



جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم
قسم الامن السيبراني

Lecture: (5)

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Level: Second

Lecturer: Asst. Lecturer Qusai AL-Durrah



The Relational Database Model

The logical view of the relational database is facilitated by the creation of data relationships based on a logical construct known as a relation. Because a relation is a mathematical construct, end-users find it much easier to think of a relation as a table.

A table is perceived as a two-dimensional structure composed of rows and columns.

Characteristics of a Relational Table:

- A table is perceived as a two-dimensional structure composed of rows and columns.
- Each table row (tuple) represents a single entity occurrence within the entity set.
- Each table column represents attribute, and each column has a distinct name.
- Each row/column intersection represents a single data value.
- All values in a column must conform to the same data format.
- Each column has a specific range of values known as the attribute domain.
- The order of the rows and columns is immaterial to the DBMS.
- Each table must have an attribute or a combination of attributes that uniquely identifies each row.

Keys

In the relational model, keys are important because they are used to ensure that each row in a table is **uniquely identifiable**. They are also used to **establish relationships** among tables and to ensure the **integrity** of the data. Therefore, a proper understanding of the concept and use of keys in the relational model is very important. A key consists of one or more attributes that determine other attributes. For example, an invoice number identifies all of the invoice attributes, such as the invoice data and the customer's name



The key role is based on a concept known as determination, when the statement "A determines B" indicates that if you know the value of attribute A, you can loop up (determine) the value of attribute B, for example as in table student

| Num | LName | FName | Init | Phone | Class | Hrs |
|-----|-----------|---------|------|-------|-------|-----|
| 232 | smith | William | C | 2267 | So | 42 |
| 233 | Bowser | Anne | M | 2255 | Jr | 81 |
| 234 | Katinga | John | P | 2267 | So | 36 |
| 235 | Robertson | John | K | 2277 | Jr | 66 |

NUM → LNAME

NUM → LNAME, FNAME, INIT

The principle of determination is very important because it is used in the definition of a central relational database concept known as functional dependence.

The attribute B is functionally dependent on the attribute A. If each value in column A determines one and only one value in column B.

For example, in student table, phone is functionally dependent on NUM, when NUM value is 233 determines the phone value 2255. On the other hand, NUM is not functionally dependent on phone because the phone value 2267 is associated with two NUM values 232, 234, similarly in NUM and Fname



Type of keys

- 1) **Super key:** is any key that uniquely identifies each row. it is functionally determines all of a row's attributes in student table

super key could be any of the following:

Num

Num, L name

Num, L name, Init

- 2) **Candidate key:** it is a super key without unnecessary attributes, that is a minimal super key such as Num, L name it is a super key but is not a candidate key because Num by itself is a candidate key L name, F name, Init, Phone might also be a candidate key, because it is impossible that two students share the same last name, first name, initial, and Phone number.

- 3) **primary key:** A candidate key selected to uniquely identify all other attribute values in any given row such as

NUM

* Null (that is, no data entry) is not permitted in the primary key.

- 4) **Secondary key:** is a key that is used strictly for data retrieval purposes. For example: suppose customer data are stored in a CUSTOMER table in which the customer number is the primary key. Do you suppose that most customers will remember their numbers? Data retrieval for customer can be facilitated when the customer's last name and phone number are used. Keep in mind that a secondary key does not necessarily yield a unique outcome.



5) **Foreign key:** is an attribute whose value match the primary key

| Pro-Code | Descript | Price | Code |
|----------|----------|-------|------|
| | | | 232 |
| | | | 235 |
| | | | 231 |
| | | | 232 |

Table name: Product

Primary key: Pro-Code

Foreign key: Code

Link



Table name: Vendor

Primary key: Code

Foreign key: none

| Code | Contact | Area code | Phone |
|------|---------|-----------|-------|
| 231 | | | |
| 232 | | | |
| 235 | | | |

The Code is the primary key in the vendor table, and it occurs as foreign key in the product table.

Because the vendor table is not linked to third table, the vendor table does not contain a foreign key.



6) Composite key: a key that is composed of more than one attribute (multi-attribute) for example in table student we can write

Num, L name, F name —————> Hrs, Class

example: if the attribute (B) is functionally dependent on a composite key (A) but not on any subset of that composite key, the attribute (B) is fully functionally dependent on (A).