MySQL Basics II

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Topics

- Advanced field modifiers
  - > AUTO_INCREMENT
  - > INDEX
  - > UNIQUE
- Table modifiers
  - > Storage Engine
  - > Other modifiers
- WHERE clause options
- GROUP BY and HAVING
- User-defined variables

Advanced Field Modifers

Advanced Field Modifiers

- AUTO_INCREMENT
  - MySQL automatically generates a number (by incrementing the previous value by 1)
  - Used for creating primary key automatically
- INDEX
  - Index a field
  - When a field is indexed, MySQL no longer has to scan the whole table, instead uses the index to locate the record(s)
  - Performance booster
- UNIQUE
  - The value has to be unique

AUTO_INCREMENT

```
/* Create "employees" table */
DROP TABLE IF EXISTS employees;

CREATE TABLE employees (
   /* If value of this field is not provided, one will be created by MySQL */
   employee_id int(11) NOT NULL AUTO_INCREMENT,
   name varchar(255) NOT NULL,
   salary decimal(7,2) NOT NULL,
   PRIMARY KEY  (employee_id)
);

/* Data for the table employees - providing employee_id explicitly  */
INSERT INTO employees(employee_id, name, salary)
VALUES
(1,'jack','3000.00'),
(2,'mary','2500.00'),
(3,'nichole','4000.00');

/* Data for the table employees - using AUTO_INCREMENT */
INSERT INTO employees(name, salary)
VALUES
('angie','5000.00'),
('jones','5000.00');
```

INDEX constraint

```
CREATE TABLE employees (
    employee_id int(11) NOT NULL AUTO_INCREMENT,
    name varchar(255) NOT NULL UNIQUE,
    department varchar(255) NOT NULL,
    salary decimal(7,2) NOT NULL,
    PRIMARY KEY  (employee_id),
    INDEX (department)
);
```

UNIQUE constraint

```
CREATE TABLE employees (
    employee_id int(11) NOT NULL AUTO_INCREMENT,
    /* name field now has UNIQUE constraint */
    /* every name in this field has to be unique */
    name varchar(255) NOT NULL UNIQUE,
    salary decimal(7,2) NOT NULL,
    PRIMARY KEY  (employee_id)
);

/* Data for the table employees - using AUTO_INCREMENT */
INSERT INTO employees(name, salary)
VALUES
('angie','5500.00'),
('jones','5000.00'),
('jones','4000.00');  /* This should result in an error */
```

Demo:

Exercise 1: Field Modifiers
1611_mysql_basics2.zip

Table Modifiers:
Storage Engine

What is a Storage Engine?

- A "storage engine" is the underlying software component that a database management system (DBMS) uses for performing database operations
- Represents table type
  - A table is associated with a particular storage engine
  - A table is either created with a particular storage engine or altered to a different storage engine

Storage Engines

- MySQL support a set of storage engines based on pluggable storage engine architecture
- Each storage engine has its own advantages and disadvantages
  - Choosing a wrong one might cause performance drag
- Different storage engines can be assigned to different tables in a single database

Factors to consider when choosing a Storage engine for a table

- Frequency of reads vs. writes
  - MyISAM would be better choice if the table access is mostly reads (SELECT)
- Whether transactional support is needed or not
  - Only InnoDB supports transactional behavior
- Indexing requirement
- OS portability
- Future extensibility and changeability

Storage Engines in MySQL

- InnoDB
  - > InnoDB is a transaction-safe (ACID compliant) storage engine for MySQL that has commit, rollback, and crash-recovery capabilities to protect user data
  - > Default
- MyISAM
  - > It is based on the older ISAM code but has many useful extensions
- MRG_MYISAM
  - > Is a collection of identical MyISAM tables that can be used as one.

Storage Engines

- FEDERATED
  - > Enables data located on a remote MySQL database can be accessed through local server
- ARCHIVE
  - > Used for storing large amounts of data without indexes in a very small footprint.
- CSV
  - > Stores data in text files using comma-separated values format.
- BLACKHOLE
  - > Acts as a “black hole” that accepts data but throws it away and does not store it.

Storage Engines

- MRG_MYISAM
  - > Is a collection of identical MyISAM tables that can be used as one.
- MEMORY (HEAP)
  - > Hash based, stored in memory, useful for temporary tables

Creating a table with ENGINE

```
mysql> CREATE TABLE  t1_InnoDB (id int) ENGINE = InnoDB;
Query OK, 0 rows affected (0.18 sec)

mysql> CREATE TABLE  t2_MyISAM (id int) ENGINE = MyISAM;
Query OK, 0 rows affected (0.07 sec)

// Create a table with a default storage engine
mysql> CREATE TABLE  t3_default (id int);
Query OK, 0 rows affected (0.13 sec)
```

Table Modifiers:
Misc. Modifiers

Table Modifiers

- AUTO_INCREMENT
  - Specifies the starting value of the AUTO_INCREMENT field
- CHARACTER SET, COLLATE
  - Specifies the table character set and collation
- CHECKSUM
  - Specifies whether the table checksum should be computed and stored
- MAX_ROWS, MIN_ROWS
  - Specifies the maximum and minimum number of rows a table can have

Table Modifiers (Continued)

- PACK_KEYS
  - Specifies whether indexes should be compressed or not
- DELAY_KEY_WRITE
  - Specifies whether indexes should be updated only after all writes to the table are complete
  - Can improve performance for tables with high frequency of writes
- DATA DIRECTORY
  - Specifies non-default data directory
- INDEX DIRECTORY
  - Specifies non-default index directory

Demo:

Exercise 2: Table Modifiers
1611_mysql_basics2.zip

WHERE Clause Options

Comparison Operators in WHERE

- =,>,<,.>=,<=,<>

```
SELECT * FROM employees
WHERE salary > 3500;
```

Logical Operators in WHERE

- AND, OR, NOT

```
SELECT * FROM employees
WHERE (department_id = 1 AND NOT name = 'nichole')
    OR salary > 4500;
```

BETWEEN

```
SELECT * FROM employees
WHERE salary BETWEEN 2000 AND 4000;
```

IN

```
SELECT * FROM employees
WHERE name IN ('nichole', 'jack');
```

LIKE

```
SELECT * FROM employees
WHERE name LIKE '%n%';

SELECT * FROM employees
WHERE name LIKE '%e';
```

Regular Expression

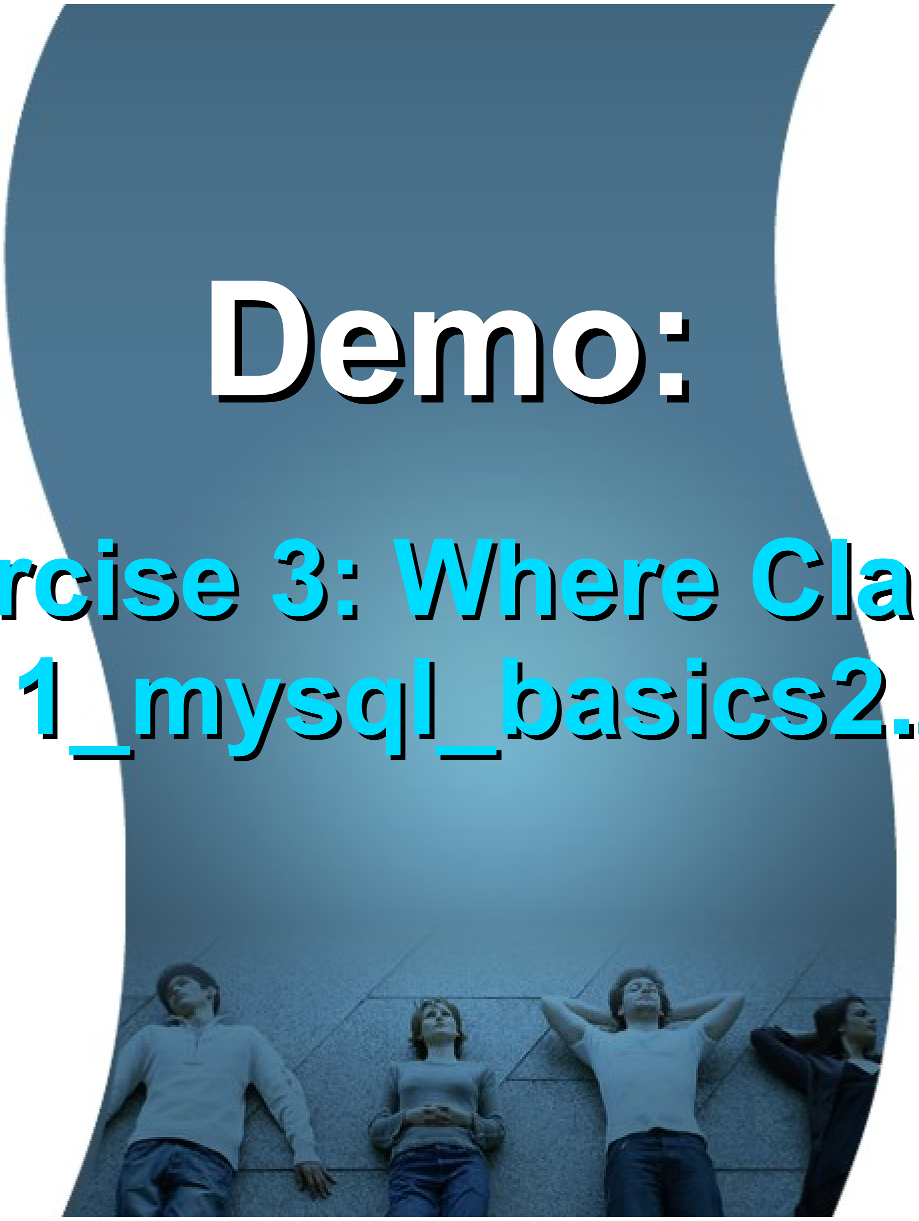
```
/* Get all records whose name is either 'jones' or 'mary' */
SELECT * FROM employees
WHERE name REGEXP 'jones|mary';

/* Get all records whose name starts with 'j' */
SELECT * FROM employees
WHERE name REGEXP '^j';

/* Get all records whose name ends with 'e' */
SELECT * FROM employees
WHERE name REGEXP 'e$';
```

DISTINCT

```
SELECT DISTINCT salary FROM employees;
```



Demo:

Exercise 3: Where Clause
1611_mysql_basics2.zip

GROUP BY and HAVING

GROUP BY

- Returns group of rows
- Divides a table into sets and it is usually used with SQL aggregate functions, like COUNT(..), which produces summary value for each set

GROUP BY Example

```
/* Data for the table employees */
INSERT INTO employees(name, salary, department_id) VALUES
('jack','3000.00', 1),
('mary','2500.00', 2),
('nichole','4000.00', 1),
('angie','5000.00', 2),
('jones','5000.00', 3);

/* Get number of employees for each department using GROUP BY */
SELECT department_id, COUNT(employee_id) AS employee_count
FROM employees
GROUP BY department_id;

+------------------+---------------- ----+
| department_id | employee_count |
+-----------==----+----===-----------+
|               1 |                2 |
|               2 |                2 |
|               3 |                1 |
+------------------+--------------------+
```

HAVING

- HAVING clause is like a WHERE clause for groups.
  - Just as WHERE clause limits rows, HAVING clause limits groups.
- In most programming contexts, you will use HAVING clause after GROUP BY clause to limit groups by searched conditions.

HAVING Example

```
/* Data for the table employees */
INSERT INTO employees(name, salary, department_id) VALUES
('jack','3000.00', 1),
('mary','2500.00', 2),
('nichole','4000.00', 1),
('angie','5000.00', 2),
('jones','5000.00', 3);

/* Get number of employees for each department using GROUP BY &
 * the number of employees are greater than or equal to 2. */
SELECT department_id, COUNT(employee_id) AS employee_count
FROM employees
GROUP BY department_id
HAVING employee_count >= 2;

+---------------+----------------+
| department_id | employee_count |
+---------------+----------------+
|             1 |              2 |
|             2 |              2 |
+---------------+----------------+
```

Demo:

Exercise 4: GROUP BY & HAVING
1611_mysql_basics2.zip

User-defined Variables

What are User-defined variables?

- You can store a value in a user-defined variable in one statement and then refer to it later in another statement
  - > This enables you to pass values from one statement to another
- User-defined variables are connection-specific
  - > A user variable defined by one client cannot be seen or used by other clients
  - > All variables for a given client connection are automatically freed when that client exits.

How to create user-defined variables

- User variables are written as @*var_name*
- One way to set a user-defined variable is by issuing a SET statement:
  - SET @var_name = expr [, @var_name = expr] ...
  - For SET, either = or := can be used as the assignment operator
- Another way to define a user-defined variable is by using SELECT.. INTO
  - SELECT .. INTO @var_name

Setting User-defined Variables with SET

```
mysql> SET @my_var1 = 10, @my_var2 := 20;
Query OK, 0 rows affected (0.24 sec)

mysql> SELECT @my_var1, @my_var2, @my_var3 := @my_var1 + @my_var2;
+----------+----------+---------------------------------+
| @my_var1 | @my_var2 | @my_var3 := @my_var1 + @my_var2 |
+----------+----------+---------------------------------+
|       10 |       20 |                              30 |
+----------+----------+---------------------------------+
1 row in set (0.05 sec)

mysql> SET @my_string_var = 'Sang Shin';
Query OK, 0 rows affected (0.00 sec)

mysql> SELECT UPPER(@my_string_var), LOWER(@my_string_var);
+-----------------------+-----------------------+
| UPPER(@my_string_var) | LOWER(@my_string_var) |
+-----------------------+-----------------------+
| SANG SHIN             | sang shin             |
+-----------------------+-----------------------+
1 row in set (0.08 sec)
```

Setting User-defined Variables with SELECT

```
mysql> SELECT 67 INTO @my_var4;
Query OK, 1 row affected (0.06 sec)

mysql> SELECT @my_var4;
+----------+
| @my_var4 |
+----------+
|       67 |
+----------+
1 row in set (0.00 sec)

mysql> SELECT @my_var4 + 10 INTO @my_var5;
Query OK, 1 row affected (0.00 sec)

mysql> SELECT @my_var4, @my_var5;
+----------+----------+
| @my_var4 | @my_var5 |
+----------+----------+
|       67 |       77 |
+----------+----------+
1 row in set (0.00 sec)
```

Setting User-defined Variables with SELECT

```
mysql> select name into @first from employees where employee_id =1;
Query OK, 1 row affected (0.00 sec)

mysql> select @first;
+--------+
| @first |
+--------+
| jack   |
+--------+
1 row in set (0.00 sec)

mysql> select sum(salary) from employees into @total;
Query OK, 1 row affected (0.00 sec)

mysql> select @total;
+----------+
| @total   |
+----------+
| 19500.00 |
+----------+
1 row in set (0.00 sec)
```

Demo:

Exercise 5: User Defined Variables
1611_mysql_basics2.zip

Thank you!

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