Structured Query Language

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What is SQL?
• A language for building relational databases that makes it easier to modify data tables and query the database.

Why SQL?
• ANSI has deemed it the standard language in database management systems.
• Most system databases incorporate although it is typical for them to have their own extensions unique to their system.
• It was designed by a mudder.
  – Don Chamberlin ’66, inventor of the SQL database language.

Different Versions of SQL
• Commercial SQL Databases
  – IBM DB2
  – Ingres
  – Oracle
  – Informix
  – Sybase
  – CQL++
  – Solid
  – Empress
  – Adabas D
  – mSQL
  – and many more....

Different Versions of SQL
• Open Source SQL Databases
  – InterBase
  – MySQL
  – PostgreSQL
  – Gadfly
  – BeagleSQL
  – GNU SQL
  – and many more....

Creating a Database
• A database consists of one or more tables. These tables consist of an identifying name and several columns and rows.
• Columns contain the column name, data type, or other attributes; each row holds a record for that column.
Creating a Table

- To create a table one uses the create statement:

```sql
create table table_name
(column_1 datatype, column_2 datatype, ...);
```

- One can also implement constraints for each column:

```sql
create table table_name
(column_1 datatype constraint, column_2 datatype constraint, ...);
```

Commonly used constraints:
- unique no two records can have the same value in the specified column
- not null the column cannot be left blank
- primary key defines a unique key or reference for each record in the table

It should be noted that there are many other constraints that can be used but they will differ depending on the DBMS server you are using.

Commonly used datatypes:
- char(size) Fixed-length character string. Size is specified in parenthesis. Max 255 bytes.
- varchar(size) Variable-length character string. Max size is specified in parenthesis.
- number(size) Number value with a maximum number of column digits specified in parenthesis.
- date Date value
- number(size,d) Number value with a maximum number of digits of “size” total, with a maximum number of “d” digits to the right of the decimal.
- Logical A column that can hold only two values: TRUE or FALSE.

Example for Creating a Table

```sql
create table famous_people
(first varchar(30),
 last varchar(30),
 hair_color varchar(15),
 age number(2,0));
```

A Sample Table

<table>
<thead>
<tr>
<th>First</th>
<th>Last</th>
<th>Hair_Color</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thus now that we can create tables, but we need to be able to store and retrieve data from them.
Adding to a Table

Adding records to a table is done using the insert command as follows:

```
insert into table_name
(first_column, ... last_column)
values [first_value, ... last_value];
```

Example of Adding to a Table

```
insert into famous_people
(first, last, hair_color, age)
values (Bruce, Willis, brown, 45);
insert into famous_people
(first, last, hair_color, age)
values (Ben, Affleck, brown, 27);
insert into famous_people
(first, last, hair_color, age)
values (Heather, Graham, blond, 29);
```

The Resulting Table

<table>
<thead>
<tr>
<th>First</th>
<th>Last</th>
<th>Hair_Color</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruce</td>
<td>Willis</td>
<td>brown</td>
<td>45</td>
</tr>
<tr>
<td>Ben</td>
<td>Affleck</td>
<td>brown</td>
<td>27</td>
</tr>
<tr>
<td>Heather</td>
<td>Graham</td>
<td>blond</td>
<td>29</td>
</tr>
</tbody>
</table>

Now that we have a table it is important to explain how to access the records stored in the table.

Queries

To query a table one uses the select command as follows:

```
select column1[, column2, etc] from tablename
[where condition];
```

The column names that follow the select command will be the information returned by the query. An “*” can be used to specify all columns.

The where clause (optional) specifies which data values or rows will be returned or displayed, based on the criteria described after the keyword where.

The where Clause

Conditional expressions used in the where clause:

- = Equal
- > Greater than
- < Less than
- >= Greater than or equal to
- <= Less than or equal to
- <> Not equal to
- LIKE Will return rows only like what you specify. The % sign can be used as a wildcard before and/or after characters.

Sample Queries

```
select first, last, age
from famous_people
where first LIKE 'B%';
```

```
select *  
from famous_people  
where first = 'Bruce';
```

```
Using a Larger Table

<table>
<thead>
<tr>
<th>first</th>
<th>last</th>
<th>hair_color</th>
<th>age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruce</td>
<td>Willis</td>
<td>brown</td>
<td>45</td>
</tr>
<tr>
<td>Ben</td>
<td>Affleck</td>
<td>brown</td>
<td>27</td>
</tr>
<tr>
<td>Heather</td>
<td>Graham</td>
<td>blond</td>
<td>28</td>
</tr>
<tr>
<td>Will</td>
<td>Smith</td>
<td>black</td>
<td>28</td>
</tr>
<tr>
<td>Britney</td>
<td>Spears</td>
<td>blond</td>
<td>18</td>
</tr>
<tr>
<td>Julia</td>
<td>Roberts</td>
<td>red</td>
<td>34</td>
</tr>
<tr>
<td>Mira</td>
<td>Sorvino</td>
<td>blond</td>
<td>32</td>
</tr>
</tbody>
</table>

Updating a Database

- To update a record or row in a table the update command can be used as follows:

```sql
update tablename
set columnname = newvalue [,nextcolumn = newvalue2 ... ]
where columnname OPERATOR value [and|or column OPERATOR value ];
[ ] = optional
```

Examples

```sql
update famous_people
set hair_color = 'brown'
where first = 'Britney' and last = 'Spears';

update famous_people
set age = 33, hair_color = 'brown'
where first = 'Mira' and last = 'Sorvino';

update famous_people
set last = 'Smith'
where age <= 30;
```

Updated Table

<table>
<thead>
<tr>
<th>first</th>
<th>last</th>
<th>hair_color</th>
<th>age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruce</td>
<td>Willis</td>
<td>brown</td>
<td>45</td>
</tr>
<tr>
<td>Ben</td>
<td>Affleck</td>
<td>brown</td>
<td>27</td>
</tr>
<tr>
<td>Heather</td>
<td>Graham</td>
<td>blond</td>
<td>28</td>
</tr>
<tr>
<td>Will</td>
<td>Smith</td>
<td>black</td>
<td>28</td>
</tr>
<tr>
<td>Britney</td>
<td>Spears</td>
<td>blond</td>
<td>18</td>
</tr>
<tr>
<td>Julia</td>
<td>Roberts</td>
<td>red</td>
<td>34</td>
</tr>
<tr>
<td>Mira</td>
<td>Sorvino</td>
<td>blond</td>
<td>32</td>
</tr>
</tbody>
</table>

Deleting

- To delete a row or record from a table use the delete command function as follows:

```sql
delete from tablename
where columnname OPERATOR value [and|or column OPERATOR value ];
[ ] = optional
```

```
NOTE: If you leave off the where clause all of the table entries will be deleted!
```

Deleting

```sql
delete from famous_people
where last = 'Smith';

delete from famous_people
where first = 'Julia' or first = 'Mira';
```
Dropping a Table

- Using the delete command it is easy to remove all of the entries in a table, but that leaves how one deletes the table from the database. This is done using the drop command which will completely delete the table and all of its entries. The form of the command is:

  drop table tablename;

- Therefore if we wanted to delete our table of famous people we would simply type:

  drop table famous_people;

References

- There are many references on the web as well as man pages and books. Although the web sites that are most useful to you will depend on the server you are using. Some sites I found useful were:
  - www.sqlcourse.com
  - www.dcs.napier.ac.uk/~andrew/sql/
  - www.sqlwire.com
  - www.emuse.net
  - www.programmingtutorials.com