

MySQL Tutorial

Abstract

This is the MySQL Tutorial from the MySQL 5.1 Reference Manual.

For legal information, see the [Legal Notices](#).

For help with using MySQL, please visit either the [MySQL Forums](#) or [MySQL Mailing Lists](#), where you can discuss your issues with other MySQL users.

For additional documentation on MySQL products, including translations of the documentation into other languages, and downloadable versions in variety of formats, including HTML and PDF formats, see the [MySQL Documentation Library](#).

Document generated on: 2015-11-25 (revision: 45635)

Table of Contents

Preface and Legal Notices	v
1 Tutorial	1
2 Connecting to and Disconnecting from the Server	3
3 Entering Queries	5
4 Creating and Using a Database	9
4.1 Creating and Selecting a Database	10
4.2 Creating a Table	11
4.3 Loading Data into a Table	12
4.4 Retrieving Information from a Table	13
4.4.1 Selecting All Data	14
4.4.2 Selecting Particular Rows	14
4.4.3 Selecting Particular Columns	15
4.4.4 Sorting Rows	17
4.4.5 Date Calculations	18
4.4.6 Working with NULL Values	20
4.4.7 Pattern Matching	21
4.4.8 Counting Rows	23
4.4.9 Using More Than one Table	25
5 Getting Information About Databases and Tables	29
6 Using mysql in Batch Mode	31
7 Examples of Common Queries	33
7.1 The Maximum Value for a Column	33
7.2 The Row Holding the Maximum of a Certain Column	34
7.3 Maximum of Column per Group	34
7.4 The Rows Holding the Group-wise Maximum of a Certain Column	34
7.5 Using User-Defined Variables	35
7.6 Using Foreign Keys	36
7.7 Searching on Two Keys	37
7.8 Calculating Visits Per Day	37
7.9 Using AUTO_INCREMENT	38
8 Using MySQL with Apache	41
A Licenses for Third-Party Components	43
A.1 ANTLR 3 License	45
A.2 dtoa.c License	45
A.3 Editline Library (libedit) License	46
A.4 FindGTest.cmake License	48
A.5 Fred Fish's Dbug Library License	49
A.6 getarg License	50
A.7 GNU General Public License Version 2.0, June 1991	50
A.8 GNU Lesser General Public License Version 2.1, February 1999	56
A.9 GNU Libtool License	64
A.10 GNU Readline License	64
A.11 Google Controlling Master Thread I/O Rate Patch License	65
A.12 Google Perftools (TCMalloc utility) License	65
A.13 Google SMP Patch License	66
A.14 lib_sql.cc License	67
A.15 libevent License	67
A.16 Linux-PAM License	69
A.17 md5 (Message-Digest Algorithm 5) License	70
A.18 memcached License	70
A.19 nt_servc (Windows NT Service class library) License	71

A.20 OpenPAM License	71
A.21 Paramiko License	71
A.22 Percona Multiple I/O Threads Patch License	72
A.23 RegEX-Spencer Library License	72
A.24 RFC 3174 - US Secure Hash Algorithm 1 (SHA1) License	73
A.25 Richard A. O'Keefe String Library License	73
A.26 SHA-1 in C License	74
A.27 zlib License	74

Preface and Legal Notices

This is the MySQL Tutorial from the MySQL 5.1 Reference Manual.

Legal Notices

Copyright © 1997, 2015, Oracle and/or its affiliates. All rights reserved.

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, then the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at

<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit

<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

This documentation is NOT distributed under a GPL license. Use of this documentation is subject to the following terms:

You may create a printed copy of this documentation solely for your own personal use. Conversion to other formats is allowed as long as the actual content is not altered or edited in any way. You shall not publish or distribute this documentation in any form or on any media, except if you distribute the documentation in a manner similar to how Oracle disseminates it (that is, electronically for download on a Web site with the software) or on a CD-ROM or similar medium, provided however that the documentation is disseminated together with the software on the same medium. Any other use, such as any dissemination of printed copies or use of this documentation, in whole or in part, in another publication, requires the prior written consent from an authorized representative of Oracle. Oracle and/or its affiliates reserve any and all rights to this documentation not expressly granted above.

Chapter 1 Tutorial

This chapter provides a tutorial introduction to MySQL by showing how to use the `mysql` client program to create and use a simple database. `mysql` (sometimes referred to as the “terminal monitor” or just “monitor”) is an interactive program that enables you to connect to a MySQL server, run queries, and view the results. `mysql` may also be used in batch mode: you place your queries in a file beforehand, then tell `mysql` to execute the contents of the file. Both ways of using `mysql` are covered here.

To see a list of options provided by `mysql`, invoke it with the `--help` option:

```
shell> mysql --help
```

This chapter assumes that `mysql` is installed on your machine and that a MySQL server is available to which you can connect. If this is not true, contact your MySQL administrator. (If *you* are the administrator, you need to consult the relevant portions of this manual, such as [MySQL Server Administration](#).)

This chapter describes the entire process of setting up and using a database. If you are interested only in accessing an existing database, you may want to skip over the sections that describe how to create the database and the tables it contains.

Because this chapter is tutorial in nature, many details are necessarily omitted. Consult the relevant sections of the manual for more information on the topics covered here.

Chapter 2 Connecting to and Disconnecting from the Server

To connect to the server, you will usually need to provide a MySQL user name when you invoke `mysql` and, most likely, a password. If the server runs on a machine other than the one where you log in, you will also need to specify a host name. Contact your administrator to find out what connection parameters you should use to connect (that is, what host, user name, and password to use). Once you know the proper parameters, you should be able to connect like this:

```
shell> mysql -h host -u user -p
Enter password: *****
```

`host` and `user` represent the host name where your MySQL server is running and the user name of your MySQL account. Substitute appropriate values for your setup. The `*****` represents your password; enter it when `mysql` displays the `Enter password:` prompt.

If that works, you should see some introductory information followed by a `mysql>` prompt:

```
shell> mysql -h host -u user -p
Enter password: *****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 25338 to server version: 5.1.73-standard
Type 'help;' or '\h' for help. Type '\c' to clear the buffer.
mysql>
```

The `mysql>` prompt tells you that `mysql` is ready for you to enter SQL statements.

If you are logging in on the same machine that MySQL is running on, you can omit the host, and simply use the following:

```
shell> mysql -u user -p
```

If, when you attempt to log in, you get an error message such as `ERROR 2002 (HY000): Can't connect to local MySQL server through socket '/tmp/mysql.sock' (2)`, it means that the MySQL server daemon (Unix) or service (Windows) is not running. Consult the administrator or see the section of [Installing and Upgrading MySQL](#) that is appropriate to your operating system.

For help with other problems often encountered when trying to log in, see [Common Errors When Using MySQL Programs](#).

Some MySQL installations permit users to connect as the anonymous (unnamed) user to the server running on the local host. If this is the case on your machine, you should be able to connect to that server by invoking `mysql` without any options:

```
shell> mysql
```

After you have connected successfully, you can disconnect any time by typing `QUIT` (or `\q`) at the `mysql>` prompt:

```
mysql> QUIT
Bye
```

On Unix, you can also disconnect by pressing Control+D.

Most examples in the following sections assume that you are connected to the server. They indicate this by the `mysql>` prompt.

Chapter 3 Entering Queries

Make sure that you are connected to the server, as discussed in the previous section. Doing so does not in itself select any database to work with, but that is okay. At this point, it is more important to find out a little about how to issue queries than to jump right in creating tables, loading data into them, and retrieving data from them. This section describes the basic principles of entering queries, using several queries you can try out to familiarize yourself with how `mysql` works.

Here is a simple query that asks the server to tell you its version number and the current date. Type it in as shown here following the `mysql>` prompt and press Enter:

```
mysql> SELECT VERSION(), CURRENT_DATE;
+-----+-----+
| VERSION() | CURRENT_DATE |
+-----+-----+
| 5.1.2-alpha-log | 2005-10-11 |
+-----+-----+
1 row in set (0.01 sec)
mysql>
```

This query illustrates several things about `mysql`:

- A query normally consists of an SQL statement followed by a semicolon. (There are some exceptions where a semicolon may be omitted. `QUIT`, mentioned earlier, is one of them. We'll get to others later.)
- When you issue a query, `mysql` sends it to the server for execution and displays the results, then prints another `mysql>` prompt to indicate that it is ready for another query.
- `mysql` displays query output in tabular form (rows and columns). The first row contains labels for the columns. The rows following are the query results. Normally, column labels are the names of the columns you fetch from database tables. If you're retrieving the value of an expression rather than a table column (as in the example just shown), `mysql` labels the column using the expression itself.
- `mysql` shows how many rows were returned and how long the query took to execute, which gives you a rough idea of server performance. These values are imprecise because they represent wall clock time (not CPU or machine time), and because they are affected by factors such as server load and network latency. (For brevity, the "rows in set" line is sometimes not shown in the remaining examples in this chapter.)

Keywords may be entered in any lettercase. The following queries are equivalent:

```
mysql> SELECT VERSION(), CURRENT_DATE;
mysql> select version(), current_date;
mysql> SeLeCt vErSiOn(), current_DATE;
```

Here is another query. It demonstrates that you can use `mysql` as a simple calculator:

```
mysql> SELECT SIN(PI()/4), (4+1)*5;
+-----+-----+
| SIN(PI()/4) | (4+1)*5 |
+-----+-----+
| 0.70710678118655 | 25 |
+-----+-----+
1 row in set (0.02 sec)
```

The queries shown thus far have been relatively short, single-line statements. You can even enter multiple statements on a single line. Just end each one with a semicolon:

```
mysql> SELECT VERSION(); SELECT NOW();
+-----+
| VERSION() |
+-----+
| 5.1.2-alpha-log |
+-----+
1 row in set (0.00 sec)
+-----+
| NOW() |
+-----+
| 2005-10-11 15:15:00 |
+-----+
1 row in set (0.00 sec)
```

A query need not be given all on a single line, so lengthy queries that require several lines are not a problem. `mysql` determines where your statement ends by looking for the terminating semicolon, not by looking for the end of the input line. (In other words, `mysql` accepts free-format input: it collects input lines but does not execute them until it sees the semicolon.)

Here is a simple multiple-line statement:

```
mysql> SELECT
-> USER()
-> ,
-> CURRENT_DATE;
+-----+
| USER() | CURRENT_DATE |
+-----+
| jon@localhost | 2005-10-11 |
+-----+
```

In this example, notice how the prompt changes from `mysql>` to `->` after you enter the first line of a multiple-line query. This is how `mysql` indicates that it has not yet seen a complete statement and is waiting for the rest. The prompt is your friend, because it provides valuable feedback. If you use that feedback, you can always be aware of what `mysql` is waiting for.

If you decide you do not want to execute a query that you are in the process of entering, cancel it by typing `\c`:

```
mysql> SELECT
-> USER()
-> \c
mysql>
```

Here, too, notice the prompt. It switches back to `mysql>` after you type `\c`, providing feedback to indicate that `mysql` is ready for a new query.

The following table shows each of the prompts you may see and summarizes what they mean about the state that `mysql` is in.

Prompt	Meaning
<code>mysql></code>	Ready for new query
<code>-></code>	Waiting for next line of multiple-line query
<code>'></code>	Waiting for next line, waiting for completion of a string that began with a single quote (" <code>'</code> ")
<code>"></code>	Waiting for next line, waiting for completion of a string that began with a double quote (" <code>"</code> ")
<code>`></code>	Waiting for next line, waiting for completion of an identifier that began with a backtick (" <code>`</code> ")

Prompt	Meaning
<code>/*></code>	Waiting for next line, waiting for completion of a comment that began with <code>/*</code>

Multiple-line statements commonly occur by accident when you intend to issue a query on a single line, but forget the terminating semicolon. In this case, `mysql` waits for more input:

```
mysql> SELECT USER()
->
```

If this happens to you (you think you've entered a statement but the only response is a `->` prompt), most likely `mysql` is waiting for the semicolon. If you don't notice what the prompt is telling you, you might sit there for a while before realizing what you need to do. Enter a semicolon to complete the statement, and `mysql` executes it:

```
mysql> SELECT USER()
-> ;
+-----+
| USER() |
+-----+
| jon@localhost |
+-----+
```

The `'>` and `>>` prompts occur during string collection (another way of saying that MySQL is waiting for completion of a string). In MySQL, you can write strings surrounded by either `"` or `'` characters (for example, `'hello'` or `"goodbye"`), and `mysql` lets you enter strings that span multiple lines. When you see a `'>` or `>>` prompt, it means that you have entered a line containing a string that begins with a `"` or `'` quote character, but have not yet entered the matching quote that terminates the string. This often indicates that you have inadvertently left out a quote character. For example:

```
mysql> SELECT * FROM my_table WHERE name = 'Smith AND age < 30;
'>
```

If you enter this `SELECT` statement, then press **Enter** and wait for the result, nothing happens. Instead of wondering why this query takes so long, notice the clue provided by the `'>` prompt. It tells you that `mysql` expects to see the rest of an unterminated string. (Do you see the error in the statement? The string `'Smith` is missing the second single quotation mark.)

At this point, what do you do? The simplest thing is to cancel the query. However, you cannot just type `\c` in this case, because `mysql` interprets it as part of the string that it is collecting. Instead, enter the closing quote character (so `mysql` knows you've finished the string), then type `\c`:

```
mysql> SELECT * FROM my_table WHERE name = 'Smith AND age < 30;
'> '\c
mysql>
```

The prompt changes back to `mysql>`, indicating that `mysql` is ready for a new query.

The ``>` prompt is similar to the `'>` and `>>` prompts, but indicates that you have begun but not completed a backtick-quoted identifier.

It is important to know what the `'>`, `>>`, and ``>` prompts signify, because if you mistakenly enter an unterminated string, any further lines you type appear to be ignored by `mysql`—including a line containing `QUIT`. This can be quite confusing, especially if you do not know that you need to supply the terminating quote before you can cancel the current query.

Chapter 4 Creating and Using a Database

Table of Contents

4.1 Creating and Selecting a Database	10
4.2 Creating a Table	11
4.3 Loading Data into a Table	12
4.4 Retrieving Information from a Table	13
4.4.1 Selecting All Data	14
4.4.2 Selecting Particular Rows	14
4.4.3 Selecting Particular Columns	15
4.4.4 Sorting Rows	17
4.4.5 Date Calculations	18
4.4.6 Working with NULL Values	20
4.4.7 Pattern Matching	21
4.4.8 Counting Rows	23
4.4.9 Using More Than one Table	25

Once you know how to enter SQL statements, you are ready to access a database.

Suppose that you have several pets in your home (your menagerie) and you would like to keep track of various types of information about them. You can do so by creating tables to hold your data and loading them with the desired information. Then you can answer different sorts of questions about your animals by retrieving data from the tables. This section shows you how to perform the following operations:

- Create a database
- Create a table
- Load data into the table
- Retrieve data from the table in various ways
- Use multiple tables

The menagerie database is simple (deliberately), but it is not difficult to think of real-world situations in which a similar type of database might be used. For example, a database like this could be used by a farmer to keep track of livestock, or by a veterinarian to keep track of patient records. A menagerie distribution containing some of the queries and sample data used in the following sections can be obtained from the MySQL Web site. It is available in both compressed `tar` file and Zip formats at <http://dev.mysql.com/doc/>.

Use the `SHOW` statement to find out what databases currently exist on the server:

```
mysql> SHOW DATABASES;
+-----+
| Database |
+-----+
| mysql   |
| test    |
| tmp     |
+-----+
```

The `mysql` database describes user access privileges. The `test` database often is available as a workspace for users to try things out.

The list of databases displayed by the statement may be different on your machine; `SHOW DATABASES` does not show databases that you have no privileges for if you do not have the `SHOW DATABASES` privilege. See [SHOW DATABASES Syntax](#).

If the `test` database exists, try to access it:

```
mysql> USE test
Database changed
```

`USE`, like `QUIT`, does not require a semicolon. (You can terminate such statements with a semicolon if you like; it does no harm.) The `USE` statement is special in another way, too: it must be given on a single line.

You can use the `test` database (if you have access to it) for the examples that follow, but anything you create in that database can be removed by anyone else with access to it. For this reason, you should probably ask your MySQL administrator for permission to use a database of your own. Suppose that you want to call yours `menagerie`. The administrator needs to execute a statement like this:

```
mysql> GRANT ALL ON menagerie.* TO 'your_mysql_name'@'your_client_host';
```

where `your_mysql_name` is the MySQL user name assigned to you and `your_client_host` is the host from which you connect to the server.

4.1 Creating and Selecting a Database

If the administrator creates your database for you when setting up your permissions, you can begin using it. Otherwise, you need to create it yourself:

```
mysql> CREATE DATABASE menagerie;
```

Under Unix, database names are case sensitive (unlike SQL keywords), so you must always refer to your database as `menagerie`, not as `Menagerie`, `MENAGERIE`, or some other variant. This is also true for table names. (Under Windows, this restriction does not apply, although you must refer to databases and tables using the same lettercase throughout a given query. However, for a variety of reasons, the recommended best practice is always to use the same lettercase that was used when the database was created.)

Note

If you get an error such as `ERROR 1044 (42000): Access denied for user 'monty'@'localhost' to database 'menagerie'` when attempting to create a database, this means that your user account does not have the necessary privileges to do so. Discuss this with the administrator or see [The MySQL Access Privilege System](#).

Creating a database does not select it for use; you must do that explicitly. To make `menagerie` the current database, use this statement:

```
mysql> USE menagerie
Database changed
```

Your database needs to be created only once, but you must select it for use each time you begin a `mysql` session. You can do this by issuing a `USE` statement as shown in the example. Alternatively, you can select

the database on the command line when you invoke `mysql`. Just specify its name after any connection parameters that you might need to provide. For example:

```
shell> mysql -h host -u user -p menagerie
Enter password: *****
```

Important

`menagerie` in the command just shown is **not** your password. If you want to supply your password on the command line after the `-p` option, you must do so with no intervening space (for example, as `-pmypassword`, not as `-p mypassword`). However, putting your password on the command line is not recommended, because doing so exposes it to snooping by other users logged in on your machine.

Note

You can see at any time which database is currently selected using `SELECT DATABASE()`.

4.2 Creating a Table

Creating the database is the easy part, but at this point it is empty, as `SHOW TABLES` tells you:

```
mysql> SHOW TABLES;
Empty set (0.00 sec)
```

The harder part is deciding what the structure of your database should be: what tables you need and what columns should be in each of them.

You want a table that contains a record for each of your pets. This can be called the `pet` table, and it should contain, as a bare minimum, each animal's name. Because the name by itself is not very interesting, the table should contain other information. For example, if more than one person in your family keeps pets, you might want to list each animal's owner. You might also want to record some basic descriptive information such as species and sex.

How about age? That might be of interest, but it is not a good thing to store in a database. Age changes as time passes, which means you'd have to update your records often. Instead, it is better to store a fixed value such as date of birth. Then, whenever you need age, you can calculate it as the difference between the current date and the birth date. MySQL provides functions for doing date arithmetic, so this is not difficult. Storing birth date rather than age has other advantages, too:

- You can use the database for tasks such as generating reminders for upcoming pet birthdays. (If you think this type of query is somewhat silly, note that it is the same question you might ask in the context of a business database to identify clients to whom you need to send out birthday greetings in the current week or month, for that computer-assisted personal touch.)
- You can calculate age in relation to dates other than the current date. For example, if you store death date in the database, you can easily calculate how old a pet was when it died.

You can probably think of other types of information that would be useful in the `pet` table, but the ones identified so far are sufficient: name, owner, species, sex, birth, and death.

Use a `CREATE TABLE` statement to specify the layout of your table:

```
mysql> CREATE TABLE pet (name VARCHAR(20), owner VARCHAR(20),
-> species VARCHAR(20), sex CHAR(1), birth DATE, death DATE);
```

`VARCHAR` is a good choice for the `name`, `owner`, and `species` columns because the column values vary in length. The lengths in those column definitions need not all be the same, and need not be `20`. You can normally pick any length from `1` to `65535`, whatever seems most reasonable to you. If you make a poor choice and it turns out later that you need a longer field, MySQL provides an `ALTER TABLE` statement.

Several types of values can be chosen to represent sex in animal records, such as `'m'` and `'f'`, or perhaps `'male'` and `'female'`. It is simplest to use the single characters `'m'` and `'f'`.

The use of the `DATE` data type for the `birth` and `death` columns is a fairly obvious choice.

Once you have created a table, `SHOW TABLES` should produce some output:

```
mysql> SHOW TABLES;
+-----+
| Tables in menagerie |
+-----+
| pet                |
+-----+
```

To verify that your table was created the way you expected, use a `DESCRIBE` statement:

```
mysql> DESCRIBE pet;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| name  | varchar(20) | YES  |     | NULL    |       |
| owner | varchar(20) | YES  |     | NULL    |       |
| species | varchar(20) | YES  |     | NULL    |       |
| sex   | char(1)    | YES  |     | NULL    |       |
| birth | date       | YES  |     | NULL    |       |
| death | date       | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
```

You can use `DESCRIBE` any time, for example, if you forget the names of the columns in your table or what types they have.

For more information about MySQL data types, see [Data Types](#).

4.3 Loading Data into a Table

After creating your table, you need to populate it. The `LOAD DATA` and `INSERT` statements are useful for this.

Suppose that your pet records can be described as shown here. (Observe that MySQL expects dates in `'YYYY-MM-DD'` format; this may be different from what you are used to.)

name	owner	species	sex	birth	death
Fluffy	Harold	cat	f	1993-02-04	
Claws	Gwen	cat	m	1994-03-17	
Buffy	Harold	dog	f	1989-05-13	
Fang	Benny	dog	m	1990-08-27	
Bowser	Diane	dog	m	1979-08-31	1995-07-29

name	owner	species	sex	birth	death
Chirpy	Gwen	bird	f	1998-09-11	
Whistler	Gwen	bird		1997-12-09	
Slim	Benny	snake	m	1996-04-29	

Because you are beginning with an empty table, an easy way to populate it is to create a text file containing a row for each of your animals, then load the contents of the file into the table with a single statement.

You could create a text file `pet.txt` containing one record per line, with values separated by tabs, and given in the order in which the columns were listed in the `CREATE TABLE` statement. For missing values (such as unknown sexes or death dates for animals that are still living), you can use `NULL` values. To represent these in your text file, use `\N` (backslash, capital-N). For example, the record for Whistler the bird would look like this (where the whitespace between values is a single tab character):

```
Whistler      Gwen      bird      \N      1997-12-09      \N
```

To load the text file `pet.txt` into the `pet` table, use this statement:

```
mysql> LOAD DATA LOCAL INFILE '/path/pet.txt' INTO TABLE pet;
```

If you created the file on Windows with an editor that uses `\r\n` as a line terminator, you should use this statement instead:

```
mysql> LOAD DATA LOCAL INFILE '/path/pet.txt' INTO TABLE pet
-> LINES TERMINATED BY '\r\n';
```

(On an Apple machine running OS X, you would likely want to use `LINES TERMINATED BY '\r'`.)

You can specify the column value separator and end of line marker explicitly in the `LOAD DATA` statement if you wish, but the defaults are tab and linefeed. These are sufficient for the statement to read the file `pet.txt` properly.

If the statement fails, it is likely that your MySQL installation does not have local file capability enabled by default. See [Security Issues with LOAD DATA LOCAL](#), for information on how to change this.

When you want to add new records one at a time, the `INSERT` statement is useful. In its simplest form, you supply values for each column, in the order in which the columns were listed in the `CREATE TABLE` statement. Suppose that Diane gets a new hamster named “Puffball.” You could add a new record using an `INSERT` statement like this:

```
mysql> INSERT INTO pet
-> VALUES ('Puffball','Diane','hamster','f','1999-03-30',NULL);
```

String and date values are specified as quoted strings here. Also, with `INSERT`, you can insert `NULL` directly to represent a missing value. You do not use `\N` like you do with `LOAD DATA`.

From this example, you should be able to see that there would be a lot more typing involved to load your records initially using several `INSERT` statements rather than a single `LOAD DATA` statement.

4.4 Retrieving Information from a Table

The `SELECT` statement is used to pull information from a table. The general form of the statement is:

```
SELECT what_to_select
FROM which_table
WHERE conditions_to_satisfy;
```

what_to_select indicates what you want to see. This can be a list of columns, or `*` to indicate “all columns.” *which_table* indicates the table from which you want to retrieve data. The `WHERE` clause is optional. If it is present, *conditions_to_satisfy* specifies one or more conditions that rows must satisfy to qualify for retrieval.

4.4.1 Selecting All Data

The simplest form of `SELECT` retrieves everything from a table:

```
mysql> SELECT * FROM pet;
```

name	owner	species	sex	birth	death
Fluffy	Harold	cat	f	1993-02-04	NULL
Claws	Gwen	cat	m	1994-03-17	NULL
Buffy	Harold	dog	f	1989-05-13	NULL
Fang	Benny	dog	m	1990-08-27	NULL
Bowser	Diane	dog	m	1979-08-31	1995-07-29
Chirpy	Gwen	bird	f	1998-09-11	NULL
Whistler	Gwen	bird	NULL	1997-12-09	NULL
Slim	Benny	snake	m	1996-04-29	NULL
Puffball	Diane	hamster	f	1999-03-30	NULL

This form of `SELECT` is useful if you want to review your entire table, for example, after you've just loaded it with your initial data set. For example, you may happen to think that the birth date for Bowser doesn't seem quite right. Consulting your original pedigree papers, you find that the correct birth year should be 1989, not 1979.

There are at least two ways to fix this:

- Edit the file `pet.txt` to correct the error, then empty the table and reload it using `DELETE` and `LOAD DATA`:

```
mysql> DELETE FROM pet;
mysql> LOAD DATA LOCAL INFILE 'pet.txt' INTO TABLE pet;
```

However, if you do this, you must also re-enter the record for Puffball.

- Fix only the erroneous record with an `UPDATE` statement:

```
mysql> UPDATE pet SET birth = '1989-08-31' WHERE name = 'Bowser';
```

The `UPDATE` changes only the record in question and does not require you to reload the table.

4.4.2 Selecting Particular Rows

As shown in the preceding section, it is easy to retrieve an entire table. Just omit the `WHERE` clause from the `SELECT` statement. But typically you don't want to see the entire table, particularly when it becomes large. Instead, you're usually more interested in answering a particular question, in which case you specify some constraints on the information you want. Let's look at some selection queries in terms of questions about your pets that they answer.

You can select only particular rows from your table. For example, if you want to verify the change that you made to Bowser's birth date, select Bowser's record like this:

```
mysql> SELECT * FROM pet WHERE name = 'Bowser';
```

name	owner	species	sex	birth	death
Bowser	Diane	dog	m	1989-08-31	1995-07-29

The output confirms that the year is correctly recorded as 1989, not 1979.

String comparisons normally are case-insensitive, so you can specify the name as 'bowser', 'BOWSER', and so forth. The query result is the same.

You can specify conditions on any column, not just `name`. For example, if you want to know which animals were born during or after 1998, test the `birth` column:

```
mysql> SELECT * FROM pet WHERE birth >= '1998-1-1';
```

name	owner	species	sex	birth	death
Chirpy	Gwen	bird	f	1998-09-11	NULL
Puffball	Diane	hamster	f	1999-03-30	NULL

You can combine conditions, for example, to locate female dogs:

```
mysql> SELECT * FROM pet WHERE species = 'dog' AND sex = 'f';
```

name	owner	species	sex	birth	death
Buffy	Harold	dog	f	1989-05-13	NULL

The preceding query uses the `AND` logical operator. There is also an `OR` operator:

```
mysql> SELECT * FROM pet WHERE species = 'snake' OR species = 'bird';
```

name	owner	species	sex	birth	death
Chirpy	Gwen	bird	f	1998-09-11	NULL
Whistler	Gwen	bird	NULL	1997-12-09	NULL
Slim	Benny	snake	m	1996-04-29	NULL

`AND` and `OR` may be intermixed, although `AND` has higher precedence than `OR`. If you use both operators, it is a good idea to use parentheses to indicate explicitly how conditions should be grouped:

```
mysql> SELECT * FROM pet WHERE (species = 'cat' AND sex = 'm')
    -> OR (species = 'dog' AND sex = 'f');
```

name	owner	species	sex	birth	death
Claws	Gwen	cat	m	1994-03-17	NULL
Buffy	Harold	dog	f	1989-05-13	NULL

4.4.3 Selecting Particular Columns

If you do not want to see entire rows from your table, just name the columns in which you are interested, separated by commas. For example, if you want to know when your animals were born, select the `name` and `birth` columns:

```
mysql> SELECT name, birth FROM pet;
```

name	birth
Fluffy	1993-02-04
Claws	1994-03-17
Buffy	1989-05-13
Fang	1990-08-27
Bowser	1989-08-31
Chirpy	1998-09-11
Whistler	1997-12-09
Slim	1996-04-29
Puffball	1999-03-30

To find out who owns pets, use this query:

```
mysql> SELECT owner FROM pet;
```

owner
Harold
Gwen
Harold
Benny
Diane
Gwen
Gwen
Benny
Diane

Notice that the query simply retrieves the `owner` column from each record, and some of them appear more than once. To minimize the output, retrieve each unique output record just once by adding the keyword `DISTINCT`:

```
mysql> SELECT DISTINCT owner FROM pet;
```

owner
Benny
Diane
Gwen
Harold

You can use a `WHERE` clause to combine row selection with column selection. For example, to get birth dates for dogs and cats only, use this query:

```
mysql> SELECT name, species, birth FROM pet  
-> WHERE species = 'dog' OR species = 'cat';
```

name	species	birth
Fluffy	cat	1993-02-04
Claws	cat	1994-03-17

Buffy	dog	1989-05-13
Fang	dog	1990-08-27
Bowser	dog	1989-08-31

4.4.4 Sorting Rows

You may have noticed in the preceding examples that the result rows are displayed in no particular order. It is often easier to examine query output when the rows are sorted in some meaningful way. To sort a result, use an `ORDER BY` clause.

Here are animal birthdays, sorted by date:

```
mysql> SELECT name, birth FROM pet ORDER BY birth;
+-----+-----+
| name   | birth   |
+-----+-----+
| Buffy  | 1989-05-13 |
| Bowser | 1989-08-31 |
| Fang   | 1990-08-27 |
| Fluffy | 1993-02-04 |
| Claws  | 1994-03-17 |
| Slim   | 1996-04-29 |
| Whistler | 1997-12-09 |
| Chirpy | 1998-09-11 |
| Puffball | 1999-03-30 |
+-----+-----+
```

On character type columns, sorting—like all other comparison operations—is normally performed in a case-insensitive fashion. This means that the order is undefined for columns that are identical except for their case. You can force a case-sensitive sort for a column by using `BINARY` like so: `ORDER BY BINARY col_name`.

The default sort order is ascending, with smallest values first. To sort in reverse (descending) order, add the `DESC` keyword to the name of the column you are sorting by:

```
mysql> SELECT name, birth FROM pet ORDER BY birth DESC;
+-----+-----+
| name   | birth   |
+-----+-----+
| Puffball | 1999-03-30 |
| Chirpy  | 1998-09-11 |
| Whistler | 1997-12-09 |
| Slim    | 1996-04-29 |
| Claws   | 1994-03-17 |
| Fluffy  | 1993-02-04 |
| Fang    | 1990-08-27 |
| Bowser  | 1989-08-31 |
| Buffy   | 1989-05-13 |
+-----+-----+
```

You can sort on multiple columns, and you can sort different columns in different directions. For example, to sort by type of animal in ascending order, then by birth date within animal type in descending order (youngest animals first), use the following query:

```
mysql> SELECT name, species, birth FROM pet
-> ORDER BY species, birth DESC;
+-----+-----+-----+
| name   | species | birth   |
+-----+-----+-----+
```

Chirpy	bird	1998-09-11
Whistler	bird	1997-12-09
Claws	cat	1994-03-17
Fluffy	cat	1993-02-04
Fang	dog	1990-08-27
Bowser	dog	1989-08-31
Buffy	dog	1989-05-13
Puffball	hamster	1999-03-30
Slim	snake	1996-04-29

The `DESC` keyword applies only to the column name immediately preceding it (`birth`); it does not affect the `species` column sort order.

4.4.5 Date Calculations

MySQL provides several functions that you can use to perform calculations on dates, for example, to calculate ages or extract parts of dates.

To determine how many years old each of your pets is, use the `TIMESTAMPDIFF()` function. Its arguments are the unit in which you want the result expressed, and the two date for which to take the difference. The following query shows, for each pet, the birth date, the current date, and the age in years. An *alias* (`age`) is used to make the final output column label more meaningful.

```
mysql> SELECT name, birth, CURDATE(),
->   TIMESTAMPDIFF(YEAR,birth,CURDATE()) AS age
->   FROM pet;
```

name	birth	CURDATE()	age
Fluffy	1993-02-04	2003-08-19	10
Claws	1994-03-17	2003-08-19	9
Buffy	1989-05-13	2003-08-19	14
Fang	1990-08-27	2003-08-19	12
Bowser	1989-08-31	2003-08-19	13
Chirpy	1998-09-11	2003-08-19	4
Whistler	1997-12-09	2003-08-19	5
Slim	1996-04-29	2003-08-19	7
Puffball	1999-03-30	2003-08-19	4

The query works, but the result could be scanned more easily if the rows were presented in some order. This can be done by adding an `ORDER BY name` clause to sort the output by name:

```
mysql> SELECT name, birth, CURDATE(),
->   TIMESTAMPDIFF(YEAR,birth,CURDATE()) AS age
->   FROM pet ORDER BY name;
```

name	birth	CURDATE()	age
Bowser	1989-08-31	2003-08-19	13
Buffy	1989-05-13	2003-08-19	14
Chirpy	1998-09-11	2003-08-19	4
Claws	1994-03-17	2003-08-19	9
Fang	1990-08-27	2003-08-19	12
Fluffy	1993-02-04	2003-08-19	10
Puffball	1999-03-30	2003-08-19	4
Slim	1996-04-29	2003-08-19	7
Whistler	1997-12-09	2003-08-19	5

To sort the output by `age` rather than `name`, just use a different `ORDER BY` clause:


```
mysql> SELECT name, birth, CURDATE(),
-> TIMESTAMPDIFF(YEAR,birth,CURDATE()) AS age
-> FROM pet ORDER BY age;
```

name	birth	CURDATE()	age
Chirpy	1998-09-11	2003-08-19	4
Puffball	1999-03-30	2003-08-19	4
Whistler	1997-12-09	2003-08-19	5
Slim	1996-04-29	2003-08-19	7
Claws	1994-03-17	2003-08-19	9
Fluffy	1993-02-04	2003-08-19	10
Fang	1990-08-27	2003-08-19	12
Bowser	1989-08-31	2003-08-19	13
Buffy	1989-05-13	2003-08-19	14

A similar query can be used to determine age at death for animals that have died. You determine which animals these are by checking whether the `death` value is `NULL`. Then, for those with non-`NULL` values, compute the difference between the `death` and `birth` values:

```
mysql> SELECT name, birth, death,
-> TIMESTAMPDIFF(YEAR,birth,death) AS age
-> FROM pet WHERE death IS NOT NULL ORDER BY age;
```

name	birth	death	age
Bowser	1989-08-31	1995-07-29	5

The query uses `death IS NOT NULL` rather than `death <> NULL` because `NULL` is a special value that cannot be compared using the usual comparison operators. This is discussed later. See [Section 4.4.6, “Working with NULL Values”](#).

What if you want to know which animals have birthdays next month? For this type of calculation, year and day are irrelevant; you simply want to extract the month part of the `birth` column. MySQL provides several functions for extracting parts of dates, such as `YEAR()`, `MONTH()`, and `DAYOFMONTH()`. `MONTH()` is the appropriate function here. To see how it works, run a simple query that displays the value of both `birth` and `MONTH(birth)`:

```
mysql> SELECT name, birth, MONTH(birth) FROM pet;
```

name	birth	MONTH(birth)
Fluffy	1993-02-04	2
Claws	1994-03-17	3
Buffy	1989-05-13	5
Fang	1990-08-27	8
Bowser	1989-08-31	8
Chirpy	1998-09-11	9
Whistler	1997-12-09	12
Slim	1996-04-29	4
Puffball	1999-03-30	3

Finding animals with birthdays in the upcoming month is also simple. Suppose that the current month is April. Then the month value is `4` and you can look for animals born in May (month `5`) like this:

```
mysql> SELECT name, birth FROM pet WHERE MONTH(birth) = 5;
```

name	birth
Buffy	1989-05-13

There is a small complication if the current month is December. You cannot merely add one to the month number (12) and look for animals born in month 13, because there is no such month. Instead, you look for animals born in January (month 1).

You can write the query so that it works no matter what the current month is, so that you do not have to use the number for a particular month. `DATE_ADD()` enables you to add a time interval to a given date. If you add a month to the value of `CURDATE()`, then extract the month part with `MONTH()`, the result produces the month in which to look for birthdays:

```
mysql> SELECT name, birth FROM pet
-> WHERE MONTH(birth) = MONTH(DATE_ADD(CURDATE(),INTERVAL 1 MONTH));
```

A different way to accomplish the same task is to add 1 to get the next month after the current one after using the modulo function (`MOD`) to wrap the month value to 0 if it is currently 12:

```
mysql> SELECT name, birth FROM pet
-> WHERE MONTH(birth) = MOD(MONTH(CURDATE()), 12) + 1;
```

`MONTH()` returns a number between 1 and 12. And `MOD(something,12)` returns a number between 0 and 11. So the addition has to be after the `MOD()`, otherwise we would go from November (11) to January (1).

4.4.6 Working with NULL Values

The `NULL` value can be surprising until you get used to it. Conceptually, `NULL` means “a missing unknown value” and it is treated somewhat differently from other values.

To test for `NULL`, use the `IS NULL` and `IS NOT NULL` operators, as shown here:

```
mysql> SELECT 1 IS NULL, 1 IS NOT NULL;
+-----+-----+
| 1 IS NULL | 1 IS NOT NULL |
+-----+-----+
| 0 | 1 |
+-----+-----+
```

You cannot use arithmetic comparison operators such as `=`, `<`, or `<>` to test for `NULL`. To demonstrate this for yourself, try the following query:

```
mysql> SELECT 1 = NULL, 1 <> NULL, 1 < NULL, 1 > NULL;
+-----+-----+-----+-----+
| 1 = NULL | 1 <> NULL | 1 < NULL | 1 > NULL |
+-----+-----+-----+-----+
| NULL | NULL | NULL | NULL |
+-----+-----+-----+-----+
```

Because the result of any arithmetic comparison with `NULL` is also `NULL`, you cannot obtain any meaningful results from such comparisons.

In MySQL, 0 or `NULL` means false and anything else means true. The default truth value from a boolean operation is 1.

This special treatment of `NULL` is why, in the previous section, it was necessary to determine which animals are no longer alive using `death IS NOT NULL` instead of `death <> NULL`.

Two `NULL` values are regarded as equal in a `GROUP BY`.

When doing an `ORDER BY`, `NULL` values are presented first if you do `ORDER BY ... ASC` and last if you do `ORDER BY ... DESC`.

A common error when working with `NULL` is to assume that it is not possible to insert a zero or an empty string into a column defined as `NOT NULL`, but this is not the case. These are in fact values, whereas `NULL` means “not having a value.” You can test this easily enough by using `IS [NOT] NULL` as shown:

```
mysql> SELECT 0 IS NULL, 0 IS NOT NULL, '' IS NULL, '' IS NOT NULL;
+-----+-----+-----+-----+
| 0 IS NULL | 0 IS NOT NULL | '' IS NULL | '' IS NOT NULL |
+-----+-----+-----+-----+
| 0 | 1 | 0 | 1 |
+-----+-----+-----+-----+
```

Thus it is entirely possible to insert a zero or empty string into a `NOT NULL` column, as these are in fact `NOT NULL`. See [Problems with NULL Values](#).

4.4.7 Pattern Matching

MySQL provides standard SQL pattern matching as well as a form of pattern matching based on extended regular expressions similar to those used by Unix utilities such as `vi`, `grep`, and `sed`.

SQL pattern matching enables you to use “`_`” to match any single character and “`%`” to match an arbitrary number of characters (including zero characters). In MySQL, SQL patterns are case-insensitive by default. Some examples are shown here. You do not use `=` or `<>` when you use SQL patterns; use the `LIKE` or `NOT LIKE` comparison operators instead.

To find names beginning with “`b`”:

```
mysql> SELECT * FROM pet WHERE name LIKE 'b%';
+-----+-----+-----+-----+-----+-----+
| name | owner | species | sex | birth | death |
+-----+-----+-----+-----+-----+-----+
| Buffy | Harold | dog | f | 1989-05-13 | NULL |
| Bowser | Diane | dog | m | 1989-08-31 | 1995-07-29 |
+-----+-----+-----+-----+-----+-----+
```

To find names ending with “`fy`”:

```
mysql> SELECT * FROM pet WHERE name LIKE '%fy';
+-----+-----+-----+-----+-----+-----+
| name | owner | species | sex | birth | death |
+-----+-----+-----+-----+-----+-----+
| Fluffy | Harold | cat | f | 1993-02-04 | NULL |
| Buffy | Harold | dog | f | 1989-05-13 | NULL |
+-----+-----+-----+-----+-----+-----+
```

To find names containing a “`w`”:

```
mysql> SELECT * FROM pet WHERE name LIKE '%w%';
+-----+-----+-----+-----+-----+-----+
| name | owner | species | sex | birth | death |
+-----+-----+-----+-----+-----+-----+
```

Claws	Gwen	cat	m	1994-03-17	NULL
Bowser	Diane	dog	m	1989-08-31	1995-07-29
Whistler	Gwen	bird	NULL	1997-12-09	NULL

To find names containing exactly five characters, use five instances of the “_” pattern character:

```
mysql> SELECT * FROM pet WHERE name LIKE '_____';
```

name	owner	species	sex	birth	death
Claws	Gwen	cat	m	1994-03-17	NULL
Buffy	Harold	dog	f	1989-05-13	NULL

The other type of pattern matching provided by MySQL uses extended regular expressions. When you test for a match for this type of pattern, use the `REGEXP` and `NOT REGEXP` operators (or `RLIKE` and `NOT RLIKE`, which are synonyms).

The following list describes some characteristics of extended regular expressions:

- “.” matches any single character.
- A character class “[...]” matches any character within the brackets. For example, “[abc]” matches “a”, “b”, or “c”. To name a range of characters, use a dash. “[a-z]” matches any letter, whereas “[0-9]” matches any digit.
- “*” matches zero or more instances of the thing preceding it. For example, “x*” matches any number of “x” characters, “[0-9]*” matches any number of digits, and “.*” matches any number of anything.
- A `REGEXP` pattern match succeeds if the pattern matches anywhere in the value being tested. (This differs from a `LIKE` pattern match, which succeeds only if the pattern matches the entire value.)
- To anchor a pattern so that it must match the beginning or end of the value being tested, use “^” at the beginning or “\$” at the end of the pattern.

To demonstrate how extended regular expressions work, the `LIKE` queries shown previously are rewritten here to use `REGEXP`.

To find names beginning with “b”, use “^” to match the beginning of the name:

```
mysql> SELECT * FROM pet WHERE name REGEXP '^b';
```

name	owner	species	sex	birth	death
Buffy	Harold	dog	f	1989-05-13	NULL
Bowser	Diane	dog	m	1989-08-31	1995-07-29

If you really want to force a `REGEXP` comparison to be case sensitive, use the `BINARY` keyword to make one of the strings a binary string. This query matches only lowercase “b” at the beginning of a name:

```
mysql> SELECT * FROM pet WHERE name REGEXP BINARY '^b';
```

To find names ending with “fy”, use “\$” to match the end of the name:

```
mysql> SELECT * FROM pet WHERE name REGEXP 'fy$';
```

name	owner	species	sex	birth	death
Fluffy	Harold	cat	f	1993-02-04	NULL
Buffy	Harold	dog	f	1989-05-13	NULL

To find names containing a “w”, use this query:

```
mysql> SELECT * FROM pet WHERE name REGEXP 'w';
```

name	owner	species	sex	birth	death
Claws	Gwen	cat	m	1994-03-17	NULL
Bowser	Diane	dog	m	1989-08-31	1995-07-29
Whistler	Gwen	bird	NULL	1997-12-09	NULL

Because a regular expression pattern matches if it occurs anywhere in the value, it is not necessary in the previous query to put a wildcard on either side of the pattern to get it to match the entire value like it would be if you used an SQL pattern.

To find names containing exactly five characters, use “^” and “\$” to match the beginning and end of the name, and five instances of “.” in between:

```
mysql> SELECT * FROM pet WHERE name REGEXP '^.....$';
```

name	owner	species	sex	birth	death
Claws	Gwen	cat	m	1994-03-17	NULL
Buffy	Harold	dog	f	1989-05-13	NULL

You could also write the previous query using the {*n*} (“repeat-*n*-times”) operator:

```
mysql> SELECT * FROM pet WHERE name REGEXP '^.{5}$';
```

name	owner	species	sex	birth	death
Claws	Gwen	cat	m	1994-03-17	NULL
Buffy	Harold	dog	f	1989-05-13	NULL

[Regular Expressions](#), provides more information about the syntax for regular expressions.

4.4.8 Counting Rows

Databases are often used to answer the question, “How often does a certain type of data occur in a table?” For example, you might want to know how many pets you have, or how many pets each owner has, or you might want to perform various kinds of census operations on your animals.

Counting the total number of animals you have is the same question as “How many rows are in the `pet` table?” because there is one record per pet. `COUNT(*)` counts the number of rows, so the query to count your animals looks like this:

```
mysql> SELECT COUNT(*) FROM pet;
```

COUNT(*)

```
| 9 |
+-----+
```

Earlier, you retrieved the names of the people who owned pets. You can use `COUNT()` if you want to find out how many pets each owner has:

```
mysql> SELECT owner, COUNT(*) FROM pet GROUP BY owner;
+-----+
| owner | COUNT(*) |
+-----+
| Benny | 2 |
| Diane | 2 |
| Gwen  | 3 |
| Harold | 2 |
+-----+
```

The preceding query uses `GROUP BY` to group all records for each `owner`. The use of `COUNT()` in conjunction with `GROUP BY` is useful for characterizing your data under various groupings. The following examples show different ways to perform animal census operations.

Number of animals per species:

```
mysql> SELECT species, COUNT(*) FROM pet GROUP BY species;
+-----+
| species | COUNT(*) |
+-----+
| bird    | 2 |
| cat     | 2 |
| dog     | 3 |
| hamster | 1 |
| snake   | 1 |
+-----+
```

Number of animals per sex:

```
mysql> SELECT sex, COUNT(*) FROM pet GROUP BY sex;
+-----+
| sex | COUNT(*) |
+-----+
| NULL | 1 |
| f    | 4 |
| m    | 4 |
+-----+
```

(In this output, `NULL` indicates that the sex is unknown.)

Number of animals per combination of species and sex:

```
mysql> SELECT species, sex, COUNT(*) FROM pet GROUP BY species, sex;
+-----+
| species | sex | COUNT(*) |
+-----+
| bird    | NULL | 1 |
| bird    | f    | 1 |
| cat     | f    | 1 |
| cat     | m    | 1 |
| dog     | f    | 1 |
| dog     | m    | 2 |
| hamster | f    | 1 |
| snake   | m    | 1 |
+-----+
```

You need not retrieve an entire table when you use `COUNT()`. For example, the previous query, when performed just on dogs and cats, looks like this:

```
mysql> SELECT species, sex, COUNT(*) FROM pet
-> WHERE species = 'dog' OR species = 'cat'
-> GROUP BY species, sex;
```

species	sex	COUNT(*)
cat	f	1
cat	m	1
dog	f	1
dog	m	2

Or, if you wanted the number of animals per sex only for animals whose sex is known:

```
mysql> SELECT species, sex, COUNT(*) FROM pet
-> WHERE sex IS NOT NULL
-> GROUP BY species, sex;
```

species	sex	COUNT(*)
bird	f	1
cat	f	1
cat	m	1
dog	f	1
dog	m	2
hamster	f	1
snake	m	1

If you name columns to select in addition to the `COUNT()` value, a `GROUP BY` clause should be present that names those same columns. Otherwise, the following occurs:

- If the `ONLY_FULL_GROUP_BY` SQL mode is enabled, an error occurs:

```
mysql> SET sql_mode = 'ONLY_FULL_GROUP_BY';
Query OK, 0 rows affected (0.00 sec)
mysql> SELECT owner, COUNT(*) FROM pet;
ERROR 1140 (42000): Mixing of GROUP columns (MIN(),MAX(),COUNT()...)
with no GROUP columns is illegal if there is no GROUP BY clause
```

- If `ONLY_FULL_GROUP_BY` is not enabled, the query is processed by treating all rows as a single group, but the value selected for each named column is indeterminate. The server is free to select the value from any row:

```
mysql> SET sql_mode = '';
Query OK, 0 rows affected (0.00 sec)
mysql> SELECT owner, COUNT(*) FROM pet;
```

owner	COUNT(*)
Harold	8

1 row in set (0.00 sec)

See also [MySQL Handling of GROUP BY](#).

4.4.9 Using More Than one Table

The `pet` table keeps track of which pets you have. If you want to record other information about them, such as events in their lives like visits to the vet or when litters are born, you need another table. What should this table look like? It needs to contain the following information:

- The pet name so that you know which animal each event pertains to.
- A date so that you know when the event occurred.
- A field to describe the event.
- An event type field, if you want to be able to categorize events.

Given these considerations, the `CREATE TABLE` statement for the `event` table might look like this:

```
mysql> CREATE TABLE event (name VARCHAR(20), date DATE,  
-> type VARCHAR(15), remark VARCHAR(255));
```

As with the `pet` table, it is easiest to load the initial records by creating a tab-delimited text file containing the following information.

name	date	type	remark
Fluffy	1995-05-15	litter	4 kittens, 3 female, 1 male
Buffy	1993-06-23	litter	5 puppies, 2 female, 3 male
Buffy	1994-06-19	litter	3 puppies, 3 female
Chirpy	1999-03-21	vet	needed beak straightened
Slim	1997-08-03	vet	broken rib
Bowser	1991-10-12	kennel	
Fang	1991-10-12	kennel	
Fang	1998-08-28	birthday	Gave him a new chew toy
Claws	1998-03-17	birthday	Gave him a new flea collar
Whistler	1998-12-09	birthday	First birthday

Load the records like this:

```
mysql> LOAD DATA LOCAL INFILE 'event.txt' INTO TABLE event;
```

Based on what you have learned from the queries that you have run on the `pet` table, you should be able to perform retrievals on the records in the `event` table; the principles are the same. But when is the `event` table by itself insufficient to answer questions you might ask?

Suppose that you want to find out the ages at which each pet had its litters. We saw earlier how to calculate ages from two dates. The litter date of the mother is in the `event` table, but to calculate her age on that date you need her birth date, which is stored in the `pet` table. This means the query requires both tables:

```
mysql> SELECT pet.name,  
-> (YEAR(date)-YEAR(birth)) - (RIGHT(date,5)<RIGHT(birth,5)) AS age,  
-> remark  
-> FROM pet INNER JOIN event  
-> ON pet.name = event.name  
-> WHERE event.type = 'litter';  
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
```


name	age	remark
Fluffy	2	4 kittens, 3 female, 1 male
Buffy	4	5 puppies, 2 female, 3 male
Buffy	5	3 puppies, 3 female

There are several things to note about this query:

- The `FROM` clause joins two tables because the query needs to pull information from both of them.
- When combining (joining) information from multiple tables, you need to specify how records in one table can be matched to records in the other. This is easy because they both have a `name` column. The query uses an `ON` clause to match up records in the two tables based on the `name` values.

The query uses an `INNER JOIN` to combine the tables. An `INNER JOIN` permits rows from either table to appear in the result if and only if both tables meet the conditions specified in the `ON` clause. In this example, the `ON` clause specifies that the `name` column in the `pet` table must match the `name` column in the `event` table. If a name appears in one table but not the other, the row will not appear in the result because the condition in the `ON` clause fails.

- Because the `name` column occurs in both tables, you must be specific about which table you mean when referring to the column. This is done by prepending the table name to the column name.

You need not have two different tables to perform a join. Sometimes it is useful to join a table to itself, if you want to compare records in a table to other records in that same table. For example, to find breeding pairs among your pets, you can join the `pet` table with itself to produce candidate pairs of males and females of like species:

```
mysql> SELECT p1.name, p1.sex, p2.name, p2.sex, p1.species
-> FROM pet AS p1 INNER JOIN pet AS p2
-> ON p1.species = p2.species AND p1.sex = 'f' AND p2.sex = 'm';
```

name	sex	name	sex	species
Fluffy	f	Claws	m	cat
Buffy	f	Fang	m	dog
Buffy	f	Bowser	m	dog

In this query, we specify aliases for the table name to refer to the columns and keep straight which instance of the table each column reference is associated with.

Chapter 5 Getting Information About Databases and Tables

What if you forget the name of a database or table, or what the structure of a given table is (for example, what its columns are called)? MySQL addresses this problem through several statements that provide information about the databases and tables it supports.

You have previously seen [SHOW DATABASES](#), which lists the databases managed by the server. To find out which database is currently selected, use the [DATABASE\(\)](#) function:

```
mysql> SELECT DATABASE();
+-----+
| DATABASE() |
+-----+
| menagerie  |
+-----+
```

If you have not yet selected any database, the result is [NULL](#).

To find out what tables the default database contains (for example, when you are not sure about the name of a table), use this statement:

```
mysql> SHOW TABLES;
+-----+
| Tables_in_menagerie |
+-----+
| event               |
| pet                 |
+-----+
```

The name of the column in the output produced by this statement is always [Tables_in_db_name](#), where [db_name](#) is the name of the database. See [SHOW TABLES Syntax](#), for more information.

If you want to find out about the structure of a table, the [DESCRIBE](#) statement is useful; it displays information about each of a table's columns:

```
mysql> DESCRIBE pet;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| name  | varchar(20) | YES  |     | NULL    |       |
| owner | varchar(20) | YES  |     | NULL    |       |
| species | varchar(20) | YES  |     | NULL    |       |
| sex   | char(1)    | YES  |     | NULL    |       |
| birth | date       | YES  |     | NULL    |       |
| death | date       | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
```

[Field](#) indicates the column name, [Type](#) is the data type for the column, [NULL](#) indicates whether the column can contain [NULL](#) values, [Key](#) indicates whether the column is indexed, and [Default](#) specifies the column's default value. [Extra](#) displays special information about columns: If a column was created with the [AUTO_INCREMENT](#) option, the value will be [auto_increment](#) rather than empty.

[DESC](#) is a short form of [DESCRIBE](#). See [DESCRIBE Syntax](#), for more information.

You can obtain the [CREATE TABLE](#) statement necessary to create an existing table using the [SHOW CREATE TABLE](#) statement. See [SHOW CREATE TABLE Syntax](#).

If you have indexes on a table, [SHOW INDEX FROM tbl_name](#) produces information about them. See [SHOW INDEX Syntax](#), for more about this statement.

Chapter 6 Using mysql in Batch Mode

In the previous sections, you used `mysql` interactively to enter statements and view the results. You can also run `mysql` in batch mode. To do this, put the statements you want to run in a file, then tell `mysql` to read its input from the file:

```
shell> mysql < batch-file
```

If you are running `mysql` under Windows and have some special characters in the file that cause problems, you can do this:

```
C:\> mysql -e "source batch-file"
```

If you need to specify connection parameters on the command line, the command might look like this:

```
shell> mysql -h host -u user -p < batch-file
Enter password: *****
```

When you use `mysql` this way, you are creating a script file, then executing the script.

If you want the script to continue even if some of the statements in it produce errors, you should use the `--force` command-line option.

Why use a script? Here are a few reasons:

- If you run a query repeatedly (say, every day or every week), making it a script enables you to avoid retyping it each time you execute it.
- You can generate new queries from existing ones that are similar by copying and editing script files.
- Batch mode can also be useful while you're developing a query, particularly for multiple-line statements or multiple-statement sequences. If you make a mistake, you don't have to retype everything. Just edit your script to correct the error, then tell `mysql` to execute it again.
- If you have a query that produces a lot of output, you can run the output through a pager rather than watching it scroll off the top of your screen:

```
shell> mysql < batch-file | more
```

- You can catch the output in a file for further processing:

```
shell> mysql < batch-file > mysql.out
```

- You can distribute your script to other people so that they can also run the statements.
- Some situations do not allow for interactive use, for example, when you run a query from a `cron` job. In this case, you must use batch mode.

The default output format is different (more concise) when you run `mysql` in batch mode than when you use it interactively. For example, the output of `SELECT DISTINCT species FROM pet` looks like this when `mysql` is run interactively:

```
+-----+
```

```
| species |  
+-----+  
| bird   |  
| cat    |  
| dog    |  
| hamster|  
| snake  |  
+-----+
```

In batch mode, the output looks like this instead:

```
species  
bird  
cat  
dog  
hamster  
snake
```

If you want to get the interactive output format in batch mode, use `mysql -t`. To echo to the output the statements that are executed, use `mysql -vvv`.

You can also use scripts from the `mysql` prompt by using the `source` command or `\.` command:

```
mysql> source filename;  
mysql> \. filename
```

See [Executing SQL Statements from a Text File](#), for more information.

Chapter 7 Examples of Common Queries

Table of Contents

7.1 The Maximum Value for a Column	33
7.2 The Row Holding the Maximum of a Certain Column	34
7.3 Maximum of Column per Group	34
7.4 The Rows Holding the Group-wise Maximum of a Certain Column	34
7.5 Using User-Defined Variables	35
7.6 Using Foreign Keys	36
7.7 Searching on Two Keys	37
7.8 Calculating Visits Per Day	37
7.9 Using AUTO_INCREMENT	38

Here are examples of how to solve some common problems with MySQL.

Some of the examples use the table `shop` to hold the price of each article (item number) for certain traders (dealers). Supposing that each trader has a single fixed price per article, then (`article`, `dealer`) is a primary key for the records.

Start the command-line tool `mysql` and select a database:

```
shell> mysql your-database-name
```

(In most MySQL installations, you can use the database named `test`).

You can create and populate the example table with these statements:

```
CREATE TABLE shop (  
  article INT(4) UNSIGNED ZEROFILL DEFAULT '0000' NOT NULL,  
  dealer CHAR(20) DEFAULT '' NOT NULL,  
  price DOUBLE(16,2) DEFAULT '0.00' NOT NULL,  
  PRIMARY KEY(article, dealer));  
INSERT INTO shop VALUES  
  (1, 'A', 3.45), (1, 'B', 3.99), (2, 'A', 10.99), (3, 'B', 1.45),  
  (3, 'C', 1.69), (3, 'D', 1.25), (4, 'D', 19.95);
```

After issuing the statements, the table should have the following contents:

```
SELECT * FROM shop;  
+-----+-----+-----+  
| article | dealer | price |  
+-----+-----+-----+  
| 0001 | A | 3.45 |  
| 0001 | B | 3.99 |  
| 0002 | A | 10.99 |  
| 0003 | B | 1.45 |  
| 0003 | C | 1.69 |  
| 0003 | D | 1.25 |  
| 0004 | D | 19.95 |  
+-----+-----+-----+
```

7.1 The Maximum Value for a Column

“What is the highest item number?”

```
SELECT MAX(article) AS article FROM shop;
+-----+
| article |
+-----+
|      4 |
+-----+
```

7.2 The Row Holding the Maximum of a Certain Column

Task: Find the number, dealer, and price of the most expensive article.

This is easily done with a subquery:

```
SELECT article, dealer, price
FROM   shop
WHERE  price=(SELECT MAX(price) FROM shop);
+-----+-----+-----+
| article | dealer | price |
+-----+-----+-----+
|    0004 | D      | 19.95 |
+-----+-----+-----+
```

Other solutions are to use a [LEFT JOIN](#) or to sort all rows descending by price and get only the first row using the MySQL-specific [LIMIT](#) clause:

```
SELECT s1.article, s1.dealer, s1.price
FROM shop s1
LEFT JOIN shop s2 ON s1.price < s2.price
WHERE s2.article IS NULL;
SELECT article, dealer, price
FROM shop
ORDER BY price DESC
LIMIT 1;
```

Note

If there were several most expensive articles, each with a price of 19.95, the [LIMIT](#) solution would show only one of them.

7.3 Maximum of Column per Group

Task: Find the highest price per article.

```
SELECT article, MAX(price) AS price
FROM   shop
GROUP BY article;
+-----+-----+
| article | price |
+-----+-----+
|    0001 | 3.99 |
|    0002 | 10.99 |
|    0003 | 1.69 |
|    0004 | 19.95 |
+-----+-----+
```

7.4 The Rows Holding the Group-wise Maximum of a Certain Column

Task: For each article, find the dealer or dealers with the most expensive price.

This problem can be solved with a subquery like this one:

```
SELECT article, dealer, price
FROM   shop s1
WHERE  price=(SELECT MAX(s2.price)
              FROM shop s2
              WHERE s1.article = s2.article);
```

article	dealer	price
0001	B	3.99
0002	A	10.99
0003	C	1.69
0004	D	19.95

The preceding example uses a correlated subquery, which can be inefficient (see [Correlated Subqueries](#)). Other possibilities for solving the problem are to use an uncorrelated subquery in the [FROM](#) clause or a [LEFT JOIN](#).

Uncorrelated subquery:

```
SELECT s1.article, dealer, s1.price
FROM shop s1
JOIN (
  SELECT article, MAX(price) AS price
  FROM shop
  GROUP BY article) AS s2
ON s1.article = s2.article AND s1.price = s2.price;
```

[LEFT JOIN](#):

```
SELECT s1.article, s1.dealer, s1.price
FROM shop s1
LEFT JOIN shop s2 ON s1.article = s2.article AND s1.price < s2.price
WHERE s2.article IS NULL;
```

The [LEFT JOIN](#) works on the basis that when [s1.price](#) is at its maximum value, there is no [s2.price](#) with a greater value and the [s2](#) rows values will be [NULL](#). See [JOIN Syntax](#).

7.5 Using User-Defined Variables

You can employ MySQL user variables to remember results without having to store them in temporary variables in the client. (See [User-Defined Variables](#).)

For example, to find the articles with the highest and lowest price you can do this:

```
mysql> SELECT @min_price:=MIN(price),@max_price:=MAX(price) FROM shop;
mysql> SELECT * FROM shop WHERE price=@min_price OR price=@max_price;
```

article	dealer	price
0003	D	1.25
0004	D	19.95

Note

It is also possible to store the name of a database object such as a table or a column in a user variable and then to use this variable in an SQL statement;

however, this requires the use of a prepared statement. See [SQL Syntax for Prepared Statements](#), for more information.

7.6 Using Foreign Keys

In MySQL, [InnoDB](#) tables support checking of foreign key constraints. See [The InnoDB Storage Engine](#), and [Foreign Key Differences](#).

A foreign key constraint is not required merely to join two tables. For storage engines other than [InnoDB](#), it is possible when defining a column to use a `REFERENCES tbl_name(col_name)` clause, which has no actual effect, and serves only as a memo or comment to you that the column which you are currently defining is intended to refer to a column in another table. It is extremely important to realize when using this syntax that:

- MySQL does not perform any sort of `CHECK` to make sure that `col_name` actually exists in `tbl_name` (or even that `tbl_name` itself exists).
- MySQL does not perform any sort of action on `tbl_name` such as deleting rows in response to actions taken on rows in the table which you are defining; in other words, this syntax induces no `ON DELETE` or `ON UPDATE` behavior whatsoever. (Although you can write an `ON DELETE` or `ON UPDATE` clause as part of the `REFERENCES` clause, it is also ignored.)
- This syntax creates a *column*; it does **not** create any sort of index or key.

You can use a column so created as a join column, as shown here:

```
CREATE TABLE person (
  id SMALLINT UNSIGNED NOT NULL AUTO_INCREMENT,
  name CHAR(60) NOT NULL,
  PRIMARY KEY (id)
);
CREATE TABLE shirt (
  id SMALLINT UNSIGNED NOT NULL AUTO_INCREMENT,
  style ENUM('t-shirt', 'polo', 'dress') NOT NULL,
  color ENUM('red', 'blue', 'orange', 'white', 'black') NOT NULL,
  owner SMALLINT UNSIGNED NOT NULL REFERENCES person(id),
  PRIMARY KEY (id)
);
INSERT INTO person VALUES (NULL, 'Antonio Paz');
SELECT @last := LAST_INSERT_ID();
INSERT INTO shirt VALUES
(NULL, 'polo', 'blue', @last),
(NULL, 'dress', 'white', @last),
(NULL, 't-shirt', 'blue', @last);
INSERT INTO person VALUES (NULL, 'Lilliana Angelovska');
SELECT @last := LAST_INSERT_ID();
INSERT INTO shirt VALUES
(NULL, 'dress', 'orange', @last),
(NULL, 'polo', 'red', @last),
(NULL, 'dress', 'blue', @last),
(NULL, 't-shirt', 'white', @last);
SELECT * FROM person;
+----+-----+
| id | name          |
+----+-----+
|  1 | Antonio Paz   |
|  2 | Lilliana Angelovska |
+----+-----+
SELECT * FROM shirt;
+----+-----+-----+-----+
| id | style  | color | owner |
+----+-----+-----+-----+
```

```

| 1 | polo | blue | 1 |
| 2 | dress | white | 1 |
| 3 | t-shirt | blue | 1 |
| 4 | dress | orange | 2 |
| 5 | polo | red | 2 |
| 6 | dress | blue | 2 |
| 7 | t-shirt | white | 2 |
+-----+
SELECT s.* FROM person p INNER JOIN shirt s
  ON s.owner = p.id
  WHERE p.name LIKE 'Lilliana%'
     AND s.color <> 'white';
+-----+
| id | style | color | owner |
+-----+
| 4 | dress | orange | 2 |
| 5 | polo | red | 2 |
| 6 | dress | blue | 2 |
+-----+

```

When used in this fashion, the [REFERENCES](#) clause is not displayed in the output of `SHOW CREATE TABLE` or `DESCRIBE`:

```

SHOW CREATE TABLE shirt\G
***** 1. row *****
Table: shirt
Create Table: CREATE TABLE `shirt` (
  `id` smallint(5) unsigned NOT NULL auto_increment,
  `style` enum('t-shirt','polo','dress') NOT NULL,
  `color` enum('red','blue','orange','white','black') NOT NULL,
  `owner` smallint(5) unsigned NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=MyISAM DEFAULT CHARSET=latin1

```

The use of [REFERENCES](#) in this way as a comment or “reminder” in a column definition works with [MyISAM](#) tables.

7.7 Searching on Two Keys

An [OR](#) using a single key is well optimized, as is the handling of [AND](#).

The one tricky case is that of searching on two different keys combined with [OR](#):

```

SELECT field1_index, field2_index FROM test_table
WHERE field1_index = '1' OR field2_index = '1'

```

This case is optimized. See [Index Merge Optimization](#).

You can also solve the problem efficiently by using a [UNION](#) that combines the output of two separate [SELECT](#) statements. See [UNION Syntax](#).

Each [SELECT](#) searches only one key and can be optimized:

```

SELECT field1_index, field2_index
  FROM test_table WHERE field1_index = '1'
UNION
SELECT field1_index, field2_index
  FROM test_table WHERE field2_index = '1';

```

7.8 Calculating Visits Per Day

The following example shows how you can use the bit group functions to calculate the number of days per month a user has visited a Web page.

```
CREATE TABLE t1 (year YEAR(4), month INT(2) UNSIGNED ZEROFILL,  
                 day INT(2) UNSIGNED ZEROFILL);  
INSERT INTO t1 VALUES(2000,1,1),(2000,1,20),(2000,1,30),(2000,2,2),  
                      (2000,2,23),(2000,2,23);
```

The example table contains year-month-day values representing visits by users to the page. To determine how many different days in each month these visits occur, use this query:

```
SELECT year,month,BIT_COUNT(BIT_OR(1<<day)) AS days FROM t1  
      GROUP BY year,month;
```

Which returns:

year	month	days
2000	01	3
2000	02	2

The query calculates how many different days appear in the table for each year/month combination, with automatic removal of duplicate entries.

7.9 Using AUTO_INCREMENT

The [AUTO_INCREMENT](#) attribute can be used to generate a unique identity for new rows:

```
CREATE TABLE animals (  
    id MEDIUMINT NOT NULL AUTO_INCREMENT,  
    name CHAR(30) NOT NULL,  
    PRIMARY KEY (id)  
) ENGINE=INNODB;  
INSERT INTO animals (name) VALUES  
    ('dog'),('cat'),('penguin'),  
    ('lax'),('whale'),('ostrich');  
SELECT * FROM animals;
```

Which returns:

id	name
1	dog
2	cat
3	penguin
4	lax
5	whale
6	ostrich

No value was specified for the [AUTO_INCREMENT](#) column, so MySQL assigned sequence numbers automatically. You can also explicitly assign 0 to the column to generate sequence numbers. If the column is declared [NOT NULL](#), it is also possible to assign [NULL](#) to the column to generate sequence numbers. When you insert any other value into a [AUTO_INCREMENT](#) column, the column is set to that value and the

sequence is reset so that the next automatically generated value follows sequentially from the inserted value.

You can retrieve the most recent automatically generated [AUTO_INCREMENT](#) value with the [LAST_INSERT_ID\(\)](#) SQL function or the [mysql_insert_id\(\)](#) C API function. These functions are connection-specific, so their return values are not affected by another connection which is also performing inserts.

Use the smallest integer data type for the [AUTO_INCREMENT](#) column that is large enough to hold the maximum sequence value you will need. When the column reaches the upper limit of the data type, the next attempt to generate a sequence number fails. Use the [UNSIGNED](#) attribute if possible to allow a greater range. For example, if you use [TINYINT](#), the maximum permissible sequence number is 127. For [TINYINT UNSIGNED](#), the maximum is 255. See [Integer Types \(Exact Value\) - INTEGER, INT, SMALLINT, TINYINT, MEDIUMINT, BIGINT](#) for the ranges of all the integer types.

Note

For a multiple-row insert, [LAST_INSERT_ID\(\)](#) and [mysql_insert_id\(\)](#) actually return the [AUTO_INCREMENT](#) key from the *first* of the inserted rows. This enables multiple-row inserts to be reproduced correctly on other servers in a replication setup.

To start with an [AUTO_INCREMENT](#) value other than 1, set that value with [CREATE TABLE](#) or [ALTER TABLE](#), like this:

```
mysql> ALTER TABLE tbl AUTO_INCREMENT = 100;
```

InnoDB Notes

For [InnoDB](#) tables, be careful if you modify the column containing the auto-increment value in the middle of a sequence of [INSERT](#) statements. For example, if you use an [UPDATE](#) statement to put a new, larger value in the auto-increment column, a subsequent [INSERT](#) could encounter a “Duplicate entry” error. The test whether an auto-increment value is already present occurs if you do a [DELETE](#) followed by more [INSERT](#) statements, or when you [COMMIT](#) the transaction, but not after an [UPDATE](#) statement.

For more information about [AUTO_INCREMENT](#) and [InnoDB](#), see [AUTO_INCREMENT Handling in InnoDB](#).

MyISAM Notes

- For [MyISAM](#) tables, you can specify [AUTO_INCREMENT](#) on a secondary column in a multiple-column index. In this case, the generated value for the [AUTO_INCREMENT](#) column is calculated as [MAX\(auto_increment_column\) + 1 WHERE prefix=given-prefix](#). This is useful when you want to put data into ordered groups.

```
CREATE TABLE animals (  
  grp ENUM('fish','mammal','bird') NOT NULL,  
  id MEDIUMINT NOT NULL AUTO_INCREMENT,  
  name CHAR(30) NOT NULL,  
  PRIMARY KEY (grp,id)  
) ENGINE=MyISAM;  
INSERT INTO animals (grp,name) VALUES  
  ('mammal','dog'),('mammal','cat'),  
  ('bird','penguin'),('fish','lax'),('mammal','whale'),  
  ('bird','ostrich');  
SELECT * FROM animals ORDER BY grp,id;
```

Which returns:

grp	id	name
fish	1	lax
mammal	1	dog
mammal	2	cat
mammal	3	whale
bird	1	penguin
bird	2	ostrich

In this case (when the `AUTO_INCREMENT` column is part of a multiple-column index), `AUTO_INCREMENT` values are reused if you delete the row with the biggest `AUTO_INCREMENT` value in any group. This happens even for `MyISAM` tables, for which `AUTO_INCREMENT` values normally are not reused.

- If the `AUTO_INCREMENT` column is part of multiple indexes, MySQL generates sequence values using the index that begins with the `AUTO_INCREMENT` column, if there is one. For example, if the `animals` table contained indexes `PRIMARY KEY (grp, id)` and `INDEX (id)`, MySQL would ignore the `PRIMARY KEY` for generating sequence values. As a result, the table would contain a single sequence, not a sequence per `grp` value.

Further Reading

More information about `AUTO_INCREMENT` is available here:

- How to assign the `AUTO_INCREMENT` attribute to a column: [CREATE TABLE Syntax](#), and [ALTER TABLE Syntax](#).
- How `AUTO_INCREMENT` behaves depending on the `NO_AUTO_VALUE_ON_ZERO` SQL mode: [Server SQL Modes](#).
- How to use the `LAST_INSERT_ID()` function to find the row that contains the most recent `AUTO_INCREMENT` value: [Information Functions](#).
- Setting the `AUTO_INCREMENT` value to be used: [Server System Variables](#).
- `AUTO_INCREMENT` and replication: [Replication and AUTO_INCREMENT](#).
- Server-system variables related to `AUTO_INCREMENT` (`auto_increment_increment` and `auto_increment_offset`) that can be used for replication: [Server System Variables](#).

Chapter 8 Using MySQL with Apache

There are programs that let you authenticate your users from a MySQL database and also let you write your log files into a MySQL table.

You can change the Apache logging format to be easily readable by MySQL by putting the following into the Apache configuration file:

```
LogFormat \
    "%h",%{Y%m%d%H%M%S}t,%>s,"%b",\ "%{Content-Type}o", \
    "%U",\ "%{Referer}i",\ "%{User-Agent}i"
```

To load a log file in that format into MySQL, you can use a statement something like this:

```
LOAD DATA INFILE '/local/access_log' INTO TABLE tbl_name
FIELDS TERMINATED BY ',' OPTIONALLY ENCLOSED BY '"' ESCAPED BY '\\'
```

The named table should be created to have columns that correspond to those that the `LogFormat` line writes to the log file.

Appendix A Licenses for Third-Party Components

Table of Contents

A.1 ANTLR 3 License	45
A.2 dtoa.c License	45
A.3 Editline Library (libedit) License	46
A.4 FindGTest.cmake License	48
A.5 Fred Fish's Dbug Library License	49
A.6 getarg License	50
A.7 GNU General Public License Version 2.0, June 1991	50
A.8 GNU Lesser General Public License Version 2.1, February 1999	56
A.9 GNU Libtool License	64
A.10 GNU Readline License	64
A.11 Google Controlling Master Thread I/O Rate Patch License	65
A.12 Google Perftools (TCMalloc utility) License	65
A.13 Google SMP Patch License	66
A.14 lib_sql.cc License	67
A.15 libevent License	67
A.16 Linux-PAM License	69
A.17 md5 (Message-Digest Algorithm 5) License	70
A.18 memcached License	70
A.19 nt_servc (Windows NT Service class library) License	71
A.20 OpenPAM License	71
A.21 Paramiko License	71
A.22 Percona Multiple I/O Threads Patch License	72
A.23 RegEX-Spencer Library License	72
A.24 RFC 3174 - US Secure Hash Algorithm 1 (SHA1) License	73
A.25 Richard A. O'Keefe String Library License	73
A.26 SHA-1 in C License	74
A.27 zlib License	74

The following is a list of the libraries we have included with the MySQL Server source and components used to test MySQL. We are thankful to all individuals that have created these. Some of the components require that their licensing terms be included in the documentation of products that include them. Cross references to these licensing terms are given with the applicable items in the list.

- Bjorn Benson

For his `safe_malloc` (memory checker) package which is used in when you build MySQL using one of the `BUILD/compile-*-debug` scripts or by manually setting the `-DSAFEMALLOC` flag.

- GroupLens Research Project

The MySQL Quality Assurance team would like to acknowledge the use of the MovieLens Data Sets (10 million ratings and 100,000 tags for 10681 movies by 71567 users) to help test MySQL products and to thank the GroupLens Research Project at the University of Minnesota for making the data sets available.

MySQL 5.1

- [Section A.2, “dtoa.c License”](#)
- [Section A.3, “Editline Library \(libedit\) License”](#)

- [Section A.4, “FindGTest.cmake License”](#)
- [Section A.5, “Fred Fish's Dbug Library License”](#)
- [Section A.6, “getarg License”](#)
- [Section A.7, “GNU General Public License Version 2.0, June 1991”](#)
- [Section A.9, “GNU Libtool License”](#)
- [Section A.10, “GNU Readline License”](#)
- [Section A.11, “Google Controlling Master Thread I/O Rate Patch License”](#)
- [Section A.13, “Google SMP Patch License”](#)
- [Section A.14, “lib_sql.cc License”](#)
- [Section A.17, “md5 \(Message-Digest Algorithm 5\) License”](#)
- [Section A.19, “nt_servc \(Windows NT Service class library\) License”](#)
- [Section A.22, “Percona Multiple I/O Threads Patch License”](#)
- [Section A.23, “RegEX-Spencer Library License”](#)
- [Section A.24, “RFC 3174 - US Secure Hash Algorithm 1 \(SHA1\) License”](#)
- [Section A.25, “Richard A. O'Keefe String Library License”](#)
- [Section A.27, “zlib License”](#)

MySQL Cluster 7.1

- [Section A.1, “ANTLR 3 License”](#)
- [Section A.2, “dtoa.c License”](#)
- [Section A.3, “Editline Library \(libedit\) License”](#)
- [Section A.4, “FindGTest.cmake License”](#)
- [Section A.5, “Fred Fish's Dbug Library License”](#)
- [Section A.6, “getarg License”](#)
- [Section A.7, “GNU General Public License Version 2.0, June 1991”](#)
- [Section A.8, “GNU Lesser General Public License Version 2.1, February 1999”](#)
- [Section A.9, “GNU Libtool License”](#)
- [Section A.10, “GNU Readline License”](#)
- [Section A.11, “Google Controlling Master Thread I/O Rate Patch License”](#)
- [Section A.12, “Google Perftools \(TCMalloc utility\) License”](#)
- [Section A.13, “Google SMP Patch License”](#)
- [Section A.14, “lib_sql.cc License”](#)
- [Section A.15, “libevent License”](#)

- [Section A.16, "Linux-PAM License"](#)
- [Section A.17, "md5 \(Message-Digest Algorithm 5\) License"](#)
- [Section A.18, "memcached License"](#)
- [Section A.19, "nt_servc \(Windows NT Service class library\) License"](#)
- [Section A.20, "OpenPAM License"](#)
- [Section A.21, "Paramiko License"](#)
- [Section A.22, "Percona Multiple I/O Threads Patch License"](#)
- [Section A.23, "RegEX-Spencer Library License"](#)
- [Section A.25, "Richard A. O'Keefe String Library License"](#)
- [Section A.26, "SHA-1 in C License"](#)
- [Section A.27, "zlib License"](#)

A.1 ANTLR 3 License

The following software may be included in this product:

ANTLR 3

ANTLR 3 License
 [The BSD License]
 Copyright (c) 2003-2007, Terence Parr
 All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- * Neither the name of the author nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.2 dtoa.c License

The following software may be included in this product:

`dtoa.c`

The author of this software is David M. Gay.

Copyright (c) 1991, 2000, 2001 by Lucent Technologies.

Permission to use, copy, modify, and distribute this software for any purpose without fee is hereby granted, provided that this entire notice is included in all copies of any software which is or includes a copy or modification of this software and in all copies of the supporting documentation for such software.

THIS SOFTWARE IS BEING PROVIDED "AS IS", WITHOUT ANY EXPRESS OR IMPLIED WARRANTY. IN PARTICULAR, NEITHER THE AUTHOR NOR LUCENT MAKES ANY REPRESENTATION OR WARRANTY OF ANY KIND CONCERNING THE MERCHANTABILITY OF THIS SOFTWARE OR ITS FITNESS FOR ANY PARTICULAR PURPOSE.

A.3 Editline Library (libedit) License

The following software may be included in this product:

Editline Library (libedit)

Some files are:

Copyright (c) 1992, 1993

The Regents of the University of California. All rights reserved.

This code is derived from software contributed to Berkeley by Christos Zoulas of Cornell University.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Some files are:

Copyright (c) 2001 The NetBSD Foundation, Inc.
All rights reserved.

This code is derived from software contributed to The NetBSD Foundation
by Anthony Mallet.

Redistribution and use in source and binary forms,
with or without modification, are permitted provided
that the following conditions are met:

1. Redistributions of source code must retain the
above copyright notice, this list of conditions
and the following disclaimer.
2. Redistributions in binary form must reproduce the
above copyright notice, this list of conditions and the
following disclaimer in the documentation and/or
other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE NETBSD FOUNDATION, INC.
AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED
WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED
WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A
PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL
THE FOUNDATION OR CONTRIBUTORS BE LIABLE FOR ANY
DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO,
PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF
USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER
CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE
OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS
SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH
DAMAGE.

Some files are:

Copyright (c) 1997 The NetBSD Foundation, Inc.
All rights reserved.

This code is derived from software contributed to The NetBSD Foundation
by Jaromir Dolecek.

Redistribution and use in source and binary forms,
with or without modification, are permitted provided
that the following conditions are met:

1. Redistributions of source code must retain the
above copyright notice, this list of conditions
and the following disclaimer.
2. Redistributions in binary form must reproduce
the above copyright notice, this list of conditions
and the following disclaimer in the documentation
and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE NETBSD FOUNDATION, INC.
AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED
WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED
WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A
PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL
THE FOUNDATION OR CONTRIBUTORS BE LIABLE FOR ANY
DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO,
PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF

```
USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER  
CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN  
CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE  
OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS  
SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH  
DAMAGE.
```

Some files are:

```
Copyright (c) 1998 Todd C. Miller <Todd.Miller@courtesan.com>
```

```
Permission to use, copy, modify, and distribute this  
software for any purpose with or without fee is hereby  
granted, provided that the above copyright notice and  
this permission notice appear in all copies.
```

```
THE SOFTWARE IS PROVIDED "AS IS" AND TODD C. MILLER  
DISCLAIMS ALL WARRANTIES WITH REGARD TO THIS SOFTWARE  
INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY  
AND FITNESS. IN NO EVENT SHALL TODD C. MILLER BE LIABLE  
FOR ANY SPECIAL, DIRECT, INDIRECT, OR CONSEQUENTIAL  
DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM  
LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION  
OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION,  
ARISING OUT OF OR IN CONNECTION WITH THE USE OR  
PERFORMANCE OF THIS SOFTWARE.
```

A.4 FindGTest.cmake License

The following software may be included in this product:

```
FindGTest.cmake helper script (part of CMake)
```

```
Copyright 2009 Kitware, Inc.  
Copyright 2009 Philip Lowman  
Copyright 2009 Daniel Blezek
```

```
Distributed under the OSI-approved BSD License (the "License");  
see accompanying file Copyright.txt for details.
```

```
This software is distributed WITHOUT ANY WARRANTY; without even the  
implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  
See the License for more information.
```

```
=====  
(To distributed this file outside of CMake, substitute the full  
License text for the above reference.)
```

```
Thanks to Daniel Blezek for the GTEST_ADD_TESTS code
```

```
Text of Copyright.txt mentioned above:
```

```
CMake - Cross Platform Makefile Generator  
Copyright 2000-2009 Kitware, Inc., Insight Software Consortium  
All rights reserved.
```

```
Redistribution and use in source and binary forms, with or without  
modification, are permitted provided that the following conditions  
are met:
```

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the

documentation and/or other materials provided with the distribution.

* Neither the names of Kitware, Inc., the Insight Software Consortium, nor the names of their contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.5 Fred Fish's Dbug Library License

The following software may be included in this product:

Fred Fish's Dbug Library

N O T I C E

Copyright Abandoned, 1987, Fred Fish

This previously copyrighted work has been placed into the public domain by the author and may be freely used for any purpose, private or commercial.

Because of the number of inquiries I was receiving about the use of this product in commercially developed works I have decided to simply make it public domain to further its unrestricted use. I specifically would be most happy to see this material become a part of the standard Unix distributions by AT&T and the Berkeley Computer Science Research Group, and a standard part of the GNU system from the Free Software Foundation.

I would appreciate it, as a courtesy, if this notice is left in all copies and derivative works. Thank you.

The author makes no warranty of any kind with respect to this

```
product and explicitly disclaims any implied warranties of mer-  
chantability or fitness for any particular purpose.
```

The `debug_analyze.c` file is subject to the following notice:

```
Copyright June 1987, Binayak Banerjee  
All rights reserved.
```

```
This program may be freely distributed under the same terms and  
conditions as Fred Fish's Dbug package.
```

A.6 getarg License

The following software may be included in this product:

[getarg](#) Function ([getarg.h](#), [getarg.c](#) files)

```
Copyright (c) 1997 - 2000 Kungliga Tekniska Högskolan  
(Royal Institute of Technology, Stockholm, Sweden).  
All rights reserved.
```

```
Redistribution and use in source and binary forms, with  
or without modification, are permitted provided that the  
following conditions are met:
```

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the Institute nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

```
THIS SOFTWARE IS PROVIDED BY THE INSTITUTE AND CONTRIBUTORS  
"AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING,  
BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY  
AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO  
EVENT SHALL THE INSTITUTE OR CONTRIBUTORS BE LIABLE FOR ANY  
DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL  
DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE  
GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS  
INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY,  
WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING  
NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF  
THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH  
DAMAGE.
```

A.7 GNU General Public License Version 2.0, June 1991

```
The following applies to all products licensed under the GNU General  
Public License, Version 2.0: You may not use the identified files  
except in compliance with the GNU General Public License, Version  
2.0 (the "License.") You may obtain a copy of the License at  
http://www.gnu.org/licenses/gpl-2.0.txt. A copy of the license is  
also reproduced below. Unless required by applicable law or agreed  
to in writing, software distributed under the License is distributed  
on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,  
either express or implied. See the License for the specific language
```


governing permissions and limitations under the License.

GNU GENERAL PUBLIC LICENSE
Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc.,
51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA
Everyone is permitted to copy and distribute verbatim
copies of this license document, but changing it is not
allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Lesser General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

GNU GENERAL PUBLIC LICENSE TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below,

refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under

the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

- a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent

infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED

WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the program's name and a brief idea of what it
does.>
```

```
Copyright (C) <year> <name of author>
```

```
This program is free software; you can redistribute it and/or
modify it under the terms of the GNU General Public License as
published by the Free Software Foundation; either version
2 of the License, or (at your option) any later version.
```

```
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.
```

```
You should have received a copy of the GNU General Public License
along with this program; if not, write to the Free Software
Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA
02110-1301 USA.
```

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details
type 'show w'. This is free software, and you are welcome
to redistribute it under certain conditions; type 'show c'
for details.
```

The hypothetical commands 'show w' and 'show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than 'show w' and 'show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if

necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the
program 'Gnomovision' (which makes passes at compilers) written
by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License.

A.8 GNU Lesser General Public License Version 2.1, February 1999

The following applies to all products licensed under the GNU Lesser General Public License, Version 2.1: You may not use the identified files except in compliance with the GNU Lesser General Public License, Version 2.1 (the "License"). You may obtain a copy of the License at <http://www.gnu.org/licenses/lgpl-2.1.html>. A copy of the license is also reproduced below. Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

GNU LESSER GENERAL PUBLIC LICENSE Version 2.1, February 1999

Copyright (C) 1991, 1999 Free Software Foundation, Inc.
51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA
Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid

distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

GNU LESSER GENERAL PUBLIC LICENSE
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices

stating that you changed the files and the date of any change.

c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to

distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is

interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

9. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.

10. Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein.

You are not responsible for enforcing compliance by third parties with this License.

11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

13. The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

14. If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

15. BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the library's name and a brief idea of what it does.>
Copyright (C) <year> <name of author>
```

```
This library is free software; you can redistribute it and/or
modify it under the terms of the GNU Lesser General Public
License as published by the Free Software Foundation; either
version 2.1 of the License, or (at your option) any later version.
```

```
This library is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU
Lesser General Public License for more details.
```

```
You should have received a copy of the GNU Lesser General Public
License along with this library; if not, write to the Free Software
Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA
02110-1301 USA
```

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the
library `Frob' (a library for tweaking knobs) written by James
Random Hacker.
```

```
<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice
```

That's all there is to it!

A.9 GNU Libtool License

The following software may be included in this product:

GNU Libtool (The GNU Portable Library Tool)

If you are receiving a copy of the Oracle software in source code, you are also receiving a copy of two files (ltmain.sh and ltdl.h) generated by the GNU Libtool in source code. If you received the Oracle software under a license other than a commercial (non-GPL) license, then the terms of the Oracle license do NOT apply to these files from GNU Libtool; they are licensed under the following licenses, separately from the Oracle programs you receive.

Oracle elects to use GNU General Public License version 2 (GPL) for any software where a choice of GPL or GNU Lesser/Library General Public License (LGPL) license versions are made available with the language indicating that GPL/LGPL or any later version may be used, or where a choice of which version of the GPL/LGPL is applied is unspecified.

From GNU Libtool:

ltmain.sh - Provide generalized library-building support services.

NOTE: Changing this file will not affect anything until you rerun configure.

Copyright (C) 1996, 1997, 1998, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007 Free Software Foundation, Inc.
Originally by Gordon Matzigkeit, 1996

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details. You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301, USA.

As a special exception to the GNU General Public License, if you distribute this file as part of a program that contains a configuration script generated by Autoconf, you may include it under the same distribution terms that you use for the rest of that program.

This component is licensed under [Section A.7, "GNU General Public License Version 2.0, June 1991"](#)

A.10 GNU Readline License

The following software may be included in this product:

GNU Readline Library

```
GNU Readline Library
With respect to MySQL Server/Cluster software licensed
under GNU General Public License, you are receiving a
copy of the GNU Readline Library in source code. The
terms of any Oracle license that might accompany the
Oracle programs do NOT apply to the GNU Readline Library;
it is licensed under the following license, separately
from the Oracle programs you receive. Oracle elects to
use GNU General Public License version 2 (GPL) for any
software where a choice of GPL license versions are
made available with the language indicating that GPLv2
or any later version may be used, or where a choice of
which version of the GPL is applied is unspecified.
```

This component is licensed under [Section A.7, "GNU General Public License Version 2.0, June 1991"](#)

A.11 Google Controlling Master Thread I/O Rate Patch License

The following software may be included in this product:

Google Controlling master thread I/O rate patch

```
Copyright (c) 2009, Google Inc.
All rights reserved.
```

```
Redistribution and use in source and binary forms, with or without
modification, are permitted provided that the following conditions
are met:
```

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- * Neither the name of the Google Inc. nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

```
THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS
"AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT
LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS
FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE
COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT,
INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING,
BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES;
LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER
CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN
ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
POSSIBILITY OF SUCH DAMAGE.
```

A.12 Google Perftools (TCMalloc utility) License

The following software may be included in this product:

```
Google Perftools (TCMalloc utility)
```

```
Copyright (c) 1998-2006, Google Inc.
All rights reserved.
```

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- * Neither the name of Google Inc. nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.13 Google SMP Patch License

The following software may be included in this product:

Google SMP Patch

Google SMP patch

Copyright (c) 2008, Google Inc.
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- * Neither the name of the Google Inc. nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.14 lib_sql.cc License

The following software may be included in this product:

[lib_sql.cc](#)

```
Copyright (c) 2000
SWsoft company
```

```
This material is provided "as is", with absolutely no warranty
expressed or implied. Any use is at your own risk.
```

```
Permission to use or copy this software for any purpose is hereby
granted without fee, provided the above notices are retained on
all copies. Permission to modify the code and to distribute modified
code is granted, provided the above notices are retained, and a
notice that the code was modified is included with the above copyright
notice.
```

```
This code was modified by the MySQL team.
```

A.15 libevent License

The following software may be included in this product:

libevent

```
Copyright (c) 2000-2007 Niels Provos <provos@citi.umich.edu>
All rights reserved.
```

```
Redistribution and use in source and binary forms, with or without
modification, are permitted provided that the following conditions
are met:
```

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

```
THIS SOFTWARE IS PROVIDED BY THE AUTHOR ``AS IS'' AND ANY EXPRESS OR
IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES
OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED.
IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT,
INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT
NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE,
DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY
THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT
(INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF
THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE
```

```
==
```

```
Parts developed by Adam Langley
```

```
==
```

```
==
```

```
log.c
```

```
Based on err.c, which was adapted from OpenBSD libc *err*warncode.
```

```
Copyright (c) 2005 Nick Mathewson
```

```
Copyright (c) 2000 Dug Song
```

```
Copyright (c) 1993 The Regents of the University of California.
```

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

==

==

min_heap.h

Copyright (c) 2006 Maxim Yegorushkin
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE AUTHOR "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

==

==

win32.c

Copyright 2000-2002 Niels Provos
Copyright 2003 Michael A. Davis
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE AUTHOR "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

==

A.16 Linux-PAM License

The following software may be included in this product:

Linux-PAM (pam-devel, Pluggable authentication modules for Linux)

Copyright Theodore Ts'o, 1996. All rights reserved.

(For the avoidance of doubt, Oracle uses and distributes this component under the terms below and elects not to do so under the GPL even though the GPL is referenced as an option below.)

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, and the entire permission notice in its entirety, including the disclaimer of warranties.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

ALTERNATIVELY, this product may be distributed under the terms of the GNU Public License, in which case the provisions of the GPL are required INSTEAD OF the above restrictions. (This clause is necessary due to a potential bad interaction between the GPL and the restrictions contained in a BSD-style copyright.)

THIS SOFTWARE IS PROVIDED ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES

```
(INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.
```

A.17 md5 (Message-Digest Algorithm 5) License

The following software may be included in this product:

md5 (Message-Digest Algorithm 5)

```
This code implements the MD5 message-digest algorithm.
The algorithm is due to Ron Rivest. This code was
written by Colin Plumb in 1993, no copyright is claimed.
This code is in the public domain; do with it what you wish.
```

```
Equivalent code is available from RSA Data Security, Inc.
This code has been tested against that, and is equivalent,
except that you don't need to include two pages of legalese
with every copy.
```

```
The code has been modified by Mikael Ronstroem to handle
calculating a hash value of a key that is always a multiple
of 4 bytes long. Word 0 of the calculated 4-word hash value
is returned as the hash value.
```

A.18 memcached License

The following software may be included in this product:

memcached

```
Copyright (c) 2003, Danga Interactive, Inc.
All rights reserved.
```

```
Redistribution and use in source and binary forms, with or without
modification, are permitted provided that the following conditions
are met:
```

```
* Redistributions of source code must retain the above copyright
notice, this list of conditions and the following disclaimer.
```

```
* Redistributions in binary form must reproduce the above
copyright notice, this list of conditions and the following disclaimer
in the documentation and/or other materials provided with the
distribution.
```

```
* Neither the name of the Danga Interactive nor the names of its
contributors may be used to endorse or promote products derived from
this software without specific prior written permission.
```

```
THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS
"AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT
LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR
A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT
OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL,
SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT
LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE,
DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY
THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT
```

(INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.19 nt_servc (Windows NT Service class library) License

The following software may be included in this product:

nt_servc (Windows NT Service class library)

Windows NT Service class library
Copyright Abandoned 1998 Irena Pancirov - Irnet Snc
This file is public domain and comes with NO WARRANTY of any kind

A.20 OpenPAM License

The following software may be included in this product:

OpenPAM

Copyright (c) 2002-2003 Networks Associates Technology, Inc.
Copyright (c) 2004-2007 Dag-Erling Smørgrav
All rights reserved.

This software was developed for the FreeBSD Project by ThinkSec AS and Network Associates Laboratories, the Security Research Division of Network Associates, Inc. under DARPA/SPAWAR contract N66001-01-C-8035 ("CBOSS"), as part of the DARPA CHATS research program.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE AUTHOR AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.21 Paramiko License

The following software may be included in this product:

Paramiko

You are receiving a copy of Paramiko in both source and object code. The terms of the Oracle license do NOT apply to the Paramiko program; it is licensed under the following license, separately from the Oracle programs you receive. If you do not wish to install this program, you may delete the Paramiko folder and all its contents.

This component is licensed under [Section A.8, "GNU Lesser General Public License Version 2.1, February 1999"](#).

A.22 Percona Multiple I/O Threads Patch License

The following software may be included in this product:

Percona Multiple I/O threads patch

Copyright (c) 2008, 2009 Percona Inc
All rights reserved.

Redistribution and use of this software in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- * Neither the name of Percona Inc. nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission of Percona Inc.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

A.23 RegEX-Spencer Library License

The following software may be included in this product: Henry Spencer's Regular-Expression Library (RegEX-Spencer)

Copyright 1992, 1993, 1994 Henry Spencer. All rights reserved.
This software is not subject to any license of the American Telephone and Telegraph Company or of the Regents of the University of California.

Permission is granted to anyone to use this software for any purpose on any computer system, and to alter it and redistribute it, subject to the following restrictions:

1. The author is not responsible for the consequences of use of this software, no matter how awful, even if they arise from flaws in it.

2. The origin of this software must not be misrepresented, either by explicit claim or by omission. Since few users ever read sources, credits must appear in the documentation.
3. Altered versions must be plainly marked as such, and must not be misrepresented as being the original software. Since few users ever read sources, credits must appear in the documentation.
4. This notice may not be removed or altered.

A.24 RFC 3174 - US Secure Hash Algorithm 1 (SHA1) License

The following software may be included in this product:

RFC 3174 - US Secure Hash Algorithm 1 (SHA1)

RFC 3174 - US Secure Hash Algorithm 1 (SHA1)

Copyright (C) The Internet Society (2001). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

A.25 Richard A. O'Keefe String Library License

The following software may be included in this product:

Richard A. O'Keefe String Library

The Richard O'Keefe String Library is subject to the following notice:

These files are in the public domain. This includes getopt.c, which is the work of Henry Spencer, University of Toronto Zoology, who says of it "None of this software is derived from Bell software. I had no access to the source for Bell's versions at the time I wrote it. This software is hereby explicitly placed in the public domain.

```
It may be used for any purpose on any machine by anyone." I would
greatly prefer it if *my* material received no military use.
```

```
The t_ctype.h file is subject to the following notice:
```

```
Copyright (C) 1998, 1999 by Pruet Boonma, all rights reserved.
Copyright (C) 1998 by Theppitak Karoonboonyanan, all rights reserved.
```

```
Permission to use, copy, modify, distribute and sell this software and its
documentation for any purpose is hereby granted without fee, provided that the above
copyright notice appear in all copies.
```

```
Smaphan Raruenrom and Pruet Boonma makes no representations about
the suitability of this software for any purpose. It is provided
"as is" without express or implied warranty.
```

A.26 SHA-1 in C License

The following software may be included in this product:

SHA-1 in C

```
SHA-1 in C
By Steve Reid <steve@edmweb.com>
100% Public Domain
```

A.27 zlib License

The following software may be included in this product:

zlib

Oracle gratefully acknowledges the contributions of Jean-loup Gailly and Mark Adler in creating the zlib general purpose compression library which is used in this product.

```
zlib.h -- interface of the 'zlib' general purpose compression library
Copyright (C) 1995-2004 Jean-loup Gailly and Mark Adler
```

```
zlib.h -- interface of the 'zlib' general purpose compression library
version 1.2.3, July 18th, 2005
Copyright (C) 1995-2005 Jean-loup Gailly and Mark Adler
```

```
zlib.h -- interface of the 'zlib' general purpose compression library
version 1.2.5, April 19th, 2010
Copyright (C) 1995-2010 Jean-loup Gailly and Mark Adler
```

```
This software is provided 'as-is', without any express or implied warranty.
In no event will the authors be held liable for any damages arising from the
use of this software. Permission is granted to anyone to use this software
for any purpose, including commercial applications, and to alter it and
redistribute it freely, subject to the following restrictions:
```

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.
2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.
3. This notice may not be removed or altered from any source distribution.

```
Jean-loup Gailly jloup@gzip.org
Mark Adler madler@alumni.caltech.edu
```