

Contents

实验四 数据查询（连接、集合查询）	1
实验目的	1
实验环境	1
实验内容	2
实验步骤	2
课内实验	2
自我实践	9

实验四 数据查询（连接、集合查询）

实验目的

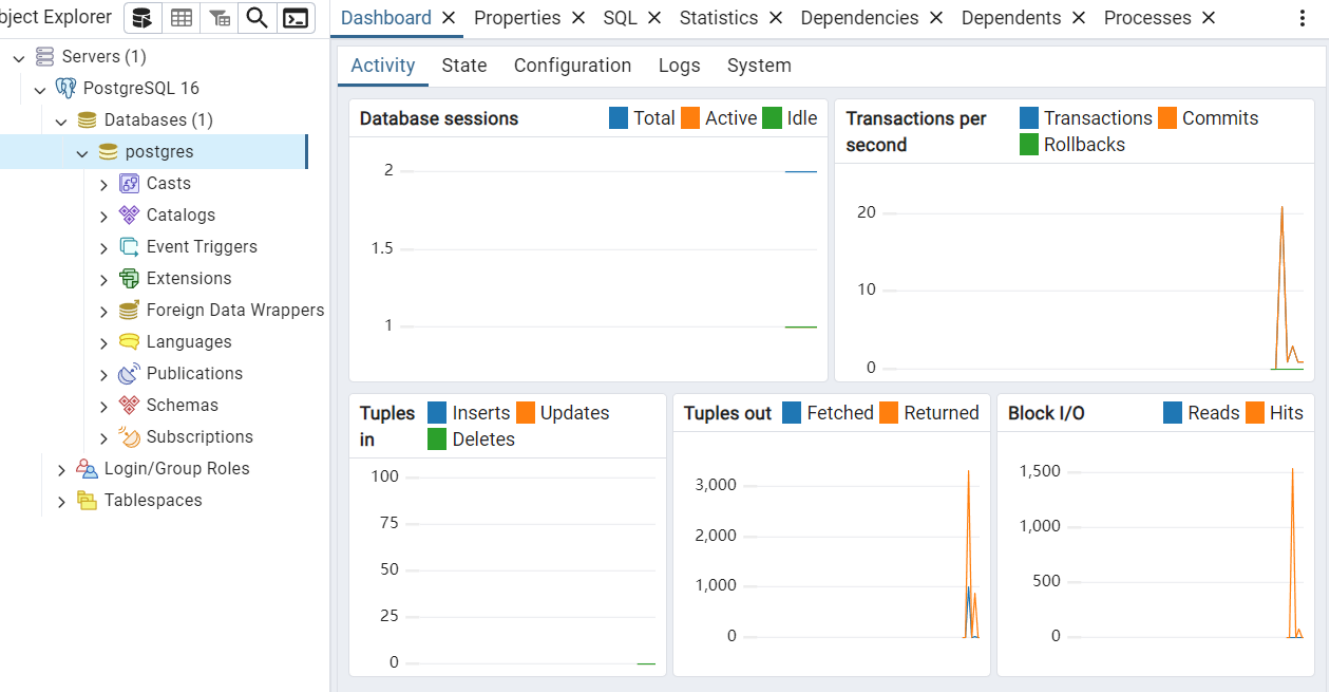
熟悉 SQL 语句的数据查询语言，能够使用 SQL 语句对数据库进行连接查询和集合查询。

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



实验内容

本节实验的主要内容包括：

笛卡尔连接和等值连接

自然连接

外连接

复合条件连接

多表连接

使用保留字UNION进行集合或运算

采用逻辑运算符AND或OR来实现集合交和减运算

实验步骤

课内实验

QUESTION:

以school数据库为例(可在本实验单元的课时材料中下载)，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。

- (1) 查询编号800009026的学生所选的全部课程的课程名和成绩
- (2) 查询所有选了database的学生的编号
- (3) 求出选择了同一个课程的学生对
- (4) 求出至少被两名学生选修的课程编号
- (5) 查询选修了编号850955252的学生所选的某个课程的学生编号
- (6) 查询学生的基本信息及选修课程编号和成绩
- (7) 查询学号850955252的学生的姓名和选修的课程名称及成绩
- (8) 利用集合运算，查询选修课程C++或课程Java的学生的编号
- (9) 实现集合交运算，查询既选修课程C++又选修课程Java的学生的编号
- (10) 实现集合减运算，查询选修课程C++而没有选修课程Java的学生的编号

ANSWER

1. 查询编号 800009026 的学生所选的全部课程的课程名和成绩:

```
select
  ch.cname, co.score
from
  CHOICES ch, COURSES co
where
  ch.cid = co.cid and ch.sid = '800009026';
```

The screenshot shows a database query editor interface. On the left is the 'Data Catalog' pane with a tree view containing 'flask_db db', 'postgres db', 'school db', 'test db' (selected), and 'vndb db'. The main area is split into a 'Query Editor' and a 'Query Results' pane. The 'Query Editor' contains the following SQL query:

```
1 select
2   co.cname, ch.score
3 from
4   CHOICES ch, COURSES co
5 where
6   ch.cid = co.cid and ch.sid = '
7   800009026';"school"."public""school"."public"
```

Below the query editor, the 'Query Results' pane shows the results of the query. It includes a 'Tx: Auto' label, a 'Limit 500' dropdown, and a 'Run Query' button. The results are displayed in a table with 3 records:

cname	score
tcp/ip protocol	94
j2me	0 null
c	83

At the bottom of the interface, there is a status bar with various keyboard shortcuts: ^q Quit, f1 Help, f8 History, ^o or ^j Run Query, f4 Format Query, ^s Save Query, ^o Open Query, ^f Find, f3 Find Next, ^g Go To Line.

2. 查询所有选了 database 的学生的编号:

```
select
  ch.sid
from
  CHOICES ch, COURSES co
where
  ch.cid = co.cid and co.cname = 'database';
```

Data Catalog
flask_db db
postgres db
▶ school db
test db
vndb db

Query Editor

```

1 select
2   ch.sid
3 from
4   CHOICES ch, COURSES co
5 where
6   ch.cid = co.cid and co.cname = 'database';

```

Tx: Auto
Query Results (5,898 Records)

Limit 500
Run Query

```

sid s
870899566
830652286
818285935
891145052
882649811
896389791
875474472
885336151
813866325
827173338
830131870
840249984
869944480
806090255

```

^q Quit f1 Help f8 History

3. 求出选择了同一个课程的学生对:

```

select
  c1.sid, c2.sid
from
  CHOICES c1, CHOICES c2
where
  c1.cid = c2.cid and c1.sid < c2.sid;

```

	sid character (9)	sid character (9)
41	829785562	831956430
42	829785562	850287746
43	829785562	850442132
44	829785562	885710245
45	829785562	883778374
46	829785562	891958794
47	829785562	893063575
48	829785562	862027207

Total rows: 1000 of 897278176 Query complete 00:12:37.771 Ln 6, Col 4

code postgres school -- NORMAL -- You, 45 minutes ago Ln

4. 求出至少被两名学生选修的课程编号:

```

select
  cid

```

```

from
  CHOICES
group by
  cid
having
  count(distinct sid) >= 2;

```

The screenshot shows a database query editor interface. On the left is a 'Data Catalog' pane listing databases: flask_db, postgres, school, test, and vndb. The 'Query Editor' pane contains the following SQL query:

```

1 select
2   cid
3 from
4   CHOICES
5 group by
6   cid
7 having
8   count(distinct sid) >= 2;

```

Below the query editor, there is a 'Tx: Auto' dropdown, a 'Limit 500' input field, and a 'Run Query' button. The 'Query Results (50 Records)' pane displays the following data:

cid
10001
10002
10003
10004
10005
10006
10007
10008
10009
10010
10011
10012
10013
10014

At the bottom right of the results pane, a status message reads: '1 query executed successfully in 0.41 seconds.' The bottom status bar shows keyboard shortcuts: ^g Quit, f1 Help, f8 History.

5. 查询选修了编号 850955252 的学生所选的某个课程的学生编号:

```

select sid
from CHOICES
where cid in (
  select cid
  from CHOICES
  where sid = '850955252'
);

```

Data Catalog

- flask_db db
- postgres db
- school db
- test db
- vndb db

Query Editor

```

1 select sid
2 from CHOICES
3 where cid in (
4     select cid
5     from CHOICES
6     where sid = '850955252'
7 );

```

Tx: Auto X Limit 500 Run Query

Query Results (23,683 Records)

sid s
850955252
847061074
801967882
830180555
834091581
873915389
847843459
820193911
835766788
852738751
816287601
829207334
884859993
829665493

| 1 query executed successfully in 0.17 seconds.

^q Quit f1 Help f8 History

6. 查询学生的基本信息及选修课程编号和成绩:

```

select
    stu.sid,    stu.sname,
    cho.cid,    cho.score
from
    STUDENTS stu, CHOICES cho
where
    stu.sid = cho.sid

```

Data Catalog

- flask_db db
- postgres db
- school db
- test db
- vndb db

Query Editor

```

1 select
2     stu.sid,    stu.sname,
3     cho.cid,    cho.score
4 from
5     STUDENTS stu, CHOICES cho
6 where
7     stu.sid = cho.sid

```

Tx: Auto X Limit 500 Run Query

Query Results (Showing 100,000 of 299,550 Records)

sid s	sname s	cid s	score #
823069829	pxfys	10037	76
829348273	rfsldreav	10010	87
850955252	baqzmo	10021	54
847061074	qxkbh	10025	92
860635914	xnhdjo	10039	82
829785562	bemgynei	10028	77
822137137	qaxwe	10011	67
826310502	cqkrjkuf	10005	90
817636568	wzinemrs	10047	60
813520169	rcypjhsnc	10023	∅ null
801967882	kvamveu	10021	70
875434315	rekmgdbo	10048	82
830180555	mbfrhwz	10016	76
848035070	kxqlbun	10007	88

| 1 query executed successfully in 0.28 seconds.

^q Quit f1 Help f8 History

7. 查询学号 850955252 的学生的姓名和选修的课程名称及成绩:

```

select
    stu.sname, cou.cname, cho.score
from
    STUDENTS stu, CHOICES cho, COURSES cou

```

```
where
cho.sid = stu.sid and
cho.cid = cou.cid and
stu.sid = '850955252';
```

Data Catalog

- flask_db db
- postgres db
- school db
- test db
- vndb db

Query Editor

```
1 select
2   stu.sname, cou.cname, cho.score
3 from
4   STUDENTS stu, CHOICES cho, COURSES cou
5 where
6   cho.sid = stu.sid and
7   cho.cid = cou.cid and
8   stu.sid = '850955252';
```

Query Results (4 Records)

sname	cname	score
baqzmo	j2me	54
baqzmo	data mining	62
baqzmo	embeded system	94
baqzmo	project management	76

1 query executed successfully in 0.11 seconds.

8. 利用集合运算，查询选修课程 C++ 或课程 Java 的学生的编号：

```
select sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'c++'
union
select sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'java';
```

Data Catalog

- flask_db db
- postgres db
- school db
- test db
- vndb db

Query Editor

```
1 select sid
2 from CHOICES cho, COURSES cou
3 where cho.cid = cou.cid and cou.cname = 'c++'
4 union
5 select sid
6 from CHOICES cho, COURSES cou
7 where cho.cid = cou.cid and cou.cname = 'java';
```

Query Results (11,522 Records)

sid
877707270
842681364
801893096
816552513
832534289
887550334
869459336
876352900
899326671
840432164
811052138
842155231
838155481
834581473

9. 实现集合交运算，查询既选修课程 C++ 又选修课程 Java 的学生的编号：

```

select sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'c++'
intersect
select sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'java';

```

The screenshot shows a database query editor with a 'Data Catalog' on the left and a 'Query Editor' on the right. The 'Data Catalog' lists databases: flask_db, postgres, school, test, and vndb. The 'Query Editor' contains the following SQL query:

```

1 select sid
2 from CHOICES cho, COURSES cou
3 where cho.cid = cou.cid and cou.cname = 'c++'
4 intersect
5 select sid
6 from CHOICES cho, COURSES cou
7 where cho.cid = cou.cid and cou.cname = 'java';

```

Below the query editor, there are controls for 'Tx: Auto', 'Limit 500', and a 'Run Query' button. The 'Query Results (306 Records)' section displays a list of student IDs (sid) in a table format:

sid
876084136
897737939
848499245
866445392
866813891
859407865
898258584
899613915
895176952
811799427
892695304
814011470
816495654
821073906

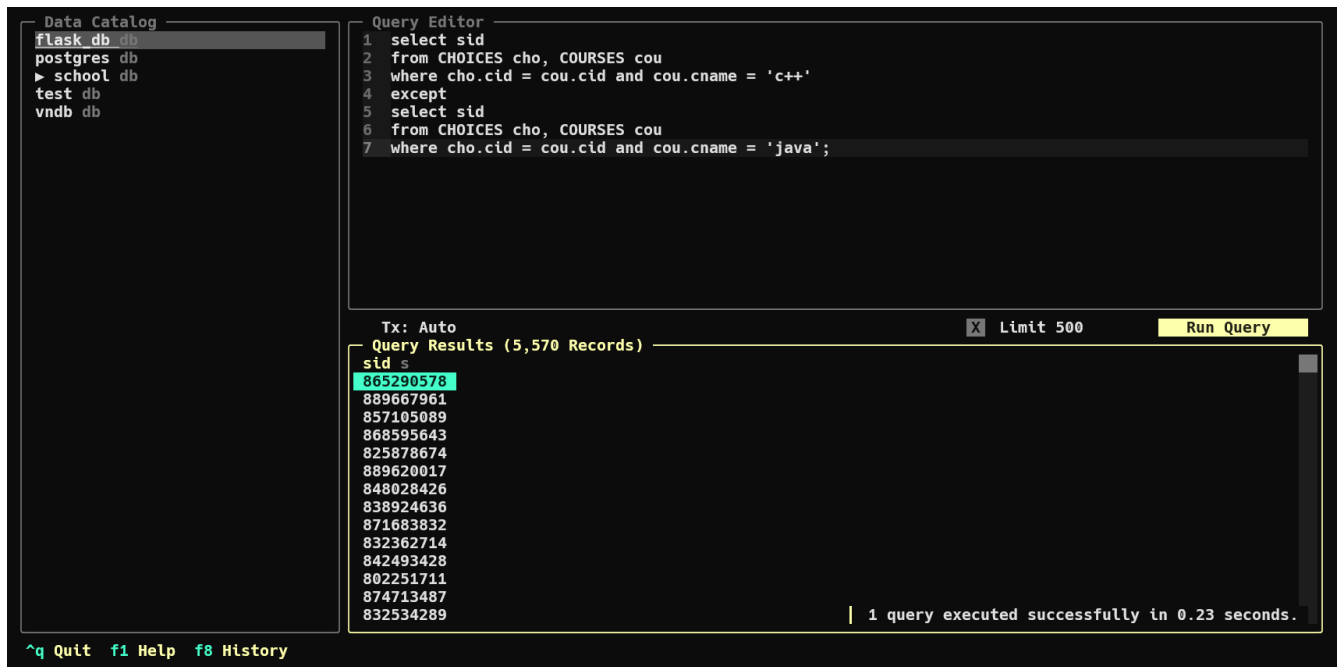
At the bottom right of the results section, it states: '1 query executed successfully in 0.20 seconds.' The bottom of the interface features a status bar with keyboard shortcuts: ^q Quit, f1 Help, f8 History, ^o or ^j Run Query, f4 Format Query, ^s Save Query, ^o Open Query, ^f Find, f3 Find Next, ^g Go To Line.

10. 实现集合减运算，查询选修课程 C++ 而没有选修课程 Java 的学生的编号：

```

select sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'c++'
except
select sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'java';

```

自我实践

QUESTION

- (1) 查询选修Java的所有学生的编号及姓名
- (2) 分别使用等值连接和谓词IN两种方式查询姓名为sssht的学生所选的课程的编号和成绩
- (3) 查询其他课时比课程C++多的课程的名称
- (4) 实现集合交运算，查询既选修课程Database又选修课程UML的学生的编号
- (5) 实现集合减运算，查询选修课程Database而没有选修课程UML的学生的编号

ANSWER

1. 查询选修 Java 的所有学生的编号及姓名:

```
select
    stu.sid, stu.sname
from
    STUDENTS stu, CHOICES cho, COURSES cou
where
    stu.sid = cho.sid and
    cho.cid = cou.cid and
    cou.cname = 'java';
```

Data Catalog

- flask_db db
- postgres db
- school db
- test db
- vndb db

Query Editor

```

1 select
2   stu.sid, stu.sname
3 from
4   STUDENTS stu, CHOICES cho, COURSES cou
5 where
6   stu.sid = cho.sid and
7   cho.cid = cou.cid and
8   cou.cname = 'java';

```

Tx: Auto Limit 500 Run Query

Query Results (6,110 Records)

sid s	sname s
833961570	bzbogqep
856259316	qnsnmk
840205068	vtyzpxh
870755799	gjikyychh
811353704	wcgatkwn
881617726	lkmsab
806836750	rryear
898186633	oaxmzg
895459694	tzaaptln
828744353	tcnib
834474228	dihliewsh
854560014	jjpgcfn
851258869	gdiqpx
851526085	etkyu

1 query executed successfully in 0.12 seconds.

^q Quit f1 Help f8 History

2. 分别使用等值连接和谓词 IN 两种方式查询姓名为 sssht 的学生所选的课程的编号和成绩:

等值连接:

```

select
  cho.cid, cho.score
from
  STUDENTS stu, CHOICES cho, COURSES cou
where
  stu.sid = cho.sid and
  cho.cid = cou.cid and
  stu.sname = 'sssht';

```

Data Catalog

- flask_db db
- postgres db
- school db
- test db
- vndb db

Query Editor

```

1 select
2   cho.cid, cho.score
3 from
4   STUDENTS stu, CHOICES cho, COURSES cou
5 where
6   stu.sid = cho.sid and
7   cho.cid = cou.cid and
8   stu.sname = 'sssht';

```

Tx: Auto Limit 500 Run Query

Query Results (5 Records)

cid s	score #
10004	76
10037	84
10037	54
10030	53
10019	79

1 query executed successfully in 0.16 seconds.

^q Quit f1 Help f8 History

谓词 IN:

```

select cho.cid, cho.score
from CHOICES cho

```

```

where cho.sid in (
    select stu.sid
    from STUDENTS stu
    where stu.sname = 'sssht'
);

```

The screenshot shows a database query tool interface with three main panels:

- Data Catalog:** Lists databases: flask_db, postgres, school, test, and vndb.
- Query Editor:** Contains the following SQL query:


```

1 select cho.cid, cho.score
2 from CHOICES cho
3 where cho.sid in (
4     select stu.sid
5     from STUDENTS stu
6     where stu.sname = 'sssht'
7 )
      
```
- Query Results (5 Records):** Displays the results of the query in a table format. The table has columns 'cid' and 'score'. The results are:

cid	score
10004	76
10037	84
10037	54
10030	53
10019	79

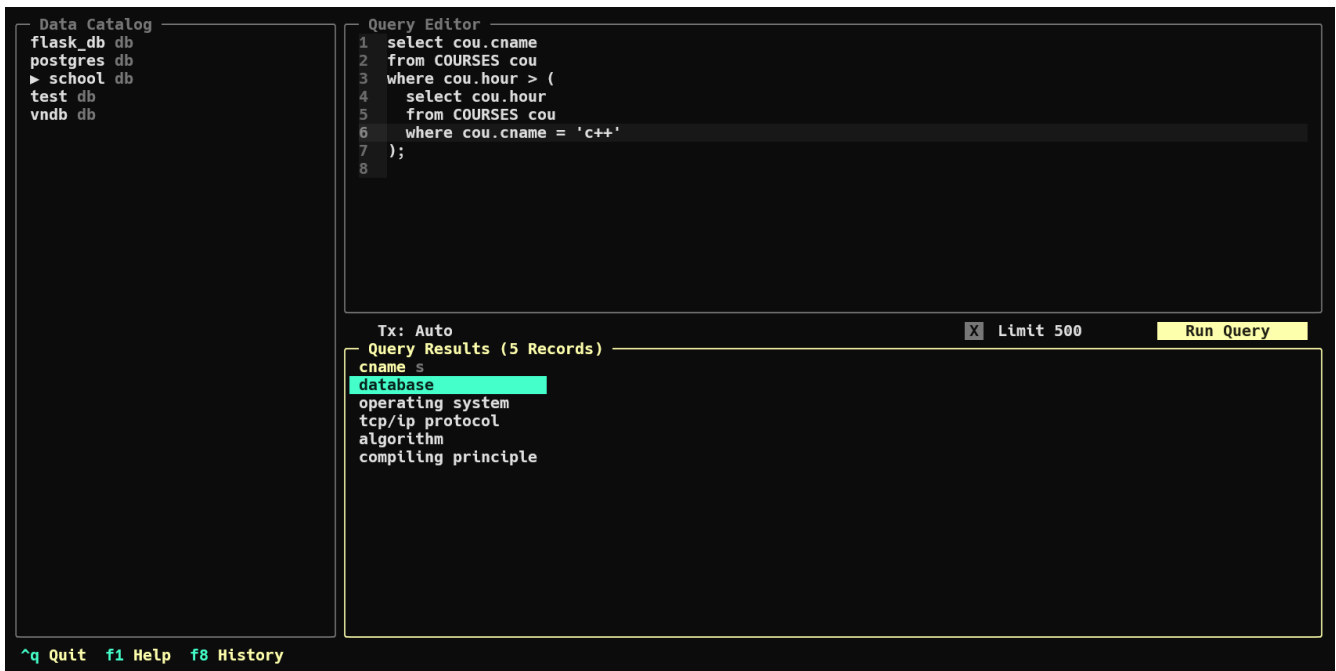
At the bottom of the interface, there are keyboard shortcuts: ^q Quit, f1 Help, and f8 History.

3. 查询其他课时比课程 C++ 多的课程的名称:

```

select cou.cname
from COURSES cou
where cou.hour > (
    select cou.hour
    from COURSES cou
    where cou.cname = 'c++'
);

```

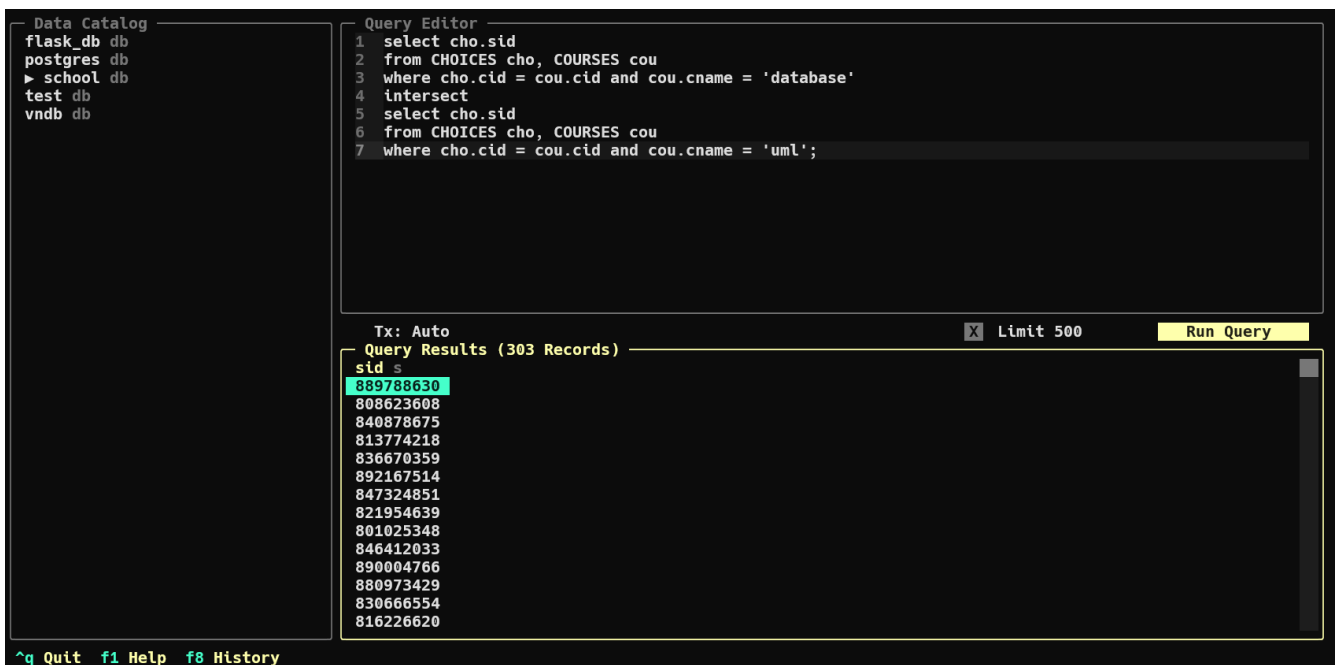


4. 实现集合交运算，查询既选修课程 Database 又选修课程 UML 的学生的编号：

```

select cho.sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'database'
intersect
select cho.sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'uml';

```



5. 实现集合减运算，查询选修课程 Database 而没有选修课程 UML 的学生的编号：

```

select cho.sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'database'
except

```

```
select cho.sid
from CHOICES cho, COURSES cou
where cho.cid = cou.cid and cou.cname = 'uml';
```

Data Catalog

- flask_db db
- postgres db
- ▶ school db
- test db
- vndb db

Query Editor

```
1 select cho.sid
2 from CHOICES cho, COURSES cou
3 where cho.cid = cou.cid and cou.cname = 'database'
4 except
5 select cho.sid
6 from CHOICES cho, COURSES cou
7 where cho.cid = cou.cid and cou.cname = 'uml';
```

Tx: Auto

X Limit 500

Run Query

Query Results (5,454 Records)

sid
883039041
874340071
802275091
892437507
858009877
887838272
826160057
868410737
803145095
812117190
887201871
818286286
808966500
816612565

| 1 query executed successfully in 0.25 seconds.

^q Quit

f1 Help

f8 History