SQL Data Manipulation (DML)
SQL Data Definition (DDL)

Today's Topics

- How did it go with the SQL exercises – any question, tips or tricks?

- We will work with
  - SQL DML statements
    - INSERT, UPDATE and DELETE

  - SQL DDL statements
    - CREATE TABLE
    - CREATE VIEW (mostly in study point assignment ☺)

  - Logical backup of tables

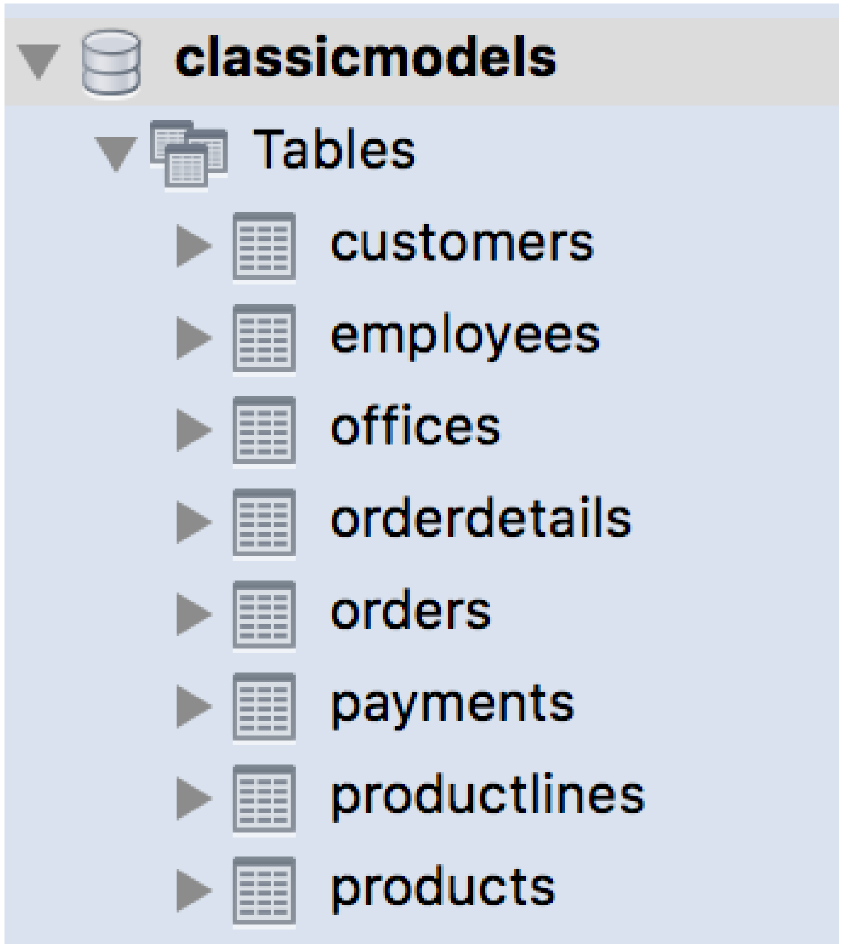
Resources

There are different resources about SQL and MySQL online. Three good ones are:

- http://www.w3schools.com/sql/default.asp
- http://www.mysqltutorial.org/basic-mysql-tutorial.aspx
- http://www.mysqltutorial.org/basic-mysql-tutorial.aspx

Wikipedia also has good examples for most SQL commands

Database & Tables


classicmodels
Tables
customers
employees
offices
orderdetails
orders
payments
productlines
products

A database describes the tables of a database. It has a name (here "classicmodels")

A database can have more than one table

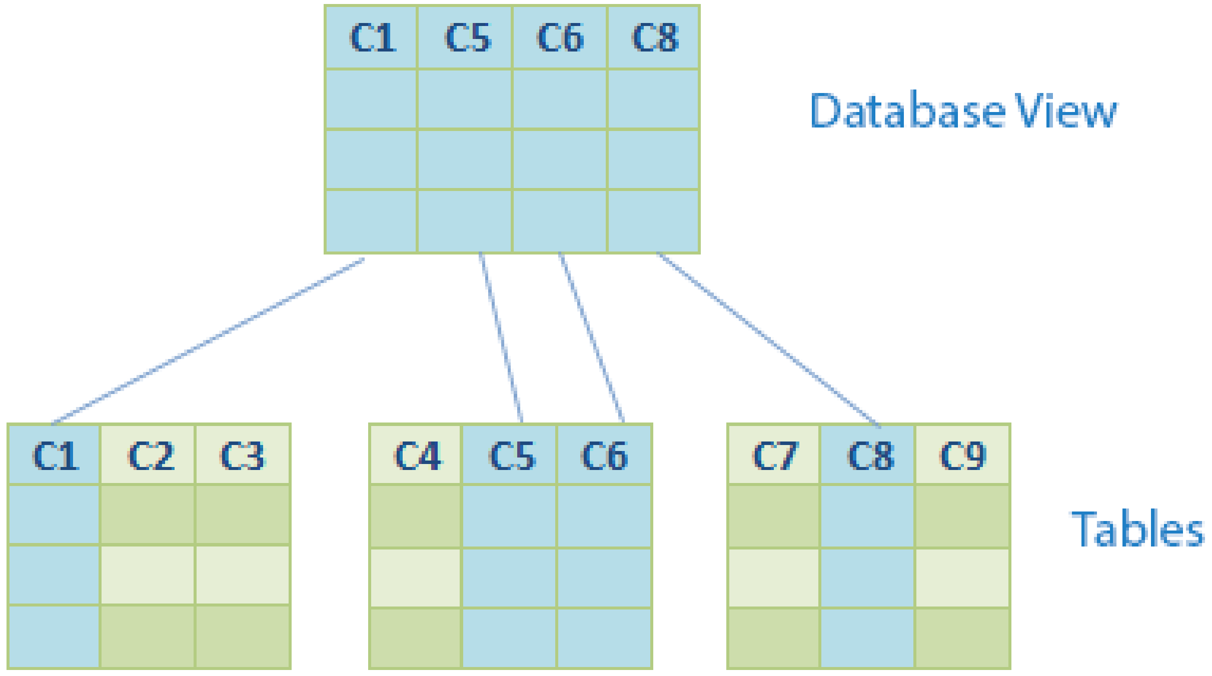
Each table has a unique name

What other object types can a database have?

Nice, but not need to know ☺

Another database object type: View

- A view is a virtual table computed or collated dynamically from data in the database when access to that view is requested.
- Example:



Nice, but not need to know ☺

Another database object type: Stored procedures

- Stored procedure
  - Logic taking place on database server instead of in the application
- It is a matter of
  - database-oriented software developers and in-memory application software developers
  - performance versus maintenance

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Nice, but not need to know ☺

Pros & Cons on Stored procedures

Pro

- SQL has extremely powerful capabilities for querying the database (i.e. better performance)
- SQL and application language are different programming skills (a problem ?)

Con

- SQL queries often embed domain logic, which goes against the basic principles of a layered enterprise application architecture.
- Database portability
- Testability

You can read more about pros and cons here:

https://www.martinfowler.com/articles/dblogic.html

.NET example of how to call procedure: https://dev.mysql.com/doc/connector-net/en/connector-net-tutorials-stored-procedures.html

Example of how to define procedure: http://www.mysqltutorial.org/mysql-if-statement/

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Aggregate functions 1

- You were asked to find the highest profit amongst products (i.e. MSRP-buyPrice)

```
SELECT max(msrp-buyprice) FROM classicmodels.products
```

- What if you want to output product name instead of the profit?

```
SELECT productname ???
```

Aggregate functions 2

Group by examples

List the name of the customer with the **highest** credit limit **in each country**. Order the list alphabetically by country name.

```
SELECT customername FROM customers
WHERE  creditlimit in (SELECT max(creditlimit)
   FROM classicmodels.customers group by country)
group by country
order by country
```

List the **total** quantity in stock for **each product scale** that has a **total quantity above 1000**

```
SELECT productscale, sum(quantityInStock)
from products
group by productscale
having sum(quantityinstock) > 1000
```

Data Definition Language (DDL)

Create Table Example

```
create table EMP (
   EMPNO integer(4) not null,
   ENAME varchar(30) not null,
   JOB varchar(10),
   MGR integer (4),
   HIREDATE date,
   SAL decimal(7,2),
   DEPTNO integer (2)
);
```

empno	ename	job	mgr	hiredate	sal	deptno
7369	SMITH	CLERK	7902	12/17/1980	800	20
7499	ALLEN	SALESMAN	7698	02/20/1981	1600	30
7521	WARD	SALESMAN	7698	02/22/1981	1250	30
7566	JONES	MANAGER	7839	04-02-1981	2975	20
7654	MARTIN	SALESMAN	7698	09/28/1981	1250	30
7698	BLAKE	MANAGER	7839	05-01-1981	2850	30
7782	CLARK	MANAGER	7839	06-09-1981	2450	10
7788	SCOTT	ANALYST	7566	04/19/1987	3000	20
7839	KING	PRESIDENT		11/17/1981	5000	10
7844	TURNER	SALESMAN	7698	09-08-1981	1500	30
7876	ADAMS	CLERK	7788	05/23/1987	1100	20
7900	JAMES	CLERK	7698	12-03-1981	950	30
7902	FORD	ANALYST	7566	12-03-1981	3000	20
7934	MILLER	CLERK	7782	01/23/1982	1300	10

Constraints – primary and foreign key

```
create table EMP (
   EMPNO integer(4) not null,
   ENAME varchar(30) not null,
   JOB varchar(10),
   MGR integer(4),
   HIREDATE date,
   SAL decimal(7,2),
   DEPTNO integer(2),
   PRIMARY KEY (empno),
   CONSTRAINT emp_fk FOREIGN KEY (deptno)
    REFERENCES dept(deptno)
)
```

empno	ename	job	mgr	hiredate	sal	deptno
7369	SMITH	CLERK	7902	12/17/1980	800	20
7499	ALLEN	SALESMAN	7698	02/20/1981	1600	30
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7902	FORD	ANALYST	7566	12-03-1981	3000	20
7934	MILLER	CLERK	7782	01/23/1982	1300	10

deptno	dname	loc
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

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Logical backup of data

SELECT INTO statement copies data from one table and inserts it into a new table.

See more here: https://www.w3schools.com/sql/sql_select_into.asp

Data Definition Language (DML) – insert, update, delete

Insert data (new rows)

insert into <table> [(<column i, . . . , column j>)]
values (<value i, . . . , value j>);

Example:

```
insert into PROJECT(PNO,PNAME,PERSONS,BUDGET, PSTART)
values(313, ’DBS’, 7411, 150000.42, ’10-OCT-16’);
```

Or

```
insert into PROJECT
values(313,’DBS’,7411,null,150000.42 ’10-OCT-16’, null);
```

Insert as a copy from another table

insert into <table> [(<column i, . . . , column j>)]
    <query>

Example:

```
insert into OLDEMP (ENO, HDATE)
select EMPNO, HIREDATE from EMP
where HIREDATE < '01-JAN-17';
```

Update data (change rows)

update <table>
set <column i> = <expression i>, . . . ,
<column j> = <expression j> [where <condition>];

Examples:

```
update EMP
set JOB = 'MANAGER', DEPTNO = 20, SAL = SAL +1000
where ENAME = 'JONES';

update EMP
Set SAL = SAL * 1.15
where DEPTNO in (10,30);
```

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Deletion

Delete data (rows):

delete **from** <table> [where <condition>];

```
delete from PROJECT
where BUDGET < 10000;
```

Delete table:

```
drop emp;
```

Commit and Rollback

- A sequence of database modifications, i.e., a sequence of insert, update, and delete statements, is called a transaction.

- Modifications of data in tables are <u>temporarily</u> stored in the database system.

- They become permanent only after the statement <u>commit</u>;

- To undo modifications, one has to use the statement <u>rollback</u>;
  - Only if you haven't committed already ☺

Exercises

- See document in exercise folder