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1. Predicates and nulls

The expressions we have been using in the Where clause are called predicates- they are expressions that have a truth value- that value can be True, False, or Unknown. Let's consider the z_name value in the zoo_2016 table. These are rows I currently have in that table.

```
select z_id, z_type, z_name
from a_testbed.zoo_2016;
+------+-----------+----------------+
| z_id | z_type    | z_name         |
+------+-----------+----------------+
|   23 | Giraffe   | Sam            |
|   25 | Armadillo | Abigail        |
|   56 | Lion      | Leon           |
|   57 | Lion      | Lenora         |
|   85 | Giraffe   | Sally Robinson |
|   43 | Zebra     | Huey           |
|   44 | Zebra     | Dewey          |
|   45 | Zebra     | Louie          |
|   47 | Horse     | NULL           |
|   52 | Giraffe   | Dewey          |
+------+-----------+----------------+
```

Suppose we write the following query:

```
select z_id, z_type, z_name
from a_testbed.zoo_2016
where z_name in ('Sam', 'Dewey', 'Trixie')
;
+------+-----------+---------+
| z_id | z_type    | z_name  |
+------+-----------+---------+
|   23 | Giraffe   | Sam     |
|   44 | Zebra     | Dewey   |
|   52 | Giraffe   | Dewey   |
+------+-----------+---------+
```

This query is executed by looking at each row in the zoo table, one row at a time, evaluating that expression.

The query is **logically** executed as using the From clause to get data from the zoo_2016 table into a temporary storage area

Then evaluating the Where clause- looking at the first row

```
23 Giraffe                  Sam
```

and evaluating the expression in the Where clause; for this row that expression evaluates as True and the row is passed into the result set.

Then the query is logically executed as looking at the next row

```
25 Armadillo                Abigail
```

and evaluating the expression in the Where clause; for this row that expression evaluates as False and the row is not passed into the result set.

Then the query is logically executed as looking at the next row

```
56 Lion                   Leon
```

and evaluating the expression in the Where clause; for this row that expression evaluates as False and the row is not passed into the result set.

The predicate is evaluated independently for each row as the query executes. The value of the predicate, **z_name** in ('Sam', 'Dewey', 'Trixie'),is dependent on the value of the column z_name for this row. In the case of the row for z_id 47, the name column is null and the truth value of the expression is unknown.

We are not sure what the human meaning is of the null in the z_name column for this row- it could be that is a horse with no name or it could be that the horse has a name but the person entering the data did not know what the name is; it could even be that the horse is a very private animal and did not want his name entered in the database! But as far as SQL and queries are concerned, the query is evaluated as if we do not know the name and therefore we do not know if the name is Sam or Dewey or Trixie- we just do not know- and so the value of the predicate is Unknown. The rule for a Where clause is that if the predicate evaluates as True then the row is returned into the result; if the predicate is evaluated as False or a Unknown the row is not returned into the result.

Suppose we change the Where clause to Where z_name Is Null. With that predicate, the value of the predicate is True for the row with z_id = 47 and False for the other rows.

1.1. Predicates and propositions (Optional)

The expression `z_name in ('Sam', 'Dewey', 'Trixie')` is called a predicate. It contains a parameter (z_name). We cannot tell if this predicate is True or not until we know a specific value for z_name. Once the dbms evaluates the expression for the row with z_id 23, the expression becomes `'Sam' in ('Sam', 'Dewey', 'Trixie'.` That is a proposition and has a truth value. The value of that proposition is True so that row is in the result. When the dbms evaluates the expression for the row with z_id 25, the expression becomes `'Abigail' in ('Sam', 'Dewey', 'Trixie')` and that is not true so that row is not in the result.

Examples:

Predicate: x > 10 We cannot tell if this expression has the value True or False since we do not have a value for x

Proposition: 15 > 10. That has the value True.

Proposition: 2 > 10. That has the value False.

2. Logical processing order of the Select statement

When you create a select statement you write the statements with the following model.

```
Select   column-expressions
From     table-expression
Where    filter_expressions
Order By sort-keys;
```

When the query is presented to the dbms, the parser and optimizer determine the actual steps used in the execution and you do not directly control that. But you should consider the statement as being processed in the following order.

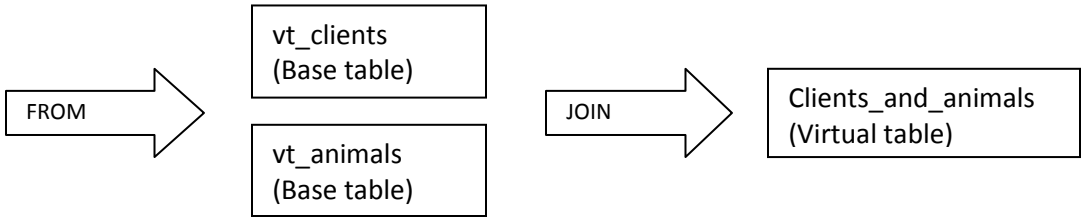
1. The FROM clause is evaluated first
2. The WHERE clause
3. The SELECT clause
4. The ORDER BY clause is done last

Suppose we are running this query; the From clause joins two tables.

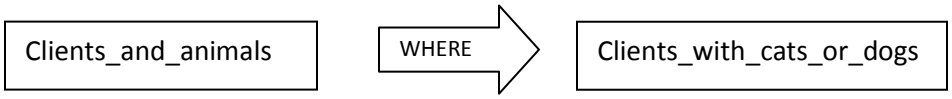
```
select concat(cl_name_last , ', ' , cl_name_first) as ClientName
, an_name as AnimalName
from vets.vt_clients CL
join vets.vt_animals AN  on CL.cl_id = AN.cl_id
where an_type in ('cat', 'dog')
```

```
order by ClientName, AnimalName;
```

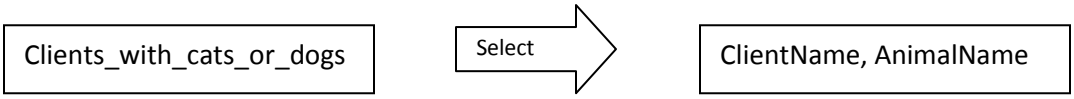
The **From** clause assembles a collection of rows from the table or tables to be used. In this unit we start to talk about more complex From clauses- but the purpose of the From clause is to get data from the tables and build the first virtual table. The optimizer ends up determining the order in which these rows are ordered in the virtual table.



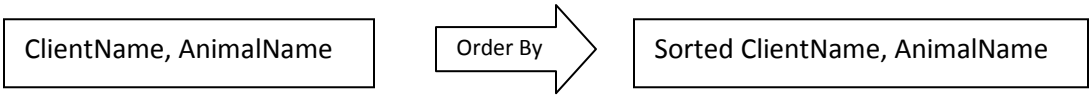
The **Where** clause filters that first virtual table for the rows that meet the Where clause filters. Assume we have a Where clause that filters for an_type in ('cat', 'dog'). The Where clause now produces a second virtual table that includes only the clients with cats and/or dogs. We have no control over the order of the rows in this virtual table.



The **Select** clause now takes that virtual table and returns only the columns and expressions in the Select clause. Perhaps we want to display only the client name and the animal name. We can also provide column aliases at this step. Since the column alias is defined only in the Select clause, MySQL does not let you use column aliases in the Where clause. MySQL also does not let you use the column alias for one of the columns to calculate another column in the select.



The **Order By** clause takes that last virtual table and sorts the rows.



Since the column aliases are now defined, we can use them in the Order By clause.

```
select concat(cl_name_last , ', ' , cl_name_first) as ClientName
, an_name as AnimalName
from vets.vt_clients CL
join vets.vt_animals AN  on CL.cl_id = AN.cl_id
where an_type in ('cat', 'dog')
order by ClientName, AnimalName;
```