More SQL Data Definition

Database Systems Lecture 6
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In this Lecture

- More SQL
  - DROP TABLE
  - ALTER TABLE
  - INSERT, UPDATE, and DELETE
  - Data dictionary
  - Sequences
- For more information
  - Connolly and Begg chapters 5 and 6
Creating Tables

- From last lecture...
  - CREATE TABLE
  - Columns
    - Data types
    - [NOT] NULL, DEFAULT values
  - Constraints
    - Primary keys
    - Unique columns
    - Foreign keys

CREATE TABLE
<name> (  
  <col-def-1>,
  <col-def-2>,
  ...
  <col-def-n>,
  <constraint-1>,
  ...
  <constraint-k>)
Deleting Tables

• To delete a table use
  • DROP TABLE
  • [IF EXISTS]
  • <name>

• Example:
  • DROP TABLE Module

• **BE CAREFUL** with any SQL statement with DROP in it
  • You will delete any information in the table as well
  • You won’t normally be asked to confirm
  • There is no easy way to undo the changes
Changing Tables

- Sometimes you want to change the structure of an existing table
  - One way is to DROP it then rebuild it
  - This is dangerous, so there is the ALTER TABLE command instead

- ALTER TABLE can
  - Add a new column
  - Remove an existing column
  - Add a new constraint
  - Remove an existing constraint
ALTERing Columns

To add or remove columns use

\[
\text{ALTER TABLE } <\text{table}> \text{ ADD COLUMN } <\text{col}>
\]
\[
\text{ALTER TABLE } <\text{table}> \text{ DROP COLUMN } <\text{name}>
\]

Examples

\[
\text{ALTER TABLE Student ADD COLUMN Degree VARCHAR(50)}
\]
\[
\text{ALTER TABLE Student DROP COLUMN Degree}
\]
ALTERing Constraints

To add or remove columns use

```
ALTER TABLE <table>
ADD CONSTRAINT <definition>
```

```
ALTER TABLE <table>
DROP CONSTRAINT <name>
```

Examples

```
ALTER TABLE Module
ADD CONSTRAINT ck UNIQUE (title)
```

```
ALTER TABLE Module
DROP CONSTRAINT ck
```

More SQL Data Definition
INSERT, UPDATE, DELETE

- **INSERT** - add a row to a table
- **UPDATE** - change row(s) in a table
- **DELETE** - remove row(s) from a table

- **UPDATE** and **DELETE** use ‘WHERE clauses’ to specify which rows to change or remove
- **BE CAREFUL** with these - an incorrect **WHERE** clause can destroy lots of data

More SQL Data Definition
INSERT INTO
<table>
(col1, col2, ...)
VALUES
(val1, val2, ...)

• The number of columns and values must be the same
• If you are adding a value to every column, you don’t have to list them
• SQL doesn’t require that all rows are different (unless a constraint says so)
INSERT INTO Student (ID, Name, Year) VALUES (2, 'Mary', 3)
INSERT INTO Student (Name, ID) VALUES ('Mary', 2)
INSERT INTO Student VALUES (2, 'Mary', 3)
### UPDATE

**UPDATE** `<table>`

**SET** `col1 = val1`  
`[,col2 = val2...]`

**[WHERE]**  
`<condition>]`

- All rows where the condition is true have the columns set to the given values
- If no condition is given all rows are changed so BE CAREFUL
- Values are constants or can be computed from columns

More SQL Data Definition
UPDATE

UPDATE Student
SET Year = Year + 1,
    Name = 'Jane'
WHERE ID = 4

UPDATE Student
SET Year = 1,
    Name = 'Jane'
WHERE ID = 4

More SQL Data Definition
DELETES

- Removes all rows which satisfy the condition

```
DELETE FROM <table>
[WHERE <condition>]
```

- If no condition is given then ALL rows are deleted - BE CAREFUL

- Some versions of SQL also have `TRUNCATE TABLE <T>` which is like `DELETE FROM <T>` but it is quicker as it doesn’t record its actions

More SQL Data Definition
DELETE

DELETE FROM Student
WHERE Year = 2

DELETE FROM Student
or
TRUNCATE TABLE Student

More SQL Data Definition
SELECT

• The SQL command you will use most often
  • Queries a set of tables and returns results as a table
  • Lots of options, we will look at many of them
  • Usually more than one way to do any given query

• SQL’s SELECT is different from the relational algebra’s selection $\sigma$

• We’ll see translation of SQL queries into relational algebra later

More SQL Data Definition
SQL SELECT Overview

SELECT

[DISTINCT | ALL] <column-list>
FROM <table-names>
[WHERE <condition>]
[ORDER BY <column-list>]
[GROUP BY <column-list>]
[HAVING <condition>]

• ([] - optional, | - or)

More SQL Data Definition
Simple SELECT

```
SELECT <columns>
FROM <table>
```

<columns> can be
- A single column
- A comma-separated list of columns
- * for ‘all columns’

• Given a table Student with columns
  - stuID
  - stuName
  - stuAddress
  - stuYear
Sample SELECTs

SELECT * FROM Student

<table>
<thead>
<tr>
<th>stuID</th>
<th>stuName</th>
<th>stuAddress</th>
<th>stuYear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anderson</td>
<td>15 High St</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Brooks</td>
<td>27 Queen’s Rd</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Chen</td>
<td>Lenton Hall</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>D’Angelo</td>
<td>Derby Hall</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Evans</td>
<td>Lenton Hall</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Franklin</td>
<td>13 Elm St</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Gandhi</td>
<td>Lenton Hall</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Harrison</td>
<td>Derby Hall</td>
<td>1</td>
</tr>
</tbody>
</table>
Sample SELECTs

SELECT stuName FROM Student

<table>
<thead>
<tr>
<th>stuName</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson</td>
</tr>
<tr>
<td>Brooks</td>
</tr>
<tr>
<td>Chen</td>
</tr>
<tr>
<td>D’Angelo</td>
</tr>
<tr>
<td>Evans</td>
</tr>
<tr>
<td>Franklin</td>
</tr>
<tr>
<td>Gandhi</td>
</tr>
<tr>
<td>Harrison</td>
</tr>
</tbody>
</table>
Sample SELECTs

```sql
SELECT stuName, stuAddress
FROM Student
```

<table>
<thead>
<tr>
<th>stuName</th>
<th>stuAddress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson</td>
<td>15 High St</td>
</tr>
<tr>
<td>Brooks</td>
<td>27 Queen’s Rd</td>
</tr>
<tr>
<td>Chen</td>
<td>Lenton Hall</td>
</tr>
<tr>
<td>D’Angelo</td>
<td>Derby Hall</td>
</tr>
<tr>
<td>Evans</td>
<td>Lenton Hall</td>
</tr>
<tr>
<td>Franklin</td>
<td>13 Elm St</td>
</tr>
<tr>
<td>Gandhi</td>
<td>Lenton Hall</td>
</tr>
<tr>
<td>Harrison</td>
<td>Derby Hall</td>
</tr>
</tbody>
</table>

More SQL Data Definition
Being Careful

- When using DELETE and UPDATE
  - You need to be careful to have the right WHERE clause
  - You can check it by running a SELECT statement with the same WHERE clause first

Before running

```sql
DELETE FROM Student
WHERE Year = 3
```

run

```sql
SELECT * FROM Student
WHERE Year = 3
```
Sequences

• Often we want to assign each row a unique number
  • These are useful as primary keys
  • Using integers to reference rows is more efficient
  • We would like the DBMS to do this

• In most versions of SQL we can use autoincrementing fields to do this
  • Details differ between versions
  • Usually the first entry is assigned 1, the next 2, and so on, but Oracle lets you change this
Sequences

- In Oracle we use a Sequence
  - A sequence is a source of numbers
  - We can declare several sequences, giving each a name, a start point, and a step size
  - We can then generate unique numbers by asking for the next element from a sequence
Sequences in Oracle

• To declare a sequence:

  CREATE SEQUENCE <name>  
    [START WITH <value>]  
    [INCREMENT BY <value>]  

• If no START WITH or INCREMENT BY values are given they default to 1

• To get the next value from a sequence

  <sequence name>.nextVal
Sequence Example

- Creating a sequence
  
  ```sql
  CREATE SEQUENCE mySeq START WITH 1
  ```

- Using a sequence
  
  ```sql
  SELECT mySeq.nextVal FROM DUAL;
  INSERT INTO Student
  (stuID, stuName, stuAddress)
  VALUES
  (mySeq.nextVal, 'Steve Mills',
   '13 Elm Street')
  ```

More SQL Data Definition
SQL and the Data Dictionary

• The *data dictionary* or *catalogue* stores:
  • Information about database tables
  • Information about the columns of tables
  • Other information - users, locks, indexes, and more
  • This is ‘metadata’

• Some DBMSs let you query the catalogue:
  • In Oracle you can access the metadata in several ways
  • There are ‘system tables’ with metadata in them
  • You can also `DESCRIBE` tables

More SQL Data Definition
Oracle Data Dictionary

• To find out what tables and sequences you have defined use

  SELECT table_name
  FROM user_tables

• The user_tables table is maintained by Oracle

• It has lots of columns, so don’t use

  SELECT * FROM user_tables
Oracle Data Dictionary

- To find the details of a table use
  `DESCRIBE <table name>`
- Example:
  ```sql
  SQL> DESCRIBE Student;
  Name       Null?    Type------------ -------- ----------
  STUID        NOT NULL NUMBER(38)
  STUNAME      NOT NULL VARCHAR2(50)
  STUADDRESS            VARCHAR2(50)
  STUYEAR               NUMBER(38)
  ```

More SQL Data Definition
## This Lecture in Exams

### Track

<table>
<thead>
<tr>
<th>cID</th>
<th>Num</th>
<th>Title</th>
<th>Time</th>
<th>aID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Violent</td>
<td>239</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Every Girl</td>
<td>410</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Breather</td>
<td>217</td>
<td>114</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>Part of Me</td>
<td>279</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Star</td>
<td>362</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Teaboy</td>
<td>417</td>
<td></td>
</tr>
</tbody>
</table>

### CD

<table>
<thead>
<tr>
<th>cID</th>
<th>Title</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mix</td>
<td>9.99</td>
</tr>
<tr>
<td>2</td>
<td>Compilation</td>
<td>12.99</td>
</tr>
</tbody>
</table>

### Artist

<table>
<thead>
<tr>
<th>aID</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stellar</td>
</tr>
<tr>
<td>2</td>
<td>Cloudboy</td>
</tr>
</tbody>
</table>
This Lecture in Exams

Add £2.50 to the price of all CDs that cost more than £10.00.

(2 marks)

Add a new column, Genre, to the CD table. This column should hold a string of up to 100 characters, and if no genre is provided then it should default to the value “Unknown”.

(3 marks)

Add a track titled “Runnin” by the artist “Fat Freddy’s Drop” which is 12 minutes and 27 second long to the CD titled “Compilation”. For this part only, you may assume that the tables contain exactly the information shown above.

(3 marks)
Next Lecture

• SQL SELECT
  • WHERE clauses
  • SELECT from multiple tables
  • JOINs

• For more information
  • Connolly and Begg Chapter 5
  • Ullman and Widom, Chapter 6.5,6.1.