

DS1105 DATABASE MANAGEMENT SYSTEMS

Mrs. Kumudu Wijerathna

Department of Computing and Information Systems

Faculty of Computing

The Relational Data Model and Relational Database Constraints

Lesson Learning Outcomes

By the end of this lesson, students will be able to:

- Define the relational model
- Identify relation, tuple, attribute, and domain
- Explain relation schema and degree
- Describe NULL values in tuples.

Content

- Relational model
- Relation, tuple, attribute, and domain
- Relation schema and degree
- NULL values

Relational Model Concepts

- The relational model represents the database as a collection of relations.
- Informally, each relation resembles a table of values or, to some extent, a flat file of records.
- When a **relation** is thought of as a **table of values**, each row in the table represents a collection of related data values.
- A row represents a fact that typically corresponds to a real-world entity or relationship.

Relational Model Concepts

- The table name and column names are used to help to interpret the meaning of the values in each row.
- In the formal relational model terminology,
 - Row is called a **tuple**,
 - Column header is called an **attribute**,
 - Table is called a **relation**.

Relational Model Concepts

- The **data type** describing the types of values that can appear in each column is represented by a **domain** of possible values.
- A relation schema is used to describe a relation.

Domain, Attribute, Tuple & Relation

Relation Name

STUDENT

Attributes

Name	Ssn	Home_phone	Address	Office_phone	Age	Gpa
Benjamin Bayer	305-61-2435	(817)373-1616	2918 Bluebonnet Lane	NULL	19	3.21
Chung-cha Kim	381-62-1245	(817)375-4409	125 Kirby Road	NULL	18	2.89
Dick Davidson	422-11-2320	NULL	3452 Elgin Road	(817)749-1253	25	3.53
Rohan Panchal	489-22-1100	(817)376-9821	265 Lark Lane	(817)749-6492	28	3.93
Barbara Benson	533-69-1238	(817)839-8461	7384 Fontana Lane	NULL	19	3.25

Tuples

The attributes and tuples of a relation STUDENT.

Domain, Attribute, Tuple & Relation

- **Domain (D)** is a set of atomic values.
 - A common method of specifying a domain is to specify a data type from which the data values forming the domain are drawn.
- **Data type or format** is also specified for each domain
 - Names: The set of character strings that represent the names of persons.
 - Employee_ages. Possible ages of employees in a company; each must be an integer value between 15 and 80.

Domain, Attribute, Tuple & Relation

- **Relation schema** R , denoted by $R(A_1, A_2, \dots, A_n)$, is made up of a relation name R and a list of attributes, A_1, A_2, \dots, A_n .
- Each attribute A_i is the name of a role played by some domain D in the relation schema R .
- D is called the domain of A_i and is denoted by $\text{dom}(A)$.
- R is called the name of this relation.
- **The degree of a relation** is the **number of attributes** (n) of its relation schema.

Domain, Attribute, Tuple & Relation

- A relation of degree **seven**, which stores information about university students, would contain seven attributes describing each student as follows:
 - STUDENT(Name, Ssn, Home_phone, Address, Office_phone, Age, Gpa)
- Using the data type of each attribute, the definition is sometimes written as:
 - STUDENT(Name: string, Ssn: string, Home_phone: string, Address: string, Office_phone: string, Age: integer, Gpa: real)

Domain, Attribute, Tuple & Relation

❑ Exercise

1. Write down a relation of degree five using the data type of each attribute –

You can write at your own wish

Domain, Attribute, Tuple & Relation

- A relation (or **relation state**) r of the relation schema

$R(A_1, A_2, \dots, A_n)$, also denoted by $r(R)$, is a set of n -tuples

$$r = \{t_1, t_2, \dots, t_m\}$$

- Each n -tuple t is an ordered list of n values $t = \langle v_1, v_2, \dots, v_n \rangle$, where each value v_i , $1 \leq i \leq n$, is an element of $\text{dom}(A_i)$ or is a special NULL value.
- The i th value in tuple t , which corresponds to the attribute A_i , is referred to as $t[A_i]$ or $t.A_i$

Domain, Attribute, Tuple & Relation

- The following terms are also commonly used.
 - relation intension for the **schema R**
 - relation extension for a **relation state $r(R)$**

Domain, Attribute, Tuple & Relation

Relation Name

STUDENT

Attributes

Tuples

Name	Ssn	Home_phone	Address	Office_phone	Age	Gpa
Benjamin Bayer	305-61-2435	(817)373-1616	2918 Bluebonnet Lane	NULL	19	3.21
Chung-cha Kim	381-62-1245	(817)375-4409	125 Kirby Road	NULL	18	2.89
Dick Davidson	422-11-2320	NULL	3452 Elgin Road	(817)749-1253	25	3.53
Rohan Panchal	489-22-1100	(817)376-9821	265 Lark Lane	(817)749-6492	28	3.93
Barbara Benson	533-69-1238	(817)839-8461	7384 Fontana Lane	NULL	19	3.25

The attributes and tuples of a relation STUDENT.

Characteristics of Relations

1. Ordering of Tuples in a Relation: A relation is defined as a set of tuples.

The relation STUDENT from previous Figure with a different order of tuples

STUDENT

Name	Ssn	Home_phone	Address	Office_phone	Age	Gpa
Dick Davidson	422-11-2320	NULL	3452 Elgin Road	(817)749-1253	25	3.53
Barbara Benson	533-69-1238	(817)839-8461	7384 Fontana Lane	NULL	19	3.25
Rohan Panchal	489-22-1100	(817)376-9821	265 Lark Lane	(817)749-6492	28	3.93
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Characteristics of Relations

1. Ordering of Tuples in a Relation: A relation is defined as a set of tuples.

Two identical tuples when the order of attributes and values is not part of relation definitions

$$t = \langle (\text{Name}, \text{Dick Davidson}), (\text{Ssn}, 422-11-2320), (\text{Home_phone}, \text{NULL}), (\text{Address}, 3452 \text{ Elgin Road}), (\text{Office_phone}, (817)749-1253), (\text{Age}, 25), (\text{Gpa}, 3.53) \rangle$$
$$t = \langle (\text{Address}, 3452 \text{ Elgin Road}), (\text{Name}, \text{Dick Davidson}), (\text{Ssn}, 422-11-2320), (\text{Age}, 25), (\text{Office_phone}, (817)749-1253), (\text{Gpa}, 3.53), (\text{Home_phone}, \text{NULL}) \rangle$$

Characteristics of Relations

2. Values and NULLs in the Tuples

- Each value in a tuple is an atomic value. that is, it is not divisible into components within the framework of the basic relational model.
- To represent the values of attributes that may be unknown or may not apply to a tuple, a special value, called **NULL** is used.
- In general, we can have several meanings for NULL values, such as value unknown, value exists but is not available, or attribute does not apply to this tuple (also known as value undefined).

Summary

- Relational model - collection of relations
- Tuple (t) - row
- Attribute (A_i) – column header
- Relation – table with values
- Data type - types of values
- Relation schema (R) - made up of a relation and a list of attributes

Summary

- Domain (D) - set of atomic values
- Degree of a relation – number of attributes
- NULL – Empty value

THANK YOU