

测试说明文档

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本文档提供了每个测试点的名称和测试内容，参赛队伍提交代码后，如果未通过某个测试点，可以通过测试点名称来查看失败测试点的测试内容。

题目二 查询执行

测试点1：尝试建表

测试示例：

```
create table t1(id int,name char(4));
show tables;
create table t2(id int);
show tables;
drop table t1;
show tables;
drop table t2;
show tables;
```

期待输出：

```
| Tables |
| t1 |
| Tables |
| t1 |
| t2 |
| Tables |
| t2 |
| Tables |
```

测试点2：单表插入与条件查询

测试示例：

```
create table grade (name char(4),id int,score float);
insert into grade values ('Data', 1, 90.5);
insert into grade values ('Data', 2, 95.0);
insert into grade values ('Calc', 2, 92.0);
insert into grade values ('Calc', 1, 88.5);
select * from grade;
select score,name,id from grade where score > 90;
select id from grade where name = 'Data';
select name from grade where id = 2 and score > 90;
```

期待输出：

```
| name | id | score |
| Data | 1 | 90.500000 |
| Data | 2 | 95.000000 |
| Calc | 2 | 92.000000 |
| Calc | 1 | 88.500000 |
```

| score | name | id |
|-----------|------|----|
| 90.500000 | Data | 1 |
| 95.000000 | Data | 2 |
| 92.000000 | Calc | 2 |

| id |
|----|
| 1 |
| 2 |

| name |
|------|
| Data |
| Calc |

测试点3：单表更新与条件查询

测试示例：

```
create table grade (name char(4),id int,score float);
insert into grade values ('Data', 1, 90.5);
insert into grade values ('Data', 2, 95.0);
insert into grade values ('Calc', 2, 92.0);
insert into grade values ('Calc', 1, 88.5);
select * from grade;
update grade set score = 99.0 where name = 'Calc' ;
select * from grade;
update grade set name = 'test' where name > 'A';
select * from grade;
update grade set name = 'test' ,id = -1,score = 0 where name = 'test' and score > 90;
select * from grade;
```

期待输出：

| name | id | score |
|------|----|-----------|
| Data | 1 | 90.500000 |
| Data | 2 | 95.000000 |
| Calc | 2 | 92.000000 |
| Calc | 1 | 88.500000 |

| name | id | score |
|------|----|-----------|
| Data | 1 | 90.500000 |
| Data | 2 | 95.000000 |
| Calc | 2 | 99.000000 |
| Calc | 1 | 99.000000 |

| name | id | score |
|------|----|-----------|
| test | 1 | 90.500000 |
| test | 2 | 95.000000 |
| test | 2 | 99.000000 |
| test | 1 | 99.000000 |

| name | id | score |
|------|----|----------|
| test | -1 | 0.000000 |
| test | -1 | 0.000000 |

| | | | | | | |
|--|------|--|----|--|----------|--|
| | test | | -1 | | 0.000000 | |
| | test | | -1 | | 0.000000 | |

测试点4：单表删除与条件查询

测试示例：

```
create table grade (name char(4),id int,score float);
insert into grade values ('Data', 1, 90.5);
select * from grade;
delete from grade where score > 90;
select * from grade;
```

期待输出：

| | | | | | | |
|--|------|--|----|--|-----------|--|
| | name | | id | | score | |
| | Data | | 1 | | 90.500000 | |
| | name | | id | | score | |

测试点5：连接查询

测试示例：

```
create table t (id int , t_name char (3));
create table d (d_name char(5),id int);
insert into t values (1,'aaa');
insert into t values (2,'baa');
insert into t values (3,'bba');
insert into d values ('12345',1);
insert into d values ('23456',2);
select * from t, d;
select t.id,t_name,d_name from t,d where t.id = d.id;
```

期待输出：

| | | | | | | | | |
|--|----|--|--------|--|--------|--|----|--|
| | id | | t_name | | d_name | | id | |
| | 1 | | aaa | | 23456 | | 2 | |
| | 1 | | aaa | | 12345 | | 1 | |
| | 2 | | baa | | 23456 | | 2 | |
| | 2 | | baa | | 12345 | | 1 | |
| | 3 | | bba | | 23456 | | 2 | |
| | 3 | | bba | | 12345 | | 1 | |
| | id | | t_name | | d_name | | | |
| | 1 | | aaa | | 12345 | | | |
| | 2 | | baa | | 23456 | | | |

测试文件说明

- basic_query_test1：DDL语句，包含create table、drop table、show tables语句的测试和语义的检查。
- basic_query_test2：单表插入与条件查询和语义检查。
- basic_query_test3：单表更新与条件查询
- basic_query_test4：单表删除与条件查询
- basic_query_test5：连接查询与浮点数精度测试

题目三 BIGINT类型

测试示例：

```
CREATE TABLE t (bid bigint, sid int);
INSERT INTO t VALUES (372036854775807, 233421);
INSERT INTO t VALUES (-922337203685477580, 124332);
SELECT * FROM t;
INSERT INTO t VALUES (9223372036854775809, 12345);
SELECT * FROM t;
```

期待输出：

```
| bid | sid |
| 372036854775807 | 233421 |
| -922337203685477580 | 124332 |
failure
| bid | sid |
| 372036854775807 | 233421 |
| -922337203685477580 | 124332 |
```

测试文件说明

- 单个测试点：bigint字段的增删改查以及合法性检查

题目四 时间类型

测试点1：建表时创建时间类型的属性，并在该字段上进行增删改查

测试示例：

```
create table t(id int , time datetime);
insert into t values(1, '2023-05-18 09:12:19');
insert into t values(2, '2023-05-32 12:34:32');
select * from t;
delete from t where time = '2023-05-32 12:34:32';
update t set id = 2023 where time = '2023-05-18 09:12:19';
select * from t;
```

期待输出:

```
| id | time |
| 1 | 2023-05-18 09:12:19 |
| 2 | 2023-05-32 12:34:32 |
| id | time |
| 2023 | 2023-05-18 09:12:19 |
```

测试点2：对输入的合法性进行判断

测试示例:

```
create table t(time datetime, temperature float)
insert into t values('1999-07-07 12:30:00' , 36.0);
select * from t;
insert into t values('1999-13-07 12:30:00' , 36.0);
insert into t values('1999-1-07 12:30:00' , 36.0);
insert into t values('1999-00-07 12:30:00' , 36.0);
insert into t values('1999-07-00 12:30:00' , 36.0);
insert into t values('0001-07-10 12:30:00' , 36.0);
insert into t values('1999-02-30 12:30:00' , 36.0);
insert into t values('1999-02-28 12:30:61' , 36.0);
select * from t;
```

期待输出:

```
| time | temperature |
| 1999-07-07 12:30:00 | 36.000000 |
failure
failure
failure
failure
failure
failure
failure
failure
| time | temperature |
| 1999-07-07 12:30:00 | 36.000000 |
```

测试文件说明

- storage_test1: 建表时创建时间类型的属性, 并在该字段上进行增删改查。
- storage_test2: 对时间类型的属性的输入值的合法性进行判断。

题目五 唯一索引

测试点1: 创建、删除、展示索引

测试示例:

```
create table warehouse (id int, name char(8));
create index warehouse (id);
show index from warehouse;
create index warehouse (id,name);
show index from warehouse;
drop index warehouse (id);
drop index warehouse (id,name);
show index from warehouse;
```

期待输出:

```
| warehouse | unique | (id) |
| warehouse | unique | (id) |
| warehouse | unique | (id,name) |
```

测试点2: 索引查询

测试示例:

```
create table warehouse (w_id int, name char(8));
insert into warehouse values (10 , 'qweruiop');
insert into warehouse values (534, 'asdfhjkl');
insert into warehouse values (100,'qwerghjk');
insert into warehouse values (500,'bgtyhnmj');
create index warehouse(w_id);
select * from warehouse where w_id = 10;
select * from warehouse where w_id < 534 and w_id > 100;
drop index warehouse(w_id);
create index warehouse(name);
select * from warehouse where name = 'qweruiop';
select * from warehouse where name > 'qwerghjk';
select * from warehouse where name > 'aszdefgh' and name < 'qweraaaa';
drop index warehouse(name);
create index warehouse(w_id,name);
```

```
select * from warehouse where w_id = 100 and name = 'qwerghjk';
select * from warehouse where w_id < 600 and name > 'bzythnmj';
```

期待输出:

```
| w_id | name |
| 10 | qweruiop |
| w_id | name |
| 500 | bgythnmj |
| w_id | name |
| 10 | qweruiop |
| w_id | name |
| 10 | qweruiop |
| w_id | name |
| 500 | bgythnmj |
| w_id | name |
| 100 | qwerghjk |
| w_id | name |
| 10 | qweruiop |
| 100 | qwerghjk |
```

测试点3: 索引维护

测试示例:

```
create table warehouse (w_id int, name char(8));
insert into warehouse values (10 , 'qweruiop');
insert into warehouse values (534, 'asdfhjkl');
select * from warehouse where w_id = 10;
select * from warehouse where w_id < 534 and w_id > 100;
create index warehouse(w_id);
insert into warehouse values (500, 'lastdanc');
update warehouse set w_id = 507 where w_id = 534;
select * from warehouse where w_id = 10;
select * from warehouse where w_id < 534 and w_id > 100;
```

期待输出:

```
| w_id | name |
| 10 | qweruiop |
| w_id | name |
| w_id | name |
| 10 | qweruiop |
| w_id | name |
| 500 | lastdanc |
| 507 | asdfhjkl |
```


测试文件说明

- storage_test3: 创建、删除、展示索引。
- storage_test4: 索引查询。
- storage_test5: 索引维护。
- judge_whether_use_index_on_single_attribute: 创建表并插入数据后，进行大量单列查询，记录耗时time_a，在某列创建索引，再次进行大量单列查询，记录耗时time_b。若 $\text{time_b} / \text{time_a} * 100\% \leq 70\%$ ，视为在单列查询时使用了索引。若判断为没有使用索引，则测试点2和测试点3零分。
- judge_whether_use_index_on_multiple_attributes: 创建表并插入数据后，进行大量多列查询，记录耗时time_a，创建多列索引，再次进行大量多列查询，记录耗时time_b。若 $\text{time_b} / \text{time_a} * 100\% \leq 70\%$ ，视为在多列查询时使用了索引。若判断为没有使用索引，则测试点2和测试点3零分。

题目六 聚合函数

测试点1: SUM

测试示例:

```
create table aggregate (id int, val float);
insert into aggregate values(1, 5.5);
insert into aggregate values(3, 4.5);
insert into aggregate values(5, 10.0);
select SUM(id) as sum_id from aggregate;
select SUM(val) as sum_val from aggregate;
```

期待输出:

```
| sum_id |
| 9      |
| sum_val |
| 20.000000 |
```

测试点2: MAX, MIN

测试示例:

```
create table aggregate (id int, val float);
insert into aggregate values(1, 5.5);
insert into aggregate values(3, 4.5);
insert into aggregate values(5, 10.0);
select MAX(id) as max_id from aggregate;
select MIN(val) as min_val from aggregate;
```

期待输出:

```
| max_id |  
| 5 |  
| min_val |  
| 4.500000 |
```

测试点3: COUNT(),COUNT(*)

测试示例:

```
create table aggregate (id int,name char(8),val float);  
insert into aggregate values (1,'qwerasdf',1.0);  
insert into aggregate values (2,'qwerasdf',2.0);  
insert into aggregate values (3,'uiophjkl',2.0);  
select COUNT(*) as count_row from aggregate;  
select COUNT(id) as count_id from aggregate;  
select COUNT(name) as count_name from aggregate where val = 2.0;
```

期待输出:

```
| count_row |  
| 3 |  
| count_id |  
| 3 |  
| count_name |  
| 2 |
```

测试文件说明

- aggregate_test1: sum函数测试, 浮点数保留6位小数, 整数不显示小数, as别名要求与SQL一致。
- aggregate_test2: max、min函数测试。
- aggregate_test3: count函数测试。

题目七 order by操作符

测试点

测试示例:

```

create table orders (company char(10), order_number int);
insert into orders values('AAA',12);
insert into orders values('ABB',13);
insert into orders values('ABC',19);
insert into orders values('ACA',1);
SELECT company, order_number FROM orders ORDER BY order_number;
SELECT company, order_number FROM orders ORDER BY company, order_number;
SELECT company, order_number FROM orders ORDER BY company DESC, order_number ASC;
SELECT company, order_number FROM orders ORDER BY order_number ASC LIMIT 2;

```

期待输出:

```

| company | order_number |
| ACA    | 1            |
| AAA    | 12           |
| ABB    | 13           |
| ABC    | 19           |
| company | order_number |
| AAA    | 12           |
| ABB    | 13           |
| ABC    | 19           |
| ACA    | 1            |
| company | order_number |
| ACA    | 1            |
| ABC    | 19           |
| ABB    | 13           |
| AAA    | 12           |
| company | order_number |
| ACA    | 1            |
| AAA    | 12           |

```

测试文件说明

- 单个测试点 (order_by_test) : 包含单字段orderby、多字段orderby、limit字段、升序和降序测试

题目八 块嵌套循环连接算法

测试点

测试示例:

```

select * from t1, t2 where t1.id = t2.t_id order by t1.id;
select * from t1, t2 where t1.id < t2.t_id and t2.t_id < 1000;

```

测试文件说明

- join_test_1: 等值连接测试
- join_test_2: 不等值连接测试

题目九 事务控制语句

测试点

测试示例:

```
create table student (id int, name char(8), score float);
insert into student values (1, 'xiaohong', 90.0);
begin;
insert into student values (2, 'xiaoming', 99.0);
delete from student where id = 2;
abort;
select * from student;
```

期待输出:

| id | name | score |
|----|----------|-----------|
| 1 | xiaohong | 90.000000 |

测试文件说明

- commit_test: 事务提交测试, 不包含索引
- abort_test: 事务回滚测试, 不包含索引
- commit_index_test: 事务提交测试, 包含索引
- abort_index_test: 事务回滚测试, 包含索引

题目十 基于死锁预防的可串行化隔离级别

测试点: 判断系统是否会出现五种数据异常

测试示例:

```
-- 对脏读数据异常进行测试:
create table concurrency_test (id int, name char(8), score float);
insert into concurrency_test values (1, 'xiaohong', 90.0);
insert into concurrency_test values (2, 'xiaoming', 95.0);
insert into concurrency_test values (3, 'zhanghua', 88.5);
```

-- 事务1的测试语句:

```
t1a begin;  
t1b update concurrency_test set score = 100.0 where id = 2;  
t1c abort;  
t1d select * from concurrency_test where id = 2;
```

--事务2的测试语句:

```
t2a begin;  
t2b select * from concurrency_test where id = 2;  
t2c commit;
```

期待操作序列:

```
t1a t2a t1b t2b t1c t1d
```

测试文件说明

- concurrency_read_test: 并发读测试
- dirty_write_test: 脏写测试
- dirty_read_test: 脏读测试
- lost_update_test: 丢失更新测试
- unrepeatable_read_test: 不可重复读测试
- unrepeatable_read_test_hard: 不可重复读测试
- phantom_read_test_1: 幻读测试
- phantom_read_test_2: 幻读测试
- phantom_read_test_3: 幻读测试
- phantom_read_test_4: 幻读测试

题目十一 系统故障恢复

测试点

测试示例:

```
create table t1 (id int, num int);
begin;
insert into t1 values(1, 1);
commit;
begin;
insert into t1 values(2, 2);
crash      // 系统接收到终止信号
...
重启系统
select * from t1;
```

测试文件说明

- crash_recovery_single_thread_test: 单个客户端连接，系统故障恢复测试
- crash_recovery_single_thread_test_2: 单个客户端连接，系统故障恢复测试
- crash_recovery_multi_thread_test: 多个并发事务运行过程中故障，系统故障恢复测试
- crash_recovery_large_data_test: 多个并发事务运行过程中故障，系统故障恢复测试