ELSEWEDY UNIVERSITY OF TECHNOLOGY
- POLYTECHNIC OF EGYPT -

Database Management Systems

Lecture 3: Introduction to SQL

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Outline

- Overview of The SQL Query Language
- SQL Data Definition
- Basic Query Structure of SQL Queries
- Additional Basic Operations
- Set Operations
- Null Values
- Aggregate Functions
- Nested Subqueries
- Modification of the Database

History

- IBM Sequel language developed as part of System R project at the IBM San Jose Research Laboratory
- Renamed Structured Query Language (SQL)
- ANSI and ISO standard SQL:
  - SQL-86
  - SQL-89
  - SQL-92
  - SQL:1999 (language name became Y2K compliant!)
  - SQL:2003
- Commercial systems offer most, if not all, SQL-92 features, plus varying feature sets from later standards and special proprietary features.
  - Not all examples here may work on your particular system.

SQL Parts

- **DML** -- provides the ability to query information from the database and to insert tuples into, delete tuples from, and modify tuples in the database.
- **integrity** – the DDL includes commands for specifying integrity constraints.
- **View definition** -- The DDL includes commands for defining views.
- **Transaction control** –includes commands for specifying the beginning and ending of transactions.
- **Embedded SQL and dynamic SQL** -- define how SQL statements can be embedded within general-purpose programming languages.
- **Authorization** – includes commands for specifying access rights to relations and views.

Data Definition Language

The SQL data-definition language **(DDL)** allows the specification of information about relations, including:

- The schema for each relation.
- The type of values associated with each attribute.
- The Integrity constraints
- The set of indices to be maintained for each relation.
- Security and authorization information for each relation.
- The physical storage structure of each relation on disk.

Domain Types in SQL

- **char(n).** Fixed length character string, with user-specified length *n.*
- **varchar(n).** Variable length character strings, with user-specified maximum length *n.*
- **int.** Integer (a finite subset of the integers that is machine-dependent).
- **smallint.** Small integer (a machine-dependent subset of the integer domain type).
- **numeric(p,d).** Fixed point number, with user-specified precision of *p* digits, with *d* digits to the right of decimal point. (ex., **numeric**(3,1), allows 44.5 to be stores exactly, but not 444.5 or 0.32)
- **real, double precision.** Floating point and double-precision floating point numbers, with machine-dependent precision.
- **float(n).** Floating point number, with user-specified precision of at least *n* digits.
- More are covered in Chapter 4.

Create Table Construct

- An SQL relation is defined using the **create table** command:

  create table *r*
  $(A_1\ D_1,\ A_2\ D_2,\ \ldots,\ A_n\ D_n,$
  (integrity-constraint$_1$),
  ...,
  (integrity-constraint$_k$))

  - *r* is the name of the relation
  - each A_i is an attribute name in the schema of relation *r*
  - D_i is the data type of values in the domain of attribute A_i

- Example:

```
create table instructor (
     ID            char(5),
     name           varchar(20),
   dept_name   varchar(20),
     salary          numeric(8,2))
```

Integrity Constraints in Create Table

- Types of integrity constraints
  - primary key (A_1, ..., A_n)
  - foreign key (A_m, ..., A_n) references *r*
  - not null
- SQL prevents any update to the database that violates an integrity constraint.

- Example:

```
create table instructor (
        ID            char(5),
        name          varchar(20) not null,
       dept_name      varchar(20),
        salary        numeric(8,2),
        primary key (ID),
        foreign key (dept_name) references department);
```

And a Few More Relation Definitions

```
create table student (
        ID                    varchar(5),
        name                  varchar(20) not null,
        dept_name             varchar(20),
        tot_cred              numeric(3,0),
        primary key (ID),
       foreign key (dept_name) references department);
```

```
create table takes (
        ID                    varchar(5),
        course_id             varchar(8),
        sec_id                varchar(8),
        semester              varchar(6),
        year                  numeric(4,0),
        grade                 varchar(2),
        primary key (ID, course_id, sec_id, semester, year) ,
        foreign key (ID) references  student,
        foreign key (course_id, sec_id, semester, year) references section);
```

And more still

```
▪  create table course (
        course_id       varchar(8),
        title           varchar(50),
        dept_name        varchar(20),
        credits         numeric(2,0),
        primary key (course_id),
        foreign key (dept_name) references department);
```

Updates to tables

- **Insert**
  - **insert into** *instructor* **values** ('10211', 'Smith', 'Biology', 66000);
- **Delete**
  - Remove all tuples from the *student* relation
    - **delete from** *student*
- **Drop Table**
  - **drop table** *r*
- **Alter**
  - **alter table** *r* **add** *A D*
    - where *A* is the name of the attribute to be added to relation *r* and *D* is the domain of *A.*
    - All exiting tuples in the relation are assigned *null* as the value for the new attribute.
  - **alter table** *r* **drop** *A*
    - where *A* is the name of an attribute of relation *r*
    - Dropping of attributes not supported by many databases.

Basic Query Structure

- A typical SQL query has the form:

  select $A_1, A_2, ..., A_n$
  from $r_1, r_2, ..., r_m$
  where P

  - A_i represents an attribute
  - R_i represents a relation
  - P is a predicate.
- The result of an SQL query is a relation.

The select Clause

- The **select** clause lists the attributes desired in the result of a query
  - corresponds to the projection operation of the relational algebra
- Example: find the names of all instructors:

  select *name*
  from *instructor*

- **NOTE**: SQL names are case insensitive (i.e., you may use upper- or lower-case letters.)
  - E.g., *Name* ≡ *NAME* ≡ *name*
  - Some people use upper case wherever we use bold font.

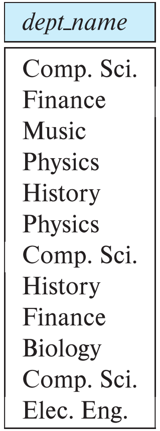
The select Clause (Cont.)

- SQL allows duplicates in relations as well as in query results.
- To force the elimination of duplicates, insert the keyword **distinct** after select.
- Find the department names of all instructors, and remove duplicates

  select distinct *dept_name*
  from *instructor*

- The keyword **all** specifies that duplicates should not be removed.

  select all *dept_name*
  from *instructor*



dept_name
Comp. Sci.
Finance
Music
Physics
History
Physics
Comp. Sci.
History
Finance
Biology
Comp. Sci.
Elec. Eng.

The select Clause (Cont.)

- An asterisk in the select clause denotes “all attributes”

  select *

  from *instructor*

- An attribute can be a literal with no **from** clause

  select '437'

  - Results is a table with one column and a single row with value “437”
  - Can give the column a name using:

    select '437' **as** *FOO*

- An attribute can be a literal with **from** clause

  select 'A'

  from *instructor*

  - Result is a table with one column and *N* rows (number of tuples in the *instructors* table), each row with value “A”

Question
&
Answer