, suppose that tiny college offers several courses; each course has several classes.

Analyzing the CLASS in the entity's contribution to the" COURSE generates CLASS" relationship, it is easy to see that a CLASS can not exist without a COURSE therefore you can conclude that the COURSE entity is mandatory in the relationship. but two scenarios for the CLASS entity may be written, shown in figure bellow the different scenarios are a function of the semantics of the problem;

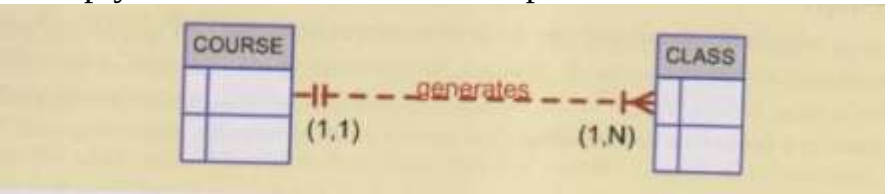
that is they depend on how the relationship defined.

1- CLASS is optional. it is possible for the department to create the entity COURSE first and then create the CLASS entity after making the teaching assignments. In the real world. Such a scenario is very likely ; there may be courses for which sections (classes) have not yet been defined .In fact some courses are taught only one a year and do not generate classes each semester.



2- CLASS is mandatory this condition is created by the constraint that is imposed by the semantics of the statement "Each COURSE generates one or more CLASSess." In ER terms, each COURSE in the "generates" relationship must have at last one class. therefore ,

a CLASS must be created as the COURSE is created in order to comply with the semantics of the problem .



The table below shows the various cardinalities that are supported by the Crow's Foot notation

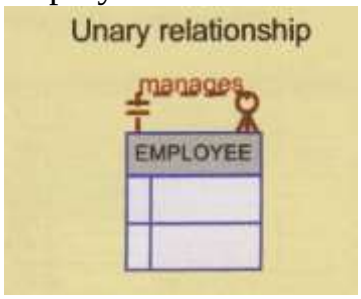
	(0,N)	Zero or many. Many side is optional.
	(1,N)	One or many. Many side is mandatory.
	(1,1)	One and only one. 1 side is mandatory.
	(0,1)	Zero or one. 1 side is optional.

Relationship degree

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

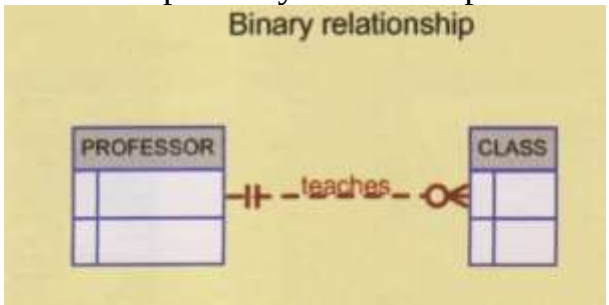
Unary relationships

Exist when association is maintained within a single entity .An employee within the EMPLOYEE entity is the manager for one or more employees within that entity .



Binary relationships

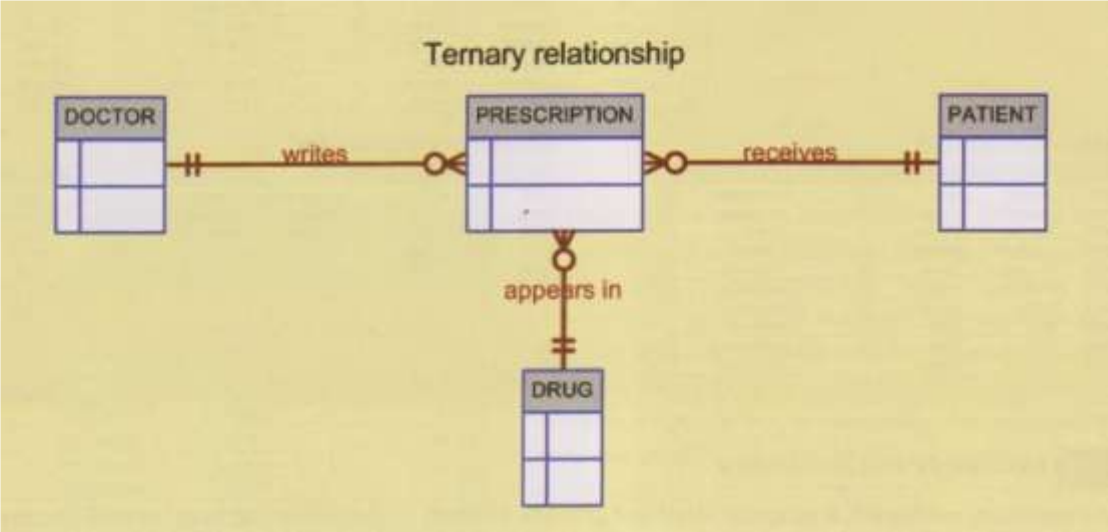
A binary relationships exist when two entities are associated in a relationship .binary relationships are most common .



Ternary and Higher _Degree Relationships

Exist when three entities associated, for example ,note the relationships (and their consequences) in figure

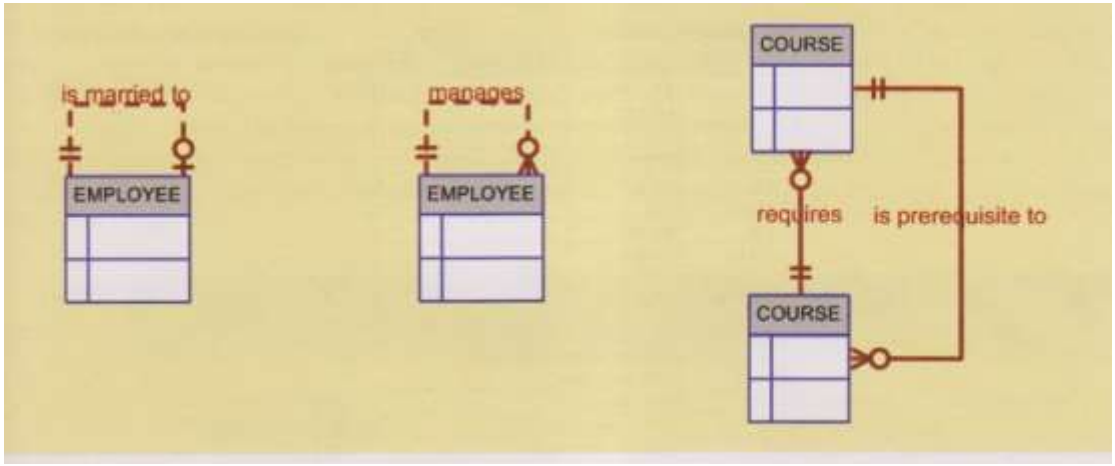
. A DOCTOR writes one or more Prescriptions.
. A PATIENT may receive one or more PRESCRIPTIONS.
. A DRUG may appear in one or more PRESCRIPTIONS.



RECURSIVE RELATIONSHIP

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) .

For example ,a 1:M unary relationship can be expressed by "an EMPLOYEE may manage many EMPLOYEES, and each EMPLOYEE is managed by one EMPLOYEE " and as long as polygamy is not legal, a 1:1 unary relationship may be expressed by "an EMPLOYEE may be married to one and only one other EMPLOYEE" finally the M:N unary relationship may be expressed by " A COURES may be a prerequisite to many other COURSES, and each COURSE may have many other COURSES as prerequisites " as shown in figure.



Database name: Ch04_PartCo
Table name: EMPLOYEE_V2

EMP_CODE	EMP_LNAME	EMP_MANAGER
101	Waddell	102
102	Orincona	
103	Jones	102
104	Rebalioh	102
105	Robertson	102
106	Deltona	102

Database name: CH04_PartCo
Table name: EMPLOYEE_V1

EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_SPOUSE
345	Ramirez	James	347
346	Jones	Anne	349
347	Ramirez	Louise	345
348	Delaney	Robert	
349	Shapiro	Anton	346

Table name: COURSE
Database name: Ch04_TinyCollege

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: PREREQ

CRS_CODE	PRE_TAKE
CIS-420	CIS-220
QM-261	MATH-243
QM-362	MATH-243
QM-362	QM-261

ASSOCIATIVE (COMPOSITE)ENTITIES

Associative entity (also known as a composite or bridge entity) is composed of the primary keys of each of the entities be connected.
In the following figure note that

Table name: STUDENT

Database name: Ch04_CollegeTry

STU_NUM	STU_LNAME
321452	Bowser
324257	Smithson

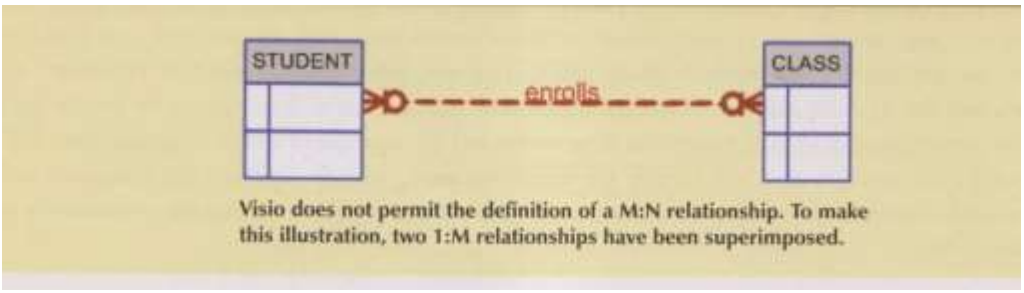
Table name: ENROLL

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	CLASS_ROOM	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

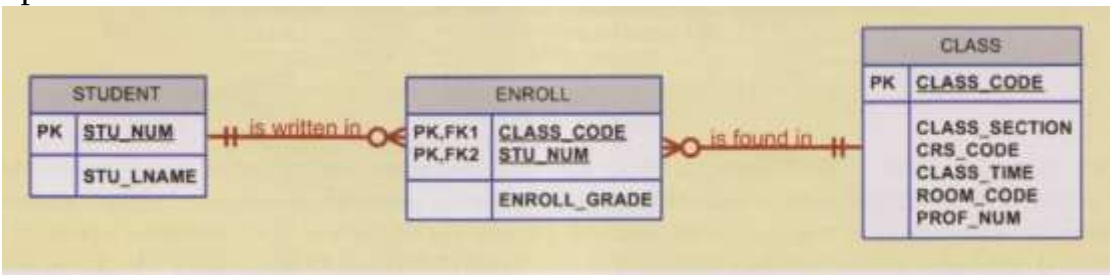
A class may exist (at least at the start of registration)even though it contains no students. Therefore an optional symbol should appear on the STUDENT side of the M:N relationship between STUDENT and CLASS.



Visio does not permit the definition of a M:N relationship. To make this illustration, two 1:M relationships have been superimposed.

To be classified as a STUDENT, a person must be enrolled in at least one CLASS. therefore , CLASS is mandatory to STUDENT from a purely point of view ,however when a student is admitted to college, that student has not (yet) signed up for any classes. therefore, at least initially ,CLASS is optional to STUDENT.

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.



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Introduction to SQL

Structured Query Language (SQL) is a high-level language that allows users to manipulate relational data. One of the strengths of SQL is that users need only specify the information they need without having to know how to retrieve it. The database management system is responsible for developing the access path needed to retrieve the data. SQL works at a set level, meaning that it is designed to retrieve rows of one or more tables.

SQL has three categories based on the functionality involved:

- DDL – Data definition language used to define, change, or drop database objects
- DML – Data manipulation language used to read and modify data
- DCL – Data control language used to grant and revoke authorizations

1. Defining a relational database schema in SQL

A relational database schema is a formal description of all the database relations and all the relationships. You can build a physical implementation of this schema (also known as "physical data model") in SQL. Though most database vendors support ANSI and ISO SQL; there are slight differences in the SQL syntax for each vendor. Therefore, a physical data model is normally specific to a particular database product.

Various elements and properties are part of a physical data model. We will discuss them in more detail below and their implementation using SQL.