

CS422 Principles of Database Systems

Convert ER Design to Relations

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Relational Model

- ◆ Proposed by Edgar F. Codd in early 1970's
- ◆ Data is stored in tables (a.k.a. relations)
- ◆ All major database systems these day are relational

student_id	first_name	last_name	birthday
2000001	John	Doe	1970-1-1
2000002	Jane	Doe	1971-1-1
2000003	Tom	Smith	1962-2-2

Table (Relation)

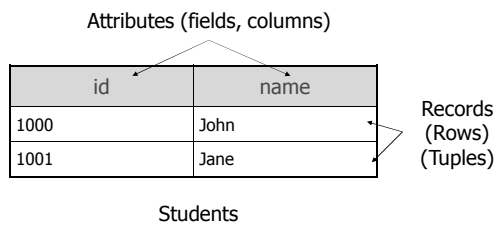


Table and Database Schema

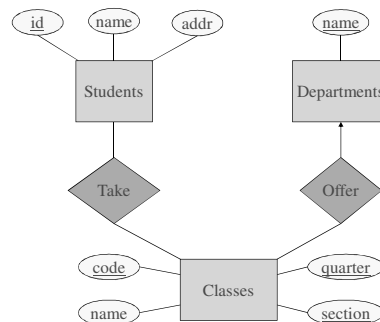
- ◆ Table schema
 - Name of the table, and the names and types of the attributes
 - E.g.


```
students(id:integer, name:string)
or just students(id, name)
```
- ◆ Database schema
 - Schemas of all the tables in the database

About Relational Model

- ◆ Attributes must be of simple type
- ◆ No order among attributes
- ◆ No order among records

From ER to Relations ...



... From ER to Relations

Students (id, name, address)

Departments (name)

Classes (code, name, quarter, section, department_name)

Enrollment (code, quarter, section, student_id)

Basic Rules of ER to Relational Conversion ...

- ◆ A entity set is converted to a table
 - Entity set name → table name
 - Entity set attributes → table columns
 - Entity set key → table key
- ◆ A many-to-many relationship is also converted to a table, including
 - Its own attributes (if any)
 - Key attributes from the associated entity sets → table key

... Basic Rules of ER to Relational Conversion

- ◆ A many-to-one relationship is converted to a foreign key column on the "many" side referencing the "one" side



Classes (code, name, quarter, section, department_name)

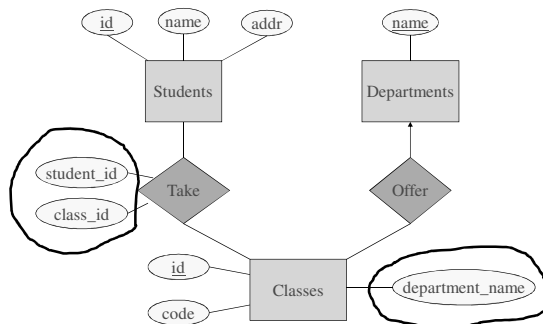
About Keys: Primary Key

- ◆ Entity set key: an attribute or a combination of several attributes that uniquely identifies an entity
- ◆ Primary key in relational model: UNIQUE + NOT NULL

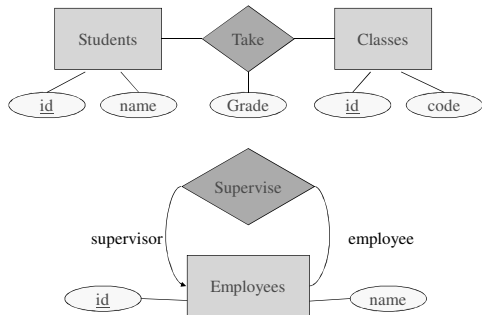
About Keys: Foreign Key

- ◆ Foreign key in relational model
 - A link (or association) between two tables – a foreign key column is like an object reference in a Java class
 - A data integrity constraint
- ◆ There is NO foreign key in ER model, *because the association is already expressed as a relationship*

Another Common Problem in ER Design



More Conversion Examples



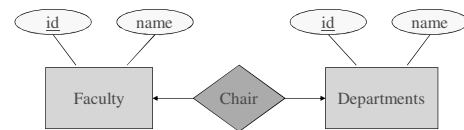
Basic ER to Relational Conversion Steps

- ◆ Step 1: convert entity sets to tables
- ◆ Step 2: convert relationships
 - Many-to-many → table
 - Many-to-one → foreign key column
- ◆ Step 3: rename tables and columns when necessary

Special Cases of Conversion

- ◆ One-to-One relationship
- ◆ Multiway relationship
- ◆ Weak entity set
- ◆ Subclass

Converting One-to-One Relationship ...



... Converting One-to-One Relationship

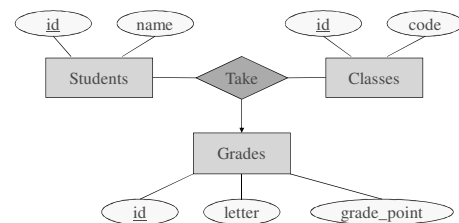
- ◆ Which one of the following is better??

Faculty(id, name, chair_of_department)
 Departments(id, name)

or

Faculty(id, name)
 Departments(id, name, department_chair)

Converting Multiway Relationship

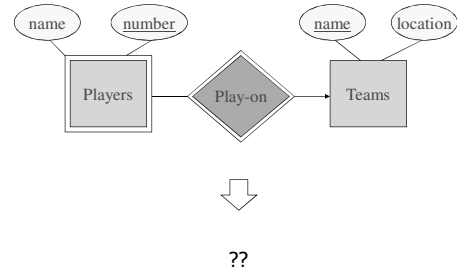


- ◆ Should this relationship be treated as many-to-many or many-to-one??

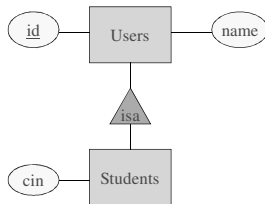
Converting Weak Entity Set ...

- ◆ The table for a weak entity set includes its *complete key* as well as its own non-key attributes
- ◆ A supporting relationship is redundant and yields no relation

... Converting Weak Entity Set



Converting Subclass ...



... Converting Subclass

- ◆ Object-oriented approach
 - One table per concrete class
 - Each entity belongs to exact one table
- ◆ ER approach
 - One table per subclass
 - Each entity may appear in multiple tables
- ◆ NULL approach
 - One table per class hierarchy

Object-Oriented Approach

id	name
1000	John

Users

id	name	cin
1001	Jane	212345678

Students

ER Approach

id	name
1000	John
1001	Jane

Users

user_id	cin
1001	212345678

Students

NULL Approach ...

id	name	cin
1000	John	NULL
1001	Jane	212345678

Users

... NULL Approach

Discriminator field

id	user_type	name	cin
1000	staff	John	NULL
1001	student	Jane	212345677

Users

Comparison of Subclass Conversion Approaches

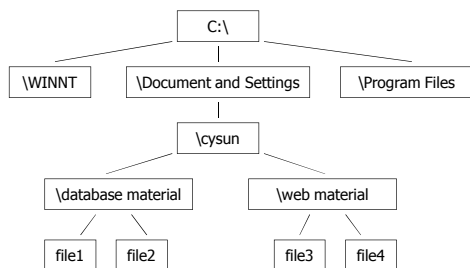
- ◆ Constraints and data integrity
- ◆ Query performance

Q1: list all students
 Q2: list all non-student users
 Q3: list all users

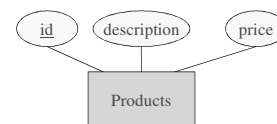
Example 1: Restaurant

#42 Some Restaurant	
Date: Jul 09, 2008	Time: 03:07PM
Server: John	# of Guest: 2
Bill: 0060	Table: 42
1 Boiled Pork Wanton	4.95
1 Dumpling w/Crabmeat	8.00
1 Beef Noodle Soup	6.80
Subtotal:	19.75
GST:	0.99
Total:	20.74
Open Time: Jul 09, 2008 02:57PM	
Printed by: Cashier	

Example 2: Folders and Files



Example 3: Price Changes



What if we want to model price changes??

