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### ADBMS Experiment-3

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ADBMS  
[Exp 3]

21  
ES

Page No. 1  
Date

Aim: To simulate query optimisation by performing SQL query on database

Theory: Query optimization is of great importance for performance of a relational database, especially for execution of complexed SQL statements. There are 2 ways:-

1) Heuristic Based 2) Cost Based

Heuristic Based:-

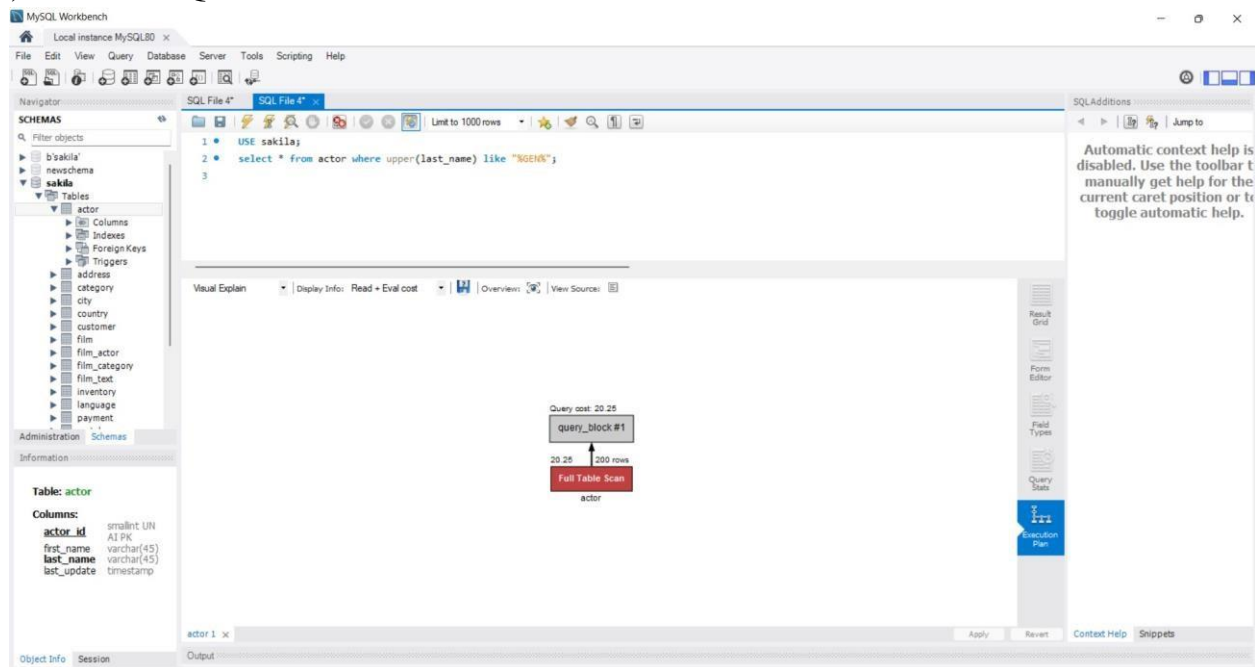
A query tree is a data structure that corresponds to a relational algebra expression. The same query could be corresponding to many different relational expressions & hence many different query trees. The task of heuristic optimization of query trees is to find a final query tree that is efficient to execute. The main heuristic is to apply first the operations that reduce the size of intermediate results.

Cost Based:-

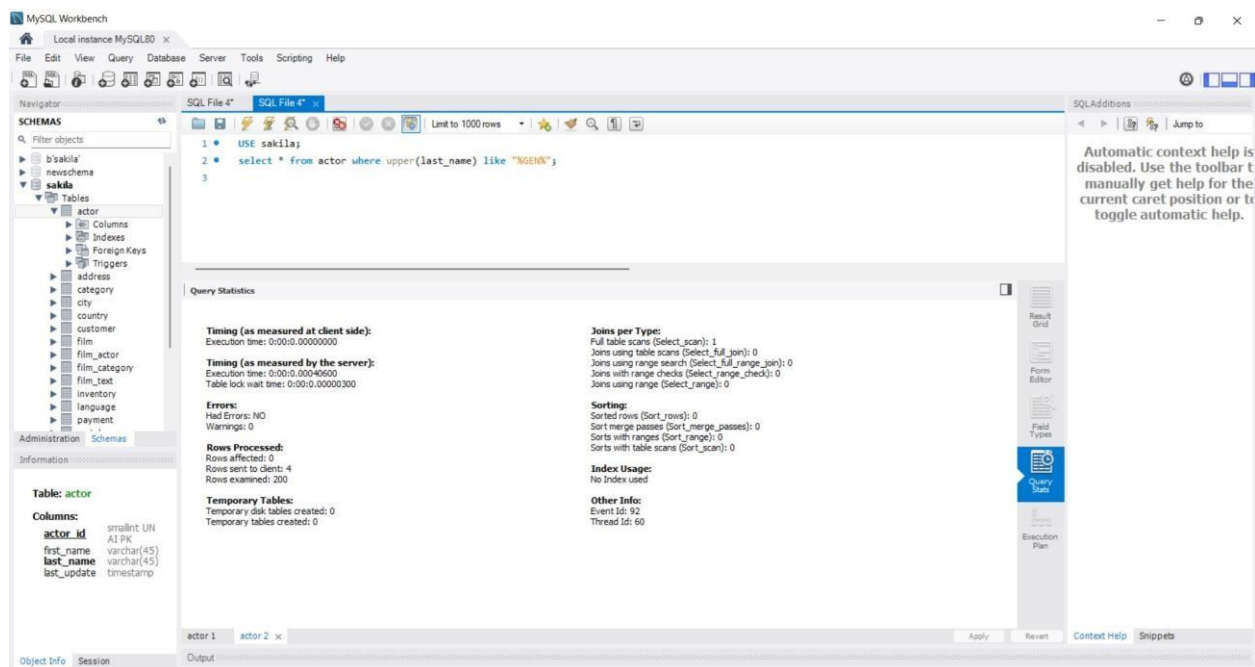
Estimate and compare the cost of executing a query using different execution strategies and choose the strategy with lowest cost estimate. The cost of any query includes access cost to secondary storage, storage cost, memory usage cost, no. of memory buffers at time of execution, communication etc.

Conclusion: In this experiment we have performed table level and index level optimization and compared it to the results of no optimization.

# 1) SELECT QUERY



## BEFORE OPTIMIZING



## AFTER OPTIMIZING

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4'

1 USE sakila;

2 select \* from actor where upper(last\_name) like "NGEM";

3 optimize table actor;

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.06200000

Timing (as measured by the server):

Execution time: 0:00:0.05738333

Table lock wait time: 0:00:0.00003900

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 0

Rows examined: 0

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 0

Joins per Type:

Full table scans (Select\_scan): 0

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

At least one Index was used

Other Info:

Event Id: 106

Thread Id: 60

actor 3 Result 4 Result 5 x

Output

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## 2) NESTED

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4'

1 USE sakila;

2 select \* from actor where upper(last\_name) like "NGEM";

3 SELECT concat(first\_name, " ", last\_name) AS name, email

4 from customer where customer\_id IN

5 (select customer\_id from rental where inventory\_id in

6 (select inventory\_id from inventory where film\_id in

7 (select film\_id from film\_category join category using (category\_id) where category.name = "Action")));

Visual Explain

Display Info: Read + Eval cost Overview: View Sources

Query cost: 1483.11

query\_block #1

DISTINCT

tmp table

1483.11 rows

nested loop

1.67K rows

670.11

584.97

3 rows

Non-Unique Key Lookup

rental idx\_R\_invent\_id

72.88

4 rows

Non-Unique Key Lookup

inventory idx\_R\_film\_id

10.41

62 rows

Non-Unique Key Lookup

film\_category fk\_film\_category\_category

12.20

100 rows

nested loop

1.8499999999999999

Full Table Scan

category

actor 6 Result 7 x

Output

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

BEFORE OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(5) UNSIGNED ZEROFILL PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4'

SQL File 4'

Limit to 1000 rows

```
1 USE sakila;
2 select * from actor where upper(last_name) like "BGENN";
3 SELECT concat(first_name, " ", last_name) AS name, email
4 from customer where customer_id IN
5 (select customer_id from rental where inventory_id in
6 (select inventory_id from inventory where film_id in
7 (select film_id from film_category join category using (category_id) where category.name = "Action"))));
```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.00000000

Timing (as measured by the server):

Execution time: 0:00:0.0034630

Table lock wait time: 0:00:0.00000400

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 510

Rows examined: 2616

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 1

Joins per Type:

Full table scans (Select\_scan): 1

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

No Index used

Other Info:

Event Id: 130

Thread Id: 60

actor 6 Result 7 Result 8 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Result Grid

Form Editor

Field Types

Query Stats

Execution Plan

Apply Revert Context Help Snippets

## AFTER OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(5) UNSIGNED ZEROFILL PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4'

SQL File 4'

Limit to 1000 rows

```
3 SELECT concat(first_name, " ", last_name) AS name, email
4 from customer where customer_id IN
5 (select customer_id from rental where inventory_id in
6 (select inventory_id from inventory where film_id in
7 (select film_id from film_category join category using (category_id) where category.name = "Action"))));
8
9 optimize table customer , rental , inventory , category ;
```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.62500000

Timing (as measured by the server):

Execution time: 0:00:0.41263200

Table lock wait time: 0:00:0.00011400

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 0

Rows examined: 0

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 0

Joins per Type:

Full table scans (Select\_scan): 0

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

At least one Index was used

Other Info:

Event Id: 135

Thread Id: 60

actor 6 Result 7 Result 8 Result 9 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Result Grid

Form Editor

Field Types

Query Stats

Execution Plan

Apply Revert Context Help Snippets



### 3) LEFT JOIN

The screenshot shows the MySQL Workbench interface. The SQL editor contains the following query:

```
6 (select inventory_id from inventory where file_id in
7 (select file_id from film_category join category using (category_id) where category.name = "Action"));
8
9 select stf.first_name, stf.last_name, ad.address, ad.district, ad.postal_code, ad.city_id
10 from staff stf
11 left join address ad
12 on stf.address_id = ad.address_id;
```

The Visual Explain tab shows the execution plan:

- Query cost: 3.90
- query\_block #1 (2 rows)
- nested loop (3.9)
- Full Table Scan stf (3.2, 2 rows)
- Unique Key Lookup ad PRIMARY (0.7, 1 row)

The right sidebar contains a help message: "Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help."

### BEFORE OPTIMIZING

The screenshot shows the MySQL Workbench interface with the same query as above. The Query Statistics tab is selected, displaying the following information:

**Timing (as measured at client side):**  
Execution time: 0:00:0.00000000

**Timing (as measured by the server):**  
Execution time: 0:00:0.00041500  
Table lock wait time: 0:00:0.00000400

**Errors:**  
Had Errors: NO  
Warnings: 0

**Rows Processed:**  
Rows affected: 0  
Rows sent to client: 2  
Rows examined: 4

**Temporary Tables:**  
Temporary disk tables created: 0  
Temporary tables created: 0

**Joins per Type:**  
Full table scans (Select\_scan): 1  
Joins using table scans (Select\_full\_join): 0  
Joins using range search (Select\_full\_range\_join): 0  
Joins with range checks (Select\_range\_check): 0  
Joins using range (Select\_range): 0

**Sorting:**  
Sorted rows (Sort\_rows): 0  
Sort merge passes (Sort\_merge\_passes): 0  
Sorts with ranges (Sort\_range): 0  
Sorts with table scans (Sort\_scan): 0

**Index Usage:**  
No Index used

**Other Info:**  
Event Id: 170  
Thread Id: 60

The right sidebar contains the same help message as the previous screenshot.

### AFTER OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(11) UNSIGNED NOT NULL AUTO\_INCREMENT PRIMARY KEY

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4\*

SQL File 4\*

Limit to 1000 rows

8

9 select stf.first\_name, stf.last\_name, ad.address, ad.district, ad.postal\_code, ad.city\_id

10 from staff stf

11 left join address ad

12 on stf.address\_id = ad.address\_id;

13

14 optimize table staff, address

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.1870000

Timing (as measured by the server):

Execution time: 0:00:0.1717933

Table lock wait time: 0:00:0.0001100

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 0

Rows examined: 0

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 0

Joins per Type:

Full table scans (Select\_scan): 0

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

At least one Index was used

Other Info:

Event Id: 191

Thread Id: 60

actor 14 Result 15 Result 16 Result 17 Result 18 x

Apply Revert Context Help Snippets

Output

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## 4) RIGHT JOIN

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(11) UNSIGNED NOT NULL AUTO\_INCREMENT PRIMARY KEY

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4\*

SQL File 4\*

Limit to 1000 rows

15 from film film

16 right join film\_actor film\_act

17 on film.file\_id = film\_act.film\_id

18 group by film.title

19 order by number\_of\_actors desc;

20

21

Visual Explain

Display Info: Read + Eval cost

Overview: View Sources

Query cost: 0.154.92

query\_block #1

ORDER

filesort

GROUP

tmp table

0.154 15.48K rows

550.38 5.48K rows

Full Index Scan

film\_act

idx\_R\_film\_id

5588.55 1 row

Unique Key Lookup

film

PRIMARY

actor 36 Result 37 Result 38 Result 39 x

Read Only Context Help Snippets

Output

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

BEFORE OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila'

newschema

sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) UNSIGNED ZEROFILL AI PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4'

Limit to 1000 rows

```

15 from film film
16 right join film_actor film_act
17 on film.file_id = film_act.film_id
18 group by film.title
19 order by number_of_actors desc;
20
21

```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.00000000

Timing (as measured by the server):

Execution time: 0:00:0.0033390

Table lock wait time: 0:00:0.00000300

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 997

Rows examined: 11921

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 1

Joins per Type:

Full table scans (Select\_scan): 1

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 997

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 1

Index Usage:

At least one Index was used

Other Info:

Event Id: 325

Thread Id: 60

actor 36 Result 37 Result 38 Result 39 Result 40 x

Apply Revert Context Help Snippets

Output

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## AFTER OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila'

newschema

sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) UNSIGNED ZEROFILL AI PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4'

Limit to 1000 rows

```

15 from film film
16 right join film_actor film_act
17 on film.file_id = film_act.film_id
18 group by film.title
19 order by number_of_actors desc;
20
21 * optimize table film , film_actor

```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.23400000

Timing (as measured by the server):

Execution time: 0:00:0.2194460

Table lock wait time: 0:00:0.00005600

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 0

Rows examined: 0

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 0

Joins per Type:

Full table scans (Select\_scan): 0

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

At least one Index was used

Other Info:

Event Id: 330

Thread Id: 60

actor 36 Result 37 Result 38 Result 39 Result 40 Result 41 x

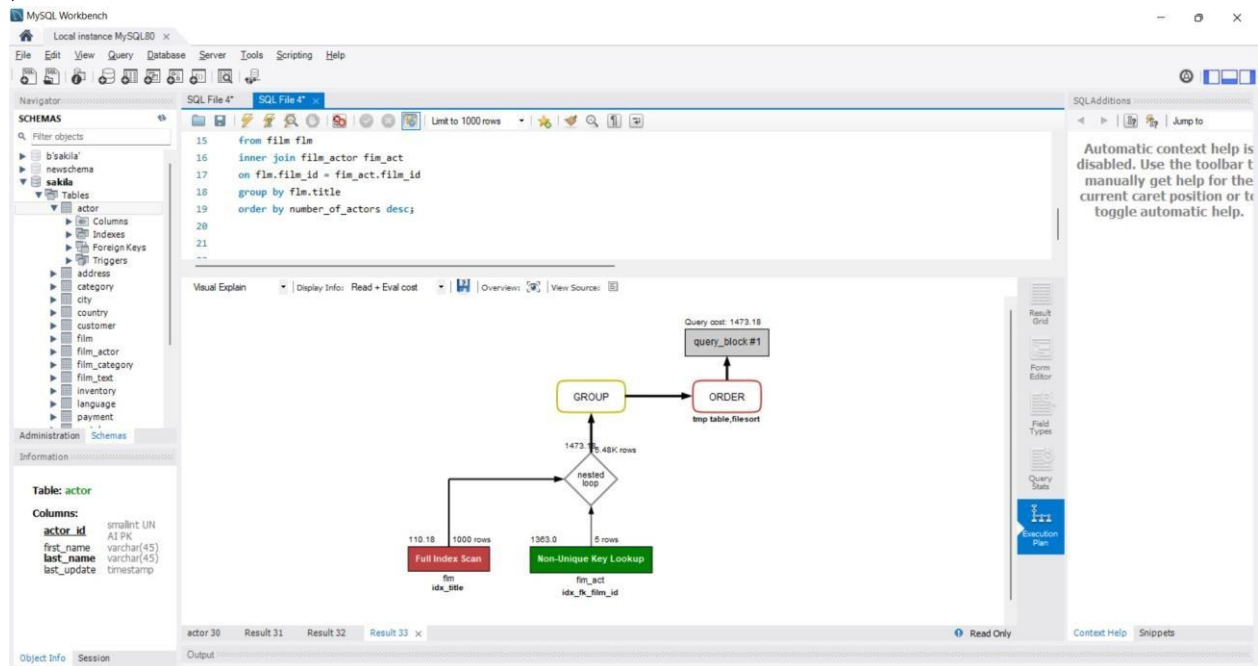
Apply Revert Context Help Snippets

Output

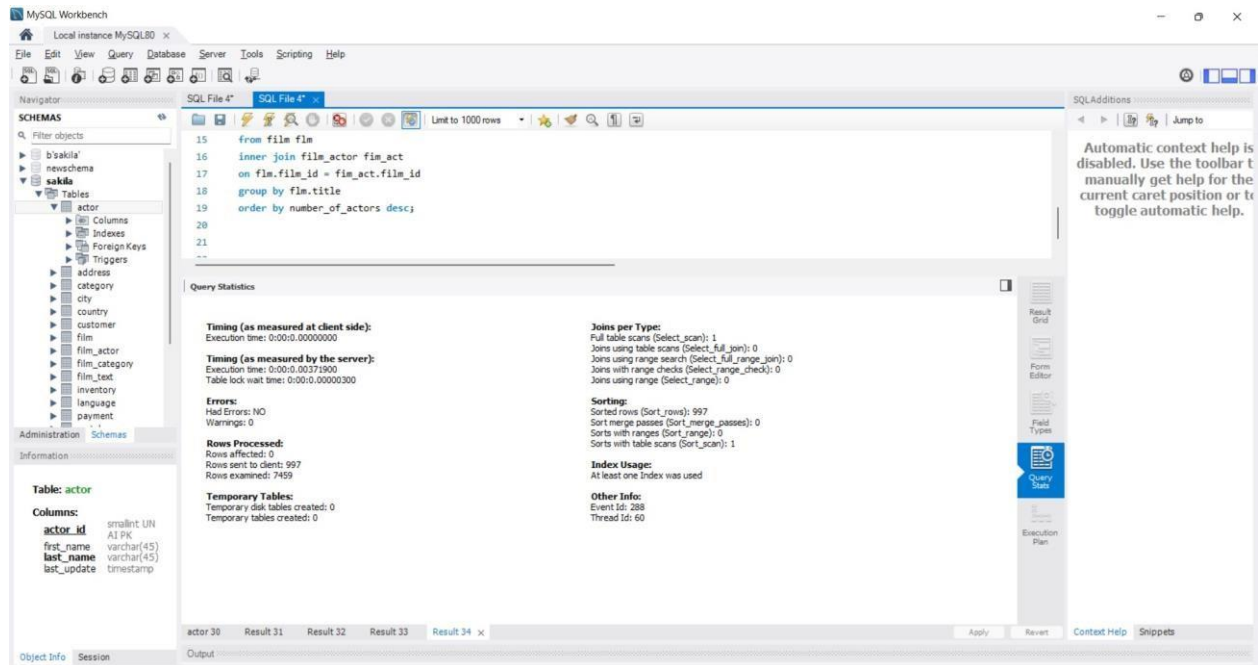
Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.



## 5) INNER JOIN



## BEFORE OPTIMIZING



## AFTER OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b/sakila  
newschema  
sakila

Tables

actor  
address  
category  
city  
country  
customer  
film  
film\_actor  
film\_category  
film\_text  
inventory  
language  
payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(5) UNSIGNED  
first\_name varchar(45)  
last\_name varchar(45)  
last\_update timestamp

SQL File 4\*

```

15 from film film
16 inner join film_actor film_act
17 on film.film_id = film_act.film_id
18 group by film.title
19 order by number_of_actors desc;
20
21 optimize table film, film_actor

```

Query Statistics

Timing (as measured at client side):  
Execution time: 0:00:0.8880000

Timing (as measured by the server):  
Execution time: 0:00:0.17638100  
Table lock wait time: 0:00:0.00006000

Errors:  
Had Errors: NO  
Warnings: 0

Rows Processed:  
Rows affected: 0  
Rows sent to client: 0  
Rows examined: 0

Temporary Tables:  
Temporary disk tables created: 0  
Temporary tables created: 0

Joins per Type:  
Full table scans (Select\_scan): 0  
Joins using table scans (Select\_full\_join): 0  
Joins using range search (Select\_full\_range\_join): 0  
Joins with range checks (Select\_range\_check): 0  
Joins using range (Select\_range): 0

Sorting:  
Sorted rows (Sort\_rows): 0  
Sort merge passes (Sort\_merge\_passes): 0  
Sorts with ranges (Sort\_range): 0  
Sorts with table scans (Sort\_scan): 0

Index Usage:  
At least one Index was used

Other Info:  
Event Id: 293  
Thread Id: 60

actor 36 Result 31 Result 32 Result 33 Result 34 Result 35 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## 6) CROSS JOIN

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b/sakila  
newschema  
sakila

Tables

actor  
address  
category  
city  
country  
customer  
film  
film\_actor  
film\_category  
film\_text  
inventory  
language  
payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(5) UNSIGNED  
first\_name varchar(45)  
last\_name varchar(45)  
last\_update timestamp

SQL File 4\*

```

15 from film film
16 cross join film_actor film_act
17 on film.film_id = film_act.film_id
18 group by film.title
19 order by number_of_actors desc;
20
21

```

Visual Explain

Display Info Read + Eval cost Overview View Source

Query cost: 901.00

GROUP

ORDER

temp table, filesort

nested loop

Full Index Scan

Non-Unique Key Lookup

film  
idx\_title

film\_actor  
idx\_fk\_film\_id

actor 19 Result 20 Result 21 Result 22 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

BEFORE OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4\*

Limit to 1000 rows

```
15 from film film
16 cross join film_actor film_act
17 on film.film_id = film_act.film_id
18 group by film.title
19 order by number_of_actors desc;
20
21
```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.01500000

Timing (as measured by the server):

Execution time: 0:00:0.0031150

Table lock wait time: 0:00:0.00000300

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 997

Rows examined: 7459

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 0

Joins per Type:

Full table scans (Select\_scan): 1

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 997

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 1

Index Usage:

At least one Index was used

Other Info:

Event Id: 222

Thread Id: 60

actor 19 Result 20 Result 21 Result 22 Result 23 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## AFTER OPTIMIZING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4\*

Limit to 1000 rows

```
15 from film film
16 cross join film_actor film_act
17 on film.film_id = film_act.film_id
18 group by film.title
19 order by number_of_actors desc;
20
21 * optimize table film , film_actor
22 --
```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.18800000

Timing (as measured by the server):

Execution time: 0:00:0.1922070

Table lock wait time: 0:00:0.00007700

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 0

Rows examined: 0

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 0

Joins per Type:

Full table scans (Select\_scan): 0

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

At least one Index was used

Other Info:

Event Id: 245

Thread Id: 60

actor 24 Result 25 Result 26 Result 27 Result 28 Result 29 x

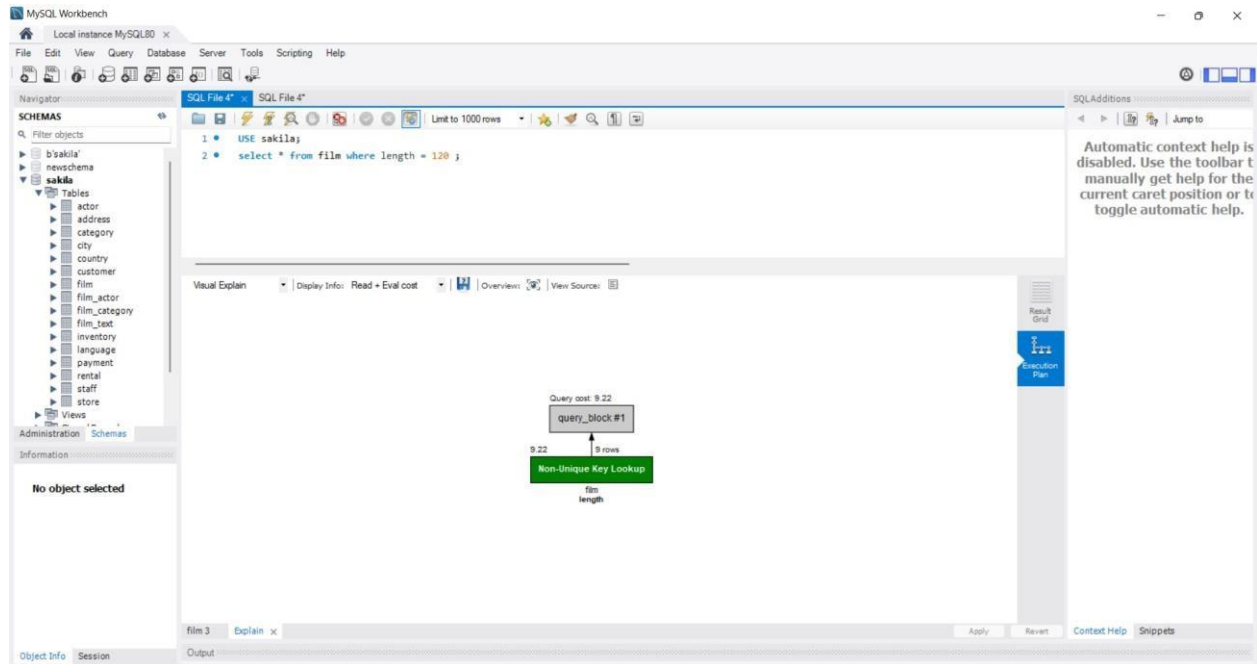
Output

SQLAdditions

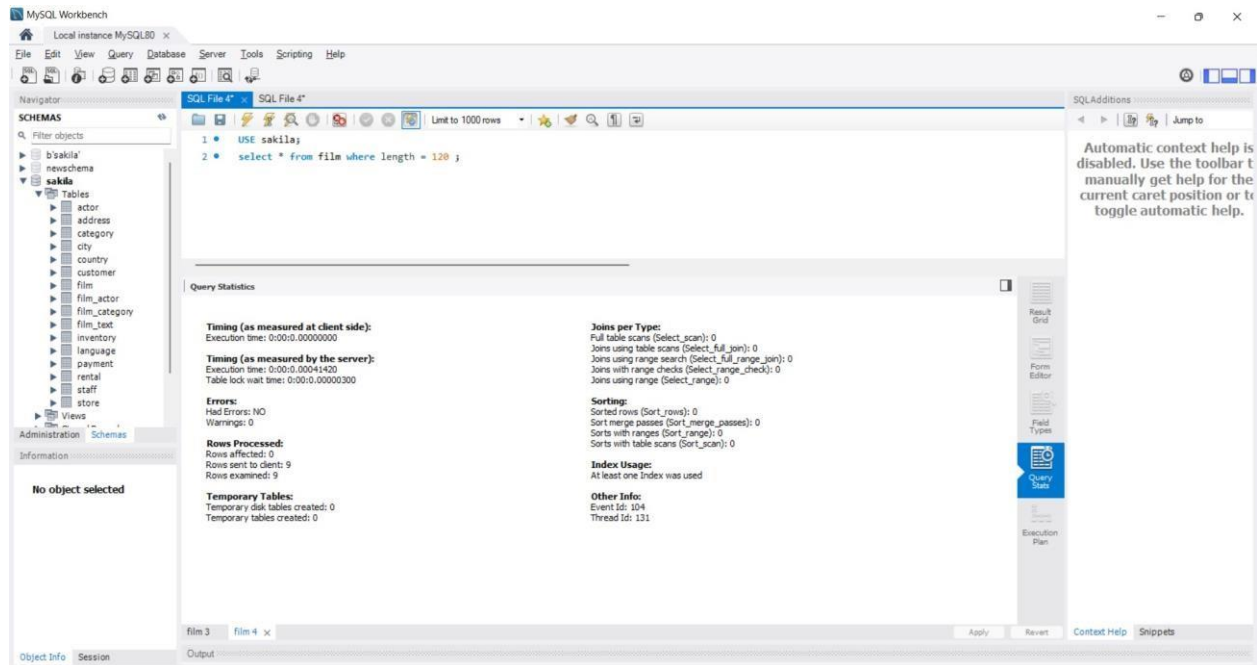
Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## USING INDEXING

# 1)SIMPLE QUERY



## BEFORE INDEXING



## AFTER INDEXING

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor address category city country customer film film\_actor film\_category film\_text inventory language payment rental staff store

Views

Administration Schemas

Information

No object selected

SQL File 4\*

```

1 USE sakila;
2 create index length on film(length);
3 select * from film where length = 128 ;

```

Query Statistics

Timing (as measured at client side):  
Execution time: 0:00:0.00000000

Timing (as measured by the server):  
Execution time: 0:00:0.00036020  
Table lock wait time: 0:00:0.00000200

Errors:  
Had Errors: NO  
Warnings: 0

Rows Processed:  
Rows affected: 0  
Rows sent to client: 9  
Rows examined: 9

Temporary Tables:  
Temporary disk tables created: 0  
Temporary tables created: 0

Joins per Type:  
Full table scans (Select\_scan): 0  
Joins using table scans (Select\_full\_join): 0  
Joins using range search (Select\_full\_range\_join): 0  
Joins with range checks (Select\_range\_check): 0  
Joins using range (Select\_range): 0

Sorting:  
Sorted rows (Sort\_rows): 0  
Sort merge passes (Sort\_merge\_passes): 0  
Sorts with ranges (Sort\_range): 0  
Sorts with table scans (Sort\_scan): 0

Index Usage:  
At least one Index was used

Other Info:  
Event Id: 143  
Thread Id: 131

Explain film 5 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## 2) NESTED

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema sakila

Tables

actor Columns Indexes Foreign Keys Triggers address category city country customer film film\_actor film\_category film\_text inventory language payment rental staff store

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(5) UNSIGNED ZEROFILL AI PK  
first\_name varchar(45)  
last\_name varchar(45)  
last\_update timestamp

SQL File 4\*

```

1 USE sakila;
2 select * from actor where upper(last_name) like "JGENA";
3 SELECT concat(first_name, " ", last_name) AS name, email
4 from customer where customer_id IN
5 (select customer_id from rental where inventory_id in
6 (select inventory_id from inventory where film_id in
7 (select film_id from film_category join category using (category_id) where category.name = "Action"))));

```

Visual Explain

Display Info: Read + Eval cost Overview: View Sources

Query cost: 1483.11

query\_block #1

DISTINCT

tmp table

1483.11 rows

nested loop

477.73999999999995

Unique Key Lookup

customer PRIMARY

1.67K rows

nested loop

670.11

Non-Unique Key Lookup

rental idx\_rental\_inventory\_id

3 rows

584.97

Non-Unique Key Lookup

inventory idx\_inventory\_id

4 rows

72.88

Non-Unique Key Lookup

film\_category fk\_film\_category\_category

62 rows

10.41

Non-Unique Key Lookup

category

1.8499999999999999

Full Table Scan

12.20

nested loop

100 rows

85.14

nested loop

478 rows

actor 6 Result 7 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

BEFORE INDEXING



MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema

sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: actor

Columns:

actor\_id smallint(4) PK

first\_name varchar(45)

last\_name varchar(45)

last\_update timestamp

SQL File 4\*

```
1 USE sakila;
2 select * from actor where upper(last_name) like "BGENN";
3 SELECT concat(first_name, " ", last_name) AS name, email
4 from customer where customer_id IN
5 (select customer_id from rental where inventory_id in
6 (select inventory_id from inventory where file_id in
7 (select file_id from film_category join category using (category_id) where category.name = "Action"))));
```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.00000000

Timing (as measured by the server):

Execution time: 0:00:0.0034680

Table lock wait time: 0:00:0.00000400

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: \$10

Rows examined: 2616

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 1

Joins per Type:

Full table scans (Select\_scan): 1

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

No Index used

Other Info:

Event Id: 130

Thread Id: 60

actor 6 Result 7 Result 8 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Result Grid

Form Editor

Field Types

Query Status

Execution Plan

Apply Revert Context Help Snippets

## AFTER INDEXING

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

b'sakila' newschema

sakila

Tables

actor

Columns

Indexes

Foreign Keys

Triggers

address

category

city

country

customer

film

film\_actor

film\_category

film\_text

inventory

language

payment

Administration Schemas

Information

Table: category

Columns:

category\_id tinyint(4) PK

name varchar(255)

last\_update timestamp

SQL File 4\*

```
1 create index first_name on customer(first_name);
2 select concat(first_name, " ", last_name) AS name, email
3 from customer where customer_id IN
4 (select customer_id from rental where inventory_id in
5 (select inventory_id from inventory where file_id in
6 (select file_id from film_category join category using (category_id) where category.name = "Action"))));
```

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.01600000

Timing (as measured by the server):

Execution time: 0:00:0.00487000

Table lock wait time: 0:00:0.00000400

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: \$10

Rows examined: 2616

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 1

Joins per Type:

Full table scans (Select\_scan): 1

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 0

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 0

Index Usage:

No Index used

Other Info:

Event Id: 329

Thread Id: 134

Result 18 Result 19 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Result Grid

Form Editor

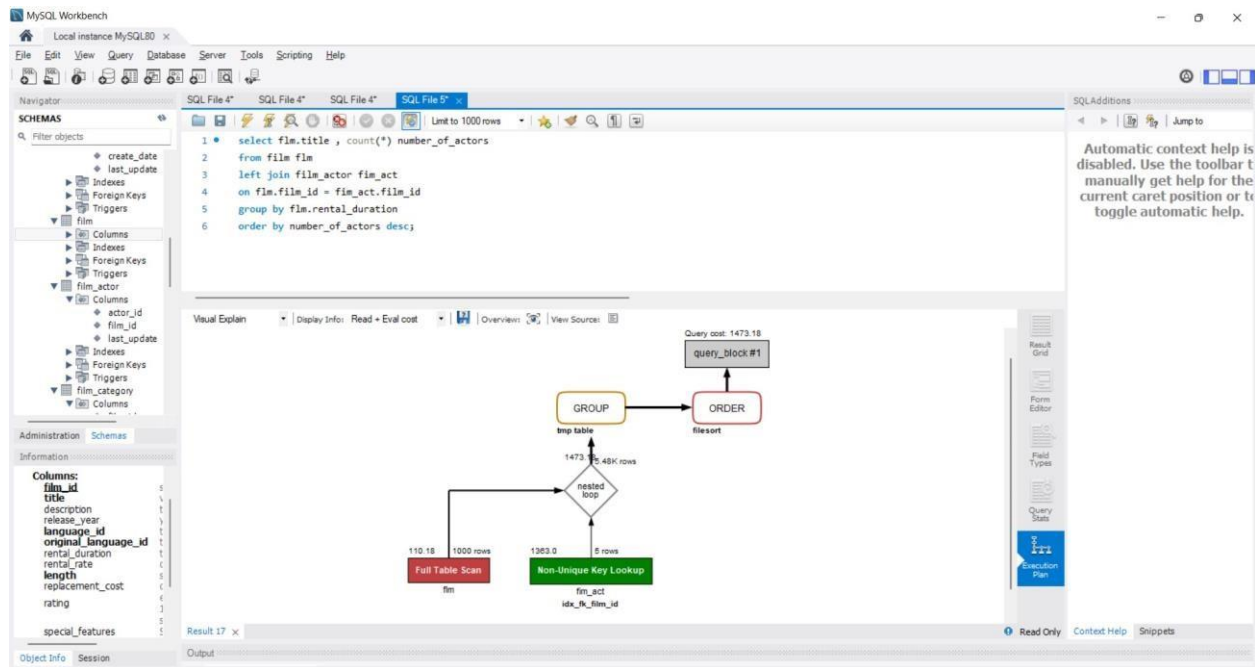
Field Types

Query Status

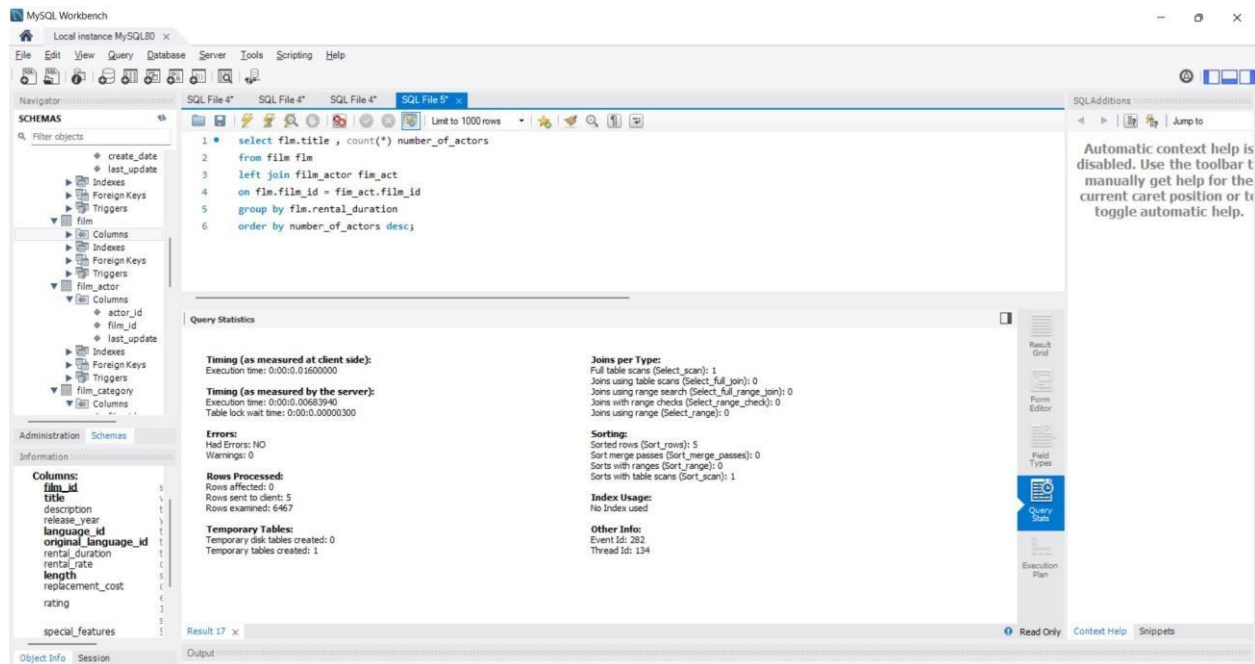
Execution Plan

Apply Context Help Snippets

### 3) LEFT JOIN



### BEFORE INDEXING



### AFTER INDEXING

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

- create\_date
- last\_update
- Indexes
- Foreign Keys
- Triggers
- film
- film\_actor
- film\_category

Columns

film\_id

title

description

release\_year

language\_id

original\_language\_id

rental\_duration

rental\_rate

length

replacement\_cost

rating

special\_features

Information

Columns:

film\_id

title

description

release\_year

language\_id

original\_language\_id

rental\_duration

rental\_rate

length

replacement\_cost

rating

special\_features

Administration Schemas

Object Info Session

SQL File 4\*

SQL File 4\*

SQL File 4\*

SQL File 4\*

Limit to 1000 rows

1 create index rental\_duration on film(rental\_duration);

2 select film.title , count(\*) number\_of\_actors

3 from film film

4 left join film\_actor film\_act

5 on film.file\_id = film\_act.film\_id

6 group by film.rental\_duration

7 order by number\_of\_actors desc;

Query Statistics

Timing (as measured at client side):

Execution time: 0:00:0.01500000

Timing (as measured by the server):

Execution time: 0:00:0.00663890

Table lock wait time: 0:00:0.00000200

Errors:

Had Errors: NO

Warnings: 0

Rows Processed:

Rows affected: 0

Rows sent to client: 5

Rows examined: 6467

Temporary Tables:

Temporary disk tables created: 0

Temporary tables created: 1

Joins per Type:

Full table scans (Select\_scan): 1

Joins using table scans (Select\_full\_join): 0

Joins using range search (Select\_full\_range\_join): 0

Joins with range checks (Select\_range\_check): 0

Joins using range (Select\_range): 0

Sorting:

Sorted rows (Sort\_rows): 5

Sort merge passes (Sort\_merge\_passes): 0

Sorts with ranges (Sort\_range): 0

Sorts with table scans (Sort\_scan): 1

Index Usage:

No Index used

Other Info:

Event Id: 279

Thread Id: 134

Result 15

Result 16 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## 4) RIGHT JOIN

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

- b'sakila'
- newschema
- sakila
- actor
- address
- category
- city
- country
- customer
- film
- film\_actor
- film\_category
- film\_text
- inventory
- language
- payment

Table: actor

Columns:

actor\_id

first\_name

last\_name

last\_update

Information

Columns:

actor\_id

first\_name

last\_name

last\_update

Administration Schemas

Object Info Session

SQL File 4\*

SQL File 4\*

SQL File 4\*

SQL File 4\*

Limit to 1000 rows

15 from film film

16 right join film\_actor film\_act

17 on film.file\_id = film\_act.film\_id

18 group by film.title

19 order by number\_of\_actors desc;

20

21

Visual Explain

Display Info: Read + Eval cost

Overview

View Sources

Query cost: 6154.82

Query\_block #1

GROUP

tmp table

ORDER

filesort

nested loop

550.38

5.48K rows

5598.55

1 row

Full Index Scan

idx\_R\_film\_id

Unique Key Lookup

PRIMARY

actor 36

Result 37

Result 38

Result 39 x

Output

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

BEFORE INDEXING

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

customer

Columns

customer\_id

store\_id

first\_name

last\_name

email

address\_id

active

create\_date

last\_update

Indexes

Foreign Keys

Triggers

film

Columns

film\_id

title

description

release\_year

language\_id

original\_language\_id

rental\_duration

rental\_rate

length

replacement\_cost

rating

special\_features

Administration Schemas

Information

Columns:

film\_id

title

description

release\_year

language\_id

original\_language\_id

rental\_duration

rental\_rate

length

replacement\_cost

rating

special\_features

Object Info Session

SQL File 4\* SQL File 4\* SQL File 4\* SQL File 5\*

Limit to 1000 rows

```
1 select film.title , count(*) number_of_actors
2 from film film
3 right join film_actor film_act
4 on film.film_id = film_act.film_id
5 group by film.title
6 order by number_of_actors desc;
```

Query Statistics

Timing (as measured at client side):  
Execution time: 0:00:0.000000000

Timing (as measured by the server):  
Execution time: 0:00:0.00562900  
Table lock wait time: 0:00:0.00000300

Errors:  
Had Errors: NO  
Warnings: 0

Rows Processed:  
Rows affected: 0  
Rows sent to client: 997  
Rows examined: 11921

Temporary Tables:  
Temporary disk tables created: 0  
Temporary tables created: 1

Joins per Type:  
Full table scans (Select\_scan): 1  
Joins using table scans (Select\_full\_join): 0  
Joins using range search (Select\_full\_range\_join): 0  
Joins with range checks (Select\_range\_check): 0  
Joins using range (Select\_range): 0

Sorting:  
Sorted rows (Sort\_rows): 997  
Sort merge passes (Sort\_merge\_passes): 0  
Sorts with ranges (Sort\_range): 0  
Sorts with table scans (Sort\_scan): 1

Index Usage:  
At least one Index was used

Other Info:  
Event Id: 244  
Thread Id: 134

Result 14 x

Read Only

Context Help Snippets

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

## AFTER INDEXING

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHEMAS

Filter objects

customer

Columns

customer\_id

store\_id

first\_name

last\_name

email

address\_id

active

create\_date

last\_update

Indexes

Foreign Keys

Triggers

film

Columns

film\_id

title

description

release\_year

language\_id

original\_language\_id

rental\_duration

rental\_rate

length

replacement\_cost

rating

special\_features

Administration Schemas

Information

Columns:

film\_id

title

description

release\_year

language\_id

original\_language\_id

rental\_duration

rental\_rate

length

replacement\_cost

rating

special\_features

Object Info Session

SQL File 4\* SQL File 4\* SQL File 4\* SQL File 5\*

Limit to 1000 rows

```
1 create index rental_rate on film(rental_rate);
2 select film.title , count(*) number_of_actors
3 from film film
4 right join film_actor film_act
5 on film.film_id = film_act.film_id
6 group by film.title
7 order by number_of_actors desc;
```

Query Statistics

Timing (as measured at client side):  
Execution time: 0:00:0.015000000

Timing (as measured by the server):  
Execution time: 0:00:0.00503120  
Table lock wait time: 0:00:0.00000300

Errors:  
Had Errors: NO  
Warnings: 0

Rows Processed:  
Rows affected: 0  
Rows sent to client: 997  
Rows examined: 11921

Temporary Tables:  
Temporary disk tables created: 0  
Temporary tables created: 1

Joins per Type:  
Full table scans (Select\_scan): 1  
Joins using table scans (Select\_full\_join): 0  
Joins using range search (Select\_full\_range\_join): 0  
Joins with range checks (Select\_range\_check): 0  
Joins using range (Select\_range): 0

Sorting:  
Sorted rows (Sort\_rows): 997  
Sort merge passes (Sort\_merge\_passes): 0  
Sorts with ranges (Sort\_range): 0  
Sorts with table scans (Sort\_scan): 1

Index Usage:  
At least one Index was used

Other Info:  
Event Id: 241  
Thread Id: 134

Result 13 x

Apply Revert

Context Help Snippets

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.