

Database Systems CSE 303

Lecture 06: SQL

2016
Subquery

Outline

- What is a Subquery
- Subquery in WHERE clause
- >ALL, >ANY, >=ALL, <=ANY etc.
- Subquery in FROM clause

What is Sub-query?

Queries within query

Query as a part of another query

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```
SELECT <attributes>  
FROM <one or more relations>  
WHERE <conditions>
```

Sub-query in WHERE clause

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000

Sub-query in WHERE clause

Find the employee(s) with the highest paid salary

First thought

```
SELECT id
FROM Employee
WHERE salary = 75000
```

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000



id	dept	salary
5004	CSE	75,000

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Sub-query in WHERE clause

Find the employee(s) with the highest paid salary

Suppose you are not allowed to use any aggregate function??

```
SELECT id
FROM Employee
WHERE salary = (SELECT MAX(salary)
FROM Employee)
```

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000



id	dept	salary
5004	CSE	75,000

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Sub-query in WHERE clause

Find the employee with the highest paid salary

```
> ALL   >= ALL
< ALL   <= ALL
> ANY   >= ANY
< ANY   <= ANY
```

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000



```
SELECT id
FROM Employee
WHERE salary >= ALL (SELECT salary
FROM Employee)
```

id	dept	salary
5004	CSE	75,000

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Chain of sub queries in the WHERE clause

Find the employee(s) with the highest paid salary

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000

```
SELECT id
FROM Employee
WHERE salary > ALL (SELECT salary
FROM Employee
WHERE salary < ANY (SELECT salary
FROM Employee))
```

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Chain of sub queries in the WHERE clause

Find the highest paid employee(s) in each department

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000

```
SELECT id, dept
FROM Employee
WHERE (dept, salary) IN (SELECT dept, MAX(salary)
FROM Employee
GROUP BY dept);
```



id	dept	salary
5002	EEE	55,000
5004	CSE	75,000

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Correlated sub queries in the WHERE clause

Find the employees that earn above average

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000

```
SELECT *
FROM Employee
WHERE salary > 60000
```



id	dept	salary
5004	CSE	75,000

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Correlated sub queries in the WHERE clause

Find the employees that earn above average

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000

```
SELECT *
FROM Employee
WHERE salary > (SELECT AVG(salary)
FROM Employee)
```



id	dept	salary
5004	CSE	75,000

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Correlated sub queries in the WHERE clause

Find the employees that earn above average of the employees within respective department

Employee

id	dept	salary
5001	EEE	50,000
5002	EEE	55,000
5003	CSE	60,000
5004	CSE	75,000

```
SELECT *
FROM Employee s
WHERE salary > (SELECT AVG(salary)
FROM Employee t
WHERE s.dept = t.dept);
```



id	dept	salary
5002	EEE	55,000
5004	CSE	75,000

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EXISTS and NOT EXISTS

```
SELECT <attributes>
FROM <one or more relations>
WHERE EXISTS (sub-query)
```

Empty
FALSE

Not Empty
TRUE

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Find all manufacturers that make both PC and Laptop

PC

model	maker
1001	A
1002	B
1003	C

Laptop

model	maker
2001	A
2002	B
2003	D

```
SELECT DISTINCT maker
FROM PC
WHERE EXISTS (SELECT *
FROM Laptop
WHERE PC.maker =
Laptop.maker)
```

maker
A
B

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Find all manufacturers that make PCs but not Laptops

PC

model	maker
1001	A
1002	B
1003	C

Laptop

model	maker
2001	A
2002	B
2003	D

```
SELECT DISTINCT maker
FROM PC
WHERE NOT EXISTS (SELECT *
FROM Laptop
WHERE PC.maker =
Laptop.maker)
```

maker
C

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Practice correlated sub queries

Find the PC model with
maximum processing speed
using and without using
aggregate function

```
SELECT model
FROM PC
WHERE speed = (SELECT MAX(speed)
FROM PC);
```

```
SELECT model
FROM PC
WHERE speed >= ALL (SELECT speed
FROM PC)
```

PC

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
1002	2.1	512	250	995
1003	1.42	512	80	478
1004	2.8	1024	250	649
1005	3.2	512	250	630
1006	3.2	1024	320	1049
1007	2.2	1024	200	510
1008	2.2	2048	250	770
1009	2	1024	250	650
1010	2.8	2048	300	770
1011	1.86	2048	160	959
1012	2.8	1024	160	649
1013	3.06	512	80	529

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Correlated sub queries in the FROM clause

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Find manufacturers of at least two different computers
(PC's or laptops) with speeds of at least 2.80

Maker	Model	Type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
...
...

MODEL	SPEED	RAM	HD	PRICE
1001	2.66	1024	250	2114
1002	2.1	512	250	995
1003	1.42	512	80	478
1004	2.8	1024	250	649
1005	3.2	512	250	630
...

PC

MODEL	SPEED	RAM	HD	SCREEN	PRICE
2001	2	2048	240	20.1	3673
2002	1.73	1024	80	17	949
2003	1.8	512	60	15.4	549
2004	2	512	60	13.3	1150
...

Laptop

Product

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Find manufacturer of at least two
different PCs with speed of at least 2.0

```
SELECT maker
FROM Product PC
WHERE Product.model = PC.model
AND speed >= 2.0
GROUP BY maker
HAVING COUNT(PC.model) >= 2
```

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Find manufacturer of at least two different
Laptops with speed of at least 2.0

```
SELECT maker
FROM Product Laptop
WHERE Product.model = Laptop.model
AND speed >= 2.0
GROUP BY maker
HAVING COUNT(Laptop.model) >= 2
```

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Find manufacturers of at least two different computers
(PC's or laptops) with speeds of at least 2.80

Think combined

```
SELECT maker
FROM Product, (SELECT model, speed FROM PC
               UNION
               SELECT model, speed FROM Laptop) T
WHERE Product.model = T.model
AND speed >= 2.0
GROUP BY maker
HAVING COUNT(T.model) >= 2
```