# 数据库第六次上机

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## TASK 1：存储过程或自定义函数实现用户操作

### Q1 使用游标

> **用户密码检查/修改**：接收四个参数（用户名，密码，新密码，动作），若动作为1，则检查用户名和密码是否和密码表中存的相符，相符则返回 true，不相符返回false；若动作为2，则首先检查用户名、密码是否相符，若不相符返回false，相符则将密码表中的密码改成新密码，返回true。密码要求只包含数字和字母，长度大于等于4、小于等于10；

代码如下：

```
create procedure user_check (
    in uname varchar(50),
    in old_pwd varchar(30),
    in new_pwd varchar(30),
    in action int,
    out judge bool
) begin
    declare _username varchar(50);
    declare _pwd varchar(30);
    declare done bool default 0;
    declare pwd_cursor cursor for select username, password from account;
    -- 游标执行结束时将会设置done变量为1
    declare continue handler for not found set done = 1;
    set judge = false;  -- judge初值为false
    open pwd_cursor;
    while done = 0 do
        fetch pwd_cursor into _username, _pwd;
        if _username = uname and _pwd = old_pwd then
            set judge = true;
            # 若动作为2,则将密码表中的密码改成新密码
            if action = 2 then
                update account set password = new_pwd where username = _username;
            end if;
        end if;
    end while;
    close pwd_cursor;
end;
```

`account` 表内数据如下图所示：

| | username | password |
|---|---|---|
| 1 | database | hahaha2 |
| 2 | gary | 111aa |
| 3 | user1 | 123456a |
| 4 | user2 | 114514eee |
| 5 | user3 | password6 |

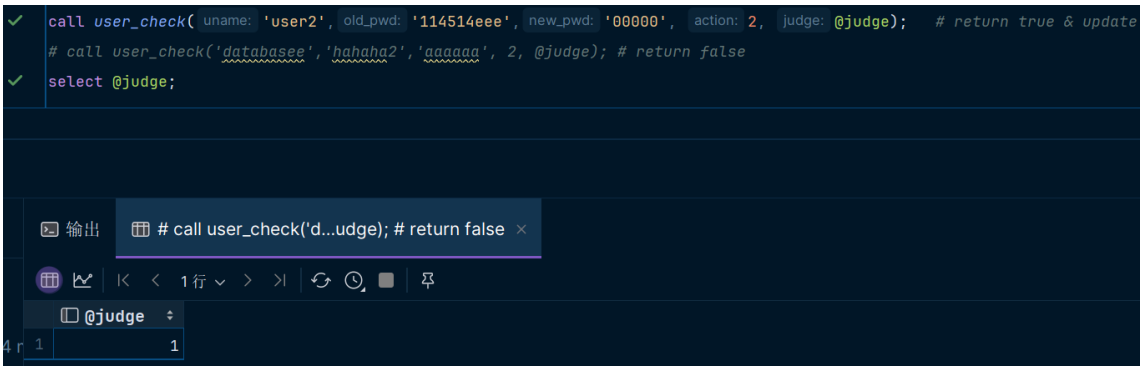
共测试了四组数据，测试语句如下代码，结果在下面分别给出图片。

```
call user_check('gary','111aa','asdfgh',1, @judge);          # return true
call user_check('user1','13456a','helloworld',1, @judge);    # return false: wrong password
call user_check('user2','114514eee','00000', 2, @judge);     # return true & update
call user_check('databasee','hahaha2','aaaaaa', 2, @judge); # return false: wrong username
select @judge;
```

- 第一组：

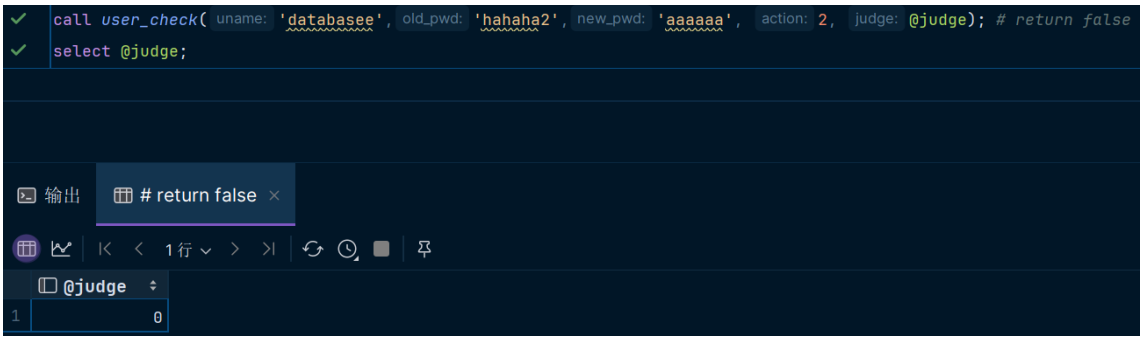

- 第二组：


- 第三组：




| | username | password |
|---|---|---|
| 1 | database | hahaha2 |
| 2 | gary | 111aa |
| 3 | user1 | 123456a |
| 4 | user2 | 00000 |
| 5 | user3 | password6 |

- 第四组：




## Q2

> **借书**：接收两个参数（用户名，ISBN），没有足够的书、用户不存在或一个人借阅两本同样的书时返回false，合法执行后，借阅记录表会新增一条记录，书库对应书的数量也需要减1，并返回true；

代码如下：

```
create procedure borrow_book(
    in uname varchar(50),
    in i varchar(50),
    out judge bool
) begin
    set judge = false;
    if exists(select * from account where username = uname) then
        if exists(select * from stack where ISBN = i and amount >= 1) then
            if not exists(select * from record where ISBN = i and username = uname) then
                set judge = true;
                insert into record values (uname, i, null, null, null);
                update stack set amount = amount - 1 where ISBN = i;
            end if;
        end if;
    end if;
end;
```

`stack` 表和 `record` 表内数据分别如下图所示（本题为图简便，涉及 `time` 的值均为 `null` ）：

| | ISBN | bookname | amount |
|---|---|---|---|
| 1 | 10001 | Discrete Mathematics | 3 |
| 2 | 10002 | Introduction to Algorithms | 0 |
| 3 | 10003 | DBMS Tutorial | 2 |

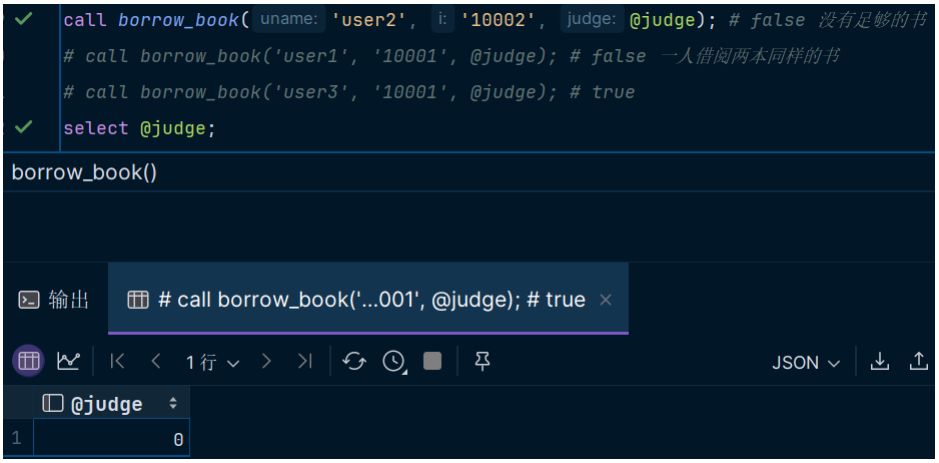
| | username | ISBN | borrow_time | due_time | return_time |
|---|---|---|---|---|---|
| 1 | user1 | 10001 | <null> | <null> | <null> |
| 2 | user1 | 10002 | <null> | <null> | <null> |
| 3 | user2 | 10001 | <null> | <null> | <null> |
| 4 | user3 | 10003 | <null> | <null> | <null> |

共测试了四组数据，测试语句如下代码，结果在下面分别给出图片。

```
call borrow_book('user114514', '10001', @judge);    # false 用户不存在
call borrow_book('user2', '10002', @judge); # false 没有足够的书
call borrow_book('user1', '10001', @judge); # false 一人借阅两本同样的书
call borrow_book('user3', '10001', @judge); # true
select @judge;
```

- 第一组：


- 第二组：




- 第三组：

```
call borrow_book( uname: 'user1', i: '10001', judge: @judge); # false 一人借阅两本同样的书
# call borrow_book('user3', '10001', @judge); # true
select @judge;
```

输出 | # call borrow_book('...001', @judge); # true

1 行 | JSON

| | @judge |
|---|---|
| 1 | 0 |

- 第四组：

```
call borrow_book( uname: 'user3', i: '10001', judge: @judge); # true
select @judge;
```

输出 | # true

1 行

| | @judge |
|---|---|
| 1 | 1 |

可见：`record`多了一条记录（第4条），书10001的库存自减一

| | username | ISBN | borrow_time | due_time | return_time |
|---|---|---|---|---|---|
| 1 | user1 | 10001 | <null> | <null> | <null> |
| 2 | user1 | 10002 | <null> | <null> | <null> |
| 3 | user2 | 10001 | <null> | <null> | <null> |
| 4 | user3 | 10001 | <null> | <null> | <null> |
| 5 | user3 | 10003 | <null> | <null> | <null> |

| | ISBN | bookname | amount |
|---|---|---|---|
| 1 | 10001 | Discrete Mathematics | 2 |
| 2 | 10002 | Introduction to Algorithms | 0 |
| 3 | 10003 | DBMS Tutorial | 2 |

## Q3

> **还书**：接收两个参数（用户名，ISBN），未查询到借阅记录时返回false，合法执行后，借阅记录表对应记录会修改还书时间，书库对应书的数量需要加1，并返回true；

代码如下：

```sql
create procedure return_book(
    in uname varchar(50),
    in i varchar(50),
    out judge bool
) begin
    set judge = false;
    if exists(select * from record where ISBN = i and username = uname) then
        set judge = true;
        # now() - 还书时间记为调用该存储过程的时间
        update record set return_time = now() where ISBN = i and username = uname;
        update stack set amount = amount + 1 where ISBN = i;
    end if;
end;
```

`record` 和 `stack` 表和Q2结束时一样。共测试了三组数据，测试语句如下代码，结果在下面分别给出图片。

```sql
call return_book('user2', '10002', @judge); # false: no record
call return_book('user1', '10001', @judge); # true
call return_book('user3', '10001', @judge); # true
select @judge;
```

- 第一组：


- 第二组：


成功还书，`stack` 和 `record` 表如下所示

| | ISBN | bookname | amount |
|---|---|---|---|
| 1 | 10001 | Discrete Mathematics | 3 |
| 2 | 10002 | Introduction to Algorithms | 0 |
| 3 | 10003 | DBMS Tutorial | 2 |

| | username | ISBN | borrow_time | due_time | return_time |
|---|---|---|---|---|---|
| 1 | user1 | 10001 | <null> | <null> | 2024-05-09 20:44:37 |
| 2 | user1 | 10002 | <null> | <null> | <null> |
| 3 | user2 | 10001 | <null> | <null> | <null> |
| 4 | user3 | 10001 | <null> | <null> | <null> |
| 5 | user3 | 10003 | <null> | <null> | <null> |

- 第三组：

```
call return_book( uname: 'user3', i: '10001', judge: @judge); # true
select @judge;
```

输出 # true

1 行

| | @judge |
|---|---|
| 1 | 1 |

成功还书，`stack`和`record`表如下所示

| | ISBN | bookname | amount |
|---|---|---|---|
| 1 | 10001 | Discrete Mathematics | 4 |
| 2 | 10002 | Introduction to Algorithms | 0 |
| 3 | 10003 | DBMS Tutorial | 2 |

| | username | ISBN | borrow_time | due_time | return_time |
|---|---|---|---|---|---|
| 1 | user1 | 10001 | <null> | <null> | 2024-05-09 20:44:37 |
| 2 | user1 | 10002 | <null> | <null> | <null> |
| 3 | user2 | 10001 | <null> | <null> | <null> |
| 4 | user3 | 10001 | <null> | <null> | 2024-05-09 20:46:36 |
| 5 | user3 | 10003 | <null> | <null> | <null> |

## Q4

> **查看当前借阅记录**：接受一个参数（用户名），返回该用户名的当前借阅中的记录(用户名, ISBN, 到期时间)

代码如下：

```
create procedure lookup_record(
    in uname varchar(50)
) begin
    if not exists(select * from record where username = uname) then
        select 'error: no record of such user!';
    else
        select username, ISBN, due_time
        from record where username = uname;
    end if;
end;
```

共测试了四组数据，测试语句如下代码，结果在下面分别给出图片。

```
call lookup_record('user0');    # no such user
call lookup_record('gary');     # no record
call lookup_record('user1');    # output correctly
call lookup_record('user2');    # output correctly
```

- 第一组

| error: no such user in the database! |
| --- |
| error: no such user in the database! |

- 第二组

| error: no record of such user! |
| --- |
| error: no record of such user! |

- 第三组

| username | ISBN | due_time |
| --- | --- | --- |
| user1 | 10001 | <null> |
| user1 | 10002 | <null> |

- 第三组

| username | ISBN | due_time |
| --- | --- | --- |
| user2 | 10001 | <null> |

# Task2：触发器相关实验

Q6中的DML检验在各触发器建立以后执行。

## Q1

> 建表：fruits（fid，fname，price），sells（fid，cid，sellTime，quantity），customer（cid，cname，level），在fruits表和customer 表插入至少一条数据。

`fruits`表：

| fid | fnname | price |
| --- | --- | --- |
| 1 | apple | 10 |
| 2 | banana | 8 |
| 3 | orange | 6 |

`sells`表：

| fid | cid | sellTime | quantity |
| --- | --- | --- | --- |
| 1 | 3 | <null> | 2 |
| 2 | 1 | <null> | 4 |
| 2 | 2 | <null> | 3 |

`customer`表：

| | cid | cname | level |
|---|---|---|---|
| 1 | 1 | gary | <null> |
| 2 | 2 | user1 | <null> |
| 3 | 3 | user2 | <null> |

## Q2

> 写一个 `sells` 表触发器 **`check_fid_exist`** ，当插入新的用户购买记录之前，检查插入的新的购买记录中的 `fid` 值在 `fruits` 表中是否存在。若不存在，则引发错误，提示信息为"该水果数据不存在"

```
create trigger check_fid_exist
    before insert on sells
    for each row
    begin
        if not exists(
            select * from fruits where fid = NEW.fid
        ) then
            SIGNAL SQLSTATE '45000' SET MESSAGE_TEXT = '该水果数据不存在';
        end if;
    end;
```

检验：

```
insert into sells values (1,1,null,99);     # success
insert into sells values (4,2,null,999);    # fail
insert into sells values (0,3,null,1);      # fail
```

语句1：

| | fid | cid | sellTime | quantity |
|---|---|---|---|---|
| 1 | 1 | 1 | <null> | 99 |
| 2 | 1 | 3 | <null> | 2 |
| 3 | 2 | 1 | <null> | 4 |
| 4 | 2 | 2 | <null> | 3 |

语句2和3结果相同，只展示语句2：

```
lab6_fruit> insert into sells values (4,2,null,999)
[2024-05-09 21:41:13] [45000][1644] 该水果数据不存在
```

## Q3

> 写一个 `sells` 表触发器 **`check_cid_exist`** ，当插入新的用户购买记录之前，检查新的购买记录中的用户 `cid` 在 `customer` 表中是否存在。若不存在，则将该用户ID插入到 `customer` 表中（ `cname` 为空， `level` 设为 `normal` ）

```
create trigger check_cid_exist
    before insert on sells
    for each row
    begin
        if not exists(
            select * from customer where cid = NEW.cid
        ) then
            insert into customer values(NEW.cid, null, 'normal');
        end if;
    end;
```

检验：

```
insert into sells values (2,3,null,10086);  # success
insert into sells values (1,777,null,999);  # trigger, insert into customer
insert into sells values (4,4,null,1);      # ought to trigger both, but only Q2
can be triggered
```

语句1：

| | fid | cid | sellTime | quantity |
|---|---|---|---|---|
| 1 | 1 | 1 | <null> | 99 |
| 2 | 1 | 3 | <null> | 2 |
| 3 | 2 | 1 | <null> | 4 |
| 4 | 2 | 2 | <null> | 3 |
| 5 | 2 | 3 | <null> | 10086 |

语句2：

`sells`：

| | fid | cid | sellTime | quantity |
|---|---|---|---|---|
| 1 | 1 | 1 | <null> | 99 |
| 2 | 1 | 3 | <null> | 2 |
| 3 | 1 | 777 | <null> | 999 |
| 4 | 2 | 1 | <null> | 4 |
| 5 | 2 | 2 | <null> | 3 |
| 6 | 2 | 3 | <null> | 10086 |

`customer`：

| | cid | cname | level |
|---|---|---|---|
| 1 | 1 | gary | <null> |
| 2 | 2 | user1 | <null> |
| 3 | 3 | user2 | <null> |
| 4 | 777 | <null> | normal |

语句3：

```
lab6_fruit> insert into sells values (4,4,null,1)
[2024-05-09 21:51:19] [45000][1644] 该水果数据不存在
```

仅触发了 `check_fid_exist` 触发器，本题实现的 `check_cid_exist` 并未触发。

## Q4

> 写一个 `sells` 表触发器 **`triADD`**：当插入新的用户购买记录之后，检查该用户购买的总价值（每种水果价格 * 销售量的和）超过1万元就设置 `customer` 表的 `level` 为 `VIP`，超过2万元设置为 `SVIP`，低于1万元则置为 `normal`。

```
create trigger triADD
    after insert on sells
    for each row
    begin
        declare total_value int;
        select sum(price * quantity) into total_value
        from fruits, sells
        where sells.fid = fruits.fid
            and cid = new.cid;      # don't forget this statement!!
        if total_value > 20000 then
            update customer set level = 'SVIP' where cid = NEW.cid;
        elseif total_value > 10000 then
            update customer set level = 'VIP' where cid = NEW.cid;
        else
            update customer set level = 'normal' where cid = NEW.cid;
        end if;
    end;
```

检验：

```
insert into sells values (1,2,null,2000); # cid = 2, total = 2000*10+8*3 = 20024
insert into sells values (3,1,null,3000); # cid = 1, total = 3000*6+4*8 = 18032
insert into sells values (2,1144,null,1000); # new cid = 114514, total = 1000*8 = 8000
insert into sells values (3,3,null,5);    # cid = 3, total = 6*5+10*2 = 50
```

执行上述语句后的 `sells`、`customer` 表如下所示：

| | fid | cid | sellTime | quantity |
|---|---|---|---|---|
| 1 | 2 | 1 | <null> | 4 |
| 2 | 3 | 1 | <null> | 3000 |
| 3 | 1 | 2 | <null> | 2000 |
| 4 | 2 | 2 | <null> | 3 |
| 5 | 1 | 3 | <null> | 2 |
| 6 | 3 | 3 | <null> | 5 |
| 7 | 1 | 777 | <null> | 999 |
| 8 | 2 | 1144 | <null> | 1 |

| | cid | cname | level |
|---|---|---|---|
| 1 | 1 | gary | VIP |
| 2 | 2 | user1 | SVIP |
| 3 | 3 | user2 | normal |
| 4 | 777 | <null> | normal |
| 5 | 1144 | <null> | normal |

## Q5

> 写两个 `sells` 表触发器 `triDEL` 和 `triUPT`，若删除或修改 `sells` 表记录，也重新计算并重置客户的 `level` 值。

```
create trigger triDEL
    after delete on sells
    for each row
    begin
        declare total_value int;
        select sum(price * quantity) into total_value
        from fruits, sells
        where sells.fid = fruits.fid
          and cid = old.cid; # don't forget this statement!
        if total_value > 20000 then
            update customer set level = 'SVIP' where cid = old.cid;
        elseif total_value > 10000 then
            update customer set level = 'VIP' where cid = old.cid;
        else
            update customer set level = 'normal' where cid = old.cid;
        end if;
    end;

# 检验：
delete from sells where fid = 3 and cid = 1;
# now cid = 1: total = 32
delete from sells where fid = 2 and cid = 2;
# now cid = 2: total = 20000
```

执行上述语句后的 `sells`、`customer` 表如下所示：

| | fid | cid | sellTime | quantity |
|---|---|---|---|---|
| 1 | 2 | 1 | <null> | 4 |
| 2 | 1 | 2 | <null> | 2000 |
| 3 | 1 | 3 | <null> | 2 |
| 4 | 3 | 3 | <null> | 5 |
| 5 | 1 | 777 | <null> | 999 |
| 6 | 2 | 1144 | <null> | 1 |

| | cid | cname | level |
|---|---|---|---|
| 1 | 1 | gary | normal |
| 2 | 2 | user1 | VIP |
| 3 | 3 | user2 | normal |
| 4 | 777 | <null> | normal |
| 5 | 1144 | <null> | normal |

```sql
create trigger triUPT
    after update on sells
    for each row
    begin
        declare total_value int;
        select sum(price * quantity) into total_value
        from fruits, sells
        where sells.fid = fruits.fid
          and cid = old.cid; # don't forget this statement!
        if total_value > 20000 then
            update customer set level = 'SVIP' where cid = old.cid;
        elseif total_value > 10000 then
            update customer set level = 'VIP' where cid = old.cid;
        else
            update customer set level = 'normal' where cid = old.cid;
        end if;
    end;

update sells set quantity = 3000 where fid = 2 and cid = 1;
# now cid = 1: total = 24000
update sells set quantity = 1500 where fid = 1 and cid = 777;
# now cid = 777: total = 15000
```

执行上述语句后的`sells`、`customer`表如下所示：

| | fid | cid | sellTime | quantity |
|---|---|---|---|---|
| 1 | 2 | 1 | <null> | 3000 |
| 2 | 1 | 2 | <null> | 2000 |
| 3 | 1 | 3 | <null> | 2 |
| 4 | 3 | 3 | <null> | 5 |
| 5 | 1 | 777 | <null> | 1500 |
| 6 | 2 | 1144 | <null> | 1 |

| | cid | cname | level |
|---|---|---|---|
| 1 | 1 | gary | SVIP |
| 2 | 2 | user1 | VIP |
| 3 | 3 | user2 | normal |
| 4 | 777 | <null> | VIP |
| 5 | 1144 | <null> | normal |