- In this document, I list many queries and their results.

- You can try them out yourself by cutting-and-running these commands on `postgreSQL`.

- For each query, I give the tables required, so you don't have to keep going back to the page for the list of tables.

- There are many technical terms to understand:

  select, where, from, group by, having, order by, inner join on, inner join using, left outer join, right outer join, natural inner join, natural left outer join, with, avg, sum, count, min, max, exists, all, some, in, is . . .

  Make sure you understand the logic behind each term.

- For each query, spend some time to see the input tables, and the result.

- For each query, important things to note are the rows in the output table, the attribute names, the order in which attributes appear in the output table.

- I have stopped using 'products' in the queries and only used joins. You should get used to using all types of joins.

The cut-and-paste code from this pdf file will work directly on the computer with `postgreSQL`, in case you want to try these queries.

Here are the tables we used in class:

course_id	title	dept_name	credits
BIO-101	Intro. to Biology	Biology	4
BIO-301	Genetics	Biology	4
BIO-399	Computational Biology	Biology	3
CS-101	Intro. to Computer Science	Comp. Sci.	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3
CS-319	Image Processing	Comp. Sci.	3
CS-347	Database System Concepts	Comp. Sci.	3
EE-181	Intro. to Digital Systems	Elec. Eng.	3
FIN-201	Investment Banking	Finance	3
HIS-351	World History	History	3
MU-199	Music Video Production	Music	3
PHY-101	Physical Principles	Physics	4

(a) course

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

(b) teacher

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

(c) student

course_id	sec_id	semester	year	building	rn	time_id
BIO-101	1	Summer	2009	Painter	514	B
BIO-301	1	Summer	2010	Painter	514	A
CS-101	1	Fall	2009	Packard	101	H
CS-101	1	Spring	2010	Packard	101	F
CS-190	1	Spring	2009	Taylor	3128	E
CS-190	2	Spring	2009	Taylor	3128	A
CS-315	1	Spring	2010	Watson	120	D
CS-319	1	Spring	2010	Watson	100	B
CS-319	2	Spring	2010	Taylor	3128	C
CS-347	1	Fall	2009	Taylor	3128	A
EE-181	1	Spring	2009	Taylor	3128	C
FIN-201	1	Spring	2010	Packard	101	B
HIS-351	1	Spring	2010	Painter	514	C
MU-199	1	Spring	2010	Packard	101	D
PHY-101	1	Fall	2009	Watson	100	A

(d) section

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

(e) teaches

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

(f) takes

dept_name	building	budget
Biology	Watson	90000.00
Comp. Sci.	Taylor	100000.00
Elec. Eng.	Taylor	85000.00
Finance	Painter	120000.00
History	Painter	50000.00
Music	Packard	80000.00
Physics	Watson	70000.00

(g) department

```sql
SELECT *
FROM teacher NATURAL JOIN teaches;
```

id	name	dept_name	salary	course_id	sec_id	semester	year
10101	Srinivasan	Comp. Sci.	65000.00	CS-101	1	Fall	2009
10101	Srinivasan	Comp. Sci.	65000.00	CS-315	1	Spring	2010
10101	Srinivasan	Comp. Sci.	65000.00	CS-347	1	Fall	2009
12121	Wu	Finance	90000.00	FIN-201	1	Spring	2010
15151	Mozart	Music	40000.00	MU-199	1	Spring	2010
22222	Einstein	Physics	95000.00	PHY-101	1	Fall	2009
32343	El Said	History	60000.00	HIS-351	1	Spring	2010
45565	Katz	Comp. Sci.	75000.00	CS-101	1	Spring	2010
45565	Katz	Comp. Sci.	75000.00	CS-319	1	Spring	2010
76766	Crick	Biology	72000.00	BIO-101	1	Summer	2009
76766	Crick	Biology	72000.00	BIO-301	1	Summer	2010
83821	Brandt	Comp. Sci.	92000.00	CS-190	1	Spring	2009
83821	Brandt	Comp. Sci.	92000.00	CS-190	2	Spring	2009
83821	Brandt	Comp. Sci.	92000.00	CS-319	2	Spring	2010
98345	Kim	Elec. Eng.	80000.00	EE-181	1	Spring	2009

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

```
SELECT *
FROM student NATURAL JOIN takes;
```

id	name	dept_name	tot_cred	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	CS-347	1	Fall	2009	A
19991	Brandt	History	80	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	BIO-301	1	Summer	2010	

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM student INNER JOIN takes USING (id);
```

id	name	dept_name	tot_cred	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	CS-347	1	Fall	2009	A
19991	Brandt	History	80	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	BIO-301	1	Summer	2010	

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM student INNER JOIN takes ON student.id = takes.id;
```

id	name	dept_name	tot_cred	id	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	00128	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	00128	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	12345	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	12345	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	12345	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	12345	CS-347	1	Fall	2009	A
19991	Brandt	History	80	19991	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	23121	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	44553	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	45678	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	45678	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	45678	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	54321	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	54321	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	55739	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	76543	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	76543	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	76653	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	98765	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	98765	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	98988	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	98988	BIO-301	1	Summer	2010	

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM (student INNER JOIN department USING (dept_name))
      NATURAL JOIN takes;
```

id	dept_name	name	tot_cred	building	budget	course_id	sec_id	semester	year	grade
00128	Comp. Sci.	Zhang	102	Taylor	100000.00	CS-101	1	Fall	2009	A
00128	Comp. Sci.	Zhang	102	Taylor	100000.00	CS-347	1	Fall	2009	A-
12345	Comp. Sci.	Shankar	32	Taylor	100000.00	CS-101	1	Fall	2009	C
12345	Comp. Sci.	Shankar	32	Taylor	100000.00	CS-190	2	Spring	2009	A
12345	Comp. Sci.	Shankar	32	Taylor	100000.00	CS-315	1	Spring	2010	A
12345	Comp. Sci.	Shankar	32	Taylor	100000.00	CS-347	1	Fall	2009	A
19991	History	Brandt	80	Painter	50000.00	HIS-351	1	Spring	2010	B
23121	Finance	Chavez	110	Painter	120000.00	FIN-201	1	Spring	2010	C+
44553	Physics	Peltier	56	Watson	70000.00	PHY-101	1	Fall	2009	B-
45678	Physics	Levy	46	Watson	70000.00	CS-101	1	Fall	2009	F
45678	Physics	Levy	46	Watson	70000.00	CS-101	1	Spring	2010	B+
45678	Physics	Levy	46	Watson	70000.00	CS-319	1	Spring	2010	B
54321	Comp. Sci.	Williams	54	Taylor	100000.00	CS-101	1	Fall	2009	A-
54321	Comp. Sci.	Williams	54	Taylor	100000.00	CS-190	2	Spring	2009	B+
55739	Music	Sanchez	38	Packard	80000.00	MU-199	1	Spring	2010	A-
76543	Comp. Sci.	Brown	58	Taylor	100000.00	CS-101	1	Fall	2009	A
76543	Comp. Sci.	Brown	58	Taylor	100000.00	CS-319	2	Spring	2010	A
76653	Elec. Eng.	Aoi	60	Taylor	85000.00	EE-181	1	Spring	2009	C
98765	Elec. Eng.	Bourikas	98	Taylor	85000.00	CS-101	1	Fall	2009	C-
98765	Elec. Eng.	Bourikas	98	Taylor	85000.00	CS-315	1	Spring	2010	B
98988	Biology	Tanaka	120	Watson	90000.00	BIO-101	1	Summer	2009	A
98988	Biology	Tanaka	120	Watson	90000.00	BIO-301	1	Summer	2010	

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

department

dept_name	building	budget
Biology	Watson	90000.00
Comp. Sci.	Taylor	100000.00
Elec. Eng.	Taylor	85000.00
Finance	Painter	120000.00
History	Painter	50000.00
Music	Packard	80000.00
Physics	Watson	70000.00

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM student LEFT OUTER JOIN takes USING (id);
```

id	name	dept_name	tot_cred	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	CS-347	1	Fall	2009	A
19991	Brandt	History	80	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	BIO-301	1	Summer	2010	
70557	Snow	Physics	0					

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```
SELECT *
FROM student RIGHT OUTER JOIN takes USING (id);
```

id	name	dept_name	tot_cred	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	CS-347	1	Fall	2009	A
19991	Brandt	History	80	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	BIO-301	1	Summer	2010	

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM student FULL OUTER JOIN takes USING (id);
```

id	name	dept_name	tot_cred	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	CS-347	1	Fall	2009	A
19991	Brandt	History	80	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	BIO-301	1	Summer	2010	
70557	Snow	Physics	0					

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```
SELECT *
FROM student NATURAL FULL OUTER JOIN takes;
```

id	name	dept_name	tot_cred	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	CS-347	1	Fall	2009	A
19991	Brandt	History	80	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	BIO-301	1	Summer	2010	
70557	Snow	Physics	0					

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM student FULL OUTER JOIN takes ON student.id = takes.id;
```

id	name	dept_name	tot_cred	id	course_id	sec_id	semester	year	grade
00128	Zhang	Comp. Sci.	102	00128	CS-101	1	Fall	2009	A
00128	Zhang	Comp. Sci.	102	00128	CS-347	1	Fall	2009	A-
12345	Shankar	Comp. Sci.	32	12345	CS-101	1	Fall	2009	C
12345	Shankar	Comp. Sci.	32	12345	CS-190	2	Spring	2009	A
12345	Shankar	Comp. Sci.	32	12345	CS-315	1	Spring	2010	A
12345	Shankar	Comp. Sci.	32	12345	CS-347	1	Fall	2009	A
19991	Brandt	History	80	19991	HIS-351	1	Spring	2010	B
23121	Chavez	Finance	110	23121	FIN-201	1	Spring	2010	C+
44553	Peltier	Physics	56	44553	PHY-101	1	Fall	2009	B-
45678	Levy	Physics	46	45678	CS-101	1	Fall	2009	F
45678	Levy	Physics	46	45678	CS-101	1	Spring	2010	B+
45678	Levy	Physics	46	45678	CS-319	1	Spring	2010	B
54321	Williams	Comp. Sci.	54	54321	CS-101	1	Fall	2009	A-
54321	Williams	Comp. Sci.	54	54321	CS-190	2	Spring	2009	B+
55739	Sanchez	Music	38	55739	MU-199	1	Spring	2010	A-
76543	Brown	Comp. Sci.	58	76543	CS-101	1	Fall	2009	A
76543	Brown	Comp. Sci.	58	76543	CS-319	2	Spring	2010	A
76653	Aoi	Elec. Eng.	60	76653	EE-181	1	Spring	2009	C
98765	Bourikas	Elec. Eng.	98	98765	CS-101	1	Fall	2009	C-
98765	Bourikas	Elec. Eng.	98	98765	CS-315	1	Spring	2010	B
98988	Tanaka	Biology	120	98988	BIO-101	1	Summer	2009	A
98988	Tanaka	Biology	120	98988	BIO-301	1	Summer	2010	
70557	Snow	Physics	0						

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM (takes INNER JOIN teaches USING (course_id, sec_id,
    semester, year) )
    INNER JOIN teacher ON teacher.id = teaches.id;
```

course_id	sec_id	semester	year	id	grade	id	id	name	dept_name	salary
BIO-101	1	Summer	2009	98988	A	76766	76766	Crick	Biology	72000.00
BIO-301	1	Summer	2010	98988		76766	76766	Crick	Biology	72000.00
CS-101	1	Fall	2009	00128	A	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-101	1	Fall	2009	12345	C	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-101	1	Fall	2009	45678	F	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-101	1	Fall	2009	54321	A-	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-101	1	Fall	2009	76543	A	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-101	1	Fall	2009	98765	C-	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-101	1	Spring	2010	45678	B+	45565	45565	Katz	Comp. Sci.	75000.00
CS-190	2	Spring	2009	54321	B+	83821	83821	Brandt	Comp. Sci.	92000.00
CS-190	2	Spring	2009	12345	A	83821	83821	Brandt	Comp. Sci.	92000.00
CS-315	1	Spring	2010	12345	A	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-315	1	Spring	2010	98765	B	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-319	1	Spring	2010	45678	B	45565	45565	Katz	Comp. Sci.	75000.00
CS-319	2	Spring	2010	76543	A	83821	83821	Brandt	Comp. Sci.	92000.00
CS-347	1	Fall	2009	12345	A	10101	10101	Srinivasan	Comp. Sci.	65000.00
CS-347	1	Fall	2009	00128	A-	10101	10101	Srinivasan	Comp. Sci.	65000.00
EE-181	1	Spring	2009	76653	C	98345	98345	Kim	Elec. Eng.	80000.00
FIN-201	1	Spring	2010	23121	C+	12121	12121	Wu	Finance	90000.00
HIS-351	1	Spring	2010	19991	B	32343	32343	El Said	History	60000.00
MU-199	1	Spring	2010	55739	A-	15151	15151	Mozart	Music	40000.00
PHY-101	1	Fall	2009	44553	B-	22222	22222	Einstein	Physics	95000.00

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

```sql
SELECT teacher.name, student.name, course_id
FROM (teacher NATURAL JOIN teaches) INNER JOIN
     (takes NATURAL JOIN student) USING (course_id, sec_id, semester,
   year)
```

name	name	course_id
Crick	Tanaka	BIO-101
Crick	Tanaka	BIO-301
Srinivasan	Zhang	CS-101
Srinivasan	Shankar	CS-101
Srinivasan	Levy	CS-101
Srinivasan	Williams	CS-101
Srinivasan	Brown	CS-101
Srinivasan	Bourikas	CS-101
Katz	Levy	CS-101
Brandt	Williams	CS-190
Brandt	Shankar	CS-190
Srinivasan	Shankar	CS-315
Srinivasan	Bourikas	CS-315
Katz	Levy	CS-319
Brandt	Brown	CS-319
Srinivasan	Shankar	CS-347
Srinivasan	Zhang	CS-347
Kim	Aoi	EE-181
Wu	Chavez	FIN-201
El Said	Brandt	HIS-351
Mozart	Sanchez	MU-199
Einstein	Peltier	PHY-101

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT teacher.name, student.name, count(*)
FROM (teacher NATURAL JOIN teaches) INNER JOIN
     (takes NATURAL JOIN student) USING (course_id, sec_id, semester,
   year)
GROUP BY teacher.name, student.name;
```

name	name	count
Brandt	Brown	1
Brandt	Shankar	1
Brandt	Williams	1
Crick	Tanaka	2
Einstein	Peltier	1
El Said	Brandt	1
Katz	Levy	2
Kim	Aoi	1
Mozart	Sanchez	1
Srinivasan	Bourikas	2
Srinivasan	Brown	1
Srinivasan	Levy	1
Srinivasan	Shankar	3
Srinivasan	Williams	1
Srinivasan	Zhang	2
Wu	Chavez	1

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT *
FROM takes NATURAL JOIN course;
```

course_id	id	sec_id	semester	year	grade	title	dept_name	credits
CS-101	00128	1	Fall	2009	A	Intro. to Computer Science	Comp. Sci.	4
CS-347	00128	1	Fall	2009	A-	Database System Concepts	Comp. Sci.	3
CS-101	12345	1	Fall	2009	C	Intro. to Computer Science	Comp. Sci.	4
CS-190	12345	2	Spring	2009	A	Game Design	Comp. Sci.	4
CS-315	12345	1	Spring	2010	A	Robotics	Comp. Sci.	3
CS-347	12345	1	Fall	2009	A	Database System Concepts	Comp. Sci.	3
HIS-351	19991	1	Spring	2010	B	World History	History	3
FIN-201	23121	1	Spring	2010	C+	Investment Banking	Finance	3
PHY-101	44553	1	Fall	2009	B-	Physical Principles	Physics	4
CS-101	45678	1	Fall	2009	F	Intro. to Computer Science	Comp. Sci.	4
CS-101	45678	1	Spring	2010	B+	Intro. to Computer Science	Comp. Sci.	4
CS-319	45678	1	Spring	2010	B	Image Processing	Comp. Sci.	3
CS-101	54321	1	Fall	2009	A-	Intro. to Computer Science	Comp. Sci.	4
CS-190	54321	2	Spring	2009	B+	Game Design	Comp. Sci.	4
MU-199	55739	1	Spring	2010	A-	Music Video Production	Music	3
CS-101	76543	1	Fall	2009	A	Intro. to Computer Science	Comp. Sci.	4
CS-319	76543	2	Spring	2010	A	Image Processing	Comp. Sci.	3
EE-181	76653	1	Spring	2009	C	Intro. to Digital Systems	Elec. Eng.	3
CS-101	98765	1	Fall	2009	C-	Intro. to Computer Science	Comp. Sci.	4
CS-315	98765	1	Spring	2010	B	Robotics	Comp. Sci.	3
BIO-101	98988	1	Summer	2009	A	Intro. to Biology	Biology	4
BIO-301	98988	1	Summer	2010		Genetics	Biology	4

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

course

course_id	title	dept_name	credits
BIO-101	Intro. to Biology	Biology	4
BIO-301	Genetics	Biology	4
BIO-399	Computational Biology	Biology	3
CS-101	Intro. to Computer Science	Comp. Sci.	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3
CS-319	Image Processing	Comp. Sci.	3
CS-347	Database System Concepts	Comp. Sci.	3
EE-181	Intro. to Digital Systems	Elec. Eng.	3
FIN-201	Investment Banking	Finance	3
HIS-351	World History	History	3
MU-199	Music Video Production	Music	3
PHY-101	Physical Principles	Physics	4

```
SELECT year, SUM(credits)
FROM takes NATURAL JOIN course
GROUP BY year;
```

year	sum
2010	29
2009	49

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

course

course_id	title	dept_name	credits
BIO-101	Intro. to Biology	Biology	4
BIO-301	Genetics	Biology	4
BIO-399	Computational Biology	Biology	3
CS-101	Intro. to Computer Science	Comp. Sci.	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3
CS-319	Image Processing	Comp. Sci.	3
CS-347	Database System Concepts	Comp. Sci.	3
EE-181	Intro. to Digital Systems	Elec. Eng.	3
FIN-201	Investment Banking	Finance	3
HIS-351	World History	History	3
MU-199	Music Video Production	Music	3
PHY-101	Physical Principles	Physics	4

dept_name	course_id	id	name	tot_cred	sec_id	semester	year	grade	title	credits
Comp. Sci.	CS-101	00128	Zhang	102	1	Fall	2009	A	Intro. to Computer Science	4
Comp. Sci.	CS-347	00128	Zhang	102	1	Fall	2009	A-	Database System Concepts	3
Comp. Sci.	CS-101	12345	Shankar	32	1	Fall	2009	C	Intro. to Computer Science	4
Comp. Sci.	CS-190	12345	Shankar	32	2	Spring	2009	A	Game Design	4
Comp. Sci.	CS-315	12345	Shankar	32	1	Spring	2010	A	Robotics	3
Comp. Sci.	CS-347	12345	Shankar	32	1	Fall	2009	A	Database System Concepts	3
History	HIS-351	19991	Brandt	80	1	Spring	2010	B	World History	3
Finance	FIN-201	23121	Chavez	110	1	Spring	2010	C+	Investment Banking	3
Physics	PHY-101	44553	Peltier	56	1	Fall	2009	B-	Physical Principles	4
Comp. Sci.	CS-101	54321	Williams	54	1	Fall	2009	A-	Intro. to Computer Science	4
Comp. Sci.	CS-190	54321	Williams	54	2	Spring	2009	B+	Game Design	4
Music	MU-199	55739	Sanchez	38	1	Spring	2010	A-	Music Video Production	3
Comp. Sci.	CS-101	76543	Brown	58	1	Fall	2009	A	Intro. to Computer Science	4
Comp. Sci.	CS-319	76543	Brown	58	2	Spring	2010	A	Image Processing	3
Elec. Eng.	EE-181	76653	Aoi	60	1	Spring	2009	C	Intro. to Digital Systems	3
Biology	BIO-101	98988	Tanaka	120	1	Summer	2009	A	Intro. to Biology	4
Biology	BIO-301	98988	Tanaka	120	1	Summer	2010		Genetics	4
Biology	BIO-399								Computational Biology	3

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

course

course_id	title	dept_name	credits
BIO-101	Intro. to Biology	Biology	4
BIO-301	Genetics	Biology	4
BIO-399	Computational Biology	Biology	3
CS-101	Intro. to Computer Science	Comp. Sci.	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3
CS-319	Image Processing	Comp. Sci.	3
CS-347	Database System Concepts	Comp. Sci.	3
EE-181	Intro. to Digital Systems	Elec. Eng.	3
FIN-201	Investment Banking	Finance	3
HIS-351	World History	History	3
MU-199	Music Video Production	Music	3
PHY-101	Physical Principles	Physics	4

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
WITH mytakes (student_id, course_id, sec_id, semester, year, grade) AS
    (SELECT id, course_id, sec_id, semester, year, grade
     FROM takes
     WHERE grade = 'A')

SELECT *
FROM (mytakes INNER JOIN teaches USING (course_id, sec_id,
      semester, year))
        RIGHT OUTER JOIN teacher USING (id)
```

id	course_id	sec_id	semester	year	student_id	grade	name	dept_name	salary
10101	CS-347	1	Fall	2009	12345	A	Srinivasan	Comp. Sci.	65000.00
10101	CS-315	1	Spring	2010	12345	A	Srinivasan	Comp. Sci.	65000.00
10101	CS-101	1	Fall	2009	00128	A	Srinivasan	Comp. Sci.	65000.00
10101	CS-101	1	Fall	2009	76543	A	Srinivasan	Comp. Sci.	65000.00
12121							Wu	Finance	90000.00
15151							Mozart	Music	40000.00
22222							Einstein	Physics	95000.00
32343							El Said	History	60000.00
33456							Gold	Physics	87000.00
45565							Katz	Comp. Sci.	75000.00
58583							Califieri	History	62000.00
76543							Singh	Finance	80000.00
76766	BIO-101	1	Summer	2009	98988	A	Crick	Biology	72000.00
83821	CS-319	2	Spring	2010	76543	A	Brandt	Comp. Sci.	92000.00
83821	CS-190	2	Spring	2009	12345	A	Brandt	Comp. Sci.	92000.00
98345							Kim	Elec. Eng.	80000.00

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

```sql
SELECT teacher.name, count(*)
FROM (takes INNER JOIN teaches USING (course_id, sec_id,
      semester, year))
      INNER JOIN teacher ON teaches.id = teacher.id
GROUP BY teacher.name, teacher.id
ORDER BY count(*) DESC;
```

name	count
Srinivasan	10
Brandt	3
Katz	2
Crick	2
El Said	1
Kim	1
Wu	1
Mozart	1
Einstein	1

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```
SELECT teacher.name, count(*)
FROM (takes INNER JOIN teaches USING (course_id, sec_id,
      semester, year) ) AS mytable(a,b,c,d,e,f,g)
        INNER JOIN teacher ON mytable.g = teacher.id
GROUP BY teacher.name, teacher.id
ORDER BY count(*) DESC;
```

name	count
Srinivasan	10
Brandt	3
Katz	2
Crick	2
El Said	1
Kim	1
Wu	1
Mozart	1
Einstein	1

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT teacher.name, mytable.e, mytable.f
FROM (takes INNER JOIN teaches USING (course_id, sec_id,
      semester, year) ) AS mytable(a,b,c,d,e,f,g)
      INNER JOIN teacher ON mytable.g = teacher.id;
```

name	e	f
Crick	98988	A
Crick	98988	
Srinivasan	00128	A
Srinivasan	12345	C
Srinivasan	45678	F
Srinivasan	54321	A-
Srinivasan	76543	A
Srinivasan	98765	C-
Katz	45678	B+
Brandt	54321	B+
Brandt	12345	A
Srinivasan	12345	A
Srinivasan	98765	B
Katz	45678	B
Brandt	76543	A
Srinivasan	12345	A
Srinivasan	00128	A-
Kim	76653	C
Wu	23121	C+
El Said	19991	B
Mozart	55739	A-
Einstein	44553	B-

teacher

id	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000.00
12121	Wu	Finance	90000.00
15151	Mozart	Music	40000.00
22222	Einstein	Physics	95000.00
32343	El Said	History	60000.00
33456	Gold	Physics	87000.00
45565	Katz	Comp. Sci.	75000.00
58583	Califieri	History	62000.00
76543	Singh	Finance	80000.00
76766	Crick	Biology	72000.00
83821	Brandt	Comp. Sci.	92000.00
98345	Kim	Elec. Eng.	80000.00

teaches

id	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2009
10101	CS-315	1	Spring	2010
10101	CS-347	1	Fall	2009
12121	FIN-201	1	Spring	2010
15151	MU-199	1	Spring	2010
22222	PHY-101	1	Fall	2009
32343	HIS-351	1	Spring	2010
45565	CS-101	1	Spring	2010
45565	CS-319	1	Spring	2010
76766	BIO-101	1	Summer	2009
76766	BIO-301	1	Summer	2010
83821	CS-190	1	Spring	2009
83821	CS-190	2	Spring	2009
83821	CS-319	2	Spring	2010
98345	EE-181	1	Spring	2009

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT A.name, B.name, course_id
FROM (student NATURAL INNER JOIN takes) as A  INNER JOIN
     (student NATURAL INNER JOIN takes) as B USING (course_id, sec_id,
   semester, year)
WHERE A.id <> B.id AND A.id < B.id
```

name	name	course_id
Zhang	Shankar	CS-101
Zhang	Levy	CS-101
Zhang	Williams	CS-101
Zhang	Brown	CS-101
Zhang	Bourikas	CS-101
Shankar	Levy	CS-101
Shankar	Williams	CS-101
Shankar	Brown	CS-101
Shankar	Bourikas	CS-101
Levy	Williams	CS-101
Levy	Brown	CS-101
Levy	Bourikas	CS-101
Williams	Brown	CS-101
Williams	Bourikas	CS-101
Brown	Bourikas	CS-101
Shankar	Williams	CS-190
Shankar	Bourikas	CS-315
Zhang	Shankar	CS-347

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	

```sql
SELECT A.name, B.name
FROM (student NATURAL INNER JOIN takes) as A  INNER JOIN
     (student NATURAL INNER JOIN takes) as B USING (course_id, sec_id,
   semester, year)
WHERE A.id <> B.id AND A.id < B.id
GROUP BY A.id, A.name, B.id, B.name
HAVING COUNT(*) >= 1;
```

name	name
Zhang	Shankar
Zhang	Levy
Zhang	Williams
Zhang	Brown
Zhang	Bourikas
Shankar	Levy
Shankar	Williams
Shankar	Brown
Shankar	Bourikas
Levy	Williams
Levy	Brown
Levy	Bourikas
Williams	Brown
Williams	Bourikas
Brown	Bourikas

student

id	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

takes

id	course_id	sec_id	semester	year	grade
00128	CS-101	1	Fall	2009	A
00128	CS-347	1	Fall	2009	A-
12345	CS-101	1	Fall	2009	C
12345	CS-190	2	Spring	2009	A
12345	CS-315	1	Spring	2010	A
12345	CS-347	1	Fall	2009	A
19991	HIS-351	1	Spring	2010	B
23121	FIN-201	1	Spring	2010	C+
44553	PHY-101	1	Fall	2009	B-
45678	CS-101	1	Fall	2009	F
45678	CS-101	1	Spring	2010	B+
45678	CS-319	1	Spring	2010	B
54321	CS-101	1	Fall	2009	A-
54321	CS-190	2	Spring	2009	B+
55739	MU-199	1	Spring	2010	A-
76543	CS-101	1	Fall	2009	A
76543	CS-319	2	Spring	2010	A
76653	EE-181	1	Spring	2009	C
98765	CS-101	1	Fall	2009	C-
98765	CS-315	1	Spring	2010	B
98988	BIO-101	1	Summer	2009	A
98988	BIO-301	1	Summer	2010	