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sqlite

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#sqlite

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About

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Chapter 1: Getting started with sqlite

Versions

Version	Major Changes	Release Date
3.0		2004-06-18
3.7.11	SELECT max(x), y	2012-03-20
3.8.3	CTEs	2014-02-11

Examples

Installation

SQLite is a C library that is typically compiled directly into the application by downloading the source code of the latest version, and adding the `sqlite3.c` file to the project.

Many script languages (e.g., Perl, Python, Ruby, etc.) and frameworks (e.g., Android) have support for SQLite; this is done with a built-in copy of the SQLite library, which does not need to be installed separately.

For testing SQL, it might be useful to use the command-line shell (`sqlite3` or `sqlite3.exe`). It is already shipped with most Linux distributions; on Windows, download the precompiled binaries in the `sqlite-tools` package, and extract them somewhere.

Documentation

SQLite already has extensive documentation, which should not be duplicated here.

Read Getting started with sqlite online: https://riptutorial.com/sqlite/topic/1753/getting-started-with-sqlite

Chapter 2: Command line dot-commands

Introduction

The `sqlite3` command-line shell implements an additional set of commands (which are not available in programs that use the SQLite library). Official documentation: Special commands to `sqlite3`

Examples

Exporting and importing a table as an SQL script

Exporting a database is a simple two step process:

```
sqlite> .output mydatabase_dump.sql
sqlite> .dump
```

Exporting a table is pretty similar:

```
sqlite> .output mytable_dump.sql
sqlite> .dump mytable
```

The output file needs to be defined with `.output` prior to using `.dump`; otherwise, the text is just output to the screen.

Importing is even simpler:

```
sqlite> .read mytable_dump.sql
```

Read Command line dot-commands online: https://riptutorial.com/sqlite/topic/3789/command-line-dot-commands

Chapter 3: Data types

Remarks

official documentation: Datatypes In SQLite Version 3

Examples

TYPEOF function

```
sqlite> SELECT TYPEOF(NULL);
null
sqlite> SELECT TYPEOF(42);
integer
sqlite> SELECT TYPEOF(3.141592653589793);
real
sqlite> SELECT TYPEOF('Hello, world!');
text
sqlite> SELECT TYPEOF(X'0123456789ABCDEF');
blob
```

Using booleans

For booleans, SQLite uses integers `0` and `1`:

```
sqlite> SELECT 2 + 2 = 4;
1
sqlite> SELECT 'a' = 'b';
0
sqlite> SELECT typeof('a' = 'b');
integer
```

```
> CREATE TABLE Users ( Name, IsAdmin );
> INSERT INTO Users VALUES ('root', 1);
> INSERT INTO Users VALUES ('john', 0);
> SELECT Name FROM Users WHERE IsAdmin;
root
```

Enforcing column types

SQLite uses dynamic typing and ignores declared column types:

```
> CREATE TABLE Test (
      Col1 INTEGER,
      Col2 VARCHAR(2),       -- length is ignored, too
      Col3 BLOB,
      Col4,                  -- no type required
      Col5 FLUFFY BUNNIES    -- use whatever you want
  );
> INSERT INTO Test VALUES (1, 1, 1, 1, 1);
```

```
> INSERT INTO Test VALUES ('xxx', 'xxx', 'xxx', 'xxx', 'xxx');
> SELECT * FROM Test;
1   1   1   1   1
xxx xxx xxx xxx xxx
```

(However, declared column types are used for type affinity.)

To enforce types, you have to add a constraint with the typeof() function:

```
CREATE TABLE Tab (
    Col1 TEXT   CHECK (typeof(Col1) = 'text' AND length(Col1) <= 10),
    [...]
);
```

(If such a column should be NULLable, you have to explicitly allow `'null'`.)

Date/time types

SQLite has no separate data type for date or time values.

ISO8601 strings

The built-in keywords `CURRENT_DATE`, `CURRENT_TIME`, and `CURRENT_TIMESTAMP` return strings in ISO8601 format:

```
> SELECT CURRENT_DATE, CURRENT_TIME, CURRENT_TIMESTAMP;
CURRENT_DATE  CURRENT_TIME  CURRENT_TIMESTAMP
------------  ------------  -------------------
2016-07-08    12:34:56      2016-07-08 12:34:56
```

Such values are also understood by all built-in date/time functions:

```
> SELECT strftime('%Y', '2016-07-08');
2016
```

Julian day numbers

The built-in date/time functions interpret numbers as Julian days:

```
> SELECT datetime(2457578.02425926);
2016-07-08 12:34:56
```

The `julianday()` function converts any supported date/time value into a Julian day number:

```
> SELECT julianday('2016-07-08 12:34:56');
2457578.02425926
```

Unix timestamps

The built-in date/time functions can interpret numbers as Unix timestamps with the `unixepoch` modifier:

```
> SELECT datetime(0, 'unixepoch');
1970-01-01 00:00:00
```

The `strftime()` function can convert any supported date/time value into a Unix timestamp:

```
> SELECT strftime('%s', '2016-07-08 12:34:56');
1467981296
```

unsupported formats

It would be possible to store date/time values in any other format in the database, but the built-in date/time functions will not parse them, and return NULL:

```
> SELECT time('1:30:00');   -- not two digits

> SELECT datetime('8 Jul 2016');
□
```

Read Data types online: https://riptutorial.com/sqlite/topic/5252/data-types

Chapter 4: PRAGMA Statements

Remarks

The SQLite documentation has a reference of all PRAGMA statements.

Examples

PRAGMAs with permanent effects

Most PRAGMA statements affect only the current database connection, which means that they have to be re-applied whenever the database has been opened.

However, the following PRAGMAs write to the database file, and can be executed at any time (but in some cases, not inside a transaction):

- application_id
- journal_mode when enabling or disabling WAL mode
- schema_version
- user_version
- wal_checkpoint

The following PRAGMA settings set properties of the database file which cannot be changed after creation, so they must be executed before the first actual write to the database:

- auto_vacuum (can also be changed before VACUUM)
- encoding
- legacy_file_format
- page_size (can also be changed before VACUUM)

For example:

```
-- open a connection to a not-yet-existing DB file
PRAGMA page_size = 4096;
PRAGMA auto_vacuum = INCREMENTAL;
CREATE TABLE t(x);              -- database is created here, with the above settings
```

Read PRAGMA Statements online: https://riptutorial.com/sqlite/topic/5223/pragma-statements

Chapter 5: sqlite3_stmt: Prepared Statement (C API)

Remarks

official documentation: Prepared Statement Object

Examples

Executing a Statement

A statement is constructed with a function such as sqlite3_prepare_v2().

A prepared statement object *must* be cleaned up with sqlite3_finalize(). Do not forget this in case of an error.

If parameters are used, set their values with the sqlite3_bind_xxx() functions.

The actual execution happens when sqlite3_step() is called.

```
const char *sql = "INSERT INTO MyTable(ID, Name) VALUES (?, ?)";
sqlite3_stmt *stmt;
int err;

err = sqlite3_prepare_v2(db, sql, -1, &stmt, NULL);
if (err != SQLITE_OK) {
    printf("prepare failed: %s\n", sqlite3_errmsg(db));
    return /* failure */;
}

sqlite3_bind_int (stmt, 1, 42);                          /* ID */
sqlite3_bind_text(stmt, 2, "Bob", -1, SQLITE_TRANSIENT); /* name */

err = sqlite3_step(stmt);
if (err != SQLITE_DONE) {
    printf("execution failed: %s\n", sqlite3_errmsg(db));
    sqlite3_finalize(stmt);
    return /* failure */;
}

sqlite3_finalize(stmt);
return /* success */;
```

Reading Data from a Cursor

A SELECT query is executed like any other statement. To read the returned data, call sqlite3_step() in a loop. It returns:

- SQLITE_ROW: if the data for the next row is available, or

- SQLITE_DONE: if there are no more rows, or
- any error code.

If a query does not return any rows, the very first step returns SQLITE_DONE.

To read the data from the current row, call the sqlite3_column_xxx() functions:

```
const char *sql = "SELECT ID, Name FROM MyTable";
sqlite3_stmt *stmt;
int err;

err = sqlite3_prepare_v2(db, sql, -1, &stmt, NULL);
if (err != SQLITE_OK) {
    printf("prepare failed: %s\n", sqlite3_errmsg(db));
    return /* failure */;
}

for (;;) {
    err = sqlite3_step(stmt);
    if (err != SQLITE_ROW)
        break;

    int         id   = sqlite3_column_int (stmt, 0);
    const char *name = sqlite3_column_text(stmt, 1);
    if (name == NULL)
        name = "(NULL)";
    printf("ID: %d, Name: %s\n", id, name);
}

if (err != SQLITE_DONE) {
    printf("execution failed: %s\n", sqlite3_errmsg(db));
    sqlite3_finalize(stmt);
    return /* failure */;
}

sqlite3_finalize(stmt);
return /* success */;
```

Executing a prepared statement multiple times

After a statement was executed, a call to sqlite3_reset() brings it back into the original state so that it can be re-executed.

Typically, while the statement itself stays the same, the parameters are changed:

```
const char *sql = "INSERT INTO MyTable(ID, Name) VALUES (?, ?)";
sqlite3_stmt *stmt;
int err;

err = sqlite3_prepare_v2(db, sql, -1, &stmt, NULL);
if (err != SQLITE_OK) {
    printf("prepare failed: %s\n", sqlite3_errmsg(db));
    return /* failure */;
}

for (...) {
    sqlite3_bind_int (stmt, 1, ...);   /* ID */
```

```
    sqlite3_bind_text(stmt, 2, ...);   /* name */

    err = sqlite3_step(stmt);
    if (err != SQLITE_DONE) {
        printf("execution failed: %s\n", sqlite3_errmsg(db));
        sqlite3_finalize(stmt);
        return /* failure */;
    }

    sqlite3_reset(stmt);
}

sqlite3_finalize(stmt);
return /* success */;
```

Read sqlite3_stmt: Prepared Statement (C API) online:
https://riptutorial.com/sqlite/topic/5456/sqlite3-stmt--prepared-statement--c-api-

Credits

S. No	Chapters	Contributors
1	Getting started with sqlite	CL., Community, e4c5, H. Pauwelyn
2	Command line dot-commands	CL., e4c5, James Toomey, Lasse Vågsæther Karlsen, ravenspoint, Thinkeye
3	Data types	CL.
4	PRAGMA Statements	CL., springy76
5	sqlite3_stmt: Prepared Statement (C API)	CL.