DBMS Mini Project 2

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The following 4 queries were executed on the Sakila-Database:

Query-1:

```sql
SELECT film.title, category.name
FROM ((film
INNER JOIN film_category ON film.film_id = film_category.film_id)
INNER JOIN category ON category.category_id = film_category.category_id);
```

Query-2

```sql
SELECT film.title, actor.first_name, actor.last_name
FROM ((film
INNER JOIN film_actor ON film.film_id = film_actor.film_id)
INNER JOIN actor ON actor.actor_id = film_actor.actor_id);
```

Query-3

```sql
SELECT city.city, address.address, customer.first_name
FROM ((city
INNER JOIN address ON city.city_id = address.city_id)
INNER JOIN customer ON customer.address_id = address.address_id);
```

Query-4

```sql
SELECT actor.first_name, actor.last_name, category.name
FROM (((
actor INNER JOIN film_actor ON actor.actor_id = film_actor.actor_id)
INNER JOIN film ON film.film_id = film_actor.film_id)
INNER JOIN film_category ON film_category.film_id = film.film_id)
INNER JOIN category ON category.category_id = film_category.category_id;
```

It is evident from the code-snippets that all four queries are join queries where first three queries include INNER-JOIN on three tables whereas the fourth table has INNER-JOIN on five tables. And since this database already had indexing, we try to drop those indexings first.

```sql
1
2   alter table film_actor drop foreign key fk_film_actor_film;
3   alter table film_category drop foreign key fk_film_category_film;
4   alter table inventory drop foreign key fk_inventory_film;
5   alter table film modify film_id smallint NOT NULL;
6   alter table film drop primary key;
7   alter table film drop index idx_fk_language_id;
8   alter table film drop index idx_fk_original_language_id;
9   alter table film drop index idx_title;
10  alter table film drop foreign key fk_film_language;
11  alter table film drop foreign key fk_film_language_original;
12  alter table film_actor drop index idx_fk_film_id;
13  alter table film_actor drop primary key;
14  alter table film_actor drop foreign key fk_film_actor_actor;
15  alter table film_category drop foreign key fk_film_category_category;
16  alter table film modify film_id smallint NOT NULL;
17  alter table actor modify actor_id smallint NOT NULL;
18  alter table actor drop primary key;
19  alter table actor drop index idx_actor_last_name;
20  alter table category modify category_id smallint NOT NULL;
21  alter table category drop primary key;
22  alter table film_category drop primary key;
23  alter table film_category drop index fk_film_category_category;
24
25  CREATE INDEX film_idx_btree ON film (film_id) USING BTREE;
26  ALTER TABLE actor engine=MEMORY;
27  CREATE INDEX actor_idx_hash ON actor (actor_id) USING HASH;
28  ALTER TABLE film_actor engine=MEMORY;
29  CREATE INDEX film_actor_idx_hash ON film_actor (film_id) USING HASH;
30  CREATE INDEX film_actor_idx_hash_2 ON film_actor (actor_id) USING HASH;
31
32  ALTER TABLE category engine=MEMORY;
33  CREATE INDEX category_idx_hash ON category (category_id) USING HASH;
34  ALTER TABLE film_category engine=MEMORY;
35  CREATE INDEX film_category_idx_hash ON film_category (film_id) USING HASH;
36  CREATE INDEX film_category_idx_hash_2 ON film_category (category_id) USING HASH;
```

And profiling for 3 out of 4 queries was done because query-3 is essentially the same as first two queries.

Profiles for Query-1:

Without Indexing		BTREE on all JOIN attributes		HASHED Indexing	
Last_query_cost	323292.222030	Last_query_cost	1420.679234	Last_query_cost	2394.799000

Status	Duration	Status	Duration	Status	Duration
starting	0.000098	starting	0.000098	starting	0.000099
checking permissions	0.000010	checking permissions	0.000011	checking permissions	0.000011
checking permissions	0.000005	checking permissions	0.000005	checking permissions	0.000005
checking permissions	0.000008	checking permissions	0.000008	checking permissions	0.000008
Opening tables	0.000030	Opening tables	0.000030	Opening tables	0.000472
init	0.000038	init	0.000080	init	0.000038
System lock	0.000015	System lock	0.000014	System lock	0.000016
optimizing	0.000016	optimizing	0.000042	optimizing	0.000016
statistics	0.000032	statistics	0.000090	statistics	0.000052
preparing	0.000031	preparing	0.000025	preparing	0.000026
executing	0.000007	executing	0.000007	executing	0.000006
Sending data	0.102313	Sending data	0.003319	Sending data	0.005473
end	0.000011	end	0.000017	end	0.000019
query end	0.000015	query end	0.000014	query end	0.000013
closing tables	0.000023	closing tables	0.000017	closing tables	0.000017
freeing items	0.000072	freeing items	0.000101	freeing items	0.000110
cleaning up	0.000013	cleaning up	0.000025	cleaning up	0.000031

Profiles for Query-2:

Without Indexing

```
Last_query_cost | 22068284.775015
+---------------------+------------+
| Status              | Duration   |
+---------------------+------------+
| starting            | 0.000136   |
| checking permissions| 0.000013   |
| checking permissions| 0.000022   |
| checking permissions| 0.000011   |
| Opening tables      | 0.000716   |
| init                | 0.000047   |
| System lock         | 0.000018   |
| optimizing          | 0.000016   |
| statistics          | 0.000035   |
| preparing           | 0.000189   |
| executing           | 0.000008   |
| Sending data        | 0.618372   |
| end                 | 0.000010   |
| query end           | 0.000036   |
| closing tables      | 0.000012   |
| freeing items       | 0.000067   |
| cleaning up         | 0.000018   |
+---------------------+------------+
```

BTREE on all JOIN attributes

```
Last_query_cost | 13019.999000
+---------------------+------------+
| Status              | Duration   |
+---------------------+------------+
| starting            | 0.000144   |
| checking permissions| 0.000010   |
| checking permissions| 0.000005   |
| checking permissions| 0.000007   |
| Opening tables      | 0.000028   |
| init                | 0.000037   |
| System lock         | 0.000016   |
| optimizing          | 0.000017   |
| statistics          | 0.000054   |
| preparing           | 0.000026   |
| executing           | 0.000007   |
| Sending data        | 0.018324   |
| end                 | 0.000011   |
| query end           | 0.000007   |
| closing tables      | 0.000010   |
| freeing items       | 0.000066   |
| cleaning up         | 0.000018   |
+---------------------+------------+
```

HASHED Indexing

```
Last_query_cost | 7892.932509
+---------------------+------------+
| Status              | Duration   |
+---------------------+------------+
| starting            | 0.000098   |
| checking permissions| 0.000010   |
| checking permissions| 0.000005   |
| checking permissions| 0.000008   |
| Opening tables      | 0.000048   |
| init                | 0.000046   |
| System lock         | 0.000016   |
| optimizing          | 0.000018   |
| statistics          | 0.000114   |
| preparing           | 0.000025   |
| executing           | 0.000007   |
| Sending data        | 0.027254   |
| end                 | 0.000021   |
| query end           | 0.000015   |
| closing tables      | 0.000019   |
| freeing items       | 0.000160   |
| cleaning up         | 0.000045   |
+---------------------+------------+
```

Profiles for Query-4:

Without Indexing

```
Last_query_cost | 34975862894.510250
+---------------------+------------+
| Status              | Duration   |
+---------------------+------------+
| starting            | 0.000115   |
| checking permissions| 0.000011   |
| checking permissions| 0.000006   |
| checking permissions| 0.000005   |
| checking permissions| 0.000005   |
| checking permissions| 0.000007   |
| Opening tables      | 0.000035   |
| init                | 0.000046   |
| System lock         | 0.000017   |
| optimizing          | 0.000018   |
| statistics          | 0.001552   |
| preparing           | 0.000133   |
| executing           | 0.000009   |
| Sending data        | 171.228781 |
| end                 | 0.000011   |
| query end           | 0.000064   |
| closing tables      | 0.000012   |
| freeing items       | 0.000022   |
| cleaning up         | 0.000027   |
+---------------------+------------+
```

BTREE on all JOIN attributes

```
Last_query_cost | 10093.767460
+---------------------+------------+
| Status              | Duration   |
+---------------------+------------+
| starting            | 0.000202   |
| checking permissions| 0.000013   |
| checking permissions| 0.000007   |
| checking permissions| 0.000007   |
| checking permissions| 0.000007   |
| checking permissions| 0.000010   |
| Opening tables      | 0.000046   |
| init                | 0.000061   |
| System lock         | 0.000031   |
| optimizing          | 0.000027   |
| statistics          | 0.008240   |
| preparing           | 0.000045   |
| executing           | 0.000008   |
| Sending data        | 0.023804   |
| end                 | 0.000018   |
| query end           | 0.000013   |
| closing tables      | 0.000019   |
| freeing items       | 0.000029   |
| cleaning up         | 0.000054   |
+---------------------+------------+
```

HASHED Indexing

```
+---------------------+------------+
| Status              | Duration   |
+---------------------+------------+
| starting            | 0.000115   |
| checking permissions| 0.000010   |
| checking permissions| 0.000006   |
| checking permissions| 0.000005   |
| checking permissions| 0.000005   |
| checking permissions| 0.000007   |
| Opening tables      | 0.000035   |
| init                | 0.000045   |
| System lock         | 0.000019   |
| optimizing          | 0.000018   |
| statistics          | 0.001381   |
| preparing           | 0.000050   |
| executing           | 0.000009   |
| Sending data        | 0.011094   |
| end                 | 0.000012   |
| query end           | 0.000010   |
| closing tables      | 0.000013   |
| freeing items       | 0.000021   |
| cleaning up         | 0.000024   |
+---------------------+------------+
```

Procedure 1: insert_actor

```
2
3      DELIMITER $$
4
5  ●  ⊟ CREATE PROCEDURE `insert_actor` (
6          first_name varchar(45),
7          last_name varchar(45)
8        )
9      ⊟ BEGIN
10         INSERT INTO actor (actor.first_name, actor.last_name) VALUES(first_name, last_name);
11         SELECT LAST_INSERT_ID();
12      END
13
14      $$
15      DELIMITER ;
16      |
```

Procedure 2:   film_by_duration

```
2
3        DELIMITER $$
4
5  ●  ⊟ CREATE PROCEDURE `film_by_duration` (
6          low smallint(5) unsigned,
7          high smallint(5) unsigned
8        )
9      ⊟ BEGIN
10         SELECT film.title FROM film where film.length <= high and film.length >= low;
11      END
12
13      $$
14      DELIMITER ;
```

Cost for Procedures for 1 & 2:

```
Procedure : film_by_duration
Last_query_cost | 211.99900


Procedure : insert_actor
Last_query_cost | 0.000000
```