实验五 数据查询（嵌套查询）

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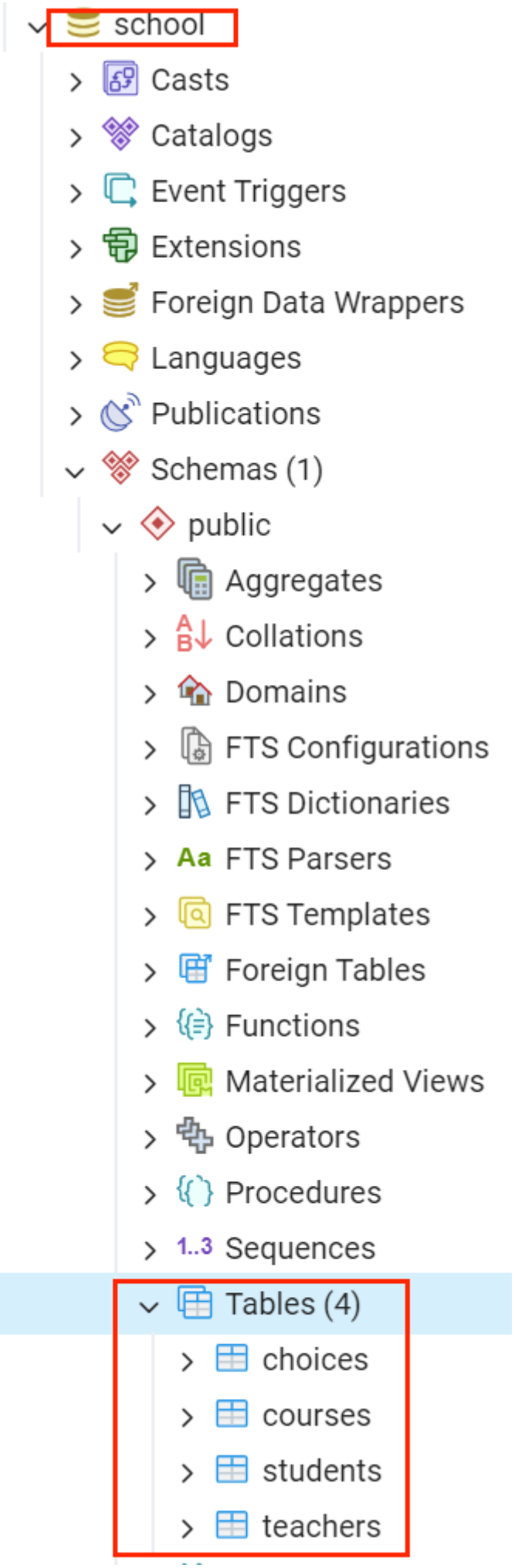
1.实验目的

熟悉SQL语句的数据查询语言，能够使用SQL语句对数据库进行嵌套查询。

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：

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：

- IN，NOT IN；
- 带有比较运算符的子查询；
- SOME，ANY或ALL谓词的子查询；
- 带有EXISTS谓词的子查询。

4.实验步骤（遇到的问题为灰色字）

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) 查询学号850955252的学生同年级的所有学生资料；

```
SELECT *
FROM STUDENTS
WHERE grade in(
      SELECT grade
      FROM STUDENTS
      WHERE sid='850955252'
);
```

	sid [PK] character (9)	sname character varying (30)	email character varying (30)	grade integer
1	800028044	ztozk	r369l9m@lmykh.gov	2001
2	800041569	pgmrkdhh	xpqi2wc@hrjtp.edu	2001
3	800070739	nkdnfq	pto7n@sci.com	2001
4	800152632	qtxblqzsv	tdvh@mneu.edu	2001
5	800166448	ctvxn	5b6zz@fpplh.org	2001
6	800169970	airnnfv	ytkyo@xeh.org	2001
7	800177146	vaesalave	tla7d4@ypzxr.gov	2001
8	800202438	xiraegdlg	_fow_i@hmbc.edu	2001
9	800268599	dwjny	9pax@ejjk.com	2001
10	800269975	vqjfxfc	i5w9ba@spu.com	2001
11	800270084	ebwxl	vp02qx@ekze.gov	2001
12	800284630	wtljfkvzh	cc33qi@tqos.org	2001

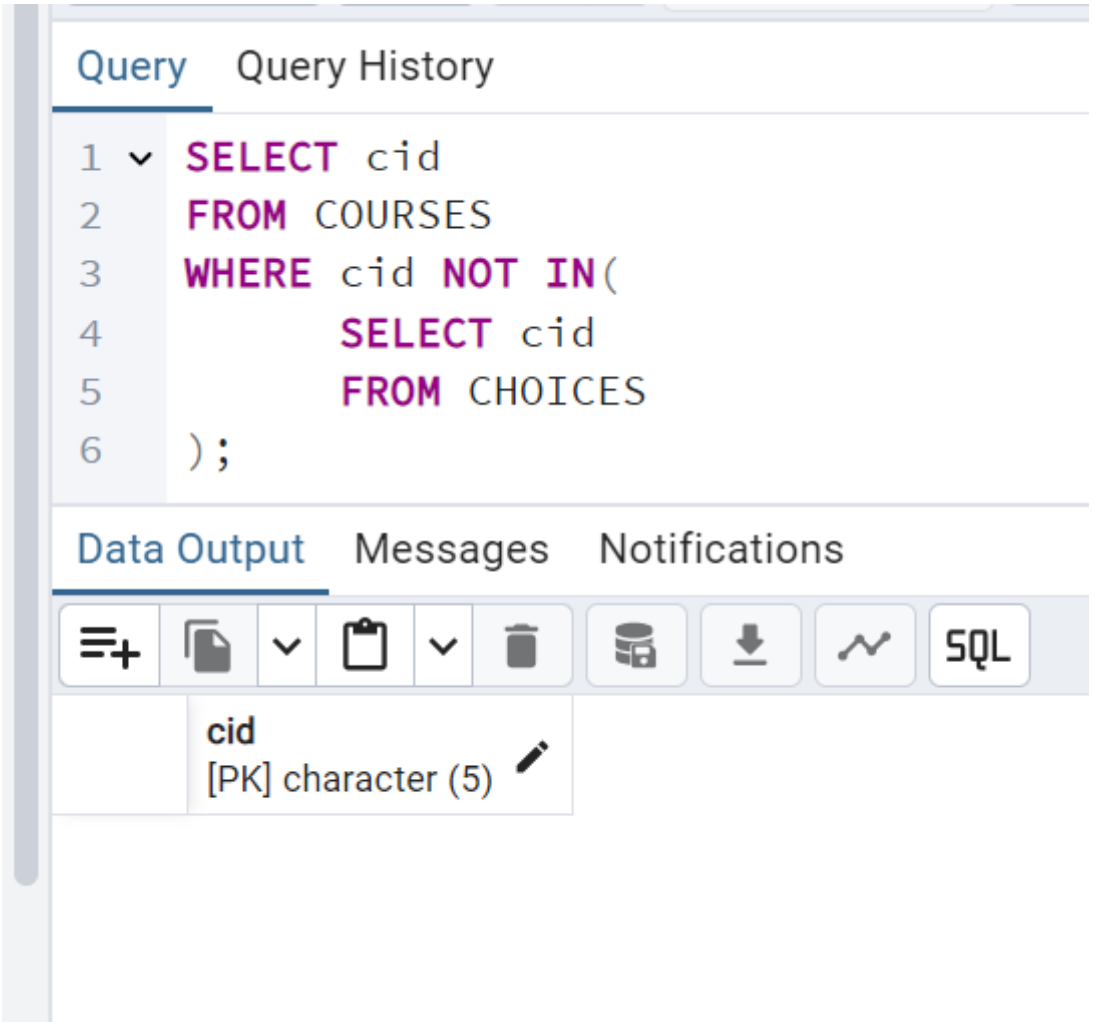
(2) 查询所有的有选课的学生的详细信息；

```
SELECT *
FROM STUDENTS
WHERE sid IN(
      SELECT sid
      FROM CHOICES
);
```

	sid [PK] character (9)	sname character varying (30)	email character varying (30)	grade integer
1	800001216	gfxrgs	hhce4@qhldj.gov	1992
2	800002933	vnbqz%svv	pvhxd4l@zqur.org	2002
3	800005753	waqcj	hlhq0h8@jdba.gov	1992
4	800006682	fiiluommh	ihzd6_k@kzvft.gov	1992
5	800006941	ogvmu	62sfbd@lrt.gov	1995
6	800007595	uxqqbkjn	cr8g@zrvgt.edu	1997
7	800008565	ehlycg	nach10@uic.com	1999
8	800009026	rcxaihj	4ul4kqb@hko.edu	2002
9	800009099	zapyv	jqmqn8@iwaiu.org	1992
10	800009249	zyuoh	8enjrcu@upfw.org	1991
11	800010666	uwphrw	emb7k@ipp.com	1992
12	800013889	nahhluoe	w6org6@maq.com	2000

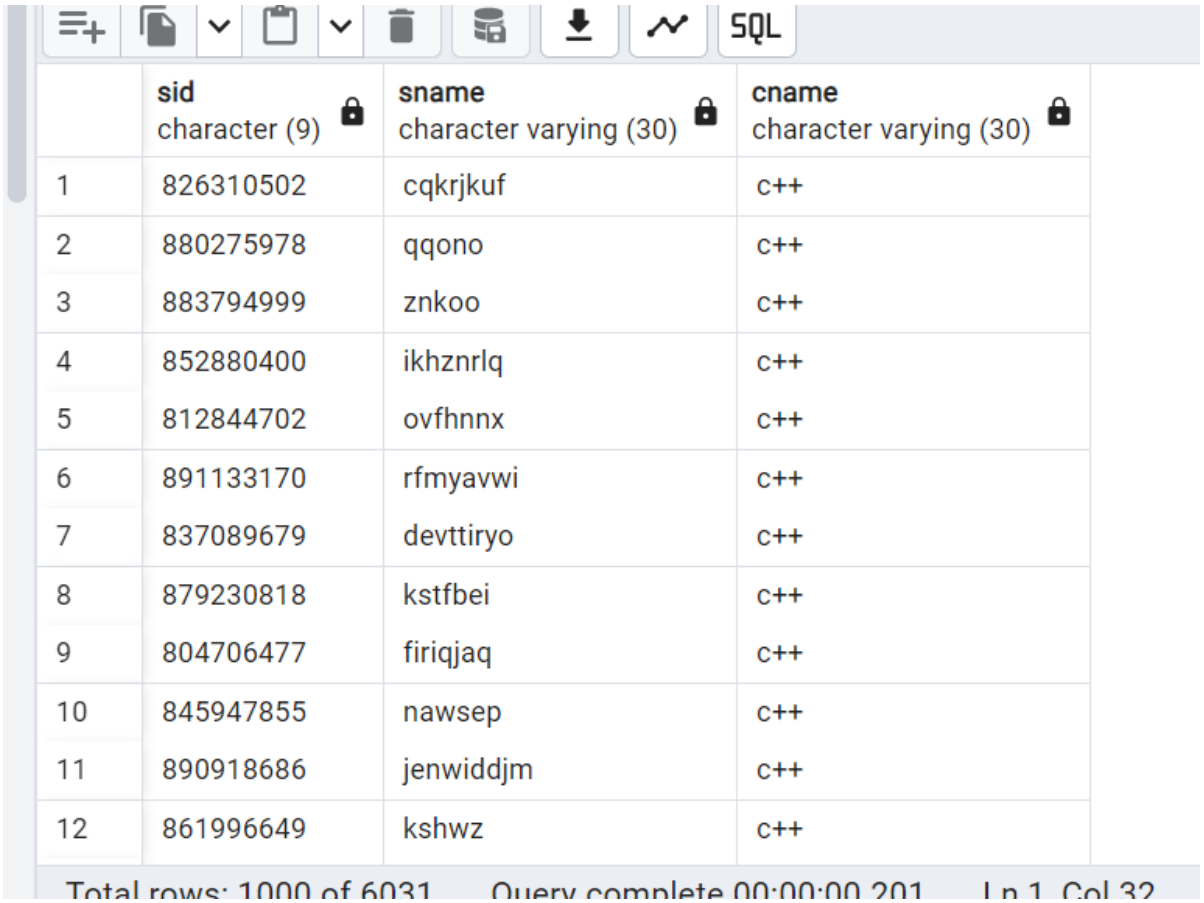
(3) 查询没有学生选的课程的编号；

```
SELECT cid
FROM COURSES
WHERE cid NOT IN(
      SELECT cid
      FROM CHOICES
);
```



(4)查询选修了课程名为C++的学生学号和姓名；

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

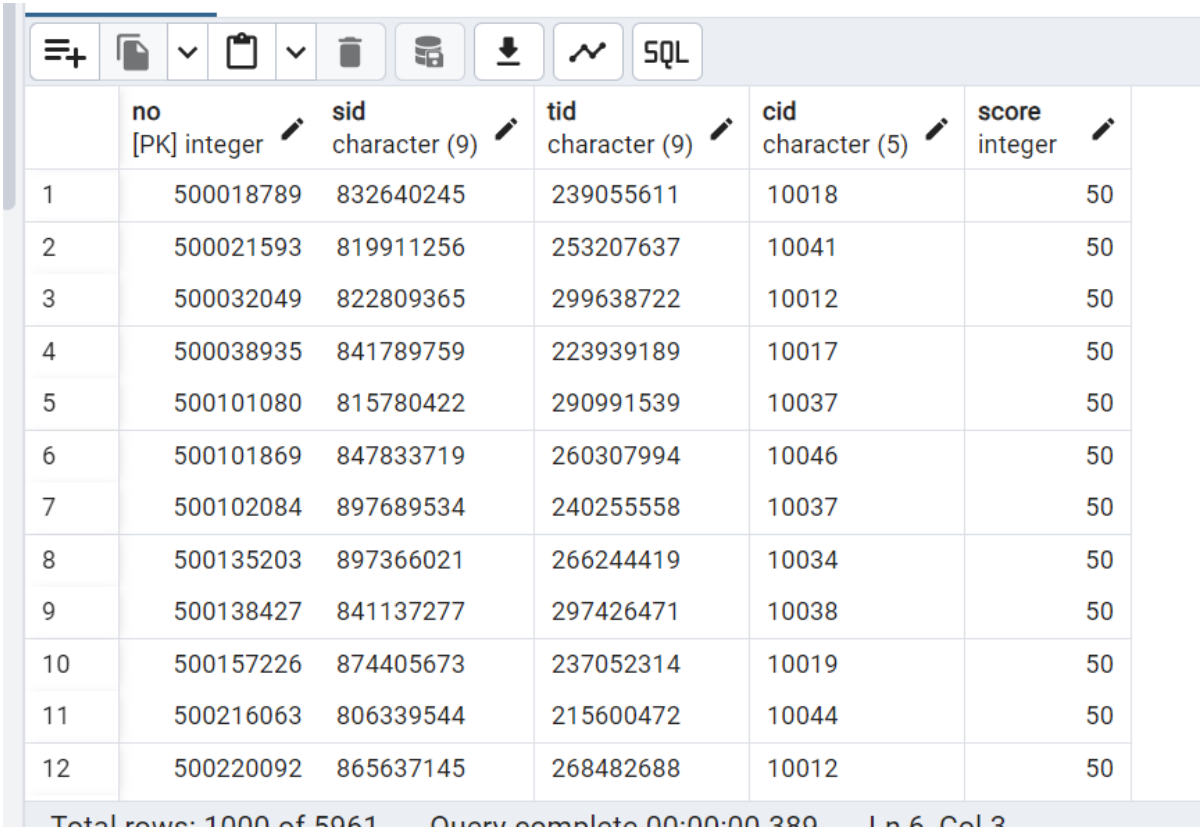


	sid character (9)	sname character varying (30)	cname character varying (30)
1	826310502	cqkrjkuf	c++
2	880275978	qqono	c++
3	883794999	znkoo	c++
4	852880400	ikhznrlq	c++
5	812844702	ovfhnnx	c++
6	891133170	rfmyavwi	c++
7	837089679	devttiryo	c++
8	879230818	kstfbei	c++
9	804706477	firiqjaq	c++
10	845947855	nawsep	c++
11	890918686	jenwiddjm	c++
12	861996649	kshwz	c++

Total rows: 1000 of 6031 Query complete 00:00:00.201 Ln 1, Col 32

(5) 找出选修课程成绩最差的选课记录；

```
SELECT *
FROM CHOICES
WHERE score IN(
      SELECT MIN(score)
      FROM CHOICES
);
```



	no [PK] integer	sid character (9)	tid character (9)	cid character (5)	score integer
1	500018789	832640245	239055611	10018	50
2	500021593	819911256	253207637	10041	50
3	500032049	822809365	299638722	10012	50
4	500038935	841789759	223939189	10017	50
5	500101080	815780422	290991539	10037	50
6	500101869	847833719	260307994	10046	50
7	500102084	897689534	240255558	10037	50
8	500135203	897366021	266244419	10034	50
9	500138427	841137277	297426471	10038	50
10	500157226	874405673	237052314	10019	50
11	500216063	806339544	215600472	10044	50
12	500220092	865637145	268482688	10012	50

在这里我原本用谓词ALL的子查询：

```
SELECT *
FROM CHOICES c1
WHERE c1.score <= ALL (
    SELECT score
    FROM CHOICES
    WHERE score <> c1.score
);
```

但这个花费的时间太长，效率远不如MIN高，因此后面关于判断类似条件我都用MIN或MAX函数进行解答。

(6) 找出和课程UML或课程C++的课时一样的课程名称；

```
SELECT cname, hour
FROM COURSES
WHERE hour IN(
      SELECT hour
      FROM COURSES
      WHERE cname='uml' OR cname='c++'
);
```

```
SELECT cname, hour
FROM COURSES
WHERE hour IN(
      SELECT hour
      FROM COURSES
      WHERE cname='uml' OR cname='c++'
);
```

Data Output Messages Notifications

SQL

cname character varying (30)	hour integer
c++	60
uml	30
data structure	60
computer network	60
asp	30
struts	30
c#	30

(7) 查询所有选修编号10001的课程的学生的姓名；

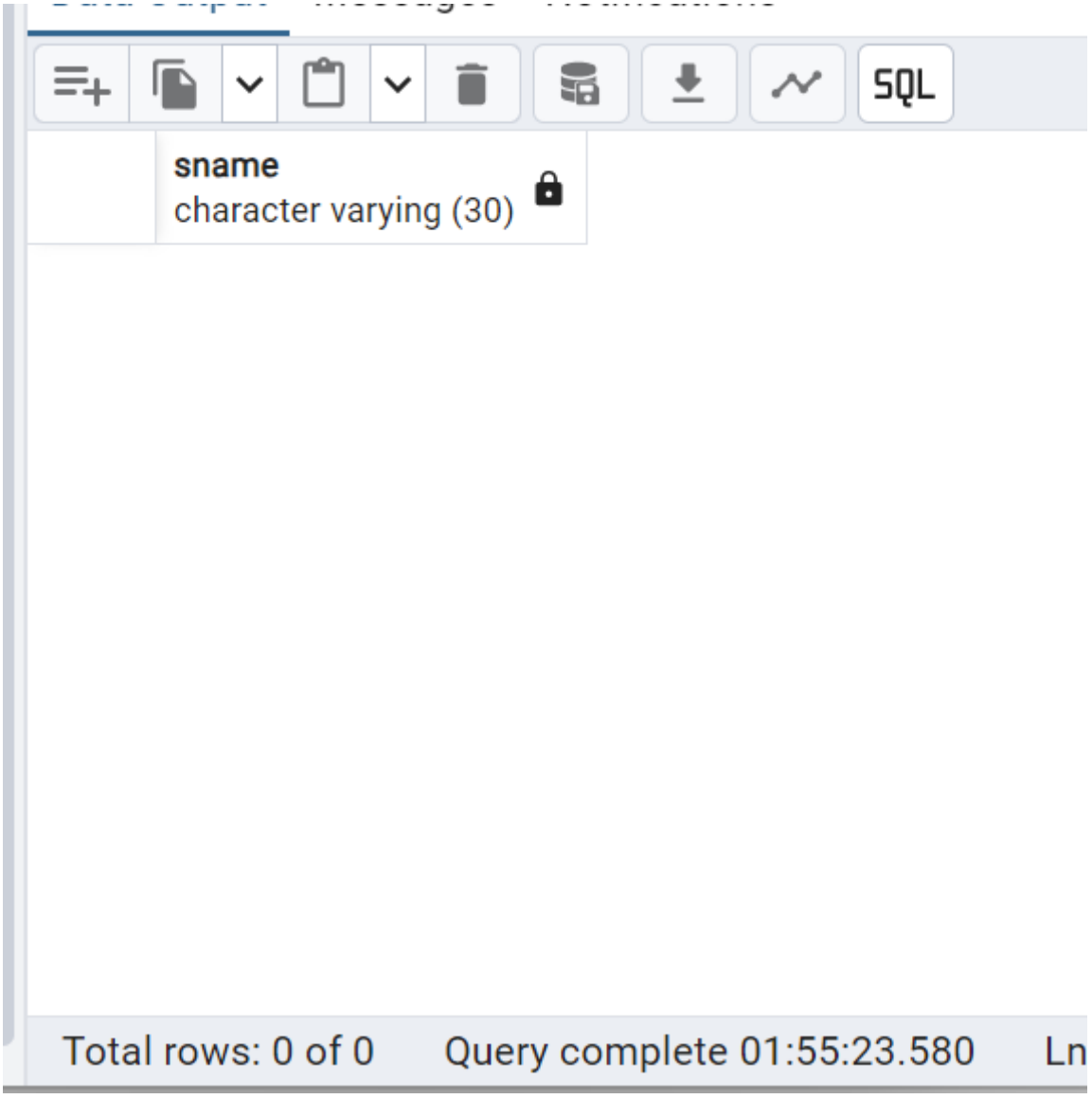
```
SELECT sname
FROM STUDENTS
WHERE sid IN(
      SELECT sid
      FROM COURSES
      WHERE cid='10001'
);
```

	sname character varying (30)
1	gfxrgs
2	vnbqz%svv
3	waqcj
4	fiiluommh
5	ogvmu
6	uxqqbkjn
7	ehlycg
8	rcxaihj
9	zapyv
10	zyuoh
11	uwphrw

Total rows: 1000 of 100001 Query con

(8) 查询选修了所有课程的学生姓名。

```
SELECT sname
FROM STUDENTS
WHERE NOT EXISTS(
      SELECT *
      FROM COURSES
      WHERE NOT EXISTS(
            SELECT *
            FROM CHOICES
            WHERE sid=STUDENTS.sid AND cid=COURSES.cid
       )
)
```



可以看到这个代码消耗了太长时间，目前我还未想出解决办法

至此，课内实验成功完成。

5.“自我实践”实验步骤

(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 STUDENTS.sid, sname, score
FROM STUDENTS,CHOICES
WHERE CHOICES.sid = STUDENTS.sid AND cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'C++'
)
AND score > (
    SELECT score
    FROM CHOICES
    JOIN STUDENTS ON STUDENTS.sid = CHOICES.sid
    WHERE sname = 'znkoo' AND cid IN (
        SELECT cid
```

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

	sid character (9)	sname character varying (30)	score integer
1	826310502	cqkrjkuf	90
2	880275978	qqono	91
3	852880400	ikhznrlq	83
4	861996649	kshwz	95
5	857601271	efnjrxqt	87
6	852114925	tvzbbjz	95
7	872842566	pboeu	99
8	898243243	qpjpu	94
9	898816495	bnfilyudm	89
10	830137611	cwlxfhu	84
11	840057879	qjqjjrnpu	99
12	877989242	pppcns	94
13	830929232	olvjip	92
14	856736968	oeaxsvr	93
15	836116925	eusitmsws	84
16	848972510	sexpd	96
17	859583746	okrmmpt	96
18	877681401	qfmixiby	87

Total rows: 1000 of 2065 Query complete 00:00:00.217

经过验证查询可得znkoo的c++成绩为82分，而我们查询的结果都在82分以上，说明查询正确

```
SELECT STUDENTS.sid,sname, score
FROM STUDENTS,CHOICES
WHERE sname = 'znkoo' AND CHOICES.sid = STUDENTS.sid A
    SELECT cid
    FROM COURSES
    WHERE cname = 'c++'
)
```

Data Output | Messages | Notifications

	sid character (9)	sname character varying (30)	score integer
1	883794999	znkoo	82

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

```
SELECT sname,grade
FROM STUDENTS
WHERE grade IN (
    SELECT grade
    FROM STUDENTS
    WHERE sid IN ('883794999', '850955252')
);
```

	sname character varying (30)	grade integer
1	uxqqbkjn	1997
2	hvylafcj	1997
3	vocojjnml	1997
4	ztozk	2001
5	efmgfprz	1997
6	pgmrkdhh	2001
7	ttyyb	1997
8	mcefjr	1997
9	rlmbgu	1997
10	nkdnfq	2001
11	grnxesrhv	1997
12	fbbiyeh	1997
13	qtxblqzsv	2001
14	ctvxn	2001
15	airnnfv	2001
16	vaesalave	2001

Total rows: 1000 of 13372 Query complete 00:

经过验证得查询正确：

Query Query History

```
1  SELECT sname,grade
2  FROM STUDENTS
3  WHERE sid IN ('883794999', '850955252');
4
5
```

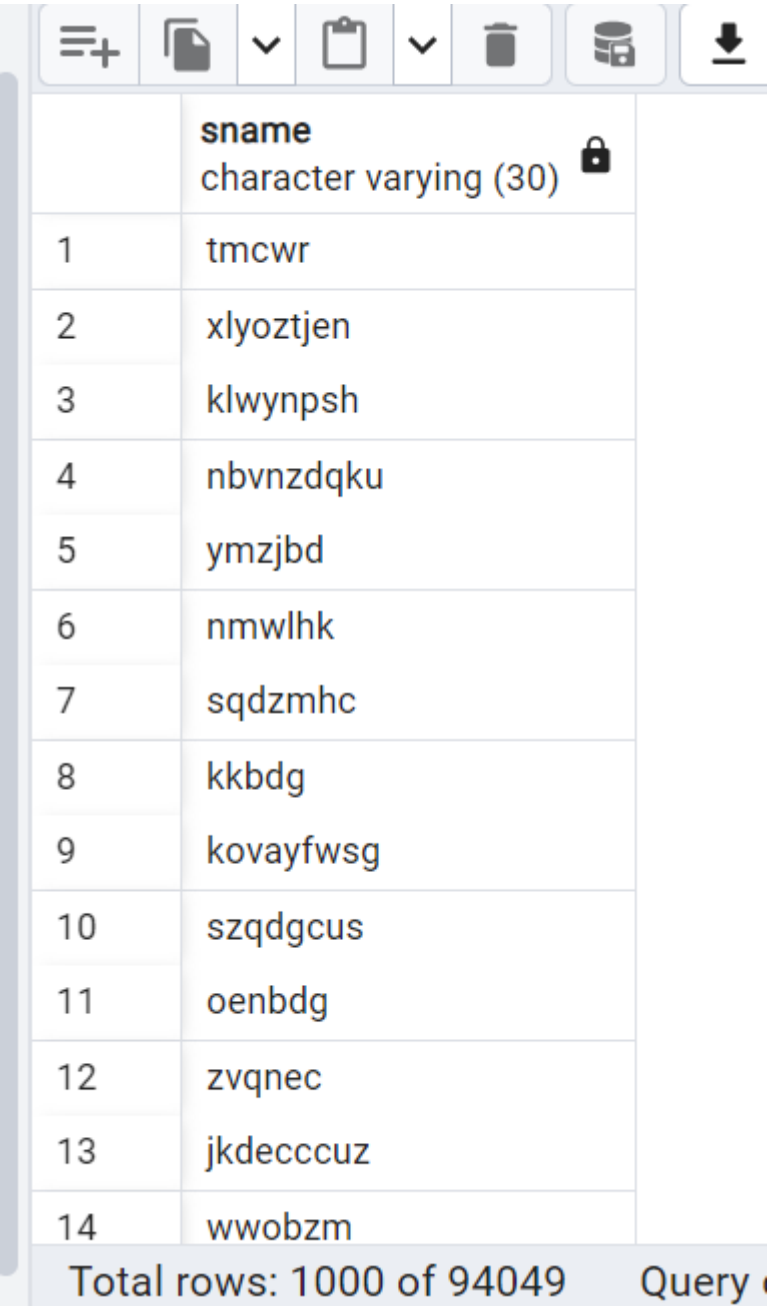
Data Output Messages Notifications

SQL

	sname character varying (30)	grade integer
1	baqzmo	2001
2	znkoo	1997

(3) 查询没有选修Java的学生名称；

```
SELECT sname
FROM STUDENTS s
WHERE NOT EXISTS (
    SELECT 1
    FROM CHOICES c
    JOIN COURSES cr ON c.cid = cr.cid
    WHERE cname = 'java' AND c.sid = s.sid
);
```



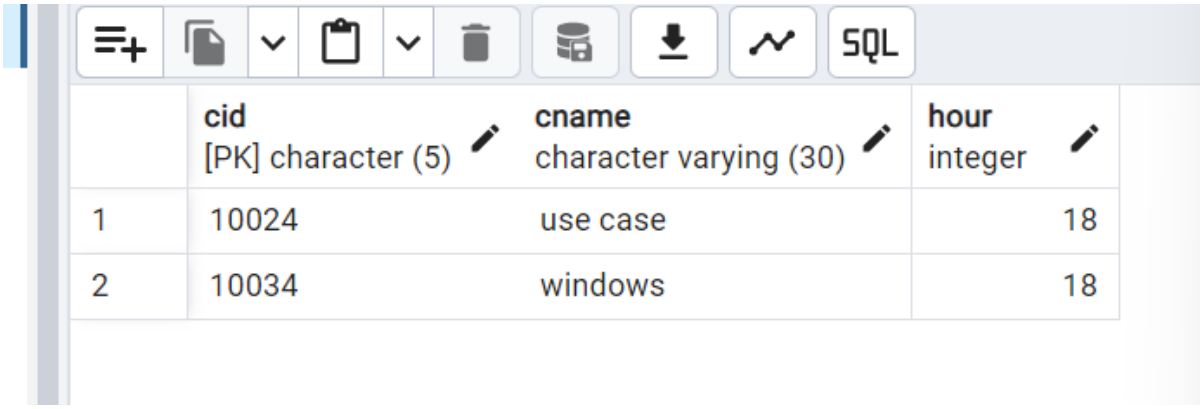
	sname character varying (30)
1	tmcwr
2	xlyoztjen
3	klwynpsh
4	nbvnzdqku
5	ymzjbd
6	nmwlhk
7	sqdzmhc
8	kkbdg
9	kovayfwsg
10	szqdgcus
11	oenbdg
12	zvqnec
13	jkdecccuz
14	wwobzm

Total rows: 1000 of 94049 Query

笔记：这里的SELECT 1和代码中的return效果一样，即这里的EXISTS只是一个判断条件，如果满足这个条件，返回什么都可以，就可以写为SELECT 1

(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
);
```



	cid [PK] character (5)	cname character varying (30)	hour integer
1	10024	use case	18
2	10034	windows	18

(5) 查询工资最高的教师的编号和开设的课程号；

```sql
SELECT t.tid, c.cid, salary
FROM TEACHERS t
JOIN CHOICES c ON t.tid = c.tid
WHERE salary = (
    SELECT MAX(salary)
    FROM TEACHERS
);
```

	tid character (9)	cid character (5)	salary integer
1	204711560	10032	4999
2	204711560	10017	4999
3	277877392	10041	4999
4	204711560	10001	4999
5	204711560	10026	4999
6	287866460	10005	4999
7	277877392	10047	4999
8	214445507	10022	4999
9	287866460	10012	4999
10	214445507	10003	4999
11	287866460	10048	4999
12	204711560	10042	4999
13	214445507	10012	4999
14	277877392	10025	4999
15	214445507	10009	4999
16	277877392	10028	4999

(6) 找出选修课程ERP成绩最高的学生编号;

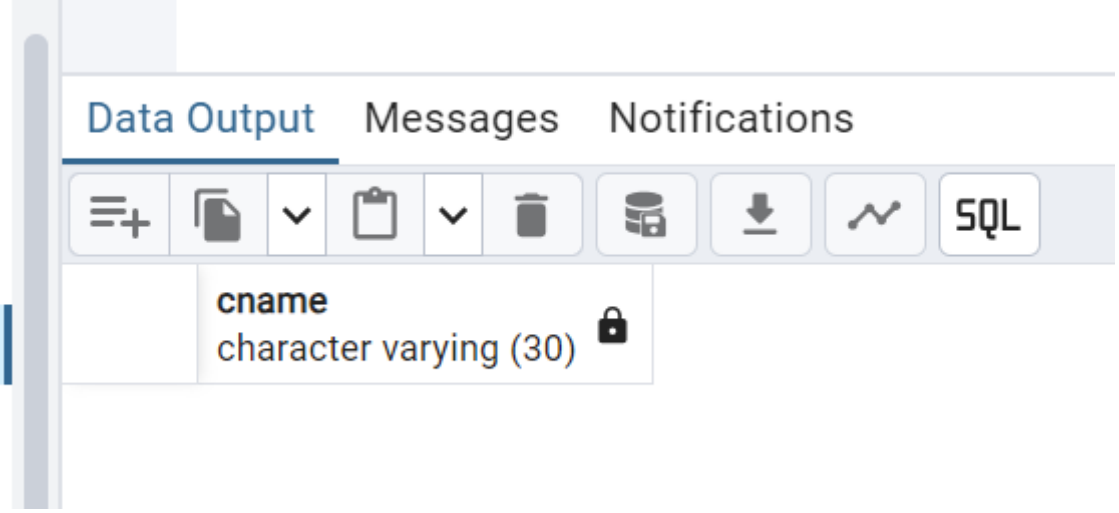
```
SELECT sid,score,cname
FROM CHOICES,COURSES
WHERE CHOICES.cid IN (
    SELECT cid
    FROM COURSES
    WHERE cname = 'erp'
)
AND score =(
    SELECT MAX(score)
    FROM CHOICES c
    JOIN COURSES cr ON c.cid = cr.cid AND cname = 'erp'
)
AND cname = 'erp'
```

	sid character (9)	score integer	cname character varying (30)
1	831163985	99	erp
2	862976650	99	erp
3	840891316	99	erp
4	844440501	99	erp
5	883884237	99	erp
6	862654622	99	erp
7	839342232	99	erp
8	865296034	99	erp
9	843643589	99	erp
10	827092658	99	erp
11	866949513	99	erp
12	896273784	99	erp
13	891039970	99	erp

Total rows: 95 of 95 Query complete 00:00:00.219 Ln

(7) 查询没有学生选修的课程的名称;

```
SELECT cname
FROM COURSES c
WHERE NOT EXISTS (
    SELECT 1
    FROM CHOICES ch
    WHERE ch.cid = c.cid
);
```



(8) 找出讲授课程UML的教师讲授的所有课程名称；

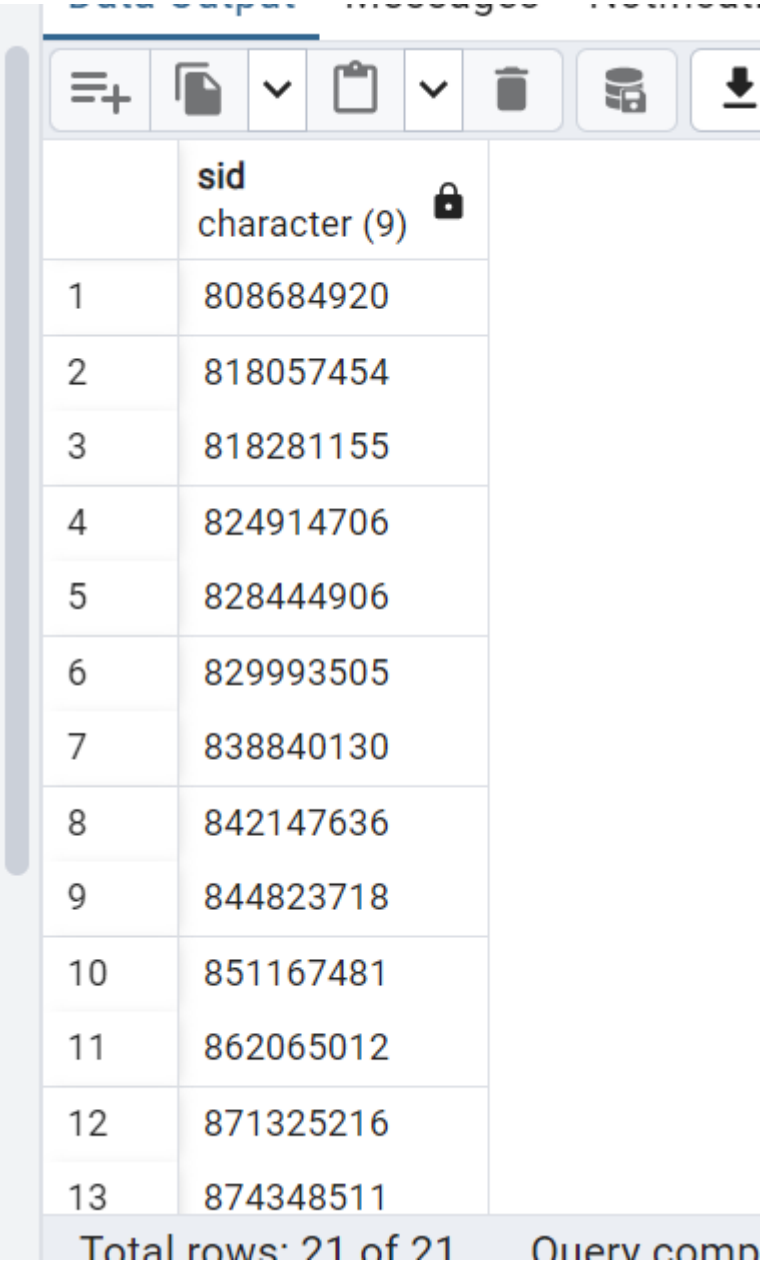
```
SELECT DISTINCT cr.cname
FROM COURSES cr
JOIN CHOICES ch ON cr.cid = ch.cid
WHERE ch.tid IN (
    SELECT tid
    FROM CHOICES
    WHERE cid IN (
        SELECT cid
        FROM COURSES
        WHERE cname = 'uml'
    )
);
```

	cname character varying (30)
1	algorithm
2	architectonics
3	artifical intelligence
4	asp
5	basic
6	c
7	c#
8	c++
9	c++/stl programming
10	cobol
11	compiling principle
12	computer graphics
13	computer interface

Total rows: 50 of 50 Query comple

(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 DISTINCT sid
FROM CHOICES ch
JOIN COURSES cr ON ch.cid = cr.cid
WHERE tid = '200102901';
```



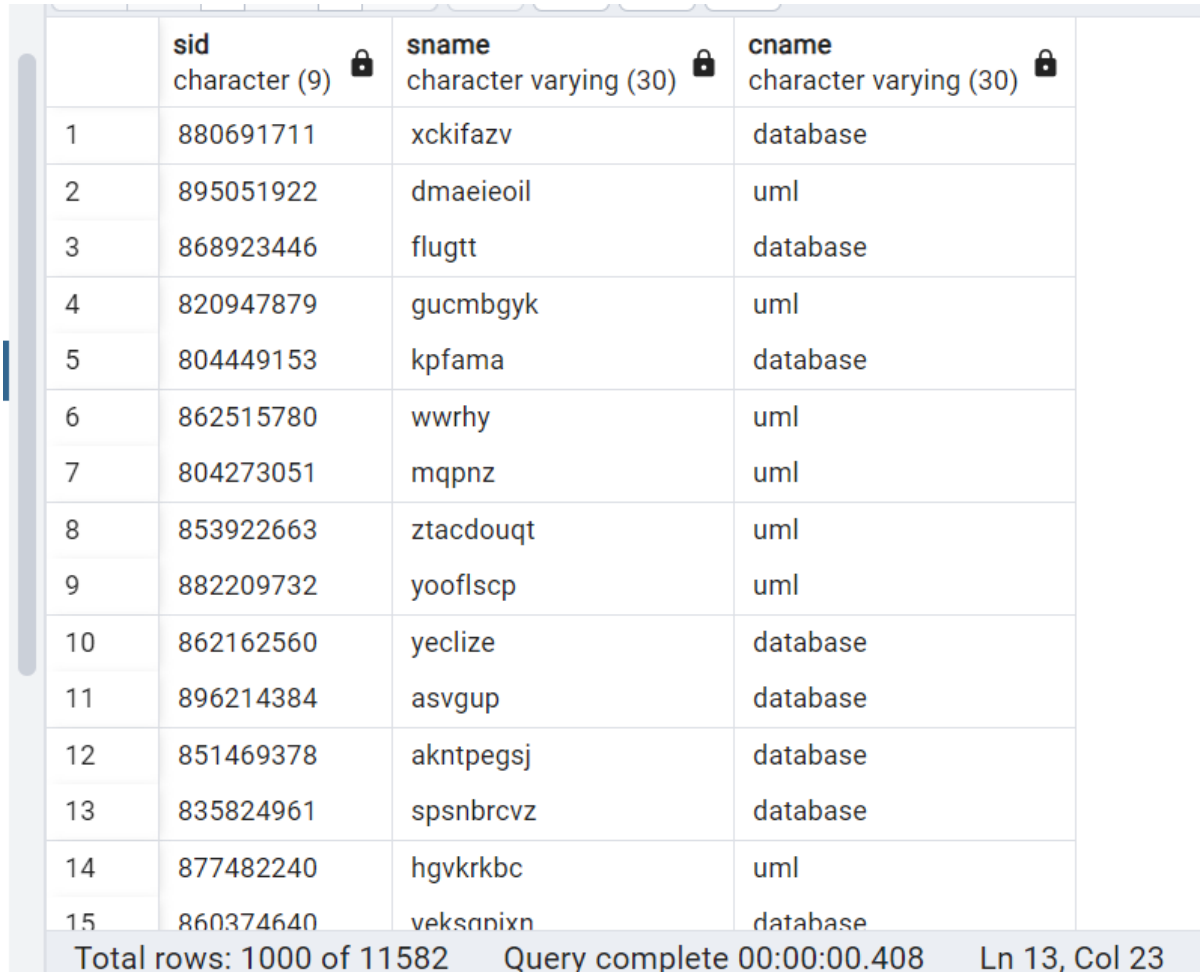
	sid character (9)
1	808684920
2	818057454
3	818281155
4	824914706
5	828444906
6	829993505
7	838840130
8	842147636
9	844823718
10	851167481
11	862065012
12	871325216
13	874348511

Total rows: 21 of 21 Query comp

(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

```
SELECT sid,sname,cname
FROM STUDENTS,COURSES
WHERE sid IN (
    SELECT sid
    FROM CHOICES ch
    JOIN COURSES cr ON ch.cid = cr.cid
    WHERE cname = 'database'
)
AND cname = 'database'

UNION

SELECT sid,sname,cname
FROM STUDENTS,COURSES
WHERE sid IN (
    SELECT sid
    FROM CHOICES ch
```

```
    JOIN COURSES cr ON ch.cid = cr.cid
    WHERE cname = 'uml'
)
AND cname = 'uml'
```



	sid character (9)	sname character varying (30)	cname character varying (30)
1	880691711	xckifazv	database
2	895051922	dmaeieoil	uml
3	868923446	flugtt	database
4	820947879	gucmbgyk	uml
5	804449153	kpfama	database
6	862515780	wwrhy	uml
7	804273051	mqpnz	uml
8	853922663	ztacdouqt	uml
9	882209732	yooflscp	uml
10	862162560	yeclize	database
11	896214384	asvgup	database
12	851469378	akntpegsj	database
13	835824961	spsnbrcvz	database
14	877482240	hgvkrkbc	uml
15	860374640	yeksqpixn	database

Total rows: 1000 of 11582 Query complete 00:00:00.408 Ln 13, Col 23

修正：

在修改实验报告时突然发现实验四的课内实验最后一题我有错误，在此修正：

原题：

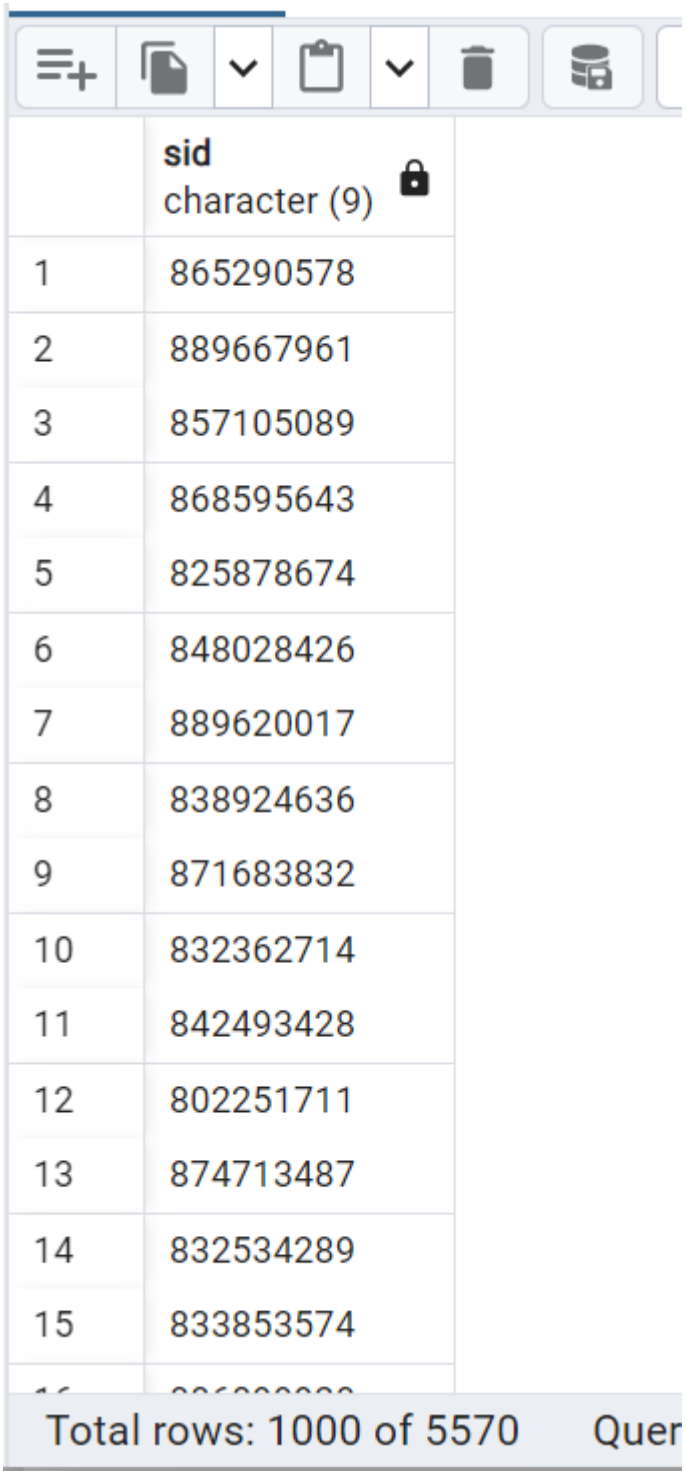
(10) 实现集合减运算，查询选修课程C++而没有选修课程Java的学生的编号。

```
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'
)
```

修改如下：

```
SELECT sid
FROM CHOICES
WHERE sid IN (
    SELECT sid
    FROM CHOICES ch
    JOIN COURSES cr ON cr.cid = ch.cid
    WHERE cname = 'c++'
)

EXCEPT

SELECT sid
FROM CHOICES
WHERE sid IN (
    SELECT sid
    FROM CHOICES ch
    JOIN COURSES cr ON cr.cid = ch.cid
    WHERE cname = 'java'
)
```



	sid character (9)
1	865290578
2	889667961
3	857105089
4	868595643
5	825878674
6	848028426
7	889620017
8	838924636
9	871683832
10	832362714
11	842493428
12	802251711
13	874713487
14	832534289
15	833853574

Total rows: 1000 of 5570 Quer

结果与上次做的一致，可能是我忘记将错误代码更新至报告中，在此更正。