

《数据库系统实验》

实验报告

题目	(实验 13)
姓名	TRY
学号	
班级	计科 X 班

一. 实验环境:

操作系统: windows

图形界面: mysql3.7.31, mysql workbench

二. 实验内容与完成情况:

本次实验在以前建立的教学管理系统 (jxgl) 的基础上完成。

2.1 对表 sc, course 和 student 分别做表备份和表恢复

2.1.1 备份表

代码:

```
lock tables student read;
select * into outfile 'student.bak' from student;
unlock tables;
lock tables sc read;
select * into outfile 'sc.bak' from sc;
unlock tables;
lock tables course read;
select * into outfile 'course.bak' from course;
unlock tables;
```

结果:

#	Time	Action	Message
✓ 1	21:11:42	lock tables student read	0 row(s) affected
✓ 2	21:11:44	select * into outfile 'student.bak' from student	10 row(s) affected
✓ 3	21:16:17	unlock tables	0 row(s) affected
✓ 4	21:16:47	lock tables sc read	0 row(s) affected
✓ 5	21:16:47	select * into outfile 'sc.bak' from sc	29 row(s) affected
✓ 6	21:16:47	unlock tables	0 row(s) affected
✓ 7	21:17:05	lock tables course read	0 row(s) affected
✓ 8	21:17:05	select * into outfile 'course.bak' from course	7 row(s) affected
✓ 9	21:17:05	unlock tables	0 row(s) affected

本地磁盘 (C:) > ProgramData > MySQL > MySQL Server 5.7 > Data > jxgl

名称	修改日期	类型	大小
course.bak	2020/12/3 21:17	BAK 文件	1 KB
course.frm	2020/9/29 20:06	FRM 文件	9 KB
course.ibd	2020/9/29 20:06	IBD 文件	96 KB
db.opt	2020/9/25 20:52	OPT 文件	1 KB
sc.bak	2020/12/3 21:16	BAK 文件	1 KB
sc.frm	2020/9/29 20:06	FRM 文件	9 KB
sc.ibd	2020/10/27 14:55	IBD 文件	112 KB
sc.TRG	2020/10/27 0:04	TRG 文件	1 KB
student.bak	2020/12/3 21:11	BAK 文件	1 KB
student.frm	2020/9/29 20:06	FRM 文件	9 KB
student.ibd	2020/10/1 17:27	IBD 文件	96 KB
teacher.frm	2020/11/17 15:14	FRM 文件	9 KB

生成了 3 个文件。

报错：

2 20:59:51 select 'into outfile 'student.bak' from student Error Code: 1290. The MySQL server is running with the --secure-file-priv option so it cannot execute this statement

在执行第二行的时候，报了上述的错误。

解决办法：

本地磁盘 (C:) > ProgramData > MySQL > MySQL Server 5.7

名称	修改日期	类型	大小
Data	2020/12/3 21:11	文件夹	
Uploads	2020/9/7 12:14	文件夹	
installer_config	2020/9/7 12:14	XML 文档	1 KB
my	2020/12/3 21:09	配置设置	17 KB

在 my.ini 文件中，修改 secure_file_priv 变量为 secure_file_priv='', 并重启 mysql 服务器即可。

2.1.2 表恢复

代码：

```
SET FOREIGN_KEY_CHECKS = 0;
lock tables student write;
load data infile 'student.bak' replace into table student;
unlock tables;
set foreign_key_checks = 1;
lock tables sc write;
load data infile 'sc.bak' replace into table sc;
unlock tables;
SET FOREIGN_KEY_CHECKS = 0;
lock tables course write;
load data infile 'course.bak' replace into table course;
unlock tables;
set foreign_key_checks = 1;
```

结果：

14	21:30:24	SET FOREIGN_KEY_CHECKS = 0	0 row(s) affected	0.000 sec
15	21:30:24	lock tables student write	0 row(s) affected	0.000 sec
16	21:30:24	load data infile 'student.bak' replace into table student	20 row(s) affected Records: 10 Deleted: 10 Skipped: 0 Warnings: 0	0.031 sec
17	21:30:24	unlock tables	0 row(s) affected	0.000 sec
18	23:14:09	set foreign_key_checks = 1	0 row(s) affected	0.015 sec
19	23:14:09	lock tables sc write	0 row(s) affected	0.015 sec
20	23:14:09	load data infile 'sc.bak' replace into table sc	29 row(s) affected Records: 29 Deleted: 0 Skipped: 0 Warnings: 0	0.047 sec
21	23:14:09	unlock tables	0 row(s) affected	0.000 sec

25	23:15:08	SET FOREIGN_KEY_CHECKS = 0	0 row(s) affected	0.000 sec
26	23:15:08	lock tables course write	0 row(s) affected	0.000 sec
27	23:15:08	load data infile 'course.bak' replace into table course	14 row(s) affected Records: 7 Deleted: 7 Skipped: 0 Warnings: 0	0.047 sec
28	23:15:08	unlock tables	0 row(s) affected	0.000 sec
29	23:15:08	set foreign_key_checks = 1	0 row(s) affected	0.000 sec

报错:

12 21:23:31 load data infile 'student.bak' replace into table student Error Code: 1451. Cannot delete or update a parent row: a foreign key constraint fails ('jxgl','sc', CONSTRAINT...

解决办法:

这是外码错误, 在执行语句前加入语句“SET FOREIGN_KEY_CHECKS = 0;”即可。

2.2 对教学管理系统采用不同方法进行完整备份和恢复

方法一: mysqldump -uroot -p jxgl>jxgl.sql

```
C:\Users\lenovo>mysqldump -uroot -p jxgl>jxgl.sql
Enter password: *****
```

jxgl 2020/12/3 23:38 SQL Text File 5,305 KB

方法二: mysqldump -uroot -p --databases jxgl>jxgl2.sql

```
C:\Users\lenovo>mysqldump -uroot -p --databases jxgl>jxgl2.sql
Enter password: *****
```

jxgl2 2020/12/3 23:51 SQL Text File 5,305 KB

方法三: mysqldump -uroot -p --all-databases>jxgl3.sql

```
C:\Users\lenovo>mysqldump -uroot -p --all-databases>jxgl3.sql
Enter password: *****
```

jxgl3 2020/12/4 0:06 SQL Text File 9,729 KB

修改数据库:

update sc set grade = 90 where cno = 1 and sno = "2005001";

insert into student values("2005006","麦佳怡",19,"女","Ma");

Result Grid						Filter Rows:		
	sno	sname	sage	ssex	sdept			
▶	2005001	钱梅	18	男	Cs			
	2005002	王林	19	女	Cs			
	2005003	李民	20	男	Is			
	2005004	赵欣然	16	女	Ma			
	2005005	杨洋	25	男	Cs			
	2005006	麦佳怡	19	女	Ma			
	2005010	赵青	18	男	Cs			

Result Grid			Filter Rows:	
	sno	cno	grade	
▶	2005001	1	90	
	2005001	2	77	
	2005001	3	90	
	2005001	7	98	
	2005002	2	94	

还原数据库:

mysql -uroot -p jxgl<jxgl.sql

```
C:\Users\lenovo>mysql -uroot -p jxgl<jxgl.sql
Enter password: *****
```

mysql -uroot -p jxgl<jxgl2.sql

```
C:\Users\lenovo>mysql -uroot -p jxgl<jxgl2.sql
Enter password: *****
```

```
mysql -uroot -p jxgl<jxgl3.sql
```

```
C:\Users\lenovo>mysql -uroot -p jxgl<jxgl3.sql
Enter password: *****
```

恢复结果：经过验证，三种方法备份都能如下面一样恢复成功。

Result Grid						Filter Rows:		
	sno	sname	sage	ssex	sdept			
▶	2005001	钱横	18	男	Cs			
	2005002	王林	19	女	Cs			
	2005003	李民	20	男	Is			
	2005004	赵欣然	16	女	Ma			
	2005005	杨洋	25	男	Cs			
	2005010	赵青江	18	男	Cs			

Result Grid			Filter Rows:		
	sno	cno	grade		
▶	2005001	1	87		
	2005001	2	77		
	2005001	3	90		
	2005001	7	98		
	2005002	2	94		

2.3 对教学管理系统与 2011 年 6 月 2?日上午 9:00: 00 进行了差异备份； 上午 9:40 数据库发生故障， 根据其差异备份和日志文件进行时间点恢复。

对系统进行差异备份：

```
mysqldump -uroot -p jxgl -F>jxglf.sql
```

```
C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqldump -uroot -p jxgl -F>jxglf.sql
Enter password: *****
```

DB.000001	2020/12/4 17:20	000001 文件	1 KB
DB.index	2020/12/4 17:20	INDEX 文件	1 KB
jxglf	2020/12/4 17:20	SQL Text File	5,305 KB

修改数据库：（注意：一定要一个个执行！不能一起执行！）

```
update sc set grade = 93 where cno = 1 and sno = "2005001";
```

```
insert into student values("2005006","Maiqy",19,"F","Ma");
```

Result Grid						Filter Rows:		
	sno	sname	sage	ssex	sdept			
▶	2005001	钱横	18	男	Cs			
	2005002	王林	19	女	Cs			
	2005003	李民	20	男	Is			
	2005004	赵欣然	16	女	Ma			
	2005005	杨洋	25	男	Cs			
	2005006	Maiqy	19	F	Ma			

Result Grid			Filter Rows:		
	sno	cno	grade		
▶	2005001	1	93		
	2005001	2	77		
	2005001	3	90		
	2005001	7	98		
	2005002	2	94		
	2005002	3	NULL		

在 my.ini 中启用日志，并重启服务器：

```
# ***** Group Replication Related *****
# Specifies the base name to use for binary log files. With binary logging
# enabled, the server logs all statements that change data to the binary
# log, which is used for backup and replication.
# log-bin
log-bin="C:/ProgramData/MySQL/MySQL Server 5.7/Data/mylog/DB.log"
```

备份 **mysqldump** 开始以后生成的 **binlog**: (其实是相当于多备份一份)

```
mysqladmin -uroot -p flush-logs
```

```
C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqladmin -uroot -p flush-logs
Enter password: *****
```

目录文件: (在上面的地址中)

DB.000001	2020/12/4 17:23	000001 文件	1 KB
DB.000002	2020/12/4 17:23	000002 文件	1 KB
DB.index	2020/12/4 17:23	INDEX 文件	1 KB
jxglf	2020/12/4 17:20	SQL Text File	5,305 KB

查看目录文件

```
mysqlbinlog -v DB.000001
```

```
C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqlbinlog -v DB.000001
/*!50530 SET @@SESSION.PSEUDO_SLAVE_MODE=1*/;
/*!50003 SET @OLD_COMPLETION_TYPE=@@COMPLETION_TYPE, COMPLETION_TYPE=0*/;
DELIMITER /*!*/;
# at 4
#201204 17:20:50 server id 1 end_log_pos 123 CRC32 0x4d904e16 Start: binlog v 4, server v 5.7.31-log created 201204 17:20:50
BINLOG
cvJXw8BAAAAAdwAAHsAAAAAAQANS43LjMxLWxvZwAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAEzgNAAgAEBAQEgAAAXwAEGggAAAAICAgCAAAACgoKKIoAEJQA
ARZ0KE0=
/*!*/;
# at 123
#201204 17:20:50 server id 1 end_log_pos 154 CRC32 0xf60caelf Previous-GTIDs
# [empty]
# at 154
#201204 17:21:16 server id 1 end_log_pos 219 CRC32 0x0f194e77 Anonymous_GTID last_committed=0 sequence_number=1 rbr_only=yes
/*!50718 SET TRANSACTION ISOLATION LEVEL READ COMMITTED/*!*/;
SET @@SESSION.GTID_NEXT= 'ANONYMOUS'/*!*/;
# at 219
#201204 17:21:16 server id 1 end_log_pos 293 CRC32 0x8declc90 Query thread_id=5 exec_time=0 error_code=0
SET TIMESTAMP=1607073676/*!*/;
SET @@session.pseudo_thread_id=5/*!*/;
SET @@session.foreign_key_checks=1, @@session.sql_auto_is_null=0, @@session.unique_checks=1, @@session.autocommit=1/*!*/;
SET @@session.sql_mode=1344274432/*!*/;
SET @@session.auto_increment_increment=1, @@session.auto_increment_offset=1/*!*/;
/*!C utf8mb4 *//*!*/;
SET @@session.character_set_client=45, @@session.collation_connection=45, @@session.collation_server=8/*!*/;
SET @@session.lc_time_names=0/*!*/;
SET @@session.collation_database=DEFAULT/*!*/;
```

执行 **mysql** 导入备份文件:

```
mysql -u root -p jxgl<jxglf.sql
```

```
C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysql -u root -p jxgl<jxglf.sql
Enter password: *****
```

数据库恢复到之前的样子:

	sno	sname	sage	ssex	sdept
▶	2005001	钱横	18	男	Cs
	2005002	王林	19	女	Cs
	2005003	李民	20	男	Is
	2005004	赵欣然	16	女	Ma
	2005005	杨洋	25	男	Cs
	2005010	赵青江	18	男	Cs

	sno	cno	grade
▶	2005001	1	87
	2005001	2	77
	2005001	3	90
	2005001	7	98
	2005002	2	94
	2005002	3	100

时间点恢复：

查看出错步骤信息如下：

第一个更新 update 语句的出错信息：

```

BINLOG '
jP/JXxMBAAAAAwAAAFgBAAAAAK4AAAAAMABGp4Z2wAAAnjAAP+/gME/hX+BgTa9FFJ
jP/JXx8BAAAAQgAAAJOBAAAAAK4AAAAAAEAAgAD///4BzIwMDUwMDEBMVcAAAD4BzIwMDUwMDEB
MVOAAAAAGvNB
/*!*/;
### UPDATE `jxgl`.`sc`
### WHERE
###   @1='2005001'
###   @2='1'
###   @3=87
### SET
###   @1='2005001'
###   @2='1'
###   @3=93
# at 410
#201204 17:21:16 server id 1  end_log_pos 441 CRC32 0x3709da44  Xid = 1708
COMMIT/*!*/;
# at 441
#201204 17:22:55 server id 1  end_log_pos 506 CRC32 0x3618d8c3  Anonymous_GTID  last_committed=1      sequence_number=2      rbr_only=yes
/*!50718 SET TRANSACTION ISOLATION LEVEL READ COMMITTED*//*!*/;
SET @@SESSION.GTID_NEXT= 'ANONYMOUS'/*!*/;
# at 506
#201204 17:22:55 server id 1  end_log_pos 580 CRC32 0xa5b307c7  Query  thread_id=5      exec_time=0      error_code=0
SET TIMESTAMP=1607073775/*!*/;
BEGIN
/*!*/;
# at 580
#201204 17:22:55 server id 1  end_log_pos 642 CRC32 0x712f7604  Table_map: `jxgl`.`student` mapped to number 175
# at 642
#201204 17:22:55 server id 1  end_log_pos 701 CRC32 0x60b539bc  Write_rows: table id 175 flags: STMT_END_F

```

第二个插入 insert 语句的出错信息：

```

BINLOG '
7//JXxMBAAAAAgAAAIICAAAAAK8AAAAAMABGp4Z2wAB3N0dWR1bnQABf4PAw8PCP4VPAAGAAAYA
HgR2L3E=
7//JXx4BAAAA0wAAALOCAAAAAK8AAAAAAEAAgAF/+AHMjAwNTAwNgVNYW1xeRMAAAABRgJNYbw5
tWA=
/*!*/;
### INSERT INTO `jxgl`.`student`
### SET
###   @1='2005006'
###   @2='Maiqy'
###   @3=19
###   @4='F'
###   @5='Ma'
# at 701
#201204 17:22:55 server id 1  end_log_pos 732 CRC32 0x0477a3d6  Xid = 1712
COMMIT/*!*/;
# at 732
#201204 17:23:10 server id 1  end_log_pos 772 CRC32 0x95b6ad3f  Rotate to DB.000002  pos: 4
SET @@SESSION.GTID_NEXT= 'AUTOMATIC' /* added by mysqlbinlog */ /*!*/;
DELIMITER ;
# End of log file
/*!50003 SET COMPLETION_TYPE=@OLD_COMPLETION_TYPE*/;
/*!50530 SET @@SESSION.PSEUDO_SLAVE_MODE=0*/;

```

实现恢复：

```
mysqlbinlog --no-defaults --stop-datetime="2020-12-04 17:21:14" DB.000001|mysql -u root -h localhost -p
```

```
mysqlbinlog --no-defaults --start-datetime="2020-12-04 17:21:20" DB.000001|mysql -u root -h localhost -p
```

```
C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqlbinlog --no-defaults --stop-datetime="2020-12-04 17:21:14" DB.000001|mysql -u root -h localhost -p
Enter password: *****

C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqlbinlog --no-defaults --start-datetime="2020-12-04 17:21:20" DB.000001|mysql -u root -h localhost -p
Enter password: *****
```

可以发现，跳过了更新 update，但 insert 实现了恢复，即实现了时间点的恢复：

Result Grid					
	sno	sname	sage	ssex	sdept
▶	2005001	钱横	18	男	Cs
	2005002	王林	19	女	Cs
	2005003	李民	20	男	Is
	2005004	赵欣然	16	女	Ma
	2005005	杨洋	25	男	Cs
	2005006	Maiqy	19	F	Ma

Result Grid		
	sno	cno
▶	2005001	1
	2005001	2
	2005001	3
	2005001	7
	2005002	2
	2005002	3

2.4 对教学管理系统与 2011 年 6 月 29 日上午 9: 00: 00 进行了差异备份； 上午 9: 40 数据库发生故障， 根据其差异备份和日志文件进行位置恢复。

位置更新点如下：

```
BEGIN
/*!*/;
# at 293
#201204 17:21:16 server id 1 end_log_pos 344 CRC32 0x4951f4da Table_map: `jxgl`.`sc` mapped to number 174
# at 344
#201204 17:21:16 server id 1 end_log_pos 410 CRC32 0x41f35a06 Update_rows: table id 174 flags: STMT_END_F

BINLOG '
JP/JXxMBAAAAmWAAAFgBAAAAAK4AAAAAAAMABGp4Z2wAAAnJAAP+/gME/hX+BgTa9FFJ
JP/JXxSBAAAAQgAAAJ0BAAAAAK4AAAAAAAEAAgAD///4BzIwMDUwMDEBMVcAAAD4BzIwMDUwMDEB
MVOAAAAAGWvNB
/*!*/;
### UPDATE `jxgl`.`sc`
### WHERE
### @1='2005001'
### @2='1'
### @3=87
### SET
### @1='2005001'
### @2='1'
### @3=93
# at 410
#201204 17:21:16 server id 1 end_log_pos 441 CRC32 0x3709da44 Xid = 1708
COMMIT /*!*/;
# at 441
#201204 17:22:55 server id 1 end_log_pos 506 CRC32 0x3618d8c3 Anonymous_GTID last_committed=1 sequence_number=2 rbr_only=yes
/*!50718 SET TRANSACTION ISOLATION LEVEL READ COMMITTED*//*!*/;
SET @@SESSION.GTID_NEXT= 'ANONYMOUS' /*!*/;
# at 506
#201204 17:22:55 server id 1 end_log_pos 580 CRC32 0xa5b307c7 Query thread_id=5 exec_time=0 error_code=0
SET TIMESTAMP=1607073775 /*!*/;
BEGIN
```

基本步骤与上面一样，只是在位置恢复时：

```
mysqlbinlog --no-defaults --stop-position=293 DB.000001|mysql -u root -h localhost -p
mysqlbinlog --no-defaults --start-position=441 DB.000001|mysql -u root -h localhost -p
```



```
C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysql -u root -p jxgl<jxglf.sql
Enter password: *****

C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqlbinlog --no-defaults --stop-position=293 DB.000001|mysql -u root -h localhost -p
Enter password: *****

C:\ProgramData\MySQL\MySQL Server 5.7\Data\mylog>mysqlbinlog --no-defaults --start-position=441 DB.000001|mysql -u root -h localhost -p
Enter password: *****
```

恢复结果如下：恢复成功！

Result Grid   Filter Rows: <input type="text"/>					
	sno	sname	sage	ssex	sdept
▶	2005001	钱横	18	男	Cs
	2005002	王林	19	女	Cs
	2005003	李民	20	男	Is
	2005004	赵欣然	16	女	Ma
	2005005	杨洋	25	男	Cs
	2005006	Maiqy	19	F	Ma

Result Grid   Filter Rows: <input type="text"/>			
	sno	cno	grade
▶	2005001	1	87
	2005001	2	77
	2005001	3	90
	2005001	7	98
	2005002	2	84