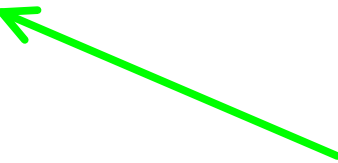




## Report

| *  | ORGUNIT        | EID | EMPLOYEE | HIREDATE            | SALARY |
|----|----------------|-----|----------|---------------------|--------|
| 1  | Company        | 101 | Patil    | 2000-05-01 00:00:00 | 180000 |
| 2  | Administration | 102 | Durmaz   | 2005-07-01 00:00:00 | 120000 |
| 3  | HR             | 105 | Dalal    | 2018-02-02 00:00:00 | 38000  |
| 4  | HR             | 103 | Blaschke | 2002-11-01 00:00:00 | 93000  |
| 5  | HR             | 104 | Stone    | 2006-06-01 00:00:00 | 42000  |
| 6  | Accounting     | 106 | Li       | 2002-12-01 00:00:00 | 89000  |
| 7  | Accounting     | 107 | Nguyen   | 2006-07-01 00:00:00 | 41000  |
| 8  | Accounting     | 108 | Sanchez  | 2014-04-01 00:00:00 | 39000  |
| 9  | Production     | 109 | Umarani  | 2006-07-01 00:00:00 | 142000 |
| 10 | Plant          | 111 | Doshi    | 2010-01-02 00:00:00 | 42000  |
| 11 | Plant          | 110 | Ortega   | 2005-09-02 00:00:00 | 90000  |
| 12 | Plant          | 112 | Singh    | 2012-03-01 00:00:00 | 43000  |
| 13 | Plant          | 113 | Jadhav   | 2001-08-01 00:00:00 | 91000  |
| 14 | Warehouse      | 118 | Okeke    | 2013-11-01 00:00:00 | 32000  |
| 15 | Warehouse      | 117 | Oezdem   | 2014-08-01 00:00:00 | 33000  |
| 16 | Warehouse      | 116 | Krause   | 2011-08-01 00:00:00 | 31000  |
| 17 | Warehouse      | 115 | Kumar    | 2013-05-01 00:00:00 | 32000  |
| 18 | Warehouse      | 114 | Popov    | 2009-03-02 00:00:00 | 34000  |

  
origin: table orgunit

  
origin: table employee

$$S1 = \{ a, b, c \}$$

$$S2 = \{ 1, 2 \}$$

$$S1 \times S2 = \{ (a,1), (b,1), (c,1), (a,2), (b,2), (c,2) \}$$

```
select *
from employee
cross join orgunit;
```

| * | EID | OID | LASTNAME | HIREDATE            | SALARY | BONUS  | OID | HEAD | SUPERUNIT | NAME |
|---|-----|-----|----------|---------------------|--------|--------|-----|------|-----------|------|
| 1 | 103 | 13  | Blaschke | 2002-11-01 00:00:00 | 93000  | (null) | 13  | 103  | 12        | HR   |
| 2 | 104 | 13  | Stone    | 2006-06-01 00:00:00 | 42000  | (null) | 13  | 103  | 12        | HR   |
| 3 | 105 | 13  | Dalal    | 2018-02-02 00:00:00 | 38000  | 1000   | 13  | 103  | 12        | HR   |
| 4 | 106 | 14  | Li       | 2002-12-01 00:00:00 | 89000  | (null) | 13  | 103  | 12        | HR   |
| 5 | 107 | 14  | Nguyen   | 2006-07-01 00:00:00 | 41000  | (null) | 13  | 103  | 12        | HR   |
| 6 | 108 | 14  | Sanchez  | 2014-04-01 00:00:00 | 39000  | 1500   | 13  | 103  | 12        | HR   |
| 7 | 109 | 15  | Umarani  | 2006-07-01 00:00:00 | 142000 | (null) | 13  | 103  | 12        | HR   |
| 8 | 110 | 16  | Ortega   | 2005-09-02 00:00:00 | 90000  | (null) | 13  | 103  | 12        | HR   |

...

|     |     |    |        |                     |        |        |    |     |    |                |
|-----|-----|----|--------|---------------------|--------|--------|----|-----|----|----------------|
| 120 | 114 | 17 | Popov  | 2009-03-02 00:00:00 | 34000  | (null) | 12 | 102 | 11 | Administration |
| 121 | 115 | 17 | Kumar  | 2013-05-01 00:00:00 | 32000  | (null) | 12 | 102 | 11 | Administration |
| 122 | 116 | 17 | Krause | 2011-08-01 00:00:00 | 31000  | (null) | 12 | 102 | 11 | Administration |
| 123 | 117 | 17 | Oezdem | 2014-08-01 00:00:00 | 33000  | 1900   | 12 | 102 | 11 | Administration |
| 124 | 118 | 17 | Okeke  | 2013-11-01 00:00:00 | 32000  | 1900   | 12 | 102 | 11 | Administration |
| 125 | 101 | 11 | Patil  | 2000-05-01 00:00:00 | 180000 | (null) | 12 | 102 | 11 | Administration |
| 126 | 102 | 12 | Durmaz | 2005-07-01 00:00:00 | 120000 | (null) | 12 | 102 | 11 | Administration |

all combination of rows, i.e  $18 \times 7 = 126$  records  
all columns of both tables

```

select *
from employee
      cross join orgunit
where employee.oid=orgunit.oid;
    
```

| *  | EID | OID | LASTNAME | HIREDATE            | SALARY | BONUS  | OID | HEAD | SUPERUNIT | NAME              |
|----|-----|-----|----------|---------------------|--------|--------|-----|------|-----------|-------------------|
| 1  | 101 | 11  | Patil    | 2000-05-01 00:00:00 | 180000 | (null) | 11  | 101  | (null)    | Company           |
| 2  | 102 | 12  | Durmaz   | 2005-07-01 00:00:00 | 120000 | (null) | 12  | 102  |           | 11 Administration |
| 3  | 105 | 13  | Dalal    | 2018-02-02 00:00:00 | 38000  | 1000   | 13  | 103  |           | 12 HR             |
| 4  | 103 | 13  | Blaschke | 2002-11-01 00:00:00 | 93000  | (null) | 13  | 103  |           | 12 HR             |
| 5  | 104 | 13  | Stone    | 2006-06-01 00:00:00 | 42000  | (null) | 13  | 103  |           | 12 HR             |
| 6  | 106 | 14  | Li       | 2002-12-01 00:00:00 | 89000  | (null) | 14  | 106  |           | 12 Accounting     |
| 7  | 107 | 14  | Nguyen   | 2006-07-01 00:00:00 | 41000  | (null) | 14  | 106  |           | 12 Accounting     |
| 8  | 108 | 14  | Sanchez  | 2014-04-01 00:00:00 | 39000  | 1500   | 14  | 106  |           | 12 Accounting     |
| 9  | 109 | 15  | Umarani  | 2006-07-01 00:00:00 | 142000 | (null) | 15  | 109  |           | 11 Production     |
| 10 | 111 | 16  | Doshi    | 2010-01-02 00:00:00 | 42000  | (null) | 16  | 110  |           | 15 Plant          |
| 11 | 110 | 16  | Ortega   | 2005-09-02 00:00:00 | 90000  | (null) | 16  | 110  |           | 15 Plant          |
| 12 | 112 | 16  | Singh    | 2012-03-01 00:00:00 | 43000  | 2100   | 16  | 110  |           | 15 Plant          |
| 13 | 113 | 16  | Jadhav   | 2001-08-01 00:00:00 | 91000  | (null) | 16  | 110  |           | 15 Plant          |
| 14 | 118 | 17  | Okeke    | 2013-11-01 00:00:00 | 32000  | 1900   | 17  | 109  |           | 15 Warehouse      |
| 15 | 117 | 17  | Oezdem   | 2014-08-01 00:00:00 | 33000  | 1900   | 17  | 109  |           | 15 Warehouse      |
| 16 | 116 | 17  | Krause   | 2011-08-01 00:00:00 | 31000  | (null) | 17  | 109  |           | 15 Warehouse      |
| 17 | 115 | 17  | Kumar    | 2013-05-01 00:00:00 | 32000  | (null) | 17  | 109  |           | 15 Warehouse      |
| 18 | 114 | 17  | Popov    | 2009-03-02 00:00:00 | 34000  | (null) | 17  | 109  |           | 15 Warehouse      |

Mittwoch, 21. April 2021 08:19

special syntax for combination of cartesian product and filtering

**select**

orgunit.name as orgunit,

employee.eid, employee.lastname as employee, employee.hiredate, employee.salary

**from** employee

**inner join** orgunit **on** orgunit.oid=employee.oid;

**short names for tables:**

employee e

orgunit ou

**inner join** can be abbreviated to **join**

short version of same query:

**select**

ou.name as orgunit,

e.eid, e.lastname as employee , e.hiredate, e.salary

**from** employee e

**join** orgunit ou **on** ou.oid=e.oid;

| *  | ORGUNIT        | EID | EMPLOYEE | HIREDATE            | SALARY |
|----|----------------|-----|----------|---------------------|--------|
| 1  | Company        | 101 | Patil    | 2000-05-01 00:00:00 | 180000 |
| 2  | Administration | 102 | Durmaz   | 2005-07-01 00:00:00 | 120000 |
| 3  | HR             | 105 | Dalal    | 2018-02-02 00:00:00 | 38000  |
| 4  | HR             | 103 | Blaschke | 2002-11-01 00:00:00 | 93000  |
| 5  | HR             | 104 | Stone    | 2006-06-01 00:00:00 | 42000  |
| 6  | Accounting     | 106 | Li       | 2002-12-01 00:00:00 | 89000  |
| 7  | Accounting     | 107 | Nguyen   | 2006-07-01 00:00:00 | 41000  |
| 8  | Accounting     | 108 | Sanchez  | 2014-04-01 00:00:00 | 39000  |
| 9  | Production     | 109 | Umarani  | 2006-07-01 00:00:00 | 142000 |
| 10 | Plant          | 111 | Doshi    | 2010-01-02 00:00:00 | 42000  |
| 11 | Plant          | 110 | Ortega   | 2005-09-02 00:00:00 | 90000  |
| 12 | Plant          | 112 | Singh    | 2012-03-01 00:00:00 | 43000  |
| 13 | Plant          | 113 | Jadhav   | 2001-08-01 00:00:00 | 91000  |
| 14 | Warehouse      | 118 | Okeke    | 2013-11-01 00:00:00 | 32000  |
| 15 | Warehouse      | 117 | Oezdem   | 2014-08-01 00:00:00 | 33000  |
| 16 | Warehouse      | 116 | Krause   | 2011-08-01 00:00:00 | 31000  |
| 17 | Warehouse      | 115 | Kumar    | 2013-05-01 00:00:00 | 32000  |
| 18 | Warehouse      | 114 | Popov    | 2009-03-02 00:00:00 | 34000  |

# Inner Working of Joins

Montag, 14. Oktober 2019

```
select *  
from R  
join S on B=D;
```

| R   |   |
|-----|---|
| A   | B |
| 10  | a |
| 100 | b |

| S   |   |
|-----|---|
| C   | D |
| 20  | a |
| 200 | b |

|     |   |     |   |
|-----|---|-----|---|
| 10  | a | 20  | a |
| 100 | b | 200 | b |

| R   |   |
|-----|---|
| A   | B |
| 10  | a |
| 100 | a |

| S   |   |
|-----|---|
| C   | D |
| 20  | a |
| 200 | b |

|     |   |    |   |
|-----|---|----|---|
| 10  | a | 20 | a |
| 100 | a | 20 | a |

multiple occurrence  
of that record due to  
many connections

doesn't appear in output,  
there is no connection

```
select p.title, e.lastname  
from project p  
      join empproj ep on ep.pid=p.pid  
      join employee e on e.eid=ep.eid  
order by p.title;
```

different order of tables -  
same result

```
select p.title, e.lastname  
from empproj ep  
      join project p on p.pid=ep.pid  
      join employee e on e.eid=ep.eid  
order by p.title;
```

```
select p.title, e.lastname  
from empproj ep  
      join employee e on e.eid=ep.eid  
      join project p on p.pid=ep.pid  
order by p.title;
```

| * | TITLE                  | LASTNAME |
|---|------------------------|----------|
| 1 | CRM                    | Durmaz   |
| 2 | CRM                    | Blaschke |
| 3 | Plant Restructurierung | Popov    |
| 4 | Plant Restructurierung | Umarani  |
| 5 | Plant Restructurierung | Oezdem   |
| 6 | Plant Restructurierung | Okeke    |
| 7 | Strategy               | Patil    |
| 8 | Strategy               | Durmaz   |
| 9 | Strategy               | Umarani  |

an arbitrary number of tables can be  
joined in one statement



```
select  
  parent.name as parent_unit,  
  child.name as child_unit  
from orgunit parent  
      join orgunit child on child.superunit=parent.oid;
```

| * | PARENT_UNIT    | CHILD_UNIT     |
|---|----------------|----------------|
| 1 | Company        | Production     |
| 2 | Company        | Administration |
| 3 | Administration | Accounting     |
| 4 | Administration | HR             |
| 5 | Production     | Warehouse      |
| 6 | Production     | Plant          |

twofold usage of same table -  
requires different names of that table

Goal: get "non-bosses"

(wrong) approach != in join

```
select e.lastname as employee
from employee e
join orgunit ou on ou.head != e.eid
order by e.lastname;
```

delivers 119 records!

| *  | EMPLOYEE |
|----|----------|
| 1  | Blaschke |
| 2  | Blaschke |
| 3  | Blaschke |
| 4  | Blaschke |
| 5  | Blaschke |
| 6  | Blaschke |
| 7  | Dalal    |
| 8  | Dalal    |
| 9  | Dalal    |
| 10 | Dalal    |
| 11 | Dalal    |
| 12 | Dalal    |
| 13 | Dalal    |

...

|    |        |
|----|--------|
| 14 | Doshi  |
| 15 | Doshi  |
| 16 | Doshi  |
| 17 | Doshi  |
| 18 | Doshi  |
| 19 | Doshi  |
| 20 | Doshi  |
| 21 | Durmaz |
| 22 | Durmaz |
| 23 | Durmaz |
| 24 | Durmaz |
| 25 | Durmaz |
| 26 | Durmaz |

...

|     |         |
|-----|---------|
| 101 | Singh   |
| 102 | Singh   |
| 103 | Singh   |
| 104 | Singh   |
| 105 | Singh   |
| 106 | Singh   |
| 107 | Singh   |
| 108 | Stone   |
| 109 | Stone   |
| 110 | Stone   |
| 111 | Stone   |
| 112 | Stone   |
| 113 | Stone   |
| 114 | Stone   |
| 115 | Umarani |
| 116 | Umarani |
| 117 | Umarani |
| 118 | Umarani |
| 119 | Umarani |

Actual head-of relationships

| *  | EMPLOYEE | HEAD_OF        |
|----|----------|----------------|
| 1  | Patil    | Company        |
| 2  | Durmaz   | Administration |
| 3  | Blaschke | HR             |
| 4  | Stone    | (null)         |
| 5  | Dalal    | (null)         |
| 6  | Li       | Accounting     |
| 7  | Nguyen   | (null)         |
| 8  | Sanchez  | (null)         |
| 9  | Umarani  | Production     |
| 10 | Umarani  | Warehouse      |
| 11 | Ortega   | Plant          |
| 12 | Doshi    | (null)         |
| 13 | Singh    | (null)         |
| 14 | Jadhav   | (null)         |
| 15 | Popov    | (null)         |
| 16 | Kumar    | (null)         |
| 17 | Krause   | (null)         |
| 18 | Oezdem   | (null)         |
| 19 | Okeke    | (null)         |

6 duplications for bosses  
7 duplications for non-bosses

# Outer Join

Montag, 14. Oktober 2019 18:08

| R  |     |
|----|-----|
| A  | B   |
| 10 | 100 |
| 11 | 101 |

| S  |     |
|----|-----|
| C  | D   |
| 20 | 100 |
| 22 | 102 |

```
select *  
from R  
inner join S on B=D;
```

| A  | B   | C  | D   |
|----|-----|----|-----|
| 10 | 100 | 20 | 100 |

```
select *  
from R  
left outer join S on B=D;
```

| A  | B   | C    | D    |
|----|-----|------|------|
| 10 | 100 | 20   | 100  |
| 11 | 101 | null | null |

```
select *  
from R  
right outer join S on B=D;
```

| A    | B    | C  | D   |
|------|------|----|-----|
| 10   | 100  | 20 | 100 |
| null | null | 22 | 102 |

Keyword **outer**  
is optional

```
select *  
from R  
full outer join S on B=D;
```

| A    | B    | C    | D    |
|------|------|------|------|
| 10   | 100  | 20   | 100  |
| 11   | 101  | null | null |
| null | null | 22   | 102  |

## select

```
e.lastname as employee,  
ou.name as head  
from employee e  
  join orgunit ou  
    on ou.head=e.eid;
```

### bosses

| * | EMPLOYEE | HEAD           |
|---|----------|----------------|
| 1 | Patil    | Company        |
| 2 | Durmaz   | Administration |
| 3 | Blaschke | HR             |
| 4 | Li       | Accounting     |
| 5 | Umarani  | Production     |
| 6 | Umarani  | Warehouse      |
| 7 | Ortega   | Plant          |

## select

```
e.lastname as employee,  
ou.name as head  
from employee e  
  left join orgunit ou  
    on ou.head=e.eid;
```

### bosses and non-bosses

| *  | EMPLOYEE | HEAD           |
|----|----------|----------------|
| 1  | Patil    | Company        |
| 2  | Durmaz   | Administration |
| 3  | Blaschke | HR             |
| 4  | Stone    | (null)         |
| 5  | Dalal    | (null)         |
| 6  | Li       | Accounting     |
| 7  | Nguyen   | (null)         |
| 8  | Sanchez  | (null)         |
| 9  | Umarani  | Production     |
| 10 | Umarani  | Warehouse      |
| 11 | Ortega   | Plant          |
| 12 | Doshi    | (null)         |
| 13 | Singh    | (null)         |
| 14 | Jadhav   | (null)         |
| 15 | Popov    | (null)         |
| 16 | Kumar    | (null)         |
| 17 | Krause   | (null)         |
| 18 | Oezdem   | (null)         |
| 19 | Okeke    | (null)         |

## select

```
e.lastname as employee,  
ou.name as head  
from employee e  
  left join orgunit ou  
    on ou.head=e.eid  
where ou.head is null;
```

### non-bosses

| *  | EMPLOYEE | HEAD   |
|----|----------|--------|
| 1  | Stone    | (null) |
| 2  | Dalal    | (null) |
| 3  | Nguyen   | (null) |
| 4  | Sanchez  | (null) |
| 5  | Doshi    | (null) |
| 6  | Singh    | (null) |
| 7  | Jadhav   | (null) |
| 8  | Popov    | (null) |
| 9  | Kumar    | (null) |
| 10 | Krause   | (null) |
| 11 | Oezdem   | (null) |
| 12 | Okeke    | (null) |

Union [all]  
intersect  
minus

Combine tables with same  
structure

```
select lastname  
from employee  
minus  
select lastname  
from employee  
  join orgunit on head=eid;
```