

Codd's Twelve Rules 1. Information represented at the logical level in tables. 2. Data is determined by table, primary key, and column. 3. Missing information is modeled as null values. 4. Metadata is part of the database. 5. Single language for all tasks in DBMS. Views and tables must change simultaneously. 6. Single operations for retrieve, insert, delete, update. Operations independent of physical storage and access. 7. 8. 9. Database modifiable without affecting applications. 10. Constraints are part of database. 11. DML independent of physical layer (distributed, etc.) 12. Row-processing obeys same rules as set-processing.

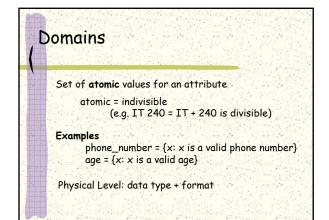
Relations

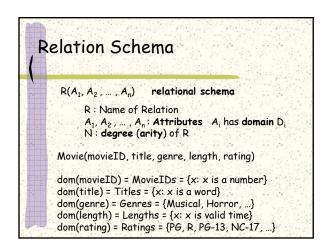
Extensional versus intensional

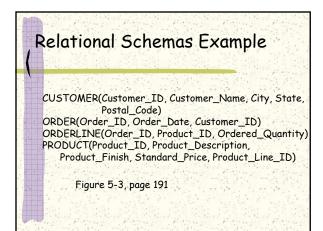
Extensional Representation:

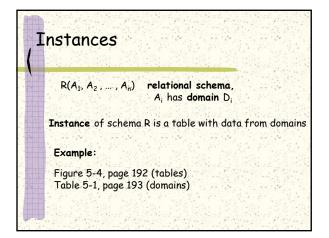
table of values rows = records columns = attributes

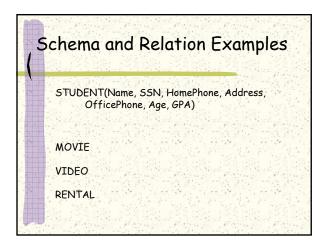
Note: tables are ordered, relations are not











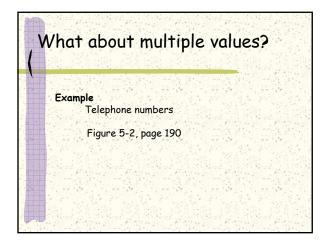
Records

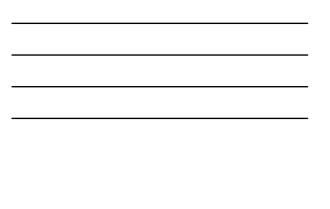
<101, "Thirty-Nine Steps", mystery, 101, R> <510, "Monkey Business", comedy, null, null>

are possible records (or tuples) in

MOVIE(movieID, title, genre, length, rating).

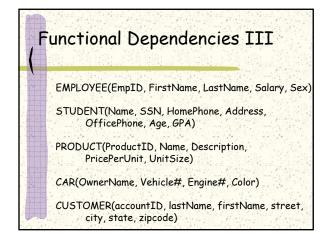
null: value unknown, or attribute does not apply values **atomic**: no multiple values (first normal form) (e.g. several genres) indivisible (name = first name + last name





Functional Dependencies I ORDER_DETAIL(Product, Quantity, PricePerUnit, Subtotal) Example <Soymilk, 3, \$3.19, \$9.57> in ORDER_DETAIL (Quantity, PricePerUnit) → Subtotal Quantity and PricePerUnit determine Subtotal

Functional Dependencies II $A \rightarrow B$ (A determines B) if setting the values of attribute(s) of A determines the values of B Example: SSN \rightarrow Name in STUDENT(SSN, Name)



Constraints

•Domain constraints •Key (uniqueness) constraints •Entity integrity constraints •Referential integrity constraints

·Data dependencies (functional dependencies, etc.)

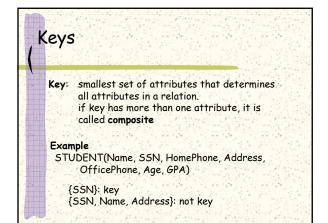
Domain Constraints

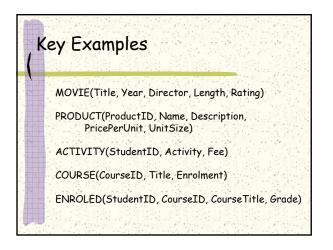
Restriction on values of attributes (domain).

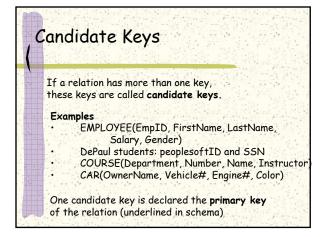
Specified as **data-type:** integer, char, etc., or user-defined type

Operations on data-types: +, *, <, =, ...

not null constraint for an attribute







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