Functional Dependencies

Wednesday, October 4 2000

Outline

- Definition and keys (3.5)

Functional Dependencies

Definition:

If two tuples agree on the attributes

$A_1, A_2, \ldots A_n$

then they must also agree on the attributes

$B_1, B_2, \ldots B_m$

Formally: $A_1, A_2, \ldots A_n \longrightarrow B_1, B_2, \ldots B_m$

Motivating example for the study of functional dependencies:

Name	Social Security Number	Phone Number

Examples

EmpID	Name	Phone	Position
E0045	Smith	1234	Clerk
E1847	John	9876	Salesrep
E1111	Smith	9876	Salesrep
E9999	Mary	1234	lawyer

- EmpID $\longrightarrow$ Name, Phone, Position
- Position $\longrightarrow$ Phone
- but Phone $\not\longrightarrow$ Position

In General

- To check A $\longrightarrow$ B, erase all other columns

…	A	…	B	
	X1		Y1	
	X2		Y2	
	…		…	

- check if the remaining relation is many-one (called ***functional*** in mathematics)

Example

EmpID	Name	Phone	Position
E0045	Smith	1234	Clerk
E1847	John	9876	Salesrep
E1111	Smith	9876	Salesrep
E9999	Mary	1234	lawyer

More Examples

Product: name → price, manufacturer
Person: ssn → name, age
Company: name → stock price, president

Key of a relation is a set of attributes that:

- functionally determines all the attributes of the relation
- none of its subsets determines all the attributes.

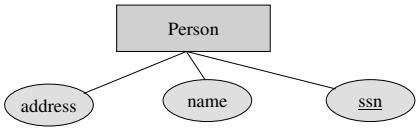
Superkey: a set of attributes that contains a key.

Finding the Keys of a Relation

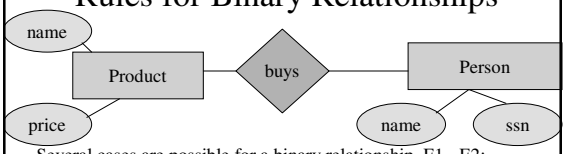
Given a relation constructed from an E/R diagram, what is its key?

Rules:

1. If the relation comes from an entity set,
   the key of the relation is the set of attributes which is the key of the entity set.



Rules for Binary Relationships



Several cases are possible for a binary relationship E1 - E2:

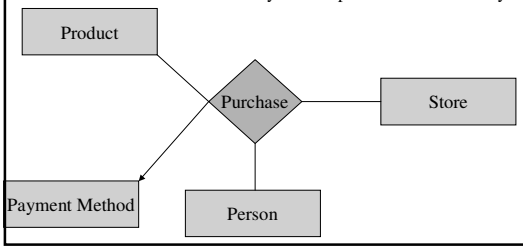
1. Many-many: the key includes the key of E1 together with the key of E2.

What happens for:

2. Many-one:

3. One-one:

Rules for Multiway Relationships

None, really.

Except: if there is an arrow from the relationship to E, then we don't need the key of E as part of the relation key.