Nested Subqueries

Warmup

instructor

ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	60000
33456	Gold	Physics	87000
45565	Katz	Comp. Sci.	75000
58583	Califieri	History	62000
76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

What does this do?

```
sqlite> select * from
    (select name, ID from instructor order by name);
```

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76766	Crick	Biology	72000
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98345	Kim	Elec. Eng.	80000

What does this do?

```
sqlite> select * from
    (select name, ID from instructor order by name);
```

```
sqlite> select * from (select name, ID from instructor order by name);
Brandt,83821
Califieri,58583
Crick,76766
Einstein,22222
"El Said",32343
Gold,33456
...
```

How to express this in SQL?

instructor

ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
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What is the most any department pays in total instructor salaries?

Trick!

```
sqlite> select dept_name, sum(salary) as total_salary
    from instructor
    group by dept_name
    order by total_salary desc
    limit 1;
```

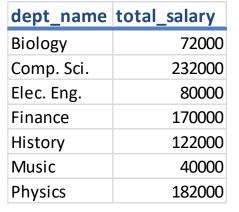
How to express this in SQL?

instructor

ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
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98345	Kim	Elec. Eng.	80000

What is the most any department pays in total instructor salaries?

Would the problem be easier if we had a table like this?



Idea: query in two steps

instructor

ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
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76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

get sum of salaries for each dept.

dept_name	total_salary
Biology	72000
Comp. Sci.	232000
Elec. Eng.	80000
Finance	170000
History	122000
Music	40000
Physics	182000

get greatest total salary

232000

Exercise: what is the first query?

instructor

ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	60000
33456	Gold	Physics	87000
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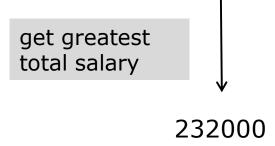
get sum of salaries for each dept.

dept_name	total_salary
Biology	72000
Comp. Sci.	232000
Elec. Eng.	80000
Finance	170000
History	122000
Music	40000
Physics	182000

Exercise: what is the second query?

Т

dept_name	total_salary
Biology	72000
Comp. Sci.	232000
Elec. Eng.	80000
Finance	170000
History	122000
Music	40000
Physics	182000



sqlite> select max(total_salary) from T;
232000

Solution

What is the most any department pays in total instructor salaries?

dept_name	total_salary
Biology	72000
Comp. Sci.	232000
Elec. Eng.	80000
Finance	170000
History	122000
Music	40000
Physics	182000

Alternative solution, using 'with'

What is the most any department pays in total instructor salaries?

```
sqlite> with T(dept_name, total_salary) as
    (select dept_name, sum(salary) as total_salary
    from instructor
    group by dept_name)
select max(total_salary) from T;
232000
```

dept_name	total_salary
Biology	72000
Comp. Sci.	232000
Elec. Eng.	80000
Finance	170000
History	122000
Music	40000
Physics	182000

How does this work?

- 1. every query produces a table
- 2. so a query can be used wherever a table is accepted

Another example

instructor

ID		name	dept_name	salary
	10101	Srinivasan	Comp. Sci.	65000
	12121	Wu	Finance	90000
	15151	Mozart	Music	40000
	22222	Einstein	Physics	95000
	32343	El Said	History	60000
	33456	Gold	Physics	87000
	45565	Katz	Comp. Sci.	75000
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What are the average instructors' salaries in departments where the average salary is > \$42,000?

Where are tables expected in SQL?

instructor

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76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

What are the instructors' names, aside from 'Mozart' and 'Einstein'?

a table can be used here

sqlite> sqlite> select distinct(name) from instructor where name not in ('Mozart', 'Einstein');
Srinivasan
Wu
El Said
Gold
Katz
Califieri
...

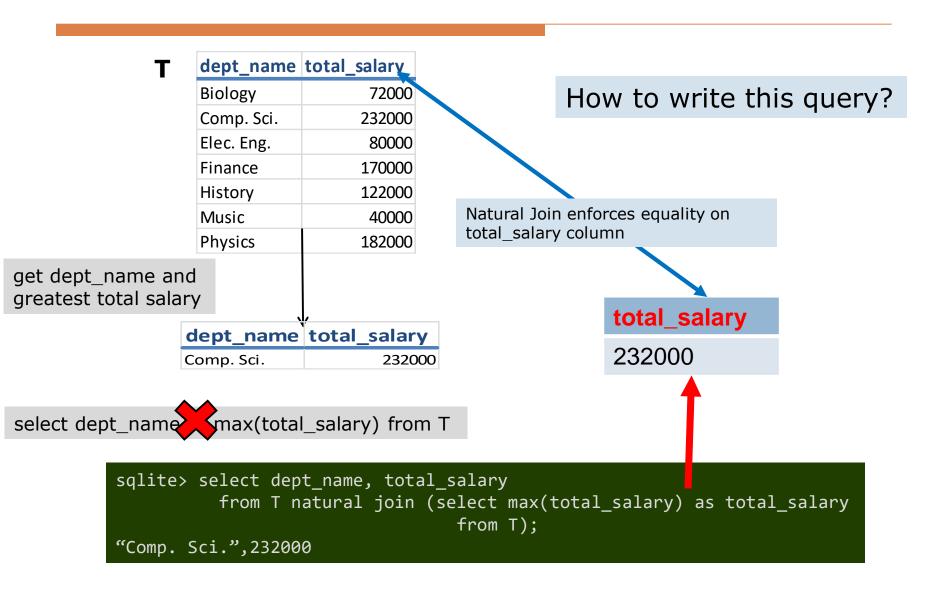
Nested queries with 'in', 'not in'

section

course_id	sec_id	semester	year	building	room_number	time_slot_id
BIO-101	1	Summer	2009	Painter	514	В
BIO-301	1	Summer	2010	Painter	514	Α
CS-101	1	Fall	2009	Packard	101	Н
CS-101	1	Spring	2010	Packard	101	F
CS-190	1	Spring	2009	Taylor	3128	E
CS-190	2	Spring	2009	Taylor	3128	Α
CS-315	1	Spring	2010	Watson	120	D
CS-319	1	Spring	2010	Watson	100	В
CS-319	2	Spring	2010	Taylor	3128	В
CS-347	1	Fall	2009	Tavlor	3128	Α

What courses are taught in Fall 2009 but not Spring 2010?

Use Case 1 – using natural join



Use Case 2 - using IN

Music

Physics

Т	dept_name	total_salary
	Biology	72000
	Comp. Sci.	232000
	Elec. Eng.	80000
	Finance	170000
	History	122000

get dept_name and greatest total salary

dept_name	total_salary
Comp. Sci.	232000

40000

182000

which wards contain both male and female patients?

```
sqlite> select ward from patient
    where sex="M"
    and ward IN (select ward from patient where sex="F");
```