



Chapter 3: RDBMS

(Relational Database Management Systems)

The Relational Model

- The Relational Model is based on the mathematical concept of relation, which is physically represented as a table.
- Relation
 - Is used to hold information about objects to be represented in the database
 - Represented as a two-dimensional table in which the rows correspond to individual records and the columns correspond to attributes.
- Relational database
 - A collection of normalized relations with distinct relation names.

Terminologies



● Attribute

- **Named column of a relation**
- **Can appear in any order**
- **Conveys the same meaning**
- **Columns contain values of a single relation**

● Domain

- **set of allowable values for one or more attributes.**
- **Are powerful features of the relational model**
- **Every attribute in a relation is defined on a domain**
- **Domains may be distinct for each attribute or 2 more attributes may be defined on the same domain**
- **Each attribute has values taken from a domain.**

Terminologies...



- **Tuple**

- Row of the relation

- **Degree (Arity)**

- The degree of a relation is the number of attributes it contains
 - A relation with only one attribute (degree 1) is called UNARY
 - A relation with two attributes is called BINARY
 - A relation with three attributes is called TERNARY

- **Cardinality**

- The cardinality of a relation is the number of tuples it contains (Number of Rows)

Terminologies...



● Candidate Key (Key Attribute)

- An attribute or set of attributes that uniquely identify individual occurrences of an entity type.
 - Eg. Id. No of a student
 - Key attributes are very important in databases

● Primary Key

- An entity type may have one or more possible candidate keys, one of which is selected to be the primary key.
- All the remaining candidate keys are called **alternate keys**.

● Foreign Key:

- A foreign key is a field in a relational table that matches the primary key column of another table.
- The foreign key can be used to cross-reference tables

Terminologies...

Alternative terminologies

○ Relation	table	file
○ Tuple	Row	Record
○ Attribute	Column	Field

- **Data value : the value of the Attribute**

- **E.g. Age = 26**

- Telephone = 0113-200366**

- Salary = 4000.00**

- Fname = Hirut**

Terminologies...



- **Record**

- A logically connected set of one or more attributes that describe a person, place or thing
- To identify each row in a table, we use key attributes.

- **File**

- A collection of related records. For example, a file might contain data about customers; or
- A file might contain the records for the students currently enrolled at the Department of Business Administration & Information Systems in AAUCC.

- **Database**

- Collection of Files - A database (DB) is a collection of related, shared, and well described data that exists over a long period of time.

Terminologies...

● Schema

- is the definition of a database. It is a named relation defined by a set of attribute and domain name pairs.
- defines the meaning of data. using a given data model. (specifies name of relation, plus name and type of each column.
 - E.g. Student (stid: string, name: string, login: string, age: integer, gpa: real)
- In mathematical terms:
 - Let A_1, A_2, \dots, A_n be attributes with domain D_1, D_2, \dots, D_n . Then the relational schema is the set $\{A_1:D_1, A_2:D_2, \dots, A_n:D_n\}$

Terminologies...



- **Instance**

- An instance of a database is the collection of data in the database at a particular point of time (snap-shot).

- a table, with rows and columns.

- In summary, A Relation is made up of 2 parts:

- Schema – Intention of the relation

- Instance – Extension of the relation

Types of Attributes



(1) Simple vs. Composite attributes

- Simple: not divided into sub parts
e.g. Age, gender
- Composite: Divided into sub parts (composed of other attributes)
e.g. Name, address

(2) Single-valued vs. multi-valued attributes

- Single-valued: has only single value
 - E.g. Name, sex, id. No., color_of_eyes (the value may change but has only one value at one time)
- Multi-valued: takes more than one value
 - E.g. Address, qualification

(3) Stored vs. Derived Attribute

- **Stored: not possible to derive or compute**
 - **E.g. Name, Address**
- **Derived: The value may be derived (computed) from the values of other attributes.**
 - **E.g. Age (current year – year of birth)**
 - **Length of employment (current date- start date)**
 - **Due date (current date + 15 days)**
 - **Profit (earning-cost)**
 - **G.P.A (grade point/credit hours)**

(4) Null Values

- **NULL applies to attributes which are not applicable or which do not have values.**
- **You may enter the value NA (meaning not applicable)**
- **Value of a key attribute can not be null.**

Example Instance of Students Relation

Student_id	First Name	Last Name	Age	GPA
53666	Gizaw	Tadelle	34	3.4
53688	Hirut	Mamo	40	3.2
53650	Kililu	Geda	28	3.5

Cardinality = 3, degree = 5 , all rows distinct

Example Instance of Bank Account

Acct	Nam	Address	Balance
1005	Abebe	Kazanchis	Birr 1023.22
1002	Worku	Bole	Birr 22.43
1003	Biruk	Kirkos	Birr 119,000.12
1008	Dawit	Bole	Birr 1077.23
1010	Alem	Kazanchis	Birr 5,000,000,.00
1012	Ayele	Aratkilo	Birr 443.77

Cardinality = 6, degree = 4 , all rows distinct

Properties of Relations



- **The relation has a name that is distinct from all other relation names in the relation schema.**
- **Each entity is represented in one relation/table**
- **Each attribute has a distinct name**
- **All values in a column represent the same attribute and have the same data format**
- **Each cell of the relation contains exactly one atomic (single) value**
- **Each tuple is distinct, there are no duplicate tuples**
- **Order of rows and columns is immaterial**
- **In a base relation, no attribute of a primary key can be null (Entity Integrity).**