

ENTITY-RELATIONSHIP MODEL

HIGH-LEVEL, CONCEPTUAL DESCRIPTION OF:

ENTITIES (OBJECTS)

THEIR ATTRIBUTES (COMPONENTS)

THEIR RELATIONSHIPS (CONNECTIONS)

ENTITIES ARE OBJECTS (PHYSICAL OR CONCEPTUAL THINGS WHICH HAVE AN INDEPENDENT EXISTENCE)

PERSON, PROJECT, COURSE, ...

ENTITIES HAVE ATTRIBUTES

PERSON(NAME, AGE, ADDRESS)

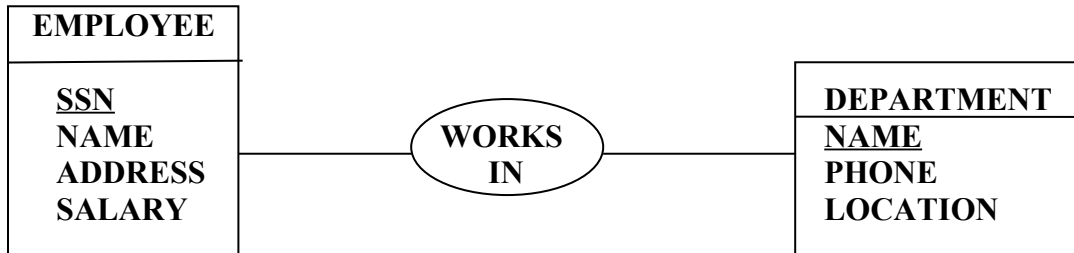
ATTRIBUTES HAVE DOMAINS (ALLOWABLE VALUES) (BUT NO VALUES IN ERM - THERE ARE NO SPECIFIC INSTANCES)

WHAT MAKES A VIABLE ENTITY?

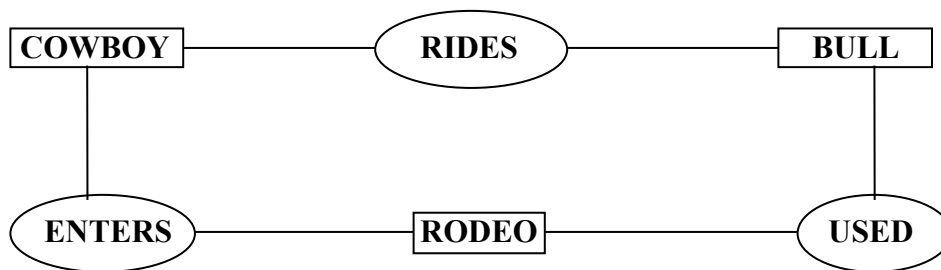
- **UNIQUE IDENTIFIER.**
- **MULTIPLE ATTRIBUTES.**
- **MULTIPLE INSTANCES.**
- **NOT REDUNDANT.**
- **RELATIONSHIPS TO OTHER ENTITIES.**

RELATIONSHIPS EXIST BETWEEN ENTITIES

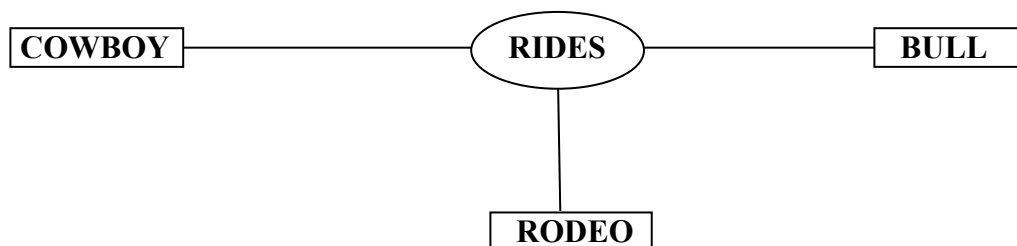
THE DEGREE OF A RELATIONSHIP IS NUMBER OF PARTICIPATING ENTITY TYPES.



BINARY RELATIONSHIPS



TERNARY RELATIONSHIP



THREE BINARY RELATIONSHIPS ARE NOT THE SAME AS A TERNARY RELATIONSHIP.

IN GENERAL, THE HIGHER THE DEGREE OF A RELATIONSHIP, THE MORE RESTRICTIVE IT IS.

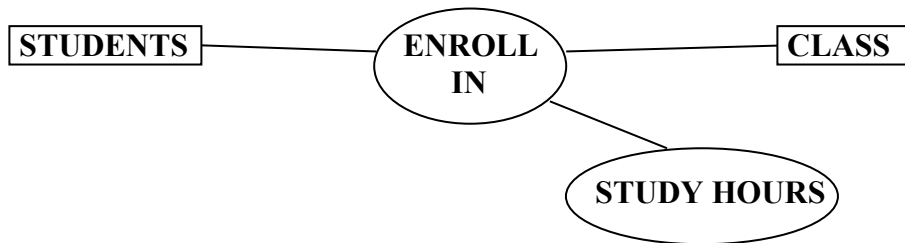
ROLE NAME

IDENTIFIES THE ROLE OF AN ENTITY IN A RELATIONSHIP



THIS IS NORMALLY SELF-EVIDENT, BUT NOT ALWAYS.

RELATIONSHIPS CAN HAVE ATTRIBUTES TOO



RELATIONSHIP ATTRIBUTES ARE DEPENDENT ON ALL ENTITIES PARTICIPATING IN THE RELATIONSHIP.

STRUCTURAL CONSTRAINTS

PARTICIPATION

- TOTAL - EVERY DEPARTMENT MUST HAVE AT LEAST ONE EMPLOYEE.**
- PARTIAL - EVERY EMPLOYEE DOES NOT HAVE TO BE ASSIGNED TO A DEPARTMENT**

CARDINALITY

MIN AND MAX PARTICIPATION

MIN = 0 (PARTIAL)

MIN > 0 (TOTAL)

RELATIONSHIP TYPES: 1:1 1:N N:M

THESE VALUES REFER TO THE MAX PARTICIPATION



STUDENTS CAN ENROLL IN MULTIPLE CLASSES AND CLASSES CAN HAVE MULTIPLE STUDENTS.



STUDENTS HAVE TO HAVE AN ADVISOR AND CAN'T HAVE MORE THAN ONE.



- EMPLOYEES DON'T HAVE TO MANAGE A DEPARTMENT
- EMPLOYEES CAN'T MANAGE MORE THAN ONE DEPARTMENT
- DEPARTMENTS HAVE ONE (AND ONLY ONE) MANAGER.

WEAK ENTITY TYPES

**ENTITIES UNIQUELY IDENTIFIABLE ONLY THROUGH
THEIR RELATIONSHIP TO ANOTHER ENTITY**

WEAK ENTITY =>

CLASS

**CLASS CANNOT BE UNIQUELY IDENTIFIED
WITHOUT A COURSE NUMBER**

IDENTIFYING OWNER =>

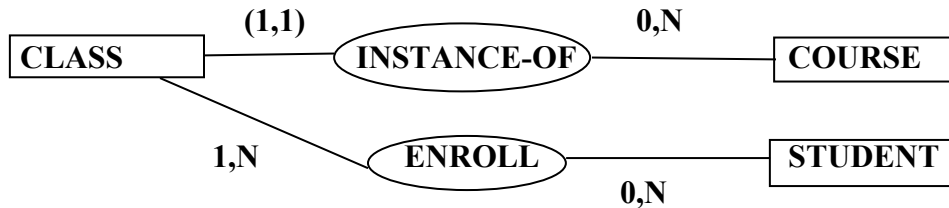
COURSE

**THE CLASS DOESN'T EXIST WITHOUT THE
COURSE**

IDENTIFYING RELATIONSHIP => INSTANCE-OF

**WEAK ENTITIES CAN HAVE OTHER
RELATIONSHIPS TOO**

PARTICIPATION MUST BE TOTAL



ERM TO RELATIONAL MAPPING

PRIMARY KEY - NOTATION IS [pk]

ONE OR MORE ATTRIBUTES CHOSEN AS THE UNIQUE IDENTIFIER FOR A RELATION.

FOREIGN KEY - NOTATION IS [fk]

A SET OF ATTRIBUTES IN A RELATION THAT CORRESPONDS TO THE PRIMARY KEY OF ANOTHER RELATION.

FOREIGN KEYS SERVE AS A LINK BETWEEN RELATIONS.

ATTRIBUTES IN A RELATION CAN BE BOTH PRIMARY AND FOREIGN KEYS. NOTATION IS [pk,fk]

THIS MEANS THAT THEY ARE PART OF THE PRIMARY OF THE RELATION AND ALSO PART OF A FOREIGN KEY CORRESPONDING TO THE PRIMARY KEY OF ANOTHER RELATION

NOTATION

**RELATION_NAME(ATT1[PK], ATT2[FK], ATT3[PK, FK],
ATT4, ... , ATTN)**

STEP 1: MAPPING STRONG ENTITIES

CREATE A RELATION FOR EACH STRONG ENTITY

INCLUDE ALL ATTRIBUTES

CHOOSE A PRIMARY KEY

PROJECT (PROJ_NAME, PROJ_NUMBER[pk],
PROJ_LOCATION

STEP 2: MAPPING WEAK ENTITIES

FOR EACH WEAK ENTITY CREATE A RELATION

INCLUDE ALL ATTRIBUTES (RAs TOO).

PRIMARY KEY IS PARTIAL KEY OF WEAK ENTITY
PLUS IDENTIFYING OWNER PRIMARY KEY



DEPENDENT (EMP_SSN[pk,fk], DEP_NAME[pk],
BIRTHDATE, SEX, RELATIONSHIP

**NOTE: THE IDENTIFYING OWNER OF A WEAK ENTITY
CAN ITSELF BE A WEAK ENTITY. THEREFORE,
MAPPING A CHAIN OF WEAK ENTITIES SHOULD
BEGIN FROM THE STRONG IDENTIFYING
OWNER AND PROCEED RECURSIVELY TO THE
END OF THE CHAIN**

STEP 3 : MAPPING BINARY RELATIONSHIPS

FOR BINARY RELATIONSHIPS BETWEEN R AND S

RELATIONSHIP TYPES ARE BASED ON THE MAXIMUM PARTICIPATION OF THE ENTITIES IN THE RELATIONSHIP

ONE-TO-ONE (1 TO 1)

ONE-TO-MANY (1 TO N)

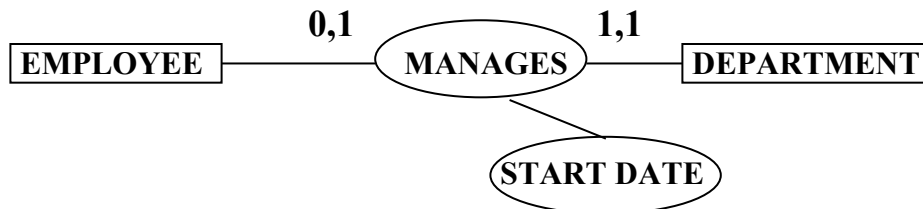
MANY TO MANY (M TO N)

CASE 1: (1 TO 1)

CHOOSE ONE WITH TOTAL PARTICIPATION (TO PREVENT WASTED SPACE).

INCLUDE ANY RELATIONSHIP ATTRIBUTES.

INCLUDE PRIMARY KEY (pk) OF THE OTHER ENTITY AS A FOREIGN KEY (fk)



DEPARTMENT (DEPT_NAME, DEPT_NUM[**pk**],
MGR_SSN[**fk**], MGR_START_DATE

CASE 2: (1 TO N)

CHOOSE THE ENTITY WITH MAX PARTICIPATION OF 1.

INCLUDE ANY RELATIONSHIP ATTRIBUTES.

INCLUDE pk OF THE OTHER ENTITY AS A fk



EMPLOYEE (EMP_SSN[pk], LAST_NAME, MIDDLE_INIT, FIRST_NAME, ADDRESS, SEX, BIRTHDATE, SALARY, DEPT_NUM[fk])

CASE 3: (M TO N)

CREATE A NEW RELATION TO REPRESENT THE RELATIONSHIP.

INCLUDE ANY RELATIONSHIP ATTRIBUTES.

PRIMARY KEY IS A COMBINATION OF THE PRIMARY KEYS OF BOTH PARTICIPATING ENTITIES



WORKS_ON (EMP_SSN[pk,fk], PROJ_NUM[pk,fk], HOURS)

STEP 4 : MAPPING MULTIVALUED ATTRIBUTES

FOR ANY MULTIVALUED ATTRIBUTES

CREATE A RELATION CONTAINING THE
ATTRIBUTE AND THE pk OF THE ENTITY.

PRIMARY KEY IS THE WHOLE THING.

DEPT_LOC (DEPT_NUM[pk,fk], DEPT_LOCATION[pk])

NOTE: RELATIONSHIP ATTRIBUTES CAN ALSO BE MV

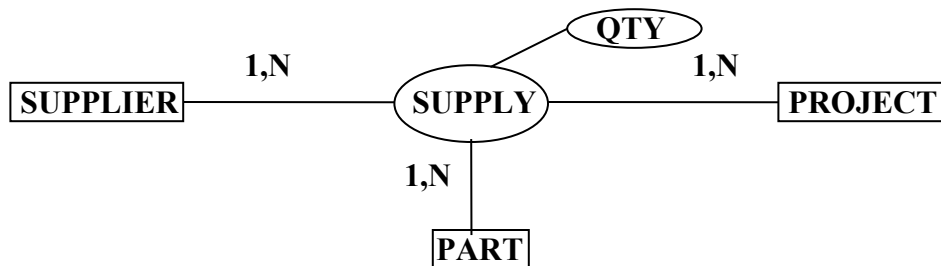
STEP 5 : MAPPING HIGHER DEGREE RELATIONSHIPS

FOR EACH N - ARY RELATIONSHIP (N > 2)

CREATE A NEW RELATION.

INCLUDE RELATIONSHIP ATTRIBUTES.

PRIMARY KEY IS A COMBINATION OF THE
PRIMARY KEYS OF ALL THREE ENTITIES.



SUPPLY (SUP_NAME[pk,fk], PROJ_NAME[pk,fk],
PART_NO[pk,fk], QTY)

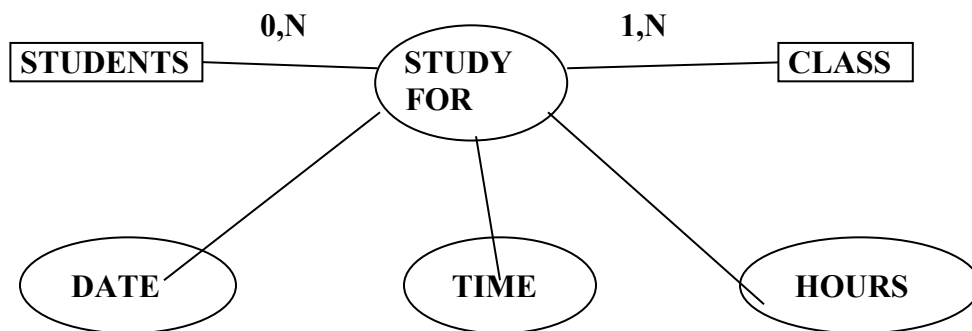
SPECIAL CASES

IN THE (1 TO 1) CASE, IF NON-PARTICIPATION IS RARE, THEN THE CHOICE SHOULD BE BASED ON ACCESS PATTERNS.



ALMOST ALL PARTS WILL HAVE A BIN

WHEN MAPPING MANY TO MANY RELATIONSHIPS IT MAY BE NECESSARY TO INCLUDE ONE OR MORE RELATIONSHIP ATTRIBUTES AS PART OF THE PRIMARY KEY



ENROLL_IN (STUDENT_CLID[pk,fk], COURSE_NUM[pk,fk], SECTION[pk,fk], TERM[pk,fk], YEAR[pk,fk], DATE[pk], TIME[pk], HOURS)

COMPANY ERM DIAGRAM MAPPED TO RELATIONAL SCHEMA

**EMPLOYEE (EMP_SSN[pk], LAST_NAME, MIDDLE_INIT,
FIRST_NAME, ADDRESS, SEX, BIRTHDATE,
SALARY, DEPT_NUM[fk],
SUPERVISOR_SSN[fk])**

**DEPARTMENT (DEPT_NAME, DEPT_NUM[pk],
MGR_SSN[fk], STARTDATE)**

DEPT_LOC (DEPT_NUM[pk,fk], DEPT_LOCATION[pk])

**PROJECT (PROJ_NAME, PROJ_NUMBER[pk] ,
PROJ_LOCATION, DEPT_NUM[fk])**

**WORKS_ON (EMP_SSN[pk,fk], PROJ_NUM[pk,fk],
HOURS)**

**DEPENDENT (EMP_SSN[pk,fk], DEP_NAME[pk],
BIRTHDATE, SEX, RELATIONSHIP)**