实验四 数据查询（连接、集合查询）

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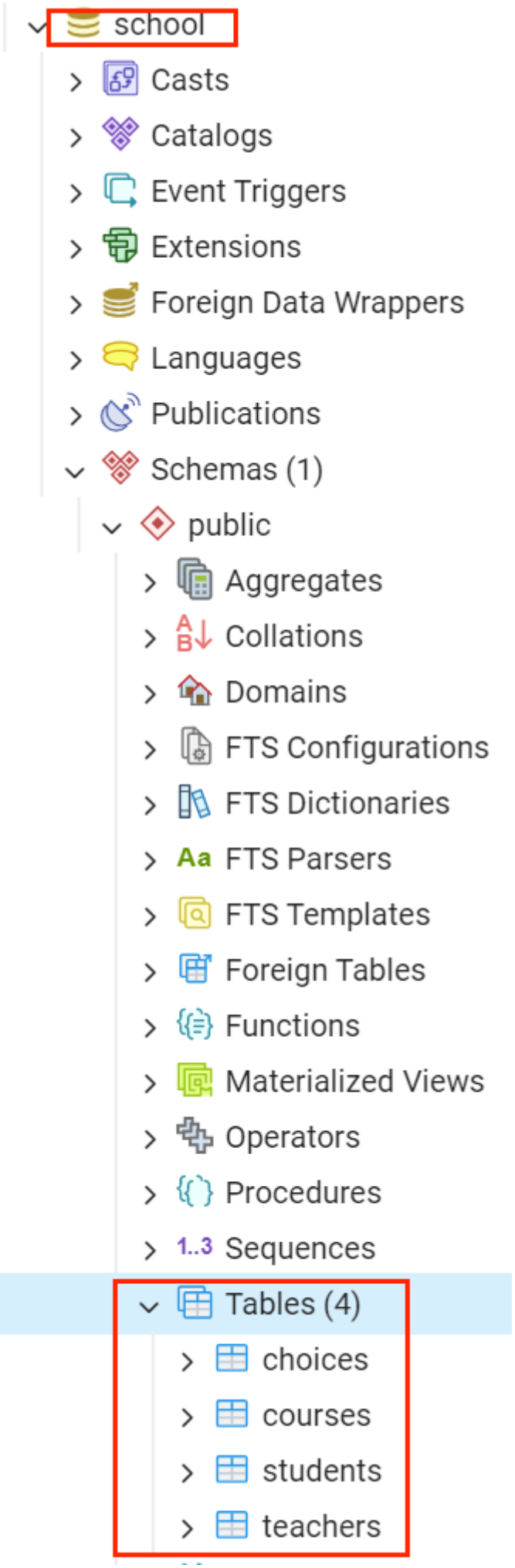
1.实验目的

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。

2.实验环境

已安装完成Postgre SQL，在pgAdmin 4进行编辑。并已配置好schoo数据库的四张表格。


school
Casts
Catalogs
Event Triggers
Extensions
Foreign Data Wrappers
Languages
Publications
Schemas (1)
public
Aggregates
Collations
Domains
FTS Configurations
FTS Dictionaries
FTS Parsers
FTS Templates
Foreign Tables
Functions
Materialized Views
Operators
Procedures
Sequences
Tables (4)
choices
courses
students
teachers

3.实验内容

本节实验的主要内容包括：

- 查笛卡儿连接和等值连接
- 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

4.实验步骤（遇到的问题为灰色字和注释）

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。

STUDENTS(sid,sname,email,grade)

TEACHERS(tid,tname,email,salary)

COURSES(cid,cname,hour)

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

(1) 查询编号800009026的学生所选的全部课程的课程名和成绩；

```
SELECT cname,score
FROM COURSES,CHOICES
WHERE CHOICES.cid=COURSES.cid AND CHOICES.sid='800009026';
```

	cname character varying (30)	score integer
1	tcp/ip protocol	94
2	c	83
3	j2me	[null]

(2) 查询所有选了database的学生的编号；

```
SELECT DISTINCT sid, cname
FROM CHOICES
JOIN COURSES ON CHOICES.cid = COURSES.cid
WHERE COURSES.cname = 'database';
```

	sid character (9)	cname character varying (30)
1	800023487	database
2	800028649	database
3	800032383	database
4	800034166	database
5	800054476	database
6	800099878	database
7	800126924	database
8	800168378	database
9	800173079	database
10	800229512	database
11	800230908	database
12	800262058	database

(3) 求出选择了同一个课程的学生对；

```
select cid, COUNT(DISTINCT sid)
from CHOICES
group by cid;
```

	cid character (5)	cname character varying (30)	count bigint
1	10001	database	5757
2	10002	operating system	5853
3	10003	computer graphics	5811
4	10004	java	5952
5	10005	c++	5876
6	10006	design pattern	5913
7	10007	uml	5825
8	10008	data structure	5825
9	10009	cryptology	5807
10	10010	software engineering	5881
11	10011	distributed computing	5937
12	10012	erp	5669
13	10013	artifical intelligence	5833
14	10014	computer network	5712
15	10015	tcp/ip protocol	5821
16	10016	data mining	5721
17	10017	algorithm	5825

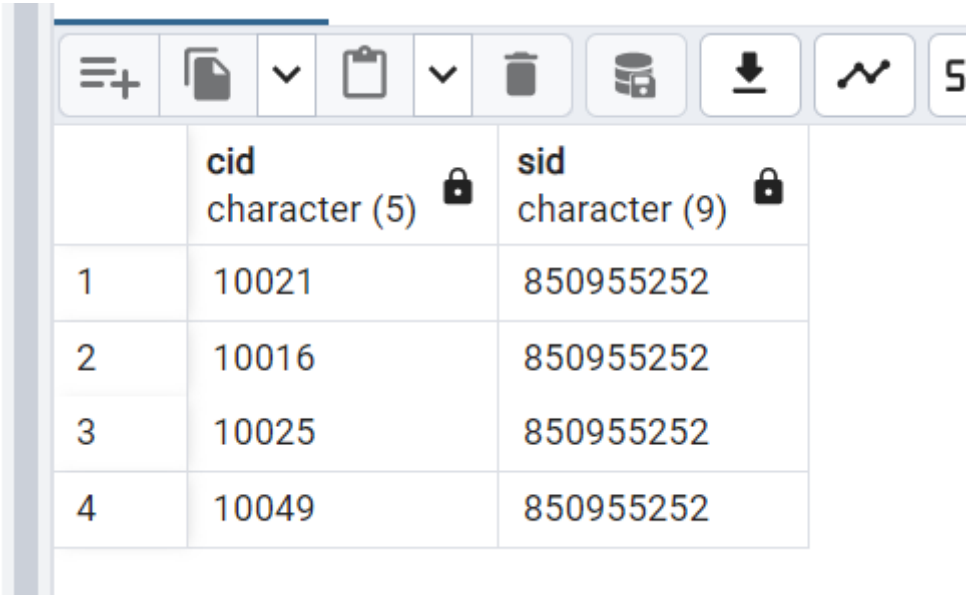
(4)求出至少被两名学生选修的课程编号；

```
SELECT cid,COUNT(DISTINCT sid)
FROM CHOICES
GROUP BY cid
HAVING COUNT(DISTINCT sid)>=2;
```

	cid character (5)	count bigint
1	10001	5757
2	10002	5853
3	10003	5811
4	10004	5952
5	10005	5876
6	10006	5913
7	10007	5825
8	10008	5825
9	10009	5807
10	10010	5881
11	10011	5937
12	10012	5669
13	10013	5833
14	10014	5712

(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 cid,sid
from CHOICES
where sid='850955252';
```



	cid character (5)	sid character (9)
1	10021	850955252
2	10016	850955252
3	10025	850955252
4	10049	850955252

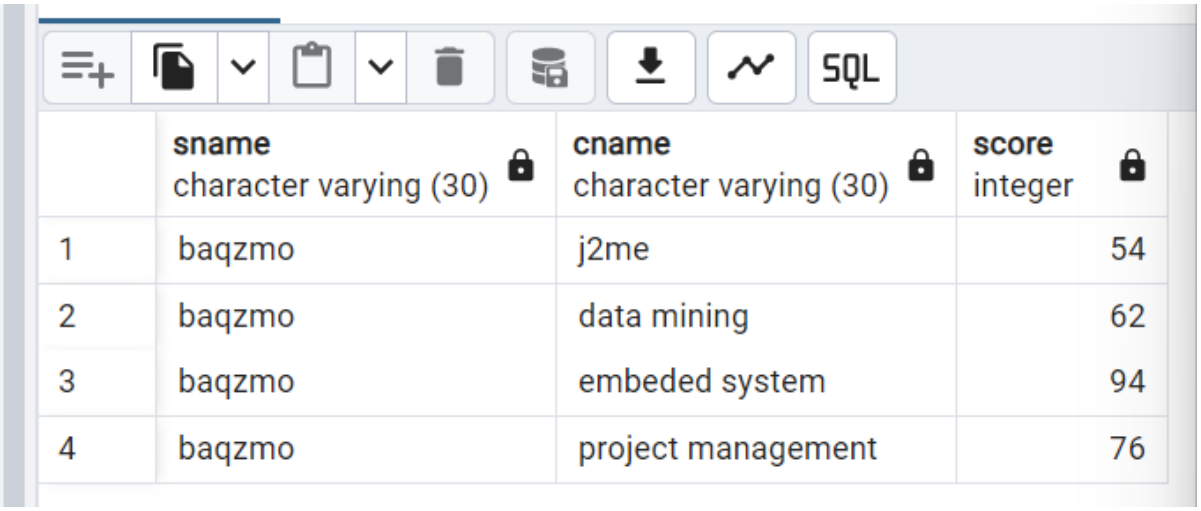
(6) 查询学生的基本信息及选修课程编号和成绩；

```
SELECT STUDENTS.*, CHOICES.cid, CHOICES.score
FROM STUDENTS
JOIN CHOICES ON STUDENTS.sid = CHOICES.sid;
```

	sid character (9)	sname character varying (30)	email character varying (30)	grade integer	cid character (5)	score integer
1	823069829	pxfys	nplb4@xsf.gov	1994	10037	76
2	850955252	baqzmo	tzlk@wed.com	2001	10021	54
3	829785562	bemgynei	jhx7@msvy.gov	1994	10028	77
4	813520169	rcypjhsnc	epy68ao@ebqho.net	1993	10023	[null]
5	830180555	mbfrhwz	sfvun5@xrgvs.org	[null]	10016	76
6	833961570	bzbogqep	bc5qz99@kohdv.gov	2001	10004	80
7	826412145	ouvxwyha	c02h2pw@cpreg.org	2002	10009	63
8	897664264	rvgbhmwaw	mzx07f6@nqd.edu	2002	10007	62
9	835265794	yvkgs	89re5@uligz.edu	1998	10043	68
10	878303907	otrvjpw	im167@nwxh.edu	1996	10026	80
11	856242358	enredxqnt	5d9e8tp@pbn.org	1995	10029	61
12	864265239	hfstwphxe	4kpro@nto.com	2000	10011	86
13	896206801	xwrvffd	ib_7uu@hjnk.gov	2001	10020	77
14	888484354	czlxhfvx	02o85n@xdt.edu	[null]	10050	54

(7) 查询学号850955252的学生的姓名和选修的课程名称及成绩；

```
SELECT sname,cname,score
FROM STUDENTS,COURSES,CHOICES
WHERE STUDENTS.sid='850955252' and CHOICES.sid='850955252' and
COURSES.cid=CHOICES.cid;
```



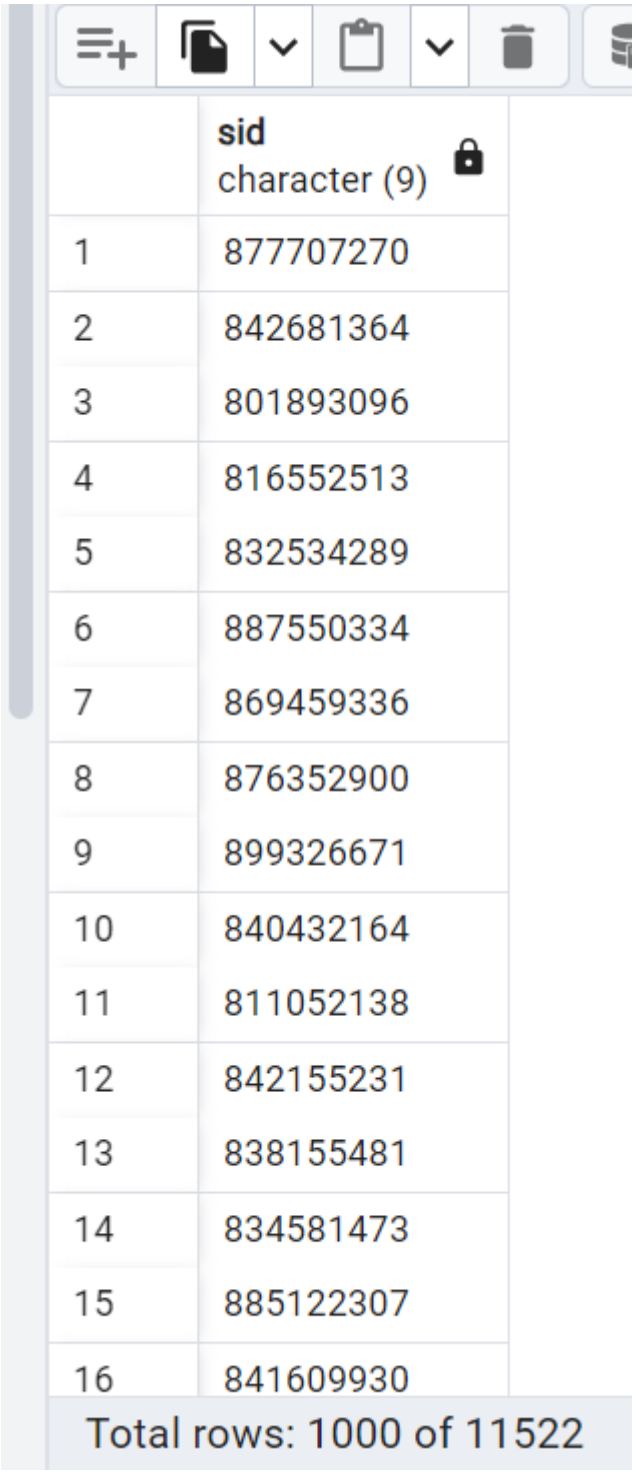
	sname character varying (30)	cname character varying (30)	score integer
1	baqzmo	j2me	54
2	baqzmo	data mining	62
3	baqzmo	embeded system	94
4	baqzmo	project management	76

(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
WHERE cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'c++'
)

UNION

SELECT sid
FROM CHOICES
WHERE cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'java'
)
```



	sid character (9)
1	877707270
2	842681364
3	801893096
4	816552513
5	832534289
6	887550334
7	869459336
8	876352900
9	899326671
10	840432164
11	811052138
12	842155231
13	838155481
14	834581473
15	885122307
16	841609930

Total rows: 1000 of 11522

(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
WHERE cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'C++'
)

INTERSECT

SELECT sid
FROM CHOICES
```

```
WHERE cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'java'
)
```

```
11  SELECT sid
12  FROM CHOICES
13  WHERE cid IN (
14      SELECT cid
15      FROM COURSES
16      WHERE cname = 'java'
17  )
```

Data Output | Messages | Notifications

	sid character (9)
1	876084136
2	897737939
3	848499245
4	866445392
5	866813891
6	859407865
7	898258584
8	899613915
9	895176952
10	811799427

Total rows: 306 of 306 Query compl

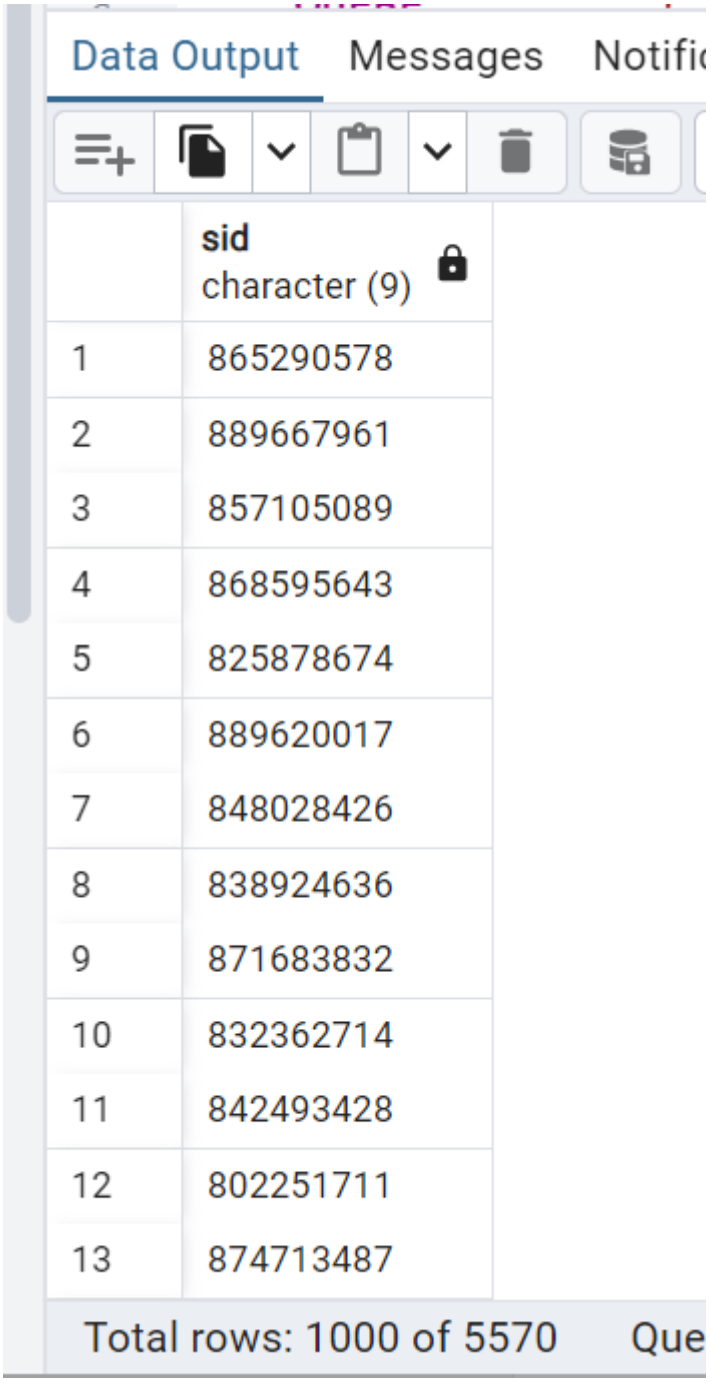
(10) 实现集合减运算，查询选修课程C++而没有选修课程Java的学生的编号。

```
SELECT sid
FROM CHOICES
WHERE sid IN (
    SELECT sid
```

```
    FROM COURSES
    WHERE cname = 'c++'
)

EXCEPT

SELECT sid
FROM CHOICES
WHERE sid IN (
    SELECT sid
    FROM COURSES
    WHERE cname = 'java'
)
```



	sid character (9)
1	865290578
2	889667961
3	857105089
4	868595643
5	825878674
6	889620017
7	848028426
8	838924636
9	871683832
10	832362714
11	842493428
12	802251711
13	874713487

Total rows: 1000 of 5570 Que

至此，课内实验成功完成。

5.“自我实践”实验步骤

(1) 查询选修java的所有学生的编号及姓名；

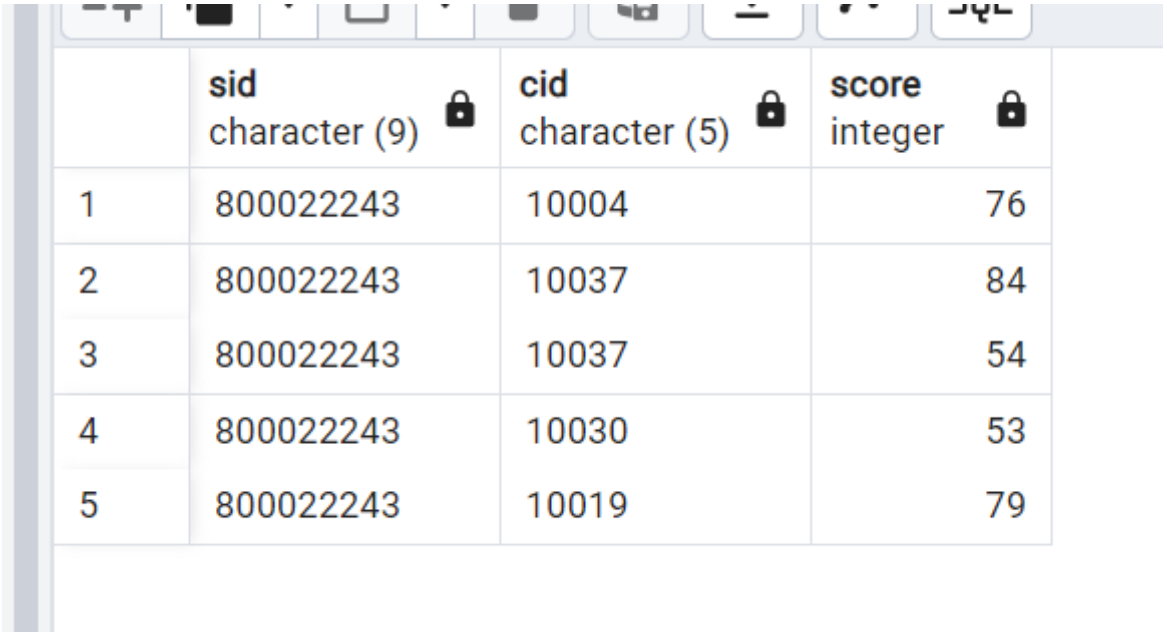
```
SELECT DISTINCT STUDENTS.sid,sname
FROM STUDENTS,COURSES,CHOICES
WHERE STUDENTS.sid=CHOICES.sid AND COURSES.cid=CHOICES.cid AND cname='java';
```

	sid [PK] character (9)	sname character varying (30)
1	833961570	bzbogqep
2	856259316	qnsmnk
3	840205068	vtyzpxh
4	870755799	gjikyychh
5	811353704	wcgatkwjn
6	881617726	ikmsab
7	806836750	rryeair
8	898186633	oaxmzg
9	895459694	tzaaptnln
10	828744353	tcnib
11	834474228	dihliewsh
12	854560014	jjpqcfn
13	851258869	gdiqpx
14	851526085	etkyu
15	889137477	uideeb
16	831093053	srklho

(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 CHOICES.sid, cid, score
FROM CHOICES
JOIN STUDENTS ON STUDENTS.sid = CHOICES.sid
WHERE STUDENTS.sname = 'sssht';
```



	sid character (9)	cid character (5)	score integer
1	800022243	10004	76
2	800022243	10037	84
3	800022243	10037	54
4	800022243	10030	53
5	800022243	10019	79

谓词IN：

```
SELECT sid, cid, score
FROM CHOICES
WHERE sid IN (
    SELECT sid
    FROM STUDENTS
    WHERE sname = 'sssht'
);
```

Query　Query History

```
SELECT sid, cid, score
FROM CHOICES
WHERE sid IN (
    SELECT sid
    FROM STUDENTS
    WHERE sname = 'sssht'
);
```

Data Output　Messages　Notifications

	sid character (9)	cid character (5)	score integer
1	800022243	10004	76
2	800022243	10037	84
3	800022243	10037	54
4	800022243	10030	53
5	800022243	10019	79

这里进行两个方法对比时我也才注意到，等值连接中的join将两个表格连接起来进行查询，此时SELECT后的sid在两个表格中都有，因此不能只写成sid，而是要明确是哪个表格中的sid；而谓词IN则不用，因为此时分为主查询和子查询，主查询只在CHOICES表格中进行，因此不需要明确表示。

(3) 查询其他课时比课程C++多的课程的名称；

```
SELECT cname, c1.hour
FROM COURSES c1
JOIN (
    SELECT hour
    FROM COURSES
    WHERE cname = 'c++'
) c2 ON c1.hour > c2.hour
WHERE c1.cname <> 'c++'
```

Query Query History

```sql
SELECT cname, c1.hour
FROM COURSES c1
JOIN (
    SELECT hour
    FROM COURSES
    WHERE cname = 'c++'
) c2 ON c1.hour > c2.hour
WHERE c1.cname <> 'c++'
```

Data Output Messages Notifications

	cname character varying (30)	hour integer
1	database	96
2	operating system	88
3	tcp/ip protocol	68
4	algorithm	72
5	compiling principle	62

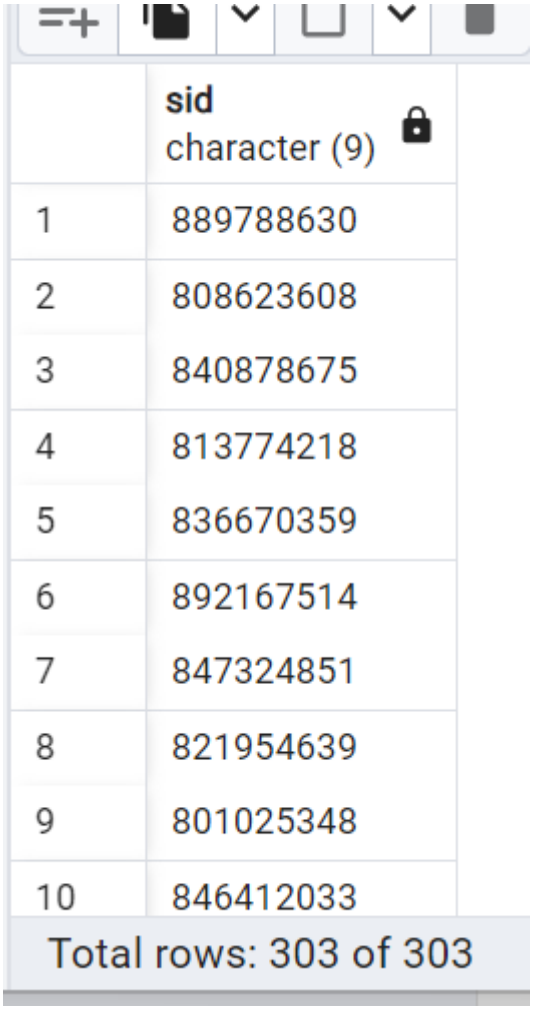
(4) 实现集合交运算，查询既选修课程Database又选修课程UML的学生的编号；

```sql
SELECT DISTINCT sid
FROM CHOICES
WHERE sid IN (
    SELECT sid
    FROM COURSES
    WHERE cname = 'database'
)

INTERSECT

SELECT DISTINCT sid
FROM CHOICES
WHERE sid IN (
```

```
    SELECT sid
    FROM COURSES
    WHERE cname = 'uml'
)
```



	sid character (9)
1	889788630
2	808623608
3	840878675
4	813774218
5	836670359
6	892167514
7	847324851
8	821954639
9	801025348
10	846412033

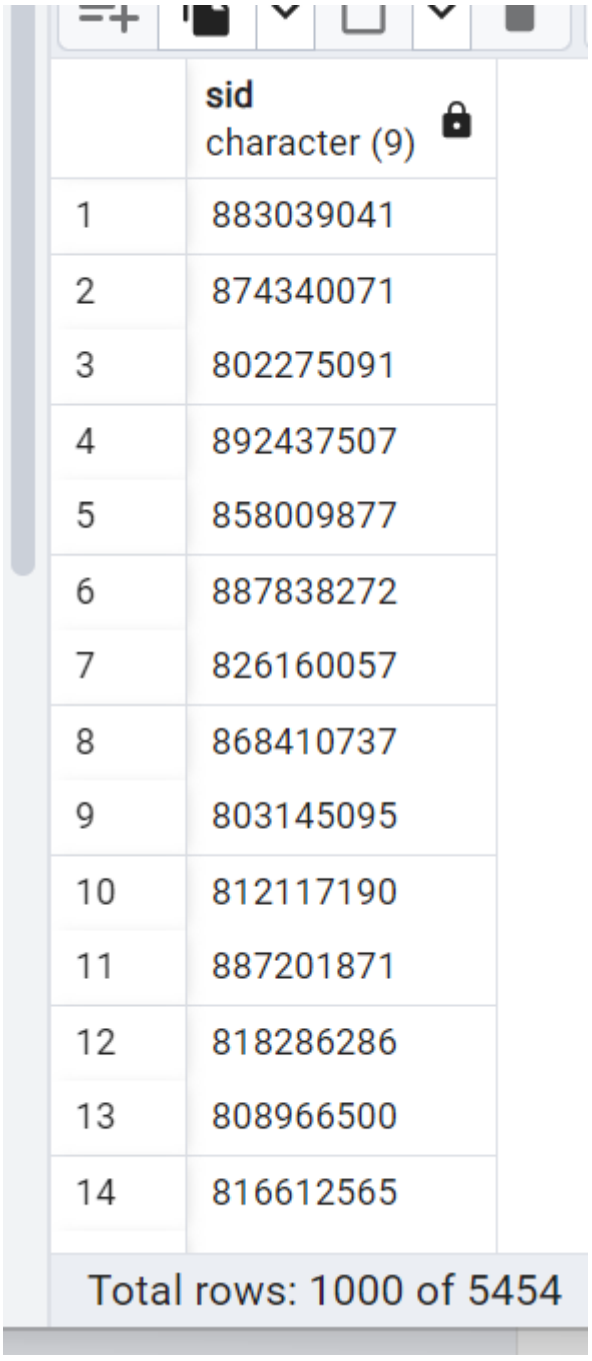
Total rows: 303 of 303

(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 sid
FROM CHOICES
WHERE cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'database'
)

EXCEPT

SELECT sid
FROM CHOICES
WHERE cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'uml'
)
```



	sid character (9)
1	883039041
2	874340071
3	802275091
4	892437507
5	858009877
6	887838272
7	826160057
8	868410737
9	803145095
10	812117190
11	887201871
12	818286286
13	808966500
14	816612565

Total rows: 1000 of 5454