Contents

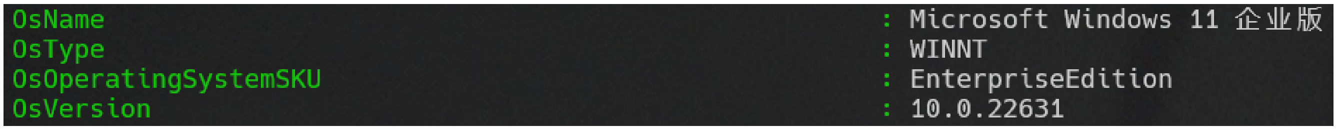
数据库系统实验五-数据查询（嵌套查询）

实验目的

熟悉 SQL 语句的数据查询语言，能够使用 SQL 语句对数据库进行嵌套查询。

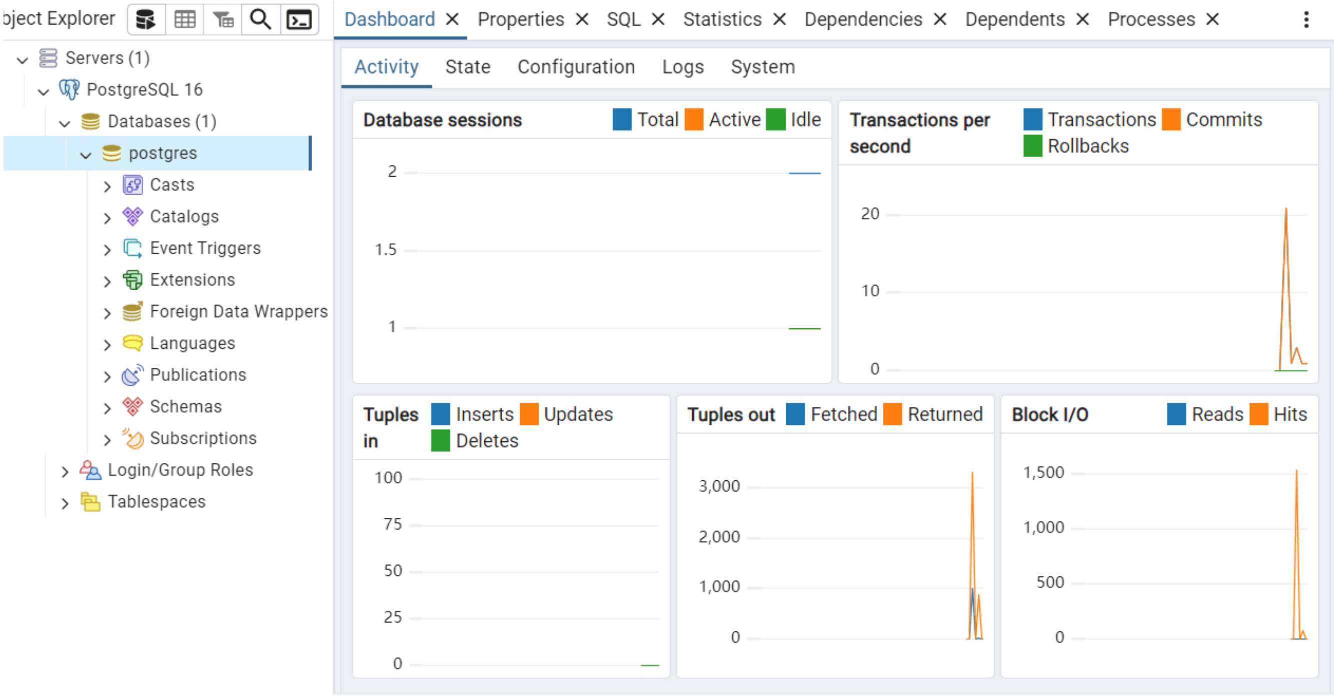
实验环境

- OS: Windows 11

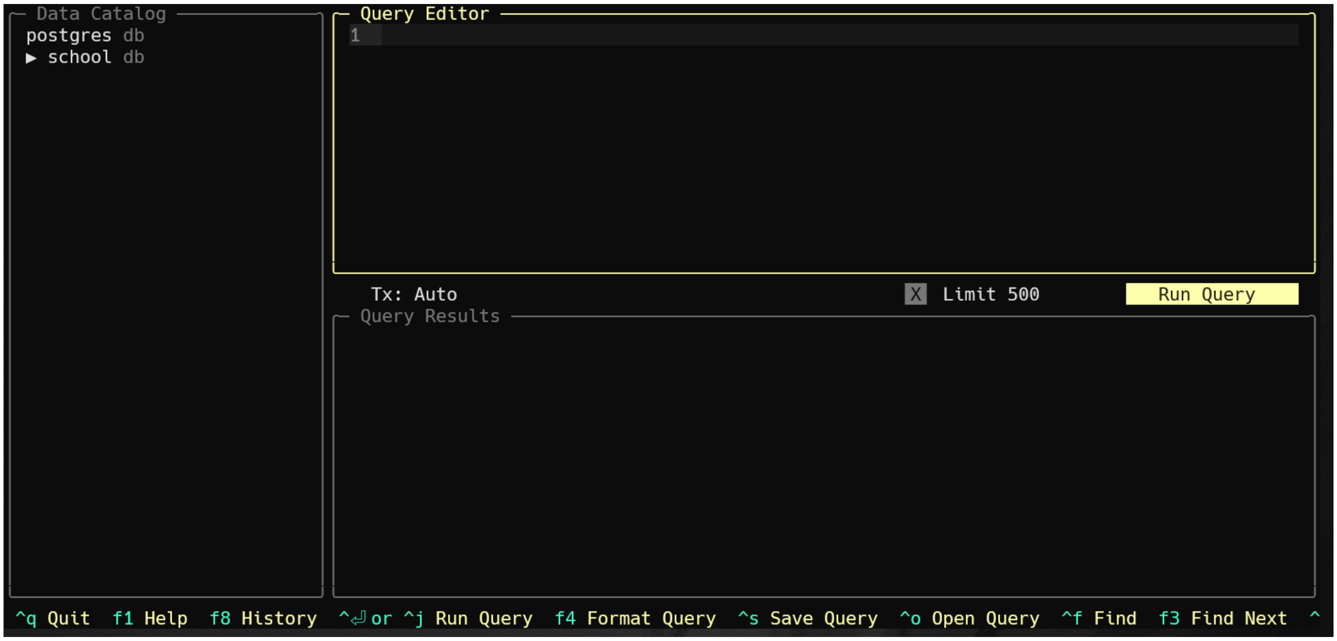


```
OsName                                                      : Microsoft Windows 11 企业版
OsType                                                      : WINNT
OsOperatingSystemSKU                                        : EnterpriseEdition
OsVersion                                                   : 10.0.22631
```

- Database: PostgreSQL 16



- UI: harlequin-postgres


Data Catalog
postgres db
▶ school db
Query Editor
1
Tx: Auto
X Limit 500
Run Query
Query Results
^q Quit f1 Help f8 History ^⏎ or ^j Run Query f4 Format Query ^s Save Query ^o Open Query ^f Find f3 Find Next ^

实验内容

本节实验的主要内容包括：

- 通过实验验证对子查询的两个限制条件。
- 体会相关子查询和不相关自查询的不同。
  - 考察 4 类谓词的用法，包括：
  - 第 1 类，IN，NOT IN；
  - 第 2 类，带有比较运算符的子查询；
  - 第 3 类，SOME，ANY 或 ALL 谓词的子查询；
  - 第 4 类，带有 EXISTS 谓词的子查询。

实验步骤

课内实验

要求：

以 school 数据库为例 (与前两次实验的数据同)，在该数据库中存在 4 张表格，分别为：

STUDENTS(sid,sname,email,grade)

TEACHERS(tid,tname,email,salary)

COURSES(cid,cname,hour)

CHOICES(no,sid,tid,cid,score)

在数据库中，存在这样的关系：学生可以选择课程。一个课程对应一个教师。在表 CHOICES 中保存学生的选课记录。

查询与学号850955252的学生同年级的所有学生资料；

查询所有的有选课的学生的详细信息；

查询没有学生选的课程的编号；

查询选修了课程名为C++的学生学号和姓名；

找出选修课程成绩最差的选课记录。

找出和课程UML或课程C++的课时一样的课程名称；

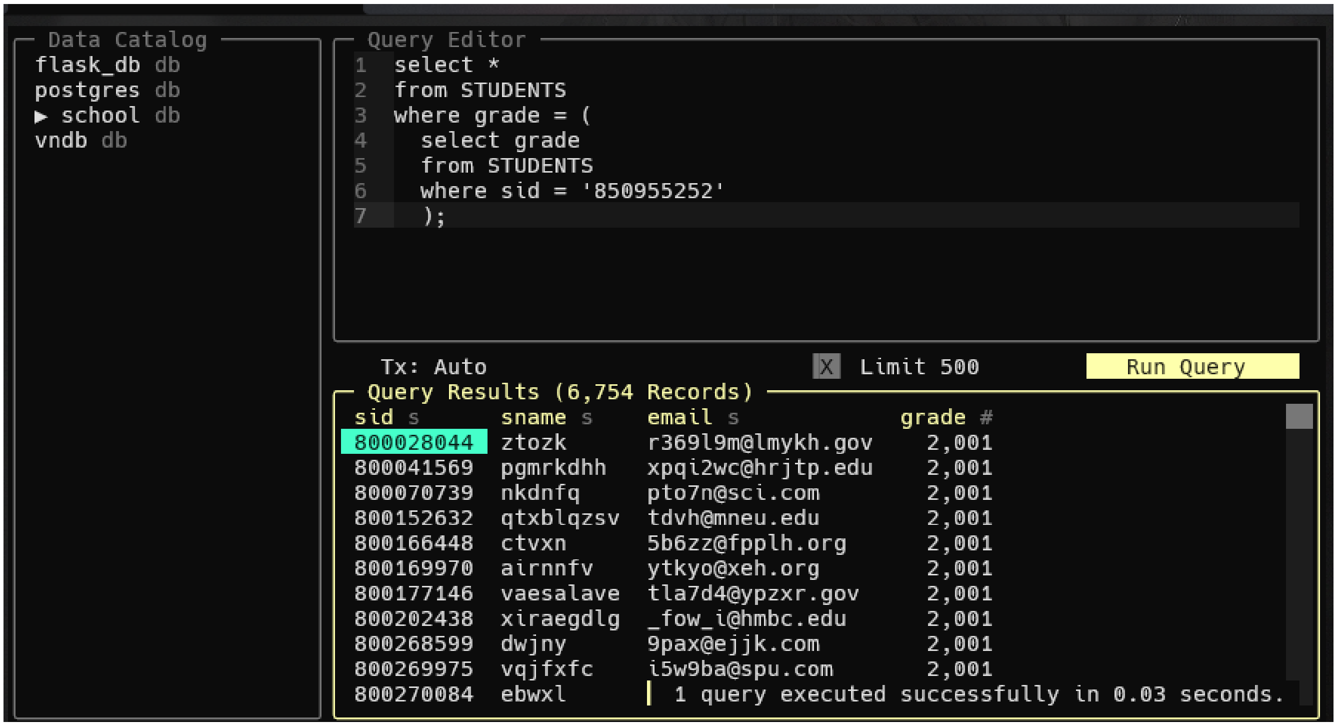
查询所有选修编号10001的课程的学生的姓名；

查询选修了所有课程的学生姓名。

ANSWER

1. 查询与学号 850955252 的学生同年级的所有学生资料：

```sql
select *
from students
where grade = (
  select grade
  from students
  where sid = '850955252'
);
```

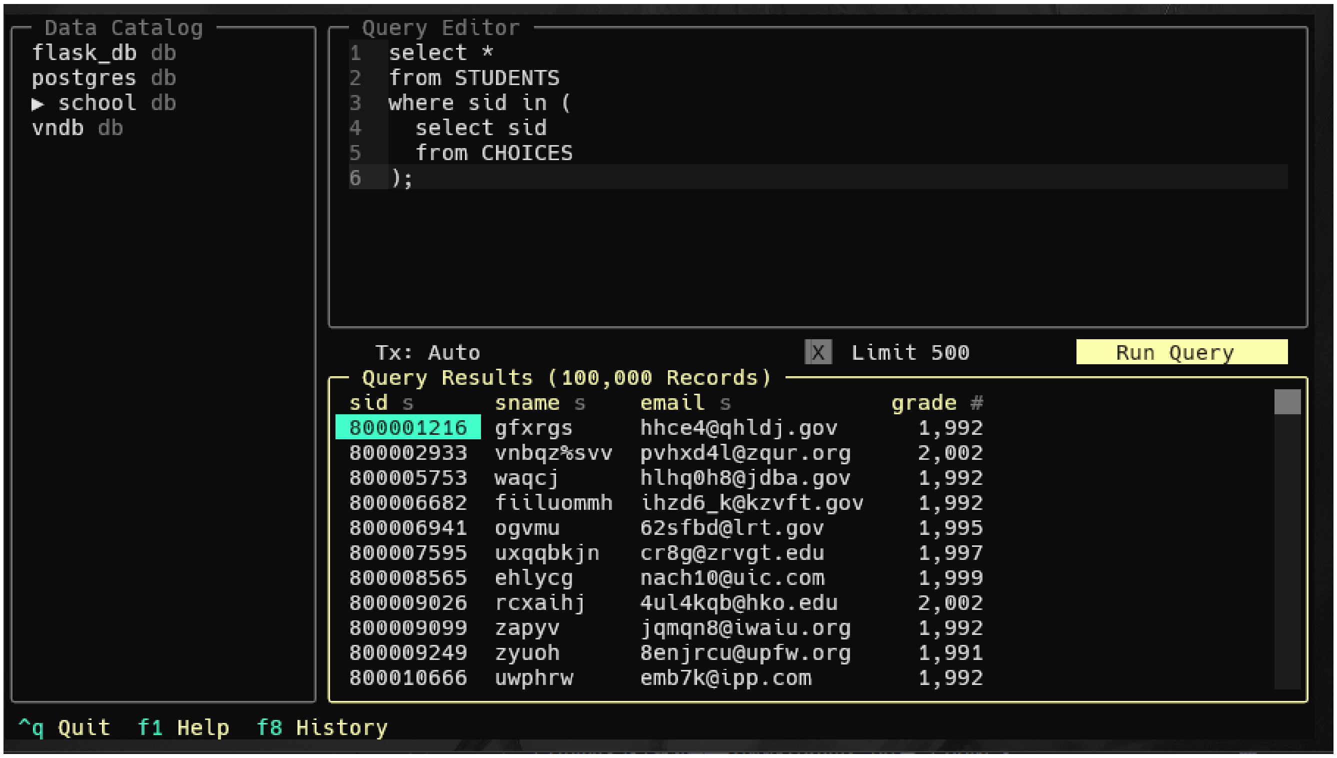


```sql
select *
from STUDENTS
where grade = (
  select grade
  from STUDENTS
  where sid = '850955252'
  );
```

```
Query Results (6,754 Records)
sid s       sname s     email s            grade #
800028044   ztozk       r369l9m@lmykh.gov    2,001
800041569   pgmrkdhh    xpqi2wc@hrjtp.edu    2,001
800070739   nkdnfq      pto7n@sci.com        2,001
800152632   qtxblqzsv   tdvh@mneu.edu        2,001
800166448   ctvxn       5b6zz@fpplh.org      2,001
800169970   airnnfv     ytkyo@xeh.org        2,001
800177146   vaesalave   tla7d4@ypzxr.gov     2,001
800202438   xiraegdlg   _fow_i@hmbc.edu      2,001
800268599   dwjny       9pax@ejjk.com        2,001
800269975   vqjfxfc     i5w9ba@spu.com       2,001
800270084   ebwxl       | 1 query executed successfully in 0.03 seconds.
```

2. 查询所有的有选课的学生的详细信息：

```sql
select *
from students
where sid in (
  select sid
  from choices
);
```

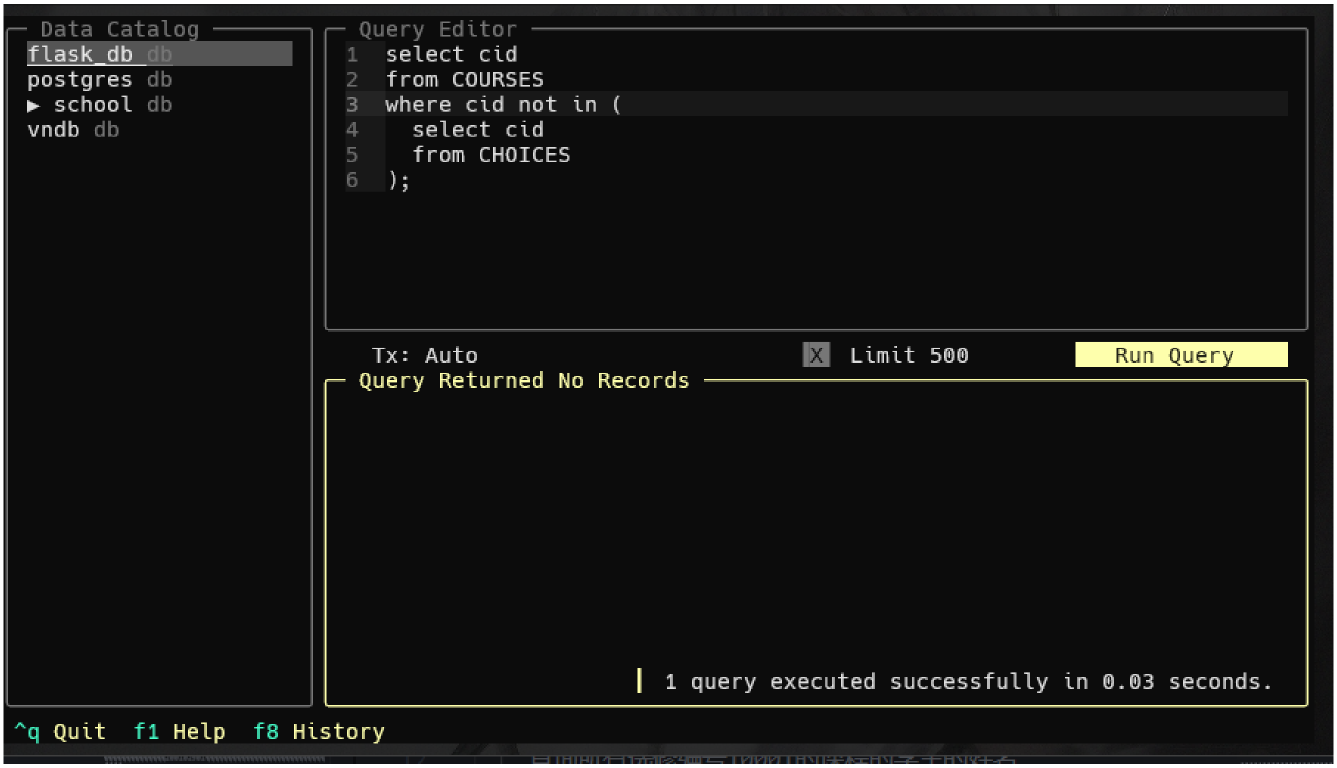


```
select *
from STUDENTS
where sid in (
  select sid
  from CHOICES
);
```

```
Query Results (100,000 Records)
sid s       sname s     email s              grade #
800001216   gfxrgs      hhce4@qhldj.gov        1,992
800002933   vnbqz%svv   pvhxd4l@zqur.org       2,002
800005753   waqcj       hlhq0h8@jdba.gov       1,992
800006682   fiiluommh   ihzd6_k@kzvft.gov      1,992
800006941   ogvmu       62sfbd@lrt.gov         1,995
800007595   uxqqbkjn    cr8g@zrvgt.edu         1,997
800008565   ehlycg      nach10@uic.com         1,999
800009026   rcxaihj     4ul4kqb@hko.edu        2,002
800009099   zapyv       jqmqn8@iwaiu.org       1,992
800009249   zyuoh       8enjrcu@upfw.org       1,991
800010666   uwphrw      emb7k@ipp.com          1,992
```

3. 查询没有学生选的课程的编号：

```
select cid
from courses
where cid not in (
  select cid
  from choices
);
```



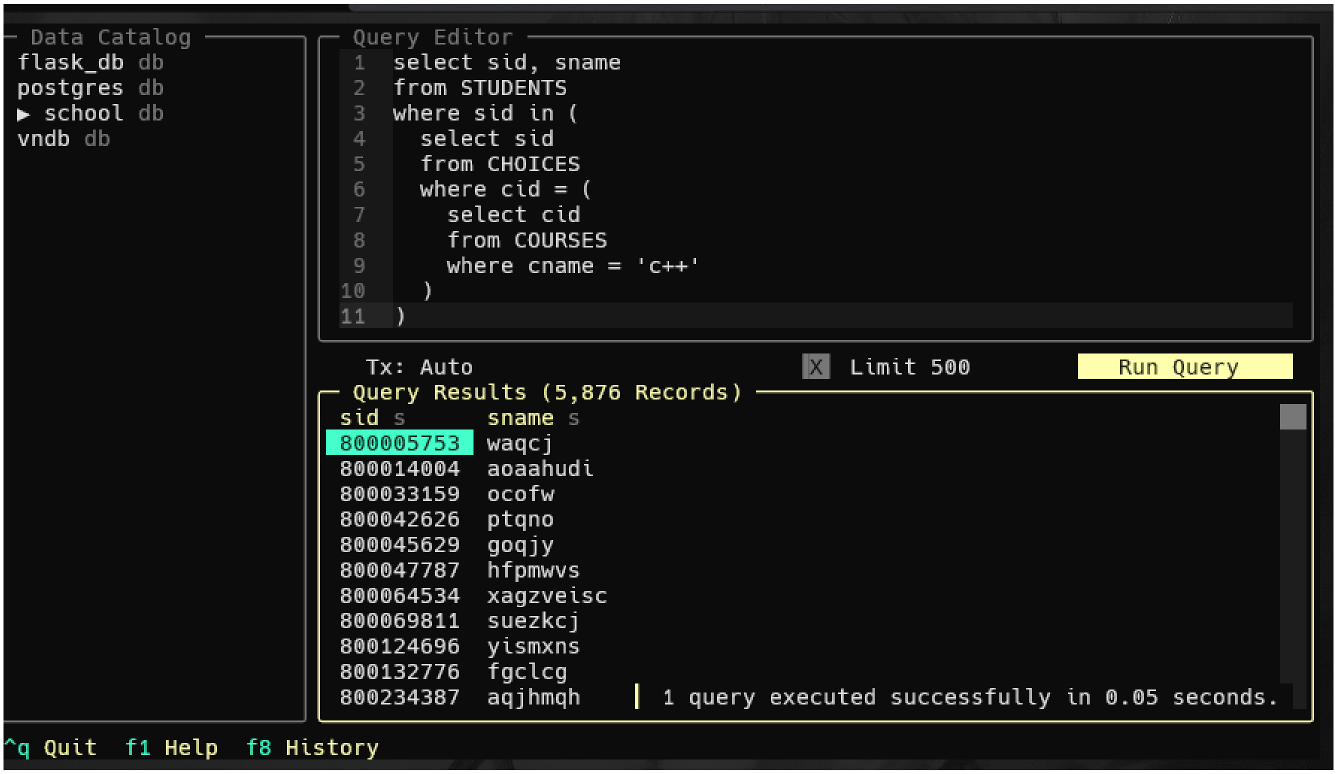
```
select cid
from COURSES
where cid not in (
  select cid
  from CHOICES
);
```

```
Query Returned No Records

1 query executed successfully in 0.03 seconds.
```

4. 查询选修了课程名为 C++ 的学生学号和姓名：

```
select sid, sname
from students
where sid in
(
  select sid
  from choices
  where cid =
  (
    select cid
    from courses
    where cname = 'c++'
  )
);
```

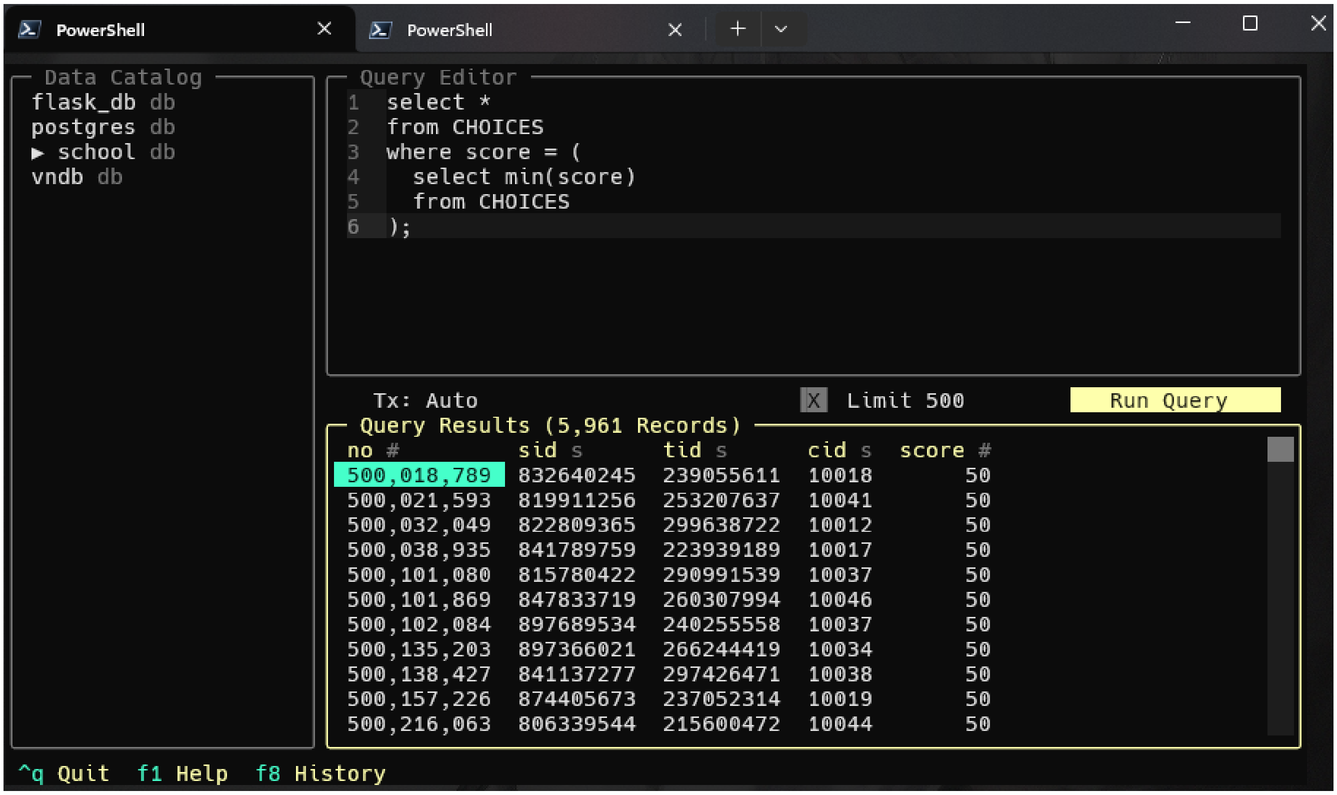


```
select sid, sname
from STUDENTS
where sid in (
  select sid
  from CHOICES
  where cid = (
    select cid
    from COURSES
    where cname = 'c++'
  )
)
```

```
Query Results (5,876 Records)
sid s        sname s
800005753    waqcj
800014004    aoaahudi
800033159    ocofw
800042626    ptqno
800045629    goqjy
800047787    hfpmwvs
800064534    xagzveisc
800069811    suezkcj
800124696    yismxns
800132776    fgclcg
800234387    aqjhmqh    ┃ 1 query executed successfully in 0.05 seconds.
```

5. 找出选修课程成绩最差的选课记录：

```
select *
from choices
where score = (
  select min(score)
  from choices
);
```

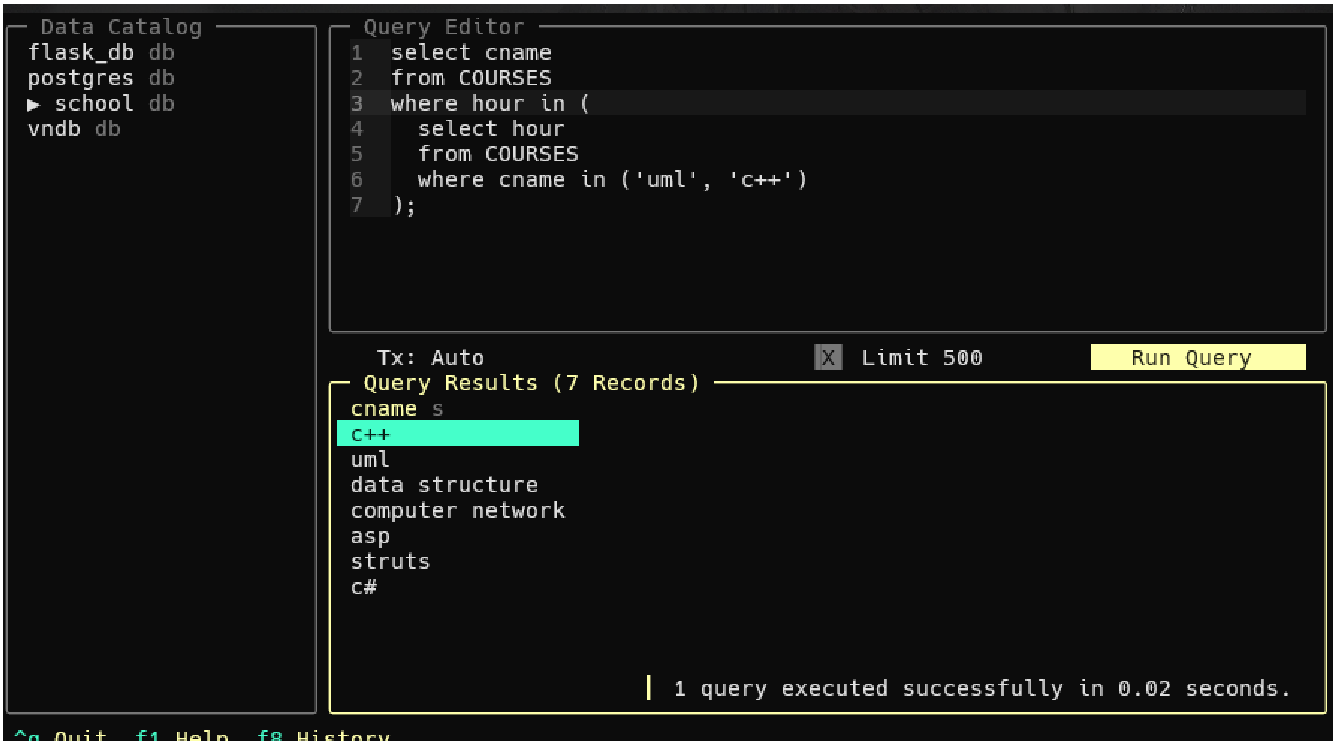


```
select *
from CHOICES
where score = (
  select min(score)
  from CHOICES
);
```

```
Query Results (5,961 Records)
no #         sid s      tid s      cid s   score #
500,018,789  832640245  239055611  10018       50
500,021,593  819911256  253207637  10041       50
500,032,049  822809365  299638722  10012       50
500,038,935  841789759  223939189  10017       50
500,101,080  815780422  290991539  10037       50
500,101,869  847833719  260307994  10046       50
500,102,084  897689534  240255558  10037       50
500,135,203  897366021  266244419  10034       50
500,138,427  841137277  297426471  10038       50
500,157,226  874405673  237052314  10019       50
500,216,063  806339544  215600472  10044       50
```

6. 找出和课程 UML 或课程 C++ 的课时一样的课程名称：

```
select cname
from courses
where hour in (
  select hour
  from courses
  where cname in ('uml', 'c++')
);
```



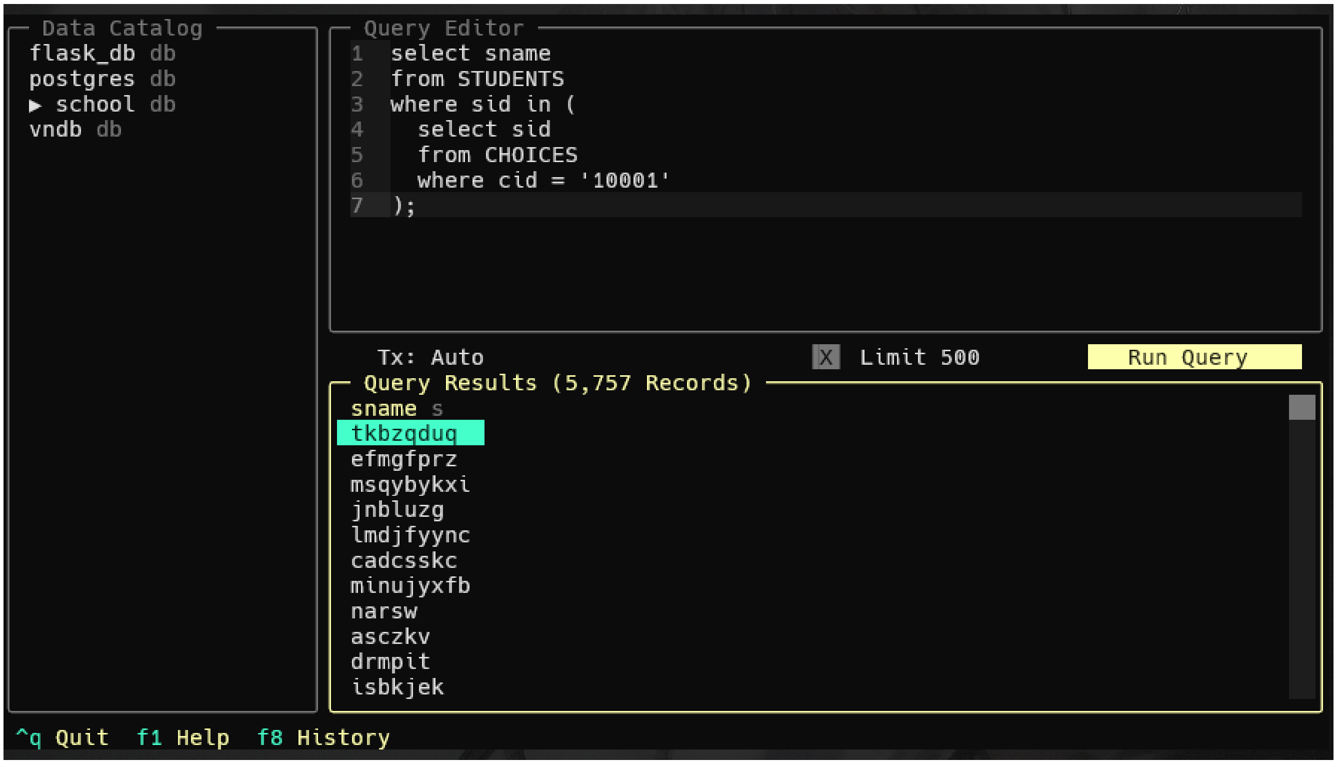
```
select cname
from COURSES
where hour in (
  select hour
  from COURSES
  where cname in ('uml', 'c++')
);
```

```
Query Results (7 Records)
cname s
c++
uml
data structure
computer network
asp
struts
c#
```

1 query executed successfully in 0.02 seconds.

7. 查询所有选修编号 10001 的课程的学生的姓名：

```
select sname
from students
where sid in (
  select sid
  from choices
  where cid = '10001'
);
```



```
select sname
from STUDENTS
where sid in (
  select sid
  from CHOICES
  where cid = '10001'
);
```

```
Query Results (5,757 Records)
sname s
tkbzqduq
efmgfprz
msqybykxi
jnbluzg
lmdjfyync
cadcsskc
minujyxfb
narsw
asczkv
drmpit
isbkjek
```

8. 查询选修了所有课程的学生姓名：

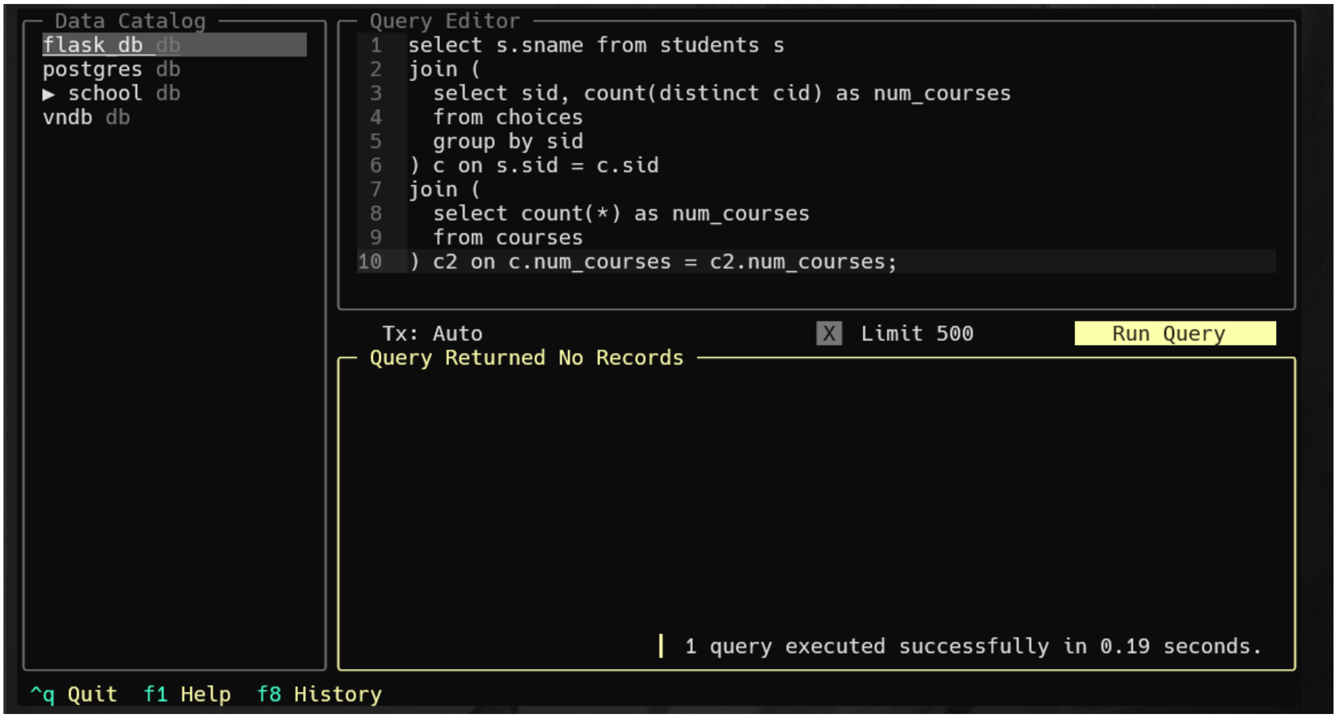
```
-- I am not recommand this way. It is TOO SLOW.
select sname
from students
where not exists (
  select cid
  from courses
  except
  select cid
  from choices
  where choices.sid = students.sid
)
```

或者：

```
select sname
from students
where sid in
(
  select sid
  from choices
  group by sid
  having count(distinct cid) =
  (
    select count(*)
    from courses
  )
)
```

或者:

```
select s.sname from students s
join (
  select sid, count(distinct cid) as num_courses
  from choices
  group by sid
) c on s.sid = c.sid
join (
  select count(*) as num_courses
  from courses
) c2 on c.num_courses = c2.num_courses;
```



```
select s.sname from students s
join (
  select sid, count(distinct cid) as num_courses
  from choices
  group by sid
) c on s.sid = c.sid
join (
  select count(*) as num_courses
  from courses
) c2 on c.num_courses = c2.num_courses;
```

```
Query Returned No Records
1 query executed successfully in 0.19 seconds.
```

自我实践

查询选修C++课程的成绩比姓名为znkoo的学生高的所有学生的编号和姓名;

找出和学生883794999或学生850955252的年级一样的学生的姓名;

查询没有选修Java的学生名称;

找出课时最少的课程的详细信息;

查询工资最高的教师的编号和开设的课程号;

找出选修课程ERP成绩最高的学生编号;

查询没有学生选修的课程的名称;

找出讲授课程UML的教师讲授的所有课程名称;

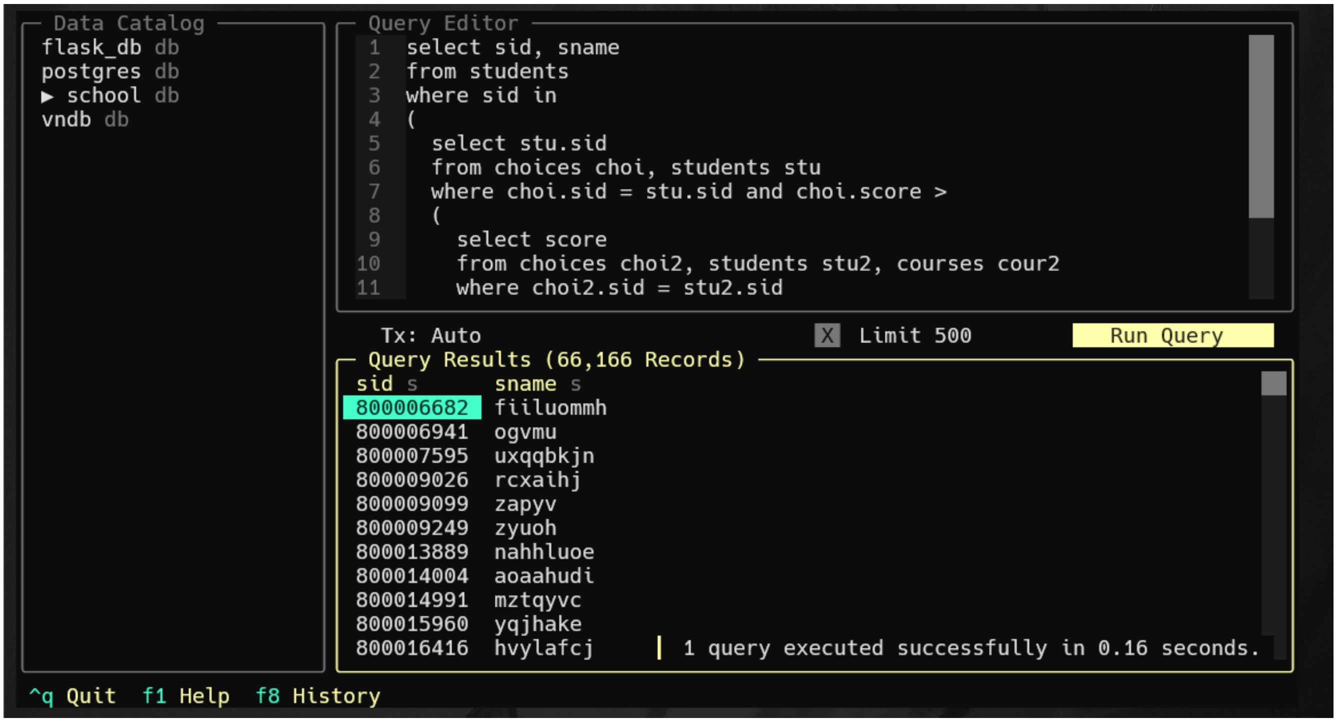
查询选修了编号200102901的教师开设的所有课程的学生编号；

查询选修课程Database的学生集合与选修课程UML的学生集合的并集.

ANSWER

1. 查询选修 C++ 课程的成绩比姓名为 znkoo 的学生高的所有学生的编号和姓名：

```
select sid, sname
from students
where sid in
(
  select stu.sid
  from choices choi, students stu, courses cour
  where choi.sid = stu.sid
    and choi.cid = cour.cid
    and cour.cname = 'c++'
    and choi.score >
  (
    select score
    from choices choi2, students stu2, courses cour2
    where choi2.sid = stu2.sid
      and choi2.cid = cour2.cid
      and stu2.sname = 'znkoo'
      and cour2.cname = 'c++'
  )
)
```

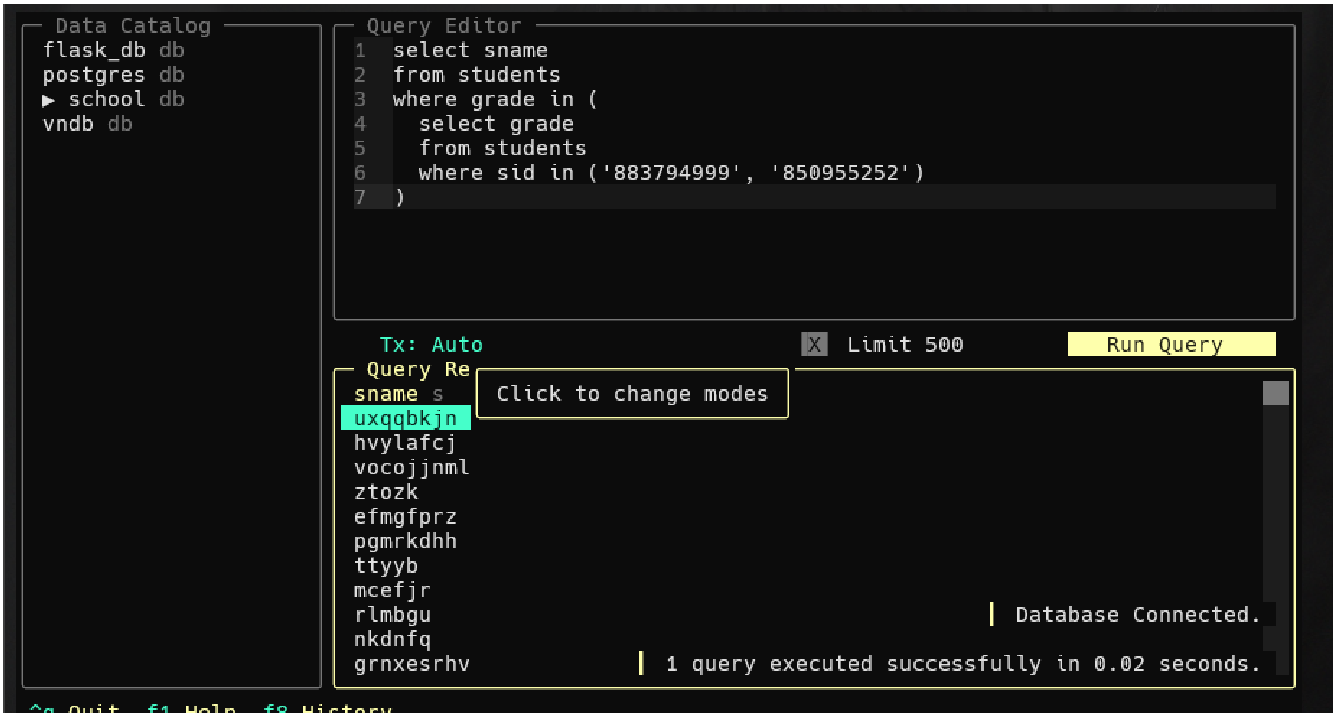


```
select sid, sname
from students
where sid in
(
  select stu.sid
  from choices choi, students stu
  where choi.sid = stu.sid and choi.score >
  (
    select score
    from choices choi2, students stu2, courses cour2
    where choi2.sid = stu2.sid
```

```
Query Results (66,166 Records)
sid s       sname s
800006682   fiiluommh
800006941   ogvmu
800007595   uxqqbkjn
800009026   rcxaihj
800009099   zapyv
800009249   zyuoh
800013889   nahhluoe
800014004   aoaahudi
800014991   mztqyvc
800015960   yqjhake
800016416   hvylafcj     | 1 query executed successfully in 0.16 seconds.
```

1. 找出和学生 883794999 或学生 850955252 的年级一样的学生的姓名：

```
select sname
from students
where grade in
(
  select grade
  from students
  where sid in ('883794999', '850955252')
)
```

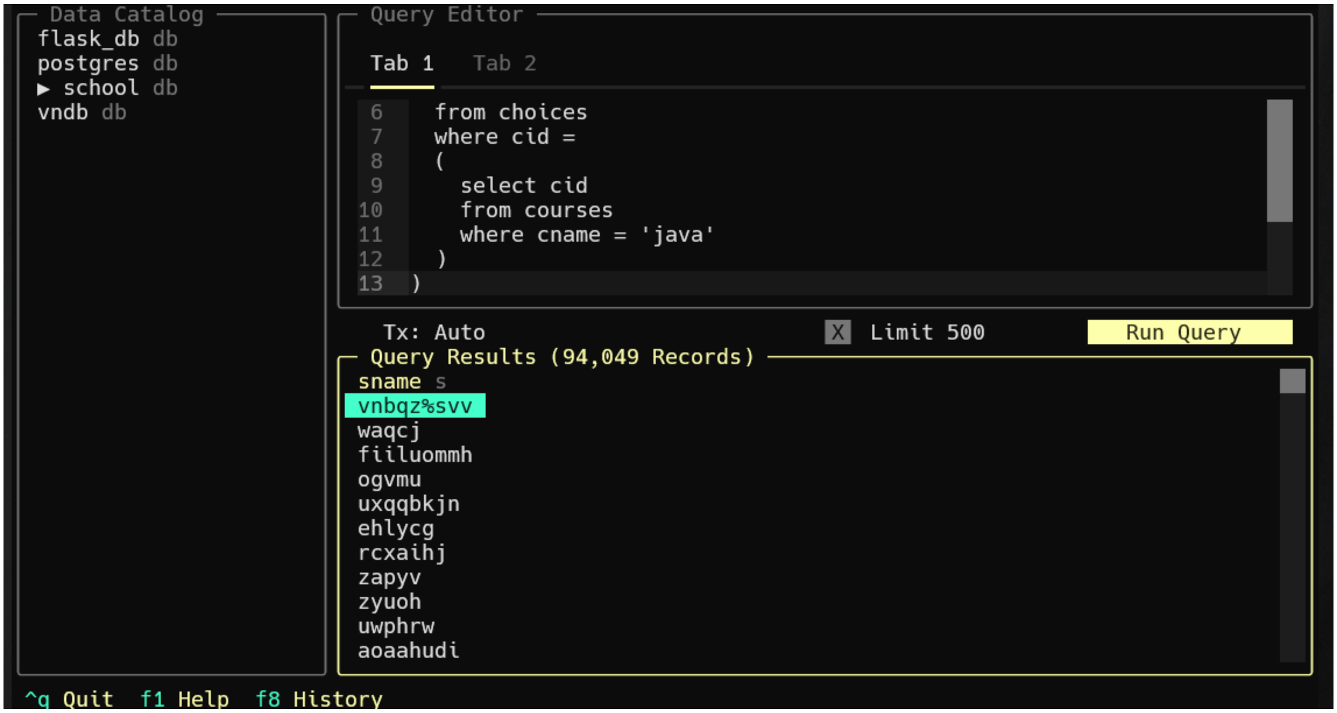


```
select sname
from students
where grade in (
  select grade
  from students
  where sid in ('883794999', '850955252')
)
```

```
sname s
uxqqbkjn
hvylafcj
vocojjnml
ztozk
efmgfprz
pgmrkdhh
ttyyb
mcefjr
rlmbgu                                    Database Connected.
nkdnfq
grnxesrhv             1 query executed successfully in 0.02 seconds.
```

3. 查询没有选修 Java 的学生名称：

```
select stu.sname
from students stu
where sid not in
(
  select sid
  from choices
  where cid =
  (
    select cid
    from courses
    where cname = 'java'
  )
)
```



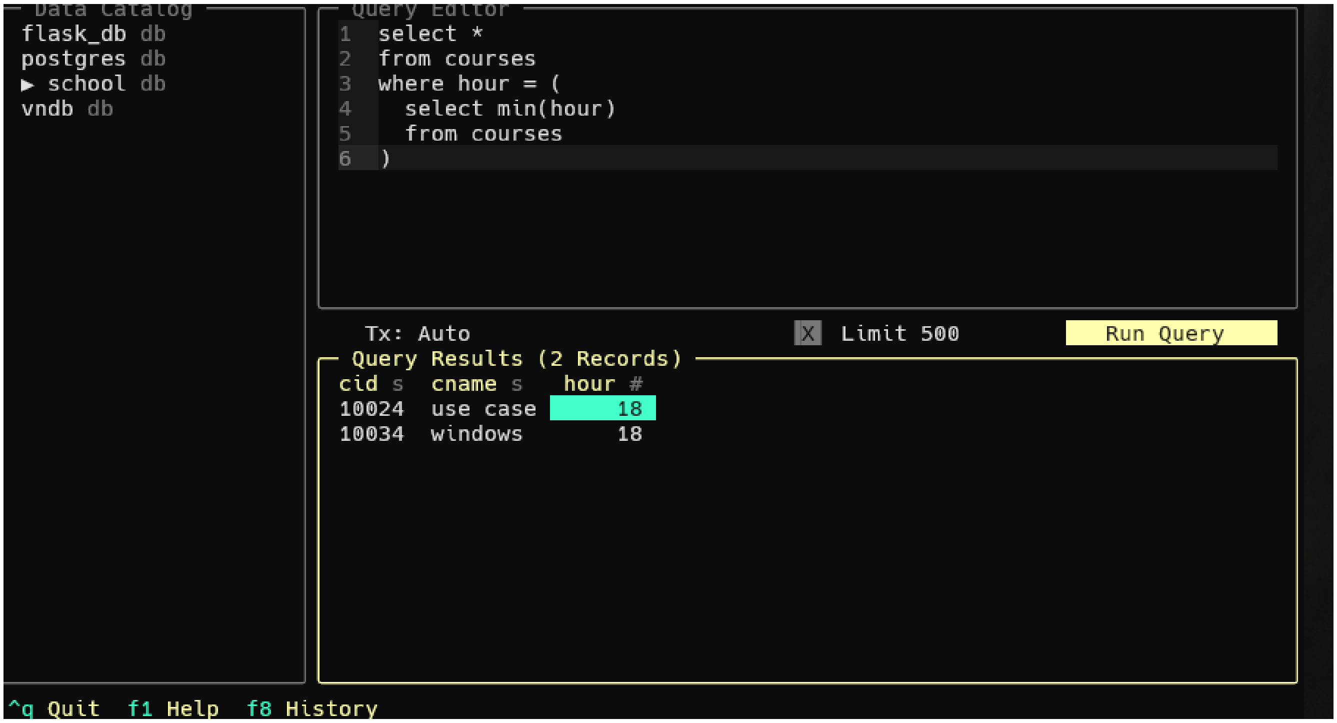
```
from choices
where cid =
(
  select cid
  from courses
  where cname = 'java'
)
)
```

Query Results (94,049 Records)

```
sname s
vnbqz%svv
waqcj
fiiluommh
ogvmu
uxqqbkjn
ehlycg
rcxaihj
zapyv
zyuoh
uwphrw
aoaahudi
```

4. 找出课时最少的课程的详细信息：

```
select *
from courses
where hour = (
  select min(hour)
  from courses
)
```



```
select *
from courses
where hour = (
  select min(hour)
  from courses
)
```

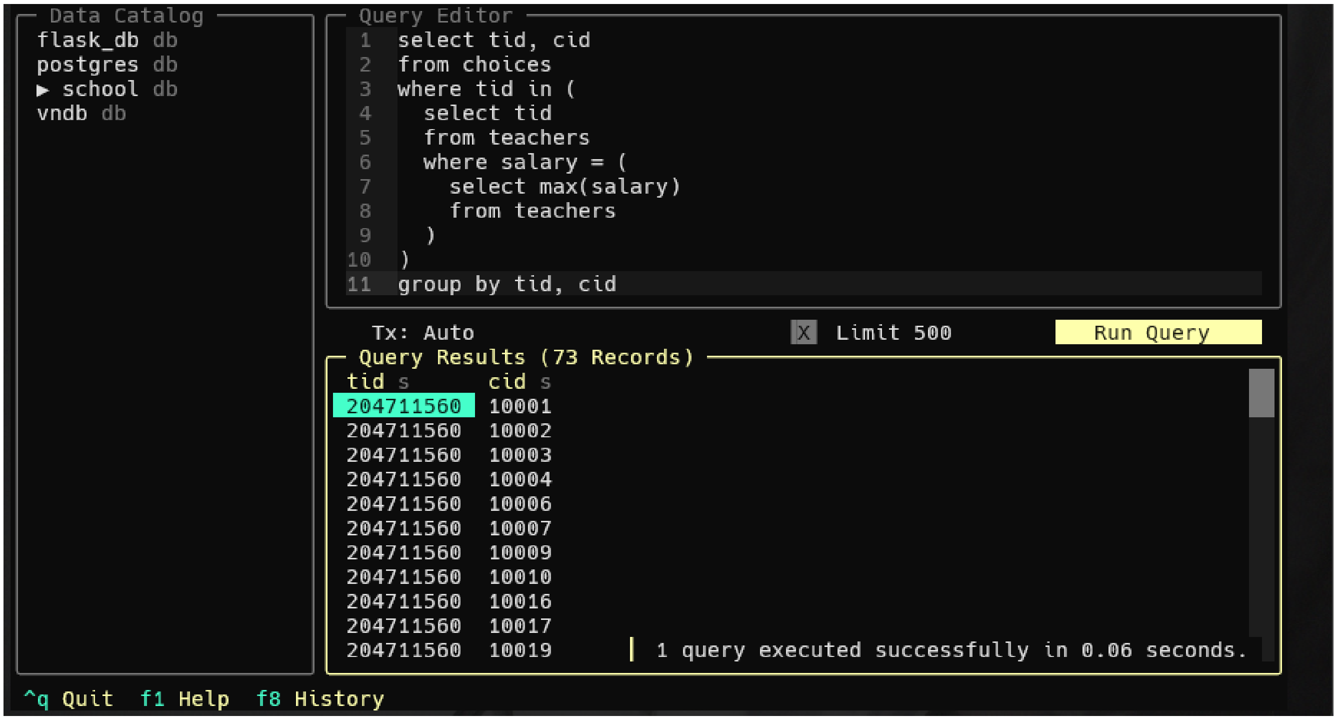
Query Results (2 Records)

```
cid s  cname s    hour #
10024  use case     18
10034  windows      18
```

5. 查询工资最高的教师的编号和开设的课程号：

```
select tid, cid
from choices
```

```
where tid in
(
  select tid
  from teachers
  where salary =
  (
    select max(salary)
    from teachers
  )
)
group by tid, cid
```

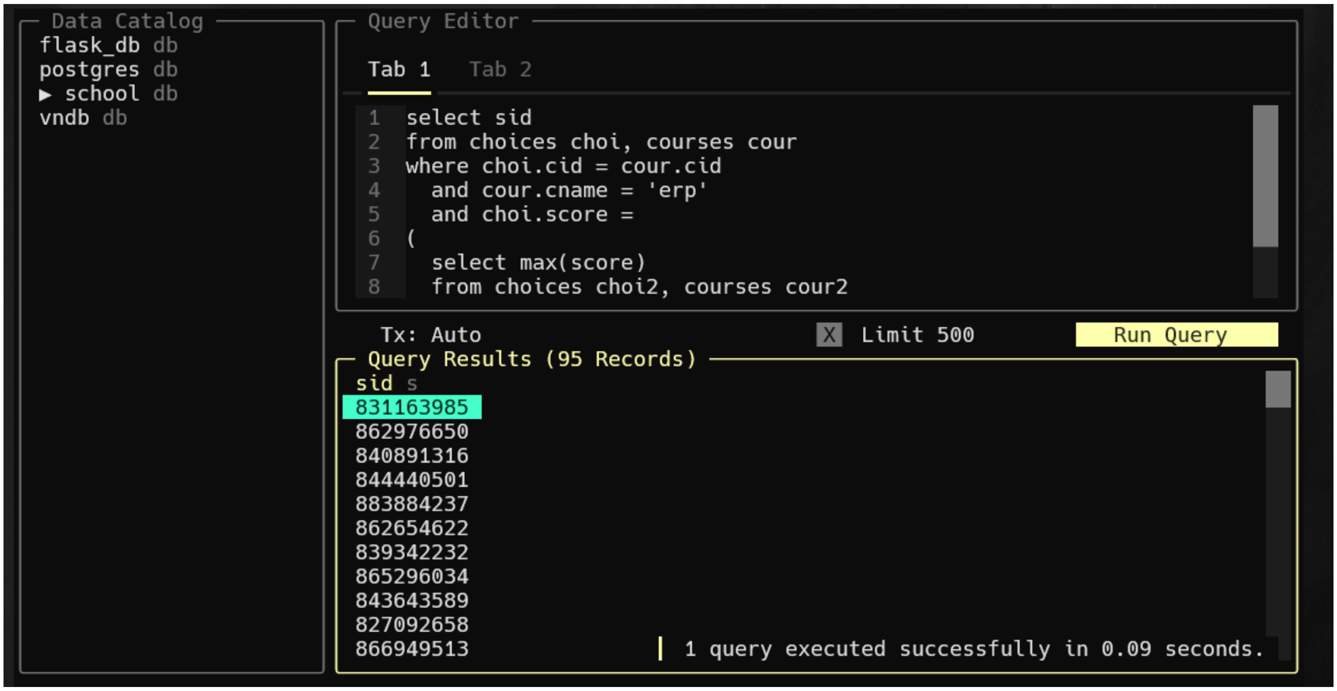


```
select tid, cid
from choices
where tid in (
  select tid
  from teachers
  where salary = (
    select max(salary)
    from teachers
  )
)
group by tid, cid
```

```
tid s      cid s
204711560  10001
204711560  10002
204711560  10003
204711560  10004
204711560  10006
204711560  10007
204711560  10009
204711560  10010
204711560  10016
204711560  10017
204711560  10019     | 1 query executed successfully in 0.06 seconds.
```

6. 找出选修课程 ERP 成绩最高的学生编号

```
select sid
from choices choi, courses cour
where choi.cid = cour.cid
  and cour.cname = 'erp'
  and choi.score =
(
  select max(score)
  from choices choi2, courses cour2
  where choi2.cid = cour2.cid
    and cour2.cname = 'erp'
)
```



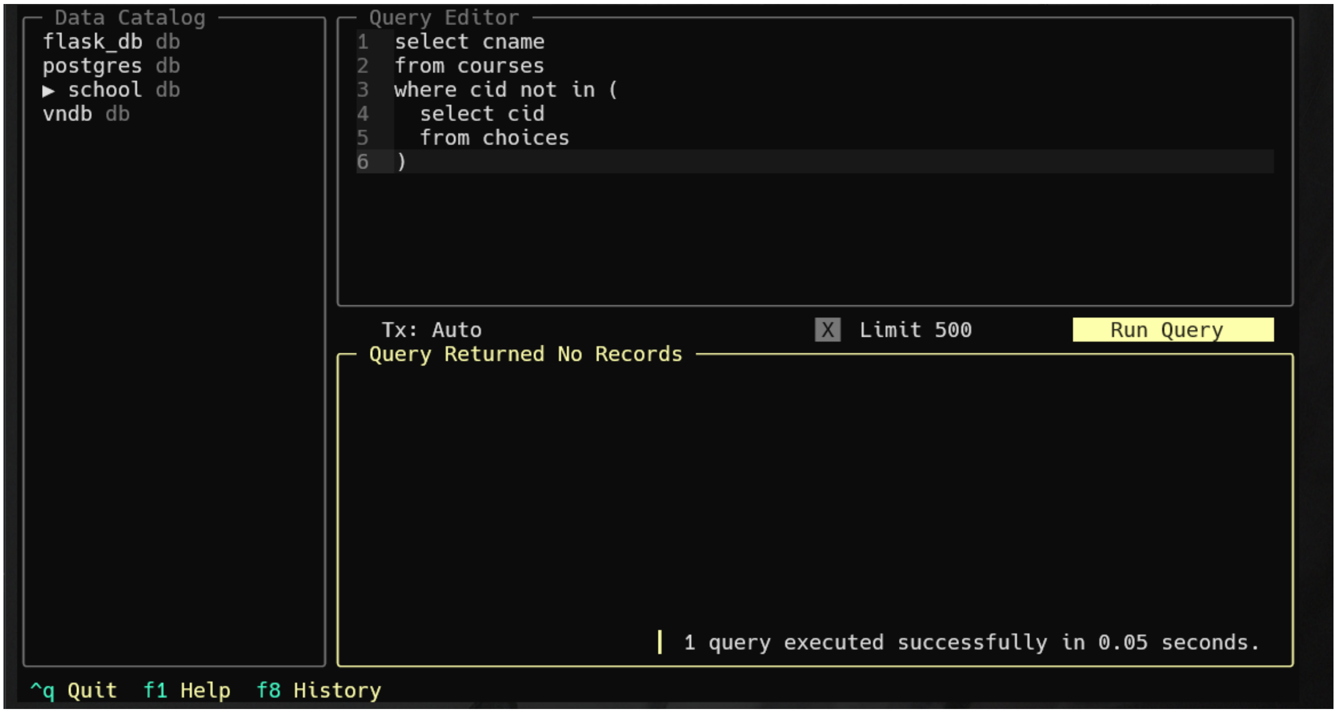
```
select sid
from choices choi, courses cour
where choi.cid = cour.cid
  and cour.cname = 'erp'
  and choi.score =
(
  select max(score)
  from choices choi2, courses cour2
```

```
Query Results (95 Records)
sid s
831163985
862976650
840891316
844440501
883884237
862654622
839342232
865296034
843643589
827092658
866949513
```

1 query executed successfully in 0.09 seconds.

7. 查询没有学生选修的课程的名称：

```
select cname
from courses
where cid not in (
  select cid
  from choices
)
```



```
select cname
from courses
where cid not in (
  select cid
  from choices
)
```

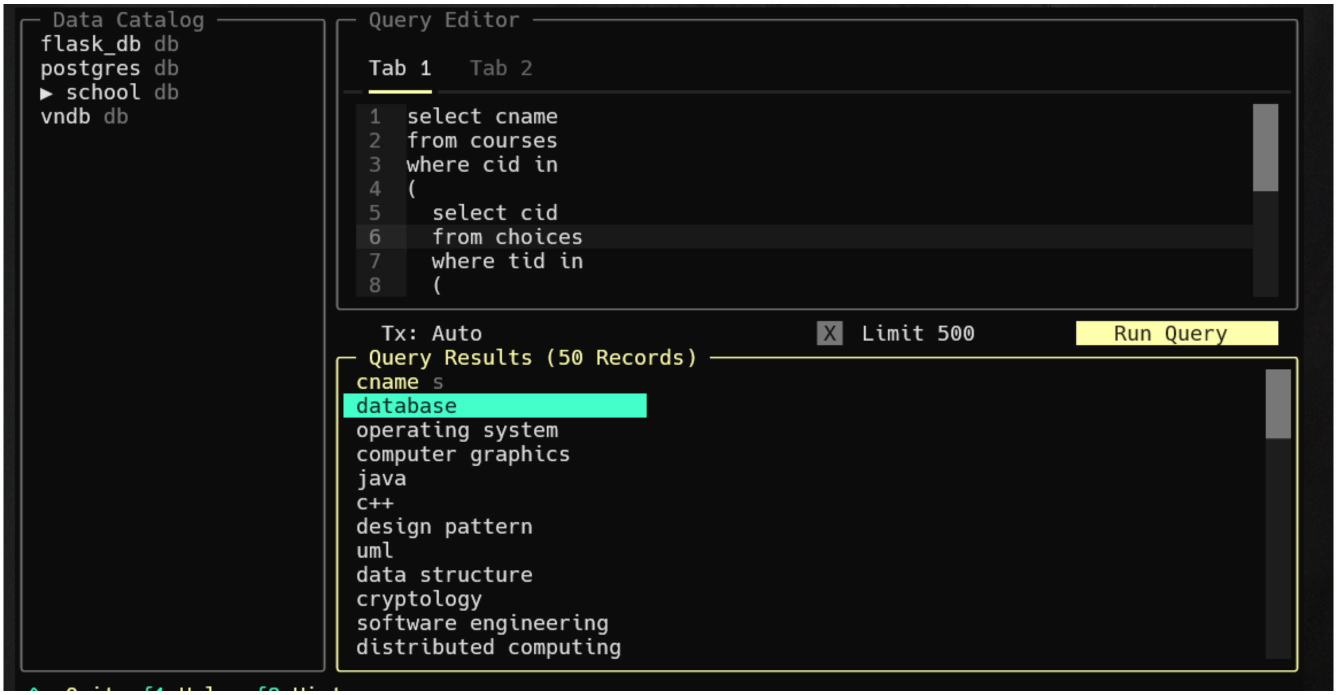
Query Returned No Records

1 query executed successfully in 0.05 seconds.

8. 找出讲授课程 UML 的教师讲授的所有课程名称：

```
select cname
from courses
where cid in
```

```
(
  select cid
  from choices
  where tid in
  (
    select tid
    from choices
    where cid =
    (
      select cid
      from courses
      where cname = 'uml'
    )
  )
)
```

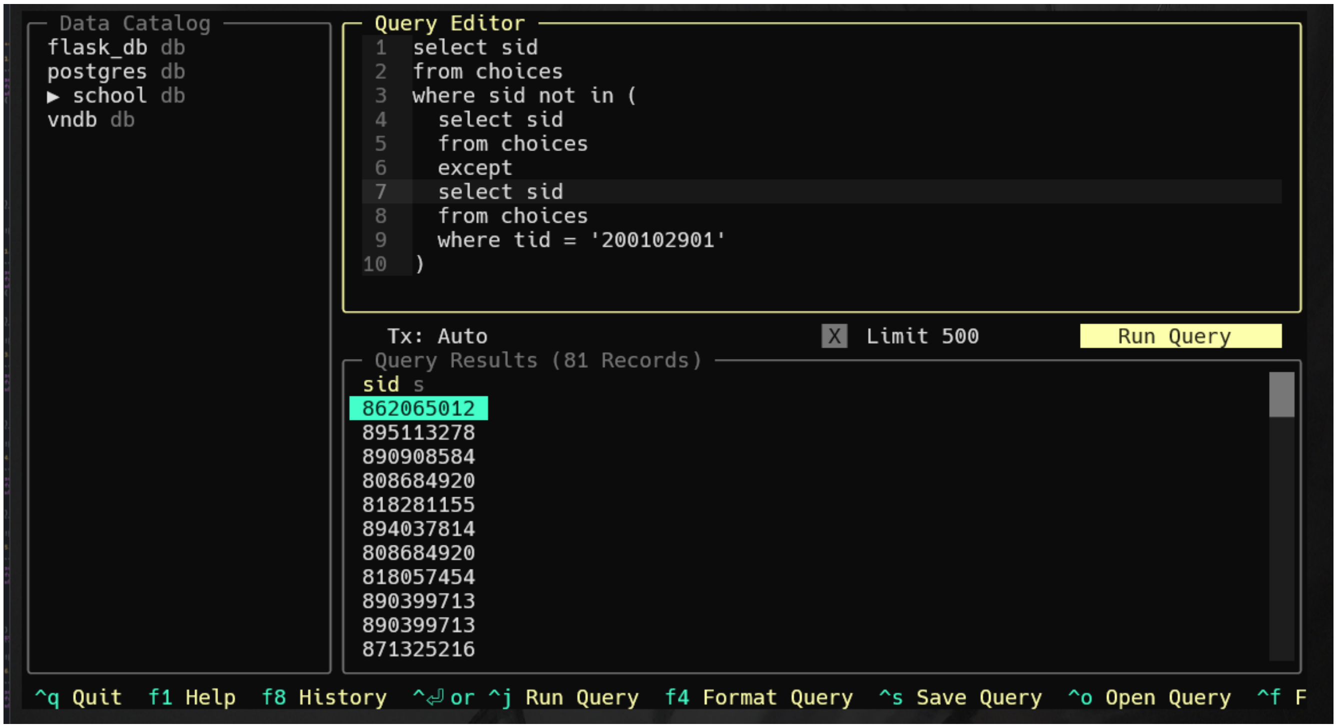


```
select cname
from courses
where cid in
(
  select cid
  from choices
  where tid in
  (
```

```
Query Results (50 Records)
cname s
database
operating system
computer graphics
java
c++
design pattern
uml
data structure
cryptology
software engineering
distributed computing
```

9. 查询选修了编号 200102901 的教师开设的所有课程的学生编号：

```
select sid
from choices
where sid no in (
  select sid
  from choices
  except
  select sid
  from choices
  where tid = '200102901'
)
```


Data Catalog
flask_db db
postgres db
▶ school db
vndb db
Query Editor
Tx: Auto
☒ Limit 500
Run Query
^q Quit f1 Help f8 History ^⏎ or ^j Run Query f4 Format Query ^s Save Query ^o Open Query ^f F

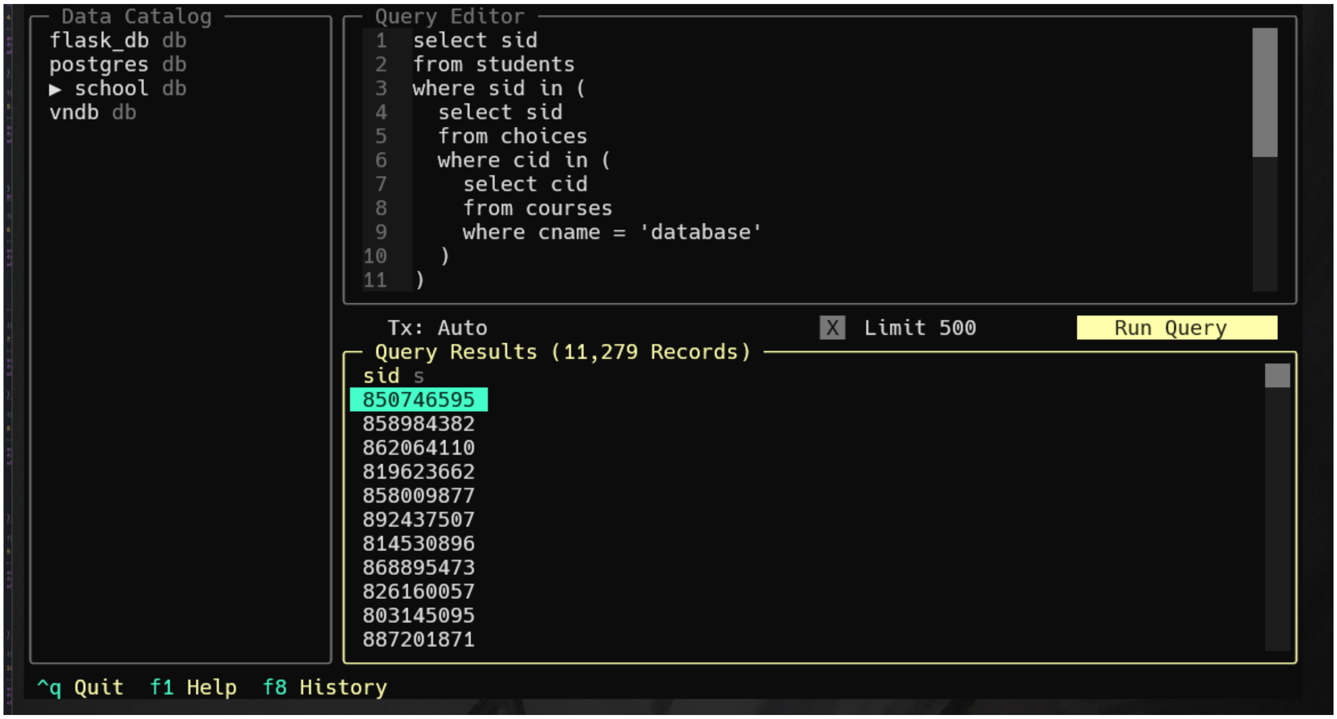
```sql
select sid
from choices
where sid not in (
  select sid
  from choices
  except
  select sid
  from choices
  where tid = '200102901'
)
```

Query Results (81 Records)

```
sid s
862065012
895113278
890908584
808684920
818281155
894037814
808684920
818057454
890399713
890399713
871325216
```

10. 查询选修课程 Database 的学生集合与选修课程 UML 的学生集合的并集：

```sql
select sid
from students
where sid in
(
  select sid
  from choices
  where cid in
  (
    select cid
    from courses
    where cname = 'database'
  )
)
union
select sid
from students
where sid in
(
  select sid
  from choices
  where cid in
  (
    select cid
    from courses
    where cname = 'uml'
  )
)
```



```sql
select sid
from students
where sid in (
  select sid
  from choices
  where cid in (
    select cid
    from courses
    where cname = 'database'
  )
)
```

Tx: Auto ☒ Limit 500

Query Results (11,279 Records)

```
sid s
850746595
858984382
862064110
819623662
858009877
892437507
814530896
868895473
826160057
803145095
887201871
```

实验总结

一到了嵌套查询，CHOICES 中庞大的数据量便会带来巨大的挑战。如何合理地组织优化查询语句是本次实验的关键点。