深 圳 大 学 实 验 报 告

课程名称：数据库系统

实验项目名称：SQL 的多表连接查询以及视图

学院：计算机与软件学院

专业：计算机科学与技术

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实验时间：2021.10.09 至 2021.11.07

实验报告提交时间：

教务处制

实验目的：

1、 掌握 postgresql 的服务管理、命令行服务管理，熟悉集群服务配置管理方式；

2、 熟悉并掌握数据库查询与数据库视图的基础原理；

3、 掌握利用 SQL 语句进行多表连接查询、建立并操纵视图的方法。

实验要求：

1、练习 postgresql 服务管理配置；

2、练习典型的多表连接查询 SQL 语句、聚合函数；

3、练习视图的创建查询、插入、更新、删除等操作

实验环境：

软件：liunx 系统，centos

（根据自己实验环境填写）

实验内容

一、在服务器端练习 postgresql 的系统配置、用户环境配置、集群服务配置：

1. 实现服务的自启动，将“源码包/contrib/start-scripts”目录下的脚本重命名为 linux1 后放到/etc/init.d 目录下，并使用 sudo chkconfig --add linux1 指令添加服务自启动（图 1-1-1）。对操作系统进行配置如图 1-1-2 所示，对 Linux 资源限制调整如图 1-1-3 所示，对系统防火墙配置如图 1-1-4 所示。

```
-bash-4.2$ sudo chkconfig --add linux1
-bash-4.2$ ls
freebsd1  functions  linux1  macos  netconsole  network  README
-bash-4.2$
```

图 1-1-1

```
[root@liujn init.d]# vi /etc/sysctl.conf
[root@liujn init.d]# sysctl -p
kernel.shmmax = 68719476736
kernel.shmall = 4294967296
kernel.shmmni = 4096
kernel.sem = 50100 64128000 50100 1280
fs.file-max = 7672460
net.ipv4.ip_local_port_range = 9000 65000
net.core.rmem_default = 1048576
net.core.wmem_default = 262144
net.core.wmem_max = 1048576
[root@liujn init.d]#
```

图 1-1-2

```
#@faculty        hard    nproc
#ftp             hard    nproc
#@student        -       maxlogins
* soft nofile 131072
* hard nofile 131072
* soft nproc 131072
* hard nproc 131072
* soft core unlimited
* hard core unlimited
* soft memlock 50000000
* hard memlock 50000000

# End of file
```

图 1-1-3

```
-A INPUT -i lo -j ACCEPT
#允许源IP
-A INPUT -s 192.168.0.0/16 -j ACCEPT
#允许源IP访问目标端口
-A INPUT -s 192.168.1.0/24 -m state --state NEW -m tcp -p tcp --dport 1922 -j ACCEPT
#允许任意IP访问目标端口
-A INPUT -p tcp -m state --state NEW -m tcp -p tcp --dport 5432 -j ACCEPT
```

图 1-1-4

2. 配置环境变量（图 1-1-5），测试 pg_ctl（图 1-1-6），成功。

```
#ljn_add
export PGPORT=1923
export PGHOME=/usr/local/pg122
export PATH=$PG_HOME/bin:$PATH
export PGDATA=$PG_HOME/data
export LD_LIBRARY_PATH=$PG_HOME/lib
export LANG=en_US.utf8
```

图 1-1-5

```
-bash-4.2$ pg_ctl -D data/ start
waiting for server to start....2021-10-31 15:03:18.426 CST [8198] LOG:  redirecting log output to logging collector process
2021-10-31 15:03:18.426 CST [8198] HINT:  Future log output will appear in directory "log".
 done
server started
```

图 1-1-6

3.pg_hba.conf 配置（图 1-1-7），postgresresql.conf 配置与重新启动 pg_ctl（图 1-1-8），进入 postgres 后输入 show all （图 1-1-9）以及 select 语句（图 1-1-10）查看当前所有配置。

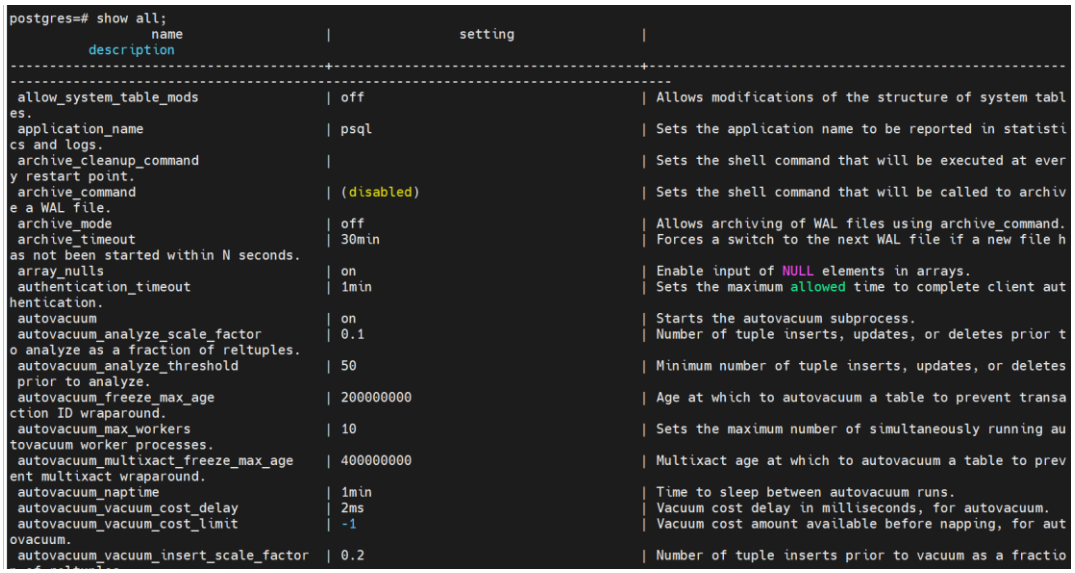
```
# TYPE  DATABASE        USER            ADDRESS                 METHOD

# "local" is for Unix domain socket connections only
local   all             all                                     trust
# IPv4 local connections:
host    all             all             127.0.0.1/32            trust
# IPv6 local connections:
host    all             all             ::1/128                 trust
# Allow replication connections from localhost, by a user with the
# replication privilege.
local   replication     all                                     trust
host    replication     all             127.0.0.1/32            trust
host    replication     all             ::1/128                 trust
~
```

图 1-1-7


listen_addresses = '*' # what IP address(es) t
监听所有ip
sses;
'*' for all
端口5866
port = 5866
max_connections = 100 最大连接数100
#superuser_reserved_connections = 3
缓冲区数据块个数/个*8KB
shared_buffers = 1024MB
#huge_pages = try
wal_buffers = 512MB
还未写入磁盘的共享内存量
ared_buffers
#wal_writer_delay = 200ms
# you actively intend to use prepared transactions.
work_mem = 4MB 用于内部排序与哈希表的内存量
able work_mem
maintenance_work_mem = 64MB 数据库维护操作使用的内存空间大小
e
random_page_cost = 2.5
规划期对非顺序获取磁盘
页面的代价估计
#cpu_tuple_cost = 0.01
autovacuum_max_workers = 10
rocesses 能同时运行autovacuum进程最大数量
checkpoint_completion_target = 0.7
.0 - 1.0 增加checkpoint_completion_target来降低检查点的I/O负载
#checkpoint_flush_after = 256kB
-bash-4.2$ pg_ctl -D data/ restart
waiting for server to shut down.... done
server stopped
waiting for server to start....2021-10-31 16:46:54.265 CST [1724] LOG: redirecting log output to logging collector process
2021-10-31 16:46:54.265 CST [1724] HINT: Future log output will appear in directory "log".
 done
server started

图 1-1-8



```
postgres=# show all;
              name                |              setting              |
         description
-----------------------------------+-----------------------------------+-----------------------------------------------
-----------------------------------------------------------------------
 allow_system_table_mods           | off                               | Allows modifications of the structure of system tabl
es.
 application_name                  | psql                              | Sets the application name to be reported in statisti
cs and logs.
 archive_cleanup_command           |                                   | Sets the shell command that will be executed at ever
y restart point.
 archive_command                   | (disabled)                        | Sets the shell command that will be called to archiv
e a WAL file.
 archive_mode                      | off                               | Allows archiving of WAL files using archive_command.
 archive_timeout                   | 30min                             | Forces a switch to the next WAL file if a new file h
as not been started within N seconds.
 array_nulls                       | on                                | Enable input of NULL elements in arrays.
 authentication_timeout            | 1min                              | Sets the maximum allowed time to complete client aut
hentication.
 autovacuum                        | on                                | Starts the autovacuum subprocess.
 autovacuum_analyze_scale_factor   | 0.1                               | Number of tuple inserts, updates, or deletes prior t
o analyze as a fraction of reltuples.
 autovacuum_analyze_threshold      | 50                                | Minimum number of tuple inserts, updates, or deletes
 prior to analyze.
 autovacuum_freeze_max_age         | 200000000                         | Age at which to autovacuum a table to prevent transa
ction ID wraparound.
 autovacuum_max_workers            | 10                                | Sets the maximum number of simultaneously running au
tovacuum worker processes.
 autovacuum_multixact_freeze_max_age | 400000000                       | Multixact age at which to autovacuum a table to prev
ent multixact wraparound.
 autovacuum_naptime                | 1min                              | Time to sleep between autovacuum runs.
 autovacuum_vacuum_cost_delay      | 2ms                               | Vacuum cost delay in milliseconds, for autovacuum.
 autovacuum_vacuum_cost_limit      | -1                                | Vacuum cost amount available before napping, for aut
ovacuum.
 autovacuum_vacuum_insert_scale_factor | 0.2                           | Number of tuple inserts prior to vacuum as a fractio
```

图 1-1-9

```
postgres=# select name,context,unit,boot_val,setting,reset_val from pg_settings where name
postgres-# in('listen_addresses','max_connections',
postgres(# 'shared_buffers','effective_cache_size','work_mem','maintenance_work_mem')
postgres-# order by context, name;
         name          |  context   | unit | boot_val  | setting | reset_val
-----------------------+------------+------+-----------+---------+-----------
 listen_addresses      | postmaster |      | localhost | *       | *
 max_connections       | postmaster |      | 100       | 100     | 100
 shared_buffers        | postmaster | 8kB  | 1024      | 131072  | 131072
 effective_cache_size  | user       | 8kB  | 524288    | 524288  | 524288
 maintenance_work_mem  | user       | kB   | 65536     | 65536   | 65536
 work_mem              | user       | kB   | 4096      | 4096    | 4096
(6 rows)
```

图 1-1-10

二、在实验一的基础上完成 EX2-EX7 的 SQL 练习题

Ex2

1.Find the name and salary of employees in Luton.

4.List all departments that do not have any employees.

* use join and no subquery

5.For each employee whose salary exceeds his manager's salary, list the employee's name and salary and the manager's name and salary.

6.List the employees who have BLAKE as their manager.

Ex3

2.Compute the average annual income (income is salary plus commission) for all salesmen

3.Find the number of characters in the longest department name

5.Count the number of people in department 30 who receive a salary and the number of people who receive a commission (single statement).

8.Compute the daily and hourly salary for employees in department 30, round to the nearest penny. Assume there are 22 working days in a month and 8 working hours in a day.(Use function round())

Ex4

1.Select the name, job, and date of hire of the employees in department (Format the HIREDATE column to MM/DD/YY)

2.Then format the HIREDATE column into DoW (day of the week), Day (day of the month), MONTH (name of the month) and YYYY(year)

3.Which employees were hired in April?

5.Are there any employees who have worked more than 30 years for the company?

6.Show the weekday of the first day of the month in which each employee was hired. (plus their names)

7.Show details of employee hiredates and the date of their first payday.
(Paydays occur on the last Friday of each month) (plus their names)
*此题为附加题

Ex5

2. Divide all employees into groups by department and by job within department. Count the employees in each group and compute each group's average annual salary.

5.Find all departments with an average commission greater than 25% of average salary.

6.Find each department's average annual salary for all its employees except the managers and the president.

Ex6

1.List the name and job of employees who have the same job as Jones.

3.List the name, job, and department of employees who have the same job as Jones or a salary greater than or equal to Ford.

4.Find all employees in department 10 that have a job that is the same as anyone in the Sales department

7.Find all the employees that earn more than JONES, using temporary labels to abbreviate table

names.

Ex7

1.Create a new table called loans with columns named LNO NUMERIC (3), EMPNO NUMERIC (4), TYPE CHAR(1), AMNT NUMERIC (8,2)

*Don't forget to create constraints

2.Insert the following data

LNO	EMPNO	TYPE	AMNT
23	7499	M	20000.00
42	7499	C	2000.00
65	7844	M	3564.00

4.The Loans table must be altered to include another column OUTST NUMERIC(8,2)

5.Add 10% interest to all M type loans

6.Remove all loans less than £3000.00

7.Change the name of loans table to accounts

8.Change the name of column LNO to LOANNO

9.Create a view for use by personnel in department 30 showing employee name, number, job and hiredate

10.Use the view to show employees in department 30 having jobs which are not salesman

实验结论或体会：

实验结论：

实验收获：

1、在 bash 界面启动 pg_ctl 时，仍然报错（图 5-1），根据网上查阅的资料未解决问题，猜测可能是自己的路径没写对（图 5-2、图 5-3、图 5-4），修改后如图 5-5 所示，但是仍然报错，后来向老师提问才明白，我是用的 yum 安装 postgres 而不是用的源码安装，因此并不存在 pg_ctl，因为 yum 安装已经自带了，所以启动不了，用户权限不够。

```
-bash-4.2$ pg_ctl start
pg_ctl: no database directory specified and environment variable PGDATA unset
Try "pg_ctl --help" for more information.
```

图 5-1

```
[root@liujn /]# find -name data
./run/udev/data
./sys/firmware/acpi/tables/data
./sys/kernel/debug/boot_params/data
./sys/kernel/boot_params/data
./var/lib/pgsql/13/data
```

图 5-2

```
[root@liujn /]# find -name bin
./sys/kernel/debug/tracing/options/bin
./usr/bin
./usr/lib/debug/usr/bin
./usr/lib/debug/bin
./usr/share/locale/bin
./usr/local/bin
./usr/pgsql-13/bin
./bin
```

图 5-3

```
# .bash_profile

# Get the aliases and functions
if [ -f ~/.bashrc ]; then
        . ~/.bashrc
fi

# User specific environment and startup programs

PATH=$PATH:$HOME/bin
PATH=$PATH:$HOME/.local/bin:$HOME/bin:/usr/local/pgsql/bin
export PGDATA=/usr/local/pgsql/data
export PATH
~
~
```

添加以下内

图 5-4

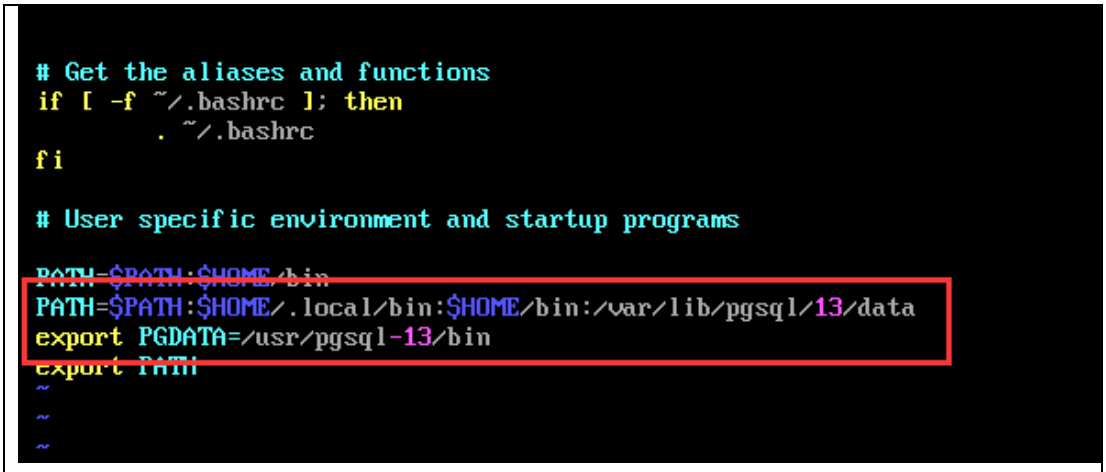


图 5-5

（给出实验结论，介绍实验过程中遇到的困难，总结实验收获！）

指导教师批阅意见： 成绩评定： 指导教师签字： 年　　月　　日
备注：

注：1、报告内的项目或内容设置，可根据实际情况加以调整和补充。

2、教师批改学生实验报告时间应在学生提交实验报告时间后 10 日内。