LAPORAN TUGAS BESAR

"TUNNING DATABASE SYSTEM"

Disusun dalam rangka memenuhi tugas bidang studi Manajemen Basis Data

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KATA PENGANTAR

Segala puji bagi Tuhan Yang Maha Esa karena berkat, rahmat, dan hidayat-Nya saya dapat menyelesaikan laporan *Tuning Database System* tepat pada waktunya.

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Tujuan daripada dibuatnya laporan ini, selain sebagai syarat menyelesaikan tugas akhir, yaitu sebagai tolak ukur dan media yang dapat menjadi evaluasi bagi saya atas dilakukannya mentuning database agar dapat dijalankan dengan se-optimal mungkin. Semoga dengan adanya karya tulis ini, diharapkan pembaca mendapat informasi yang bermanfaat yang telah saya tuangkan dalam tulisan ini, serta perbaikan yang mampu membuat isi laporan ini menjadi lebih sempurna.

Lampung Selatan, 22 Desember 2019

Penulis

DAFTAR ISI

BAB I

STUDI LITERATUR

1.1 Tunning : Index

Indeks basis data adalah struktur data yang dapat meningkatkan kecepatan operasi pengambilan data pada tabel basis data dengan biaya penulisan tambahan dan ruang penyimpanan untuk mempertahankan struktur data indeks. Indeks digunakan untuk memcepat menemukan data tanpa harus mencari setiap baris dalam tabel database setiap diakses. Indeks dapat dibuat menggunakan satu atau lebih kolom dari tabel database.

Indeks adalah salinan kolom data yang dipilih dari tabel, yang disebut kunci basis data atau kunci sederhana, yang dapat dicari dengan sangat efisien yang juga mencakup alamat blok disk tingkat rendah atau tautan langsung ke baris lengkap data yang disalin. Untuk melakukan indexing, terdapat berbagaimacam cara untuk melakukan indexing. Tipe-tipe tersebut antara lain seperti B-Tree, Bitmap, Function-based, Partitioned. Pada indexing yang akan digunakan adalah B-Tree Indexes. B-Tree Indexes ini merupakan Teknik indeks yang standar dengan keunggulan untuk primary key dan indeks dengan pemilihan selektif yang tinggi.

1.2 Tunning : Setting Configuration DBMS

Terdapat beberapa persyaratan untuk melakukan tunning database. Untuk bagian tunning query, terdapat syarat yang harus diperhatikan, yaitu database harus berjumlah sangat besar, kemudian primary key berurutan dan tidak boleh acak. Hal tersebut apabila database dalam cakupan yang masih kecil dan hanya memiliki beberapa data table, maka pengindexan tersebut akan sia-sia, karena hal tersebut tidaklah terlalu berpengaruh. Untuk Tunning, harus memperhatikan konfigurasi perangkat yang digunakan seperti hardware dan software yang digunakan. Hardware akan berpengaruh terhadap jalannya suatu sistem yang di eksekusi. Begitupun dengan software, software dbms akan berpengaruh terhadap kinerja yang akan dijalankan pada hardware. Pada bagian ini, catat total waktu sebelum dilakukannya tunning, lalu bandingkan durasi waktu yang sudah dilakukannya tunning. Jika waktu sebelum tunning

lebih besar dari pada waktu druasi yang dihasilkan sesudah mentunning query, maka dipastikan tunning yang telah kita setting telah berhasil.

BAB II
DESKRIPSI PERCOBAAN

2.1 Tunning : Index

Pada percobaan yang telah saya lakukan, terdapat 8 jumlah total dalam melakukan indexing. Jumlah tersebut terdiri dari 4 database sebelum di tunning dan 4 database setelah dilakukan tunning. Berikut ini merupakan query-query yang digunakan dalam menjalankan query sql database :

a. SELECT * FROM student;
b. SELECT * FROM student WHERE tot_cred > 30;
c. SELECT dept_name FROM student WHERE tot_cred > 30;
d. SELECT * FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id;
e. SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,section.room_number,section.building,course.course_id,course.dept_name FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id JOIN course ON section.course_id = course.course_id;

2.1.1 Data Pertama (DBMS 1)

- Data : advisor = 100, student = 100, section = 200,takes = 200

a. Sebelum dilakukan indexing:
   1. SELECT * FROM student;

```
| 96301 | Budi   | BN        |       77 |
| 96544 | Johan  | GT        |       58 |
| 96691 | rahmat | GT        |       28 |
| 98    | Adri   | WW        |       46 |
| 98866 | Adri   | WW        |       97 |
| 99231 | rahmat | GO        |       46 |
| 99955 | Yohan  | MT        |       25 |
+-------+--------+-----------+----------+
100 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+-----------------------+
| Query_ID | Duration   | Query                 |
+----------+------------+-----------------------+
|        1 | 0.00022150 | SELECT DATABASE()     |
|        2 | 0.00043020 | SELECT * FROM student |
+----------+------------+-----------------------+
2 rows in set (0.00 sec)
```

Time: 0.00043020

2. SELECT * FROM student WHERE tot_cred > 30;

```
| 96544 | Johan  | GT        |       58 |
| 98    | Adri   | WW        |       46 |
| 98866 | Adri   | WW        |       97 |
| 99231 | rahmat | GO        |       46 |
+-------+--------+-----------+----------+
81 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+---------------------------------------+
| Query_ID | Duration   | Query                                 |
+----------+------------+---------------------------------------+
|        1 | 0.00022150 | SELECT DATABASE()                     |
|        2 | 0.00043020 | SELECT * FROM student                 |
|        3 | 0.00079250 | SELECT * FROM student WHERE tot_cred>30 |
+----------+------------+---------------------------------------+
3 rows in set (0.00 sec)
```

Time: 0.00079250

3. SELECT dept_name FROM student WHERE tot_cred > 30;

```
| GT         |
| WW         |
| WW         |
| GO         |
+------------+
81 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+-------------------------------------------------+
| Query_ID | Duration   | Query                                           |
+----------+------------+-------------------------------------------------+
|        1 | 0.00022150 | SELECT DATABASE()                               |
|        2 | 0.00043020 | SELECT * FROM student                           |
|        3 | 0.00079250 | SELECT * FROM student WHERE tot_cred>30         |
|        4 | 0.00026970 | SELECT dept_name FROM student WHERE tot_cred > 30 |
+----------+------------+-------------------------------------------------+
4 rows in set (0.00 sec)
```

Time: 0.00026970

4. SELECT * FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id;

```
| 99955 | 278 | 1 | Spring | 2001 | C  | 99955 | Yohan | MT | 25 | 278 | 2 | Spring | 2002 | D
| 99955 | 278 | 1 | Spring | 2001 | C  | 99955 | Yohan | MT | 25 | 278 | 3 | Spring | 2002 | D
| 99955 | 354 | 1 | Spring | 2004 | A- | 99955 | Yohan | MT | 25 | 354 | 1 | Spring | 2004 | B
| 99955 | 587 | 1 | Spring | 2010 | B  | 99955 | Yohan | MT | 25 | 587 | 1 | Spring | 2010 | B
| 99955 | 982 | 1 | Fall   | 2009 | A  | 99955 | Yohan | MT | 25 | 982 | 1 | Fall   | 2009 | H
| 99955 | 982 | 1 | Fall   | 2009 | A  | 99955 | Yohan | MT | 25 | 982 | 2 | Spring | 2006 | D
+-------+-----+---+--------+------+----+-------+-------+----+----+-----+---+--------+------+---
367 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+---------------------------------------------------------------------------------------------------+
| Query_ID | Duration   | Query                                                                                             |
+----------+------------+---------------------------------------------------------------------------------------------------+
|        1 | 0.00022150 | SELECT DATABASE()                                                                                 |
|        2 | 0.00043020 | SELECT * FROM student                                                                             |
|        3 | 0.00079250 | SELECT * FROM student WHERE tot_cred>30                                                           |
|        4 | 0.00026970 | SELECT dept_name FROM student WHERE tot_cred > 30                                                 |
|        5 | 0.00142980 | SELECT *  FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id |
+----------+------------+---------------------------------------------------------------------------------------------------+
5 rows in set (0.00 sec)
```

Time : 0.00142980

5. SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,section.room_number,section.building,course.course_id,course.dept_name FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id JOIN course ON section.course_id = course.course_id;

```
| Yohan | MT | 1 | Fall | 14 | D
+-------+----+---+------+----+---
367 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+----------------------------------------
----------------------------------------------------------------
| Query_ID | Duration   | Query

+----------+------------+----------------------------------------
----------------------------------------------------------------
|        1 | 0.00022150 | SELECT DATABASE()

|        2 | 0.00043020 | SELECT * FROM student

|        3 | 0.00079250 | SELECT * FROM student WHERE tot_cred>30

|        4 | 0.00026970 | SELECT dept_name FROM student WHERE tot_cred

|        5 | 0.00142980 | SELECT *  FROM takes JOIN student ON takes.II

|        6 | 0.00104590 | SELECT student.`name`,student.dept_name,take
 takes JOIN student ON takes.ID = student.ID JOIN section ON takes.cou
+----------+------------+----------------------------------------
----------------------------------------------------------------
6 rows in set (0.00 sec)
```

Time : 0.00104590

a. Sesudah dilakukan Indexing

```
MariaDB [dbms1]> CREATE INDEX index_btree
    -> ON takes(course_id) USING BTREE;
Query OK, 0 rows affected (1.35 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [dbms1]> CREATE INDEX index_btree
    -> ON section(course_id) USING BTREE;
Query OK, 0 rows affected (0.85 sec)
Records: 0  Duplicates: 0  Warnings: 0
```

1. SELECT * FROM student;

```
|       10 | 0.00026180 | SELECT * FROM student

+----------+------------+-----------------------------
-------------------------------------------------------
10 rows in set (0.00 sec)
```

Time : 0.00026180

2. SELECT * FROM student WHERE tot_cred > 30;

```
| 98    | Adri   | WW        |       46 |
| 98866 | Adri   | WW        |       97 |
| 99231 | rahmat | GO        |       46 |
+-------+--------+-----------+----------+
81 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+-----------------------------------------+
| Query_ID | Duration   | Query                                   |
+----------+------------+-----------------------------------------+
|        1 | 0.00027410 | SELECT DATABASE()                       |
|        2 | 0.00043810 | SELECT * FROM student WHERE tot_cred>30 |
+----------+------------+-----------------------------------------+
2 rows in set (0.00 sec)
```

Time : 0.00043810

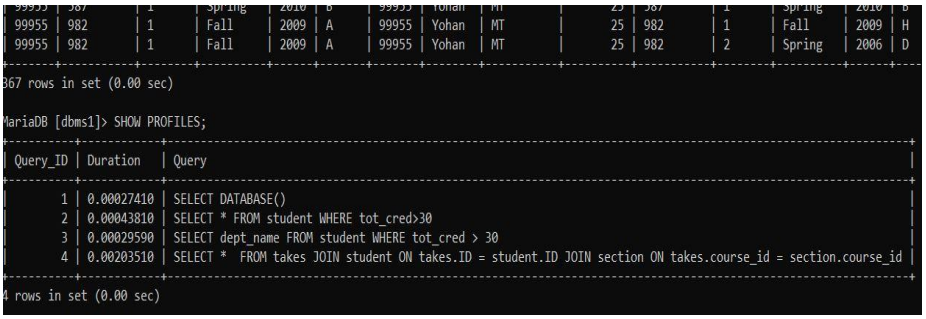
3. SELECT dept_name FROM student WHERE tot_cred > 30;

```
| BN         |
| GT         |
| WW         |
| WW         |
| GO         |
+------------+
81 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+-------------------------------------------------+
| Query_ID | Duration   | Query                                           |
+----------+------------+-------------------------------------------------+
|        1 | 0.00027410 | SELECT DATABASE()                               |
|        2 | 0.00043810 | SELECT * FROM student WHERE tot_cred>30         |
|        3 | 0.00029590 | SELECT dept_name FROM student WHERE tot_cred > 30 |
+----------+------------+-------------------------------------------------+
3 rows in set (0.00 sec)
```

Time : 0.00029590

4. SELECT * FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id;

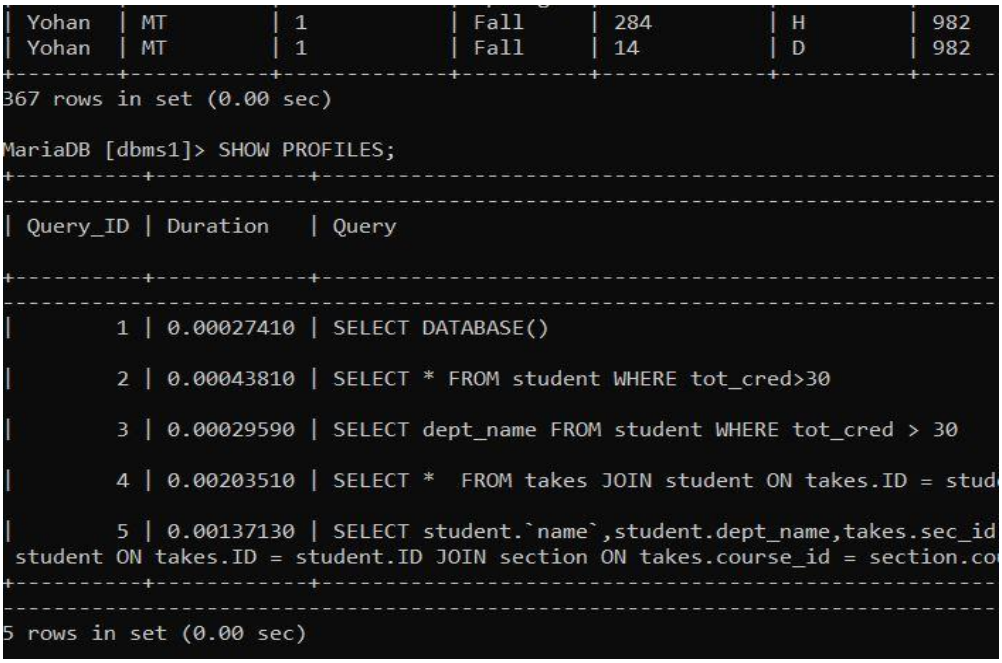


```
| 99955 | 982      | 1      | Fall     | 2009 | A     | 99955 | Yohan | MT    |      25 | 982      | 1      | Fall     | 2009 | H
| 99955 | 982      | 1      | Fall     | 2009 | A     | 99955 | Yohan | MT    |      25 | 982      | 2      | Spring   | 2006 | D
+-------+----------+--------+----------+------+-------+-------+-------+-------+---------+----------+--------+----------+------+---
367 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+-----------------------------------------------------------------------------------------------------------------------------+
| Query_ID | Duration   | Query                                                                                                                       |
+----------+------------+-----------------------------------------------------------------------------------------------------------------------------+
|        1 | 0.00027410 | SELECT DATABASE()                                                                                                           |
|        2 | 0.00043810 | SELECT * FROM student WHERE tot_cred>30                                                                                     |
|        3 | 0.00029590 | SELECT dept_name FROM student WHERE tot_cred > 30                                                                           |
|        4 | 0.00203510 | SELECT *  FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id              |
+----------+------------+-----------------------------------------------------------------------------------------------------------------------------+
4 rows in set (0.00 sec)
```

Time : 0.00203510

5. SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,section.room_number,section.building,course.course_id,course.dept_name FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id JOIN course ON section.course_id = course.course_id;



```
| Yohan  | MT        | 1           | Fall     | 284         | H         | 982
| Yohan  | MT        | 1           | Fall     | 14          | D         | 982
+--------+-----------+-------------+----------+-------------+-----------+------
367 rows in set (0.00 sec)

MariaDB [dbms1]> SHOW PROFILES;
+----------+------------+-----------------------------------------------------------
-----------------------------------------------------------------------------------
| Query_ID | Duration   | Query

+----------+------------+-----------------------------------------------------------
-----------------------------------------------------------------------------------
|        1 | 0.00027410 | SELECT DATABASE()

|        2 | 0.00043810 | SELECT * FROM student WHERE tot_cred>30

|        3 | 0.00029590 | SELECT dept_name FROM student WHERE tot_cred > 30

|        4 | 0.00203510 | SELECT *  FROM takes JOIN student ON takes.ID = stud

|        5 | 0.00137130 | SELECT student.`name`,student.dept_name,takes.sec_id
 student ON takes.ID = student.ID JOIN section ON takes.course_id = section.co
+----------+------------+-----------------------------------------------------------
-----------------------------------------------------------------------------------
5 rows in set (0.00 sec)
```

Time : 0.00137130

2.1.2 Kedua (DBMS 2)

- Data : advisor = 200, student = 200, section = 400,takes = 400

1. Sebelum dilakukan Indexing

```
MariaDB [dbms2]> SHOW PROFILES;
+----------+------------+-----------------------------------------------------------------
-----------------------------------------------------------------------------------------
| Query_ID | Duration   | Query

+----------+------------+-----------------------------------------------------------------
-----------------------------------------------------------------------------------------
|        1 | 0.00023140 | SELECT DATABASE()

|        2 | 0.00081590 | SELECT * FROM student

|        3 | 0.00034920 | SELECT * FROM student WHERE tot_cred>30

|        4 | 0.00036920 | SELECT dept_name FROM student WHERE tot_cred > 30

|        5 | 0.00291100 | SELECT *  FROM takes JOIN student ON takes.ID = student.ID JOIN sect

|        6 | 0.00397880 | SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,
```

Time : 1 = 0.00081590

2 = 0.00034920

3 = 0.00036920

4 = 0.00291100

5 = 0.00397880

2. Setelah dilakukan Indexing

```
MariaDB [dbms2]> CREATE INDEX index_btree
    -> ON takes(course_id) USING BTREE;
Query OK, 0 rows affected (1.13 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [dbms2]> CREATE INDEX index_btree
    -> ON section(course_id) USING BTREE;
Query OK, 0 rows affected (1.03 sec)
Records: 0  Duplicates: 0  Warnings: 0
```

```
MariaDB [dbms2]> SHOW PROFILES;
+----------+------------+-----------------------------------------------------------------
-----------------------------------------------------------------------------------------
| Query_ID | Duration   | Query

+----------+------------+-----------------------------------------------------------------
-----------------------------------------------------------------------------------------
|        1 | 0.00017890 | SELECT DATABASE()

|        2 | 0.00038250 | SELECT * FROM student

|        3 | 0.00031740 | SELECT * FROM student WHERE tot_cred>30

|        4 | 0.00027520 | SELECT dept_name FROM student WHERE tot_cred > 30

|        5 | 0.00241430 | SELECT *  FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.cou

|        6 | 0.00210440 | SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,se
```

Time : 1 = 0.00038250

2 = 0.00031740

3 = 0.00027520

4 = 0.00241430

5 = 0.00210440

2.1.3 Data Ketiga (DBMS 3)

- Data : advisor = 500, student = 500, section = 1000,takes = 1000

a. Sebelum dilakukan Indexing

```
MariaDB [dbms3]> SHOW PROFILES;
+----------+------------+------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------
| Query_ID | Duration   | Query

+----------+------------+------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------
|        1 | 0.00014880 | SELECT DATABASE()

|        2 | 0.00011060 | SET profiling = 1

|        3 | 0.00082820 | SELECT * FROM student

|        4 | 0.00045690 | SELECT * FROM student WHERE tot_cred>30

|        5 | 0.00039740 | SELECT dept_name FROM student WHERE tot_cred > 30

|        6 | 0.01149860 | SELECT *  FROM takes JOIN student ON takes.ID = student.ID JOIN section ON ta

|        7 | 0.00711550 | SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.sem
```

Time : 1 = 0.00082820

2 = 0.00045690

3 = 0.00039740

4 = 0.01149860

5 = 0.00711550

b. Setelah dilakukan Indexing

```
MariaDB [dbms3]> CREATE INDEX index_btree
    -> ON takes(course_id) USING BTREE;
Query OK, 0 rows affected (0.73 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [dbms3]> CREATE INDEX index_btree
    -> ON section(course_id) USING BTREE;
Query OK, 0 rows affected (0.49 sec)
Records: 0  Duplicates: 0  Warnings: 0
```

```
MariaDB [dbms3]> SHOW PROFILES;
+----------+------------+---------------------------------------------------------------------------
| Query_ID | Duration   | Query
+----------+------------+---------------------------------------------------------------------------
|        1 | 0.00046660 | SELECT * FROM student
|        2 | 0.00047400 | SELECT * FROM student WHERE tot_cred>30
|        3 | 0.00037050 | SELECT dept_name FROM student WHERE tot_cred > 30
|        4 | 0.01241860 | SELECT *  FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id =
|        5 | 0.00820600 | SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,section.ro
```

Time : 1 = 0.00046660

2 = 0.00047440

3 = 0.00037050

4 = 0.01241860

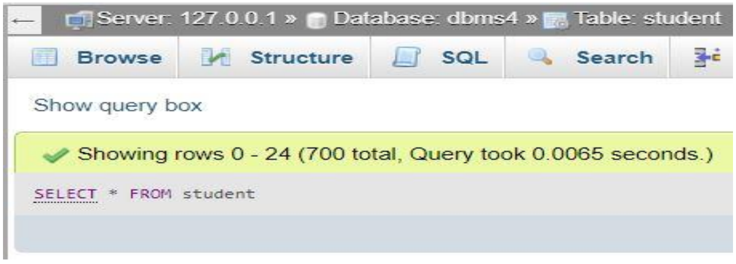
5 = 0.00820600

2.1.1 Data Keempat (DBMS 4)

- Data : advisor = 700, student = 700, section = 20000,takes = 20000

a. Sebelum dilakukan Indexing

1. SELECT * FROM student;

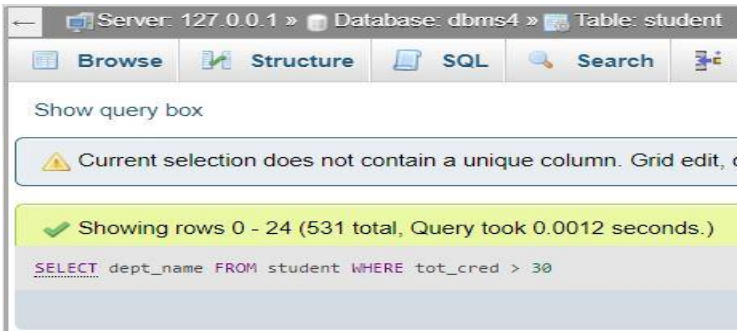


Time : 0.0065

2. SELECT * FROM student WHERE tot_cred > 30;

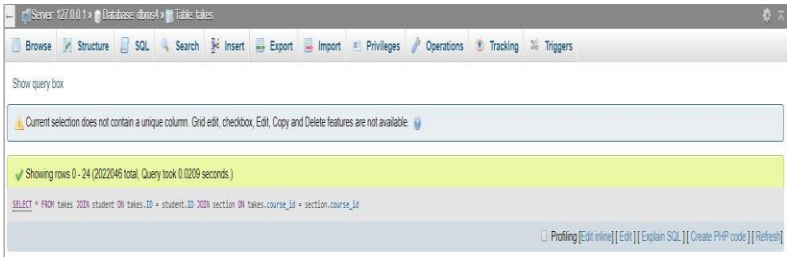
Time : 0.0011

3. SELECT dept_name FROM student WHERE tot_cred > 30;



Time : 0.0012

4. SELECT * FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id;

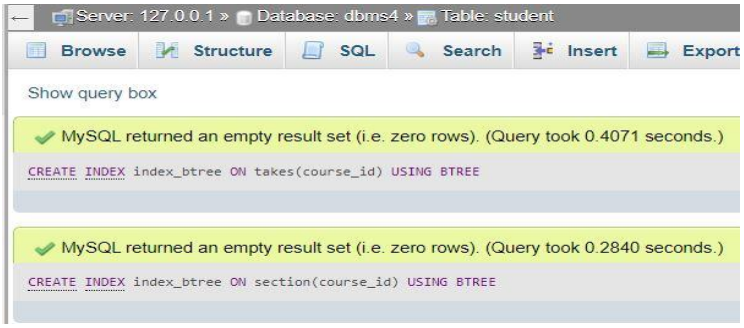


Time : 0.0209

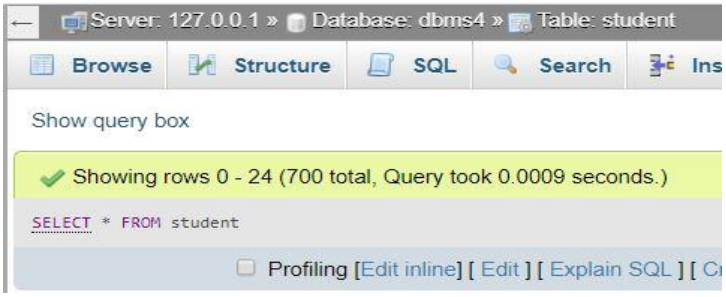
5. SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,section.room_number,section.building,course.course_id,course.dept_name FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id JOIN course ON section.course_id = course.course_id;

Time : 0.1009

b. Setelah dilakukan Indexing



1. SELECT * FROM student;

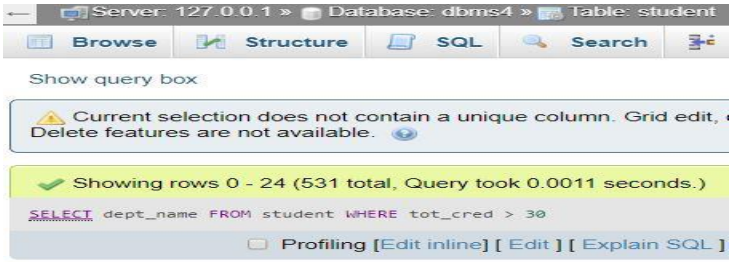


Time : 0.0009

2. SELECT * FROM student WHERE tot_cred > 30;

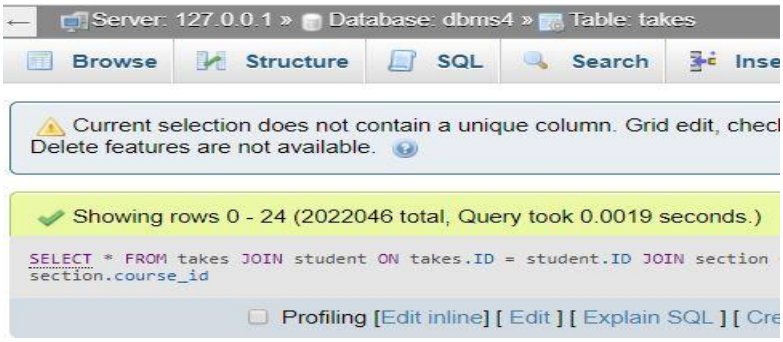
Time : 0.0010

3. SELECT dept_name FROM student WHERE tot_cred > 30;



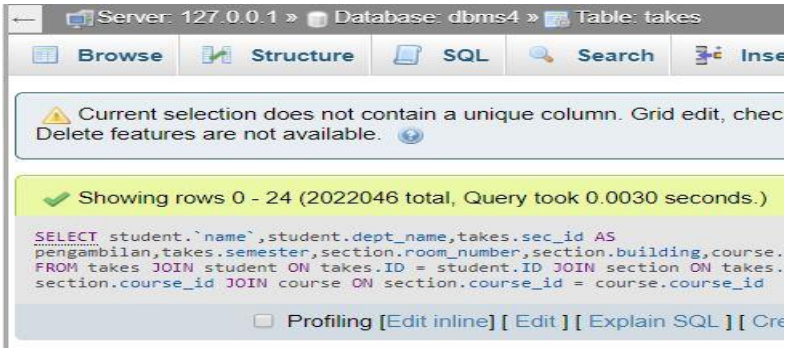
Time : 0.0011

4. SELECT * FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id;



Time : 0.0019

5. SELECT student.`name`,student.dept_name,takes.sec_id AS pengambilan,takes.semester,section.room_number,section.building,course.course_id,course.dept_name FROM takes JOIN student ON takes.ID = student.ID JOIN section ON takes.course_id = section.course_id JOIN course ON section.course_id = course.course_id;



Time : 0.0030

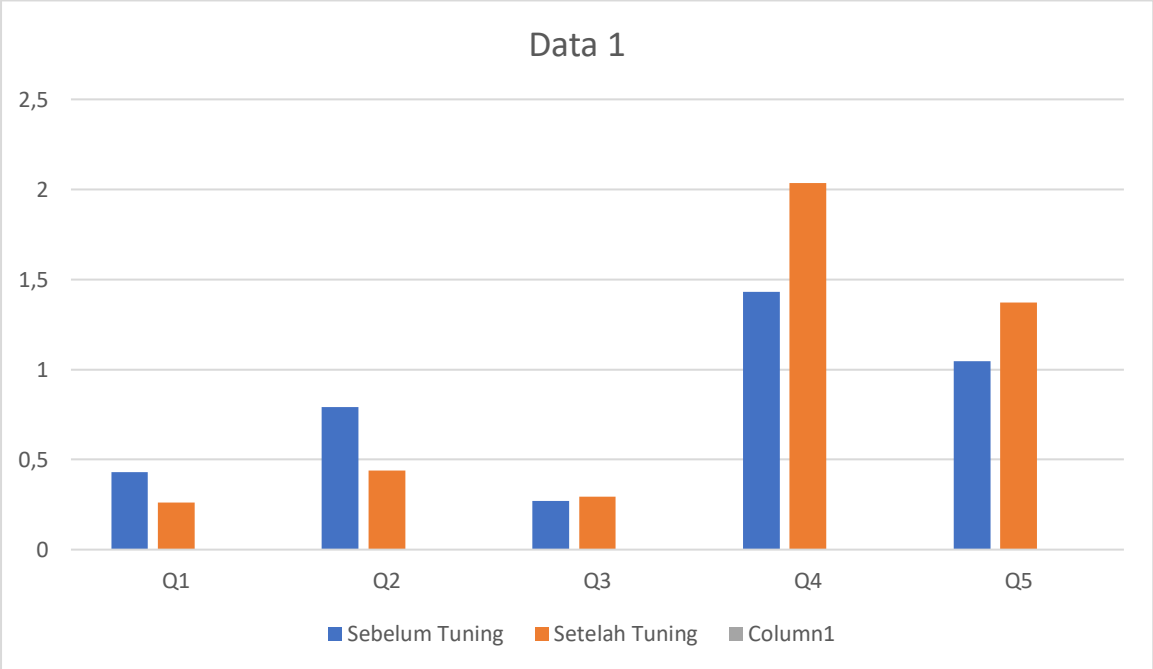
BAB III

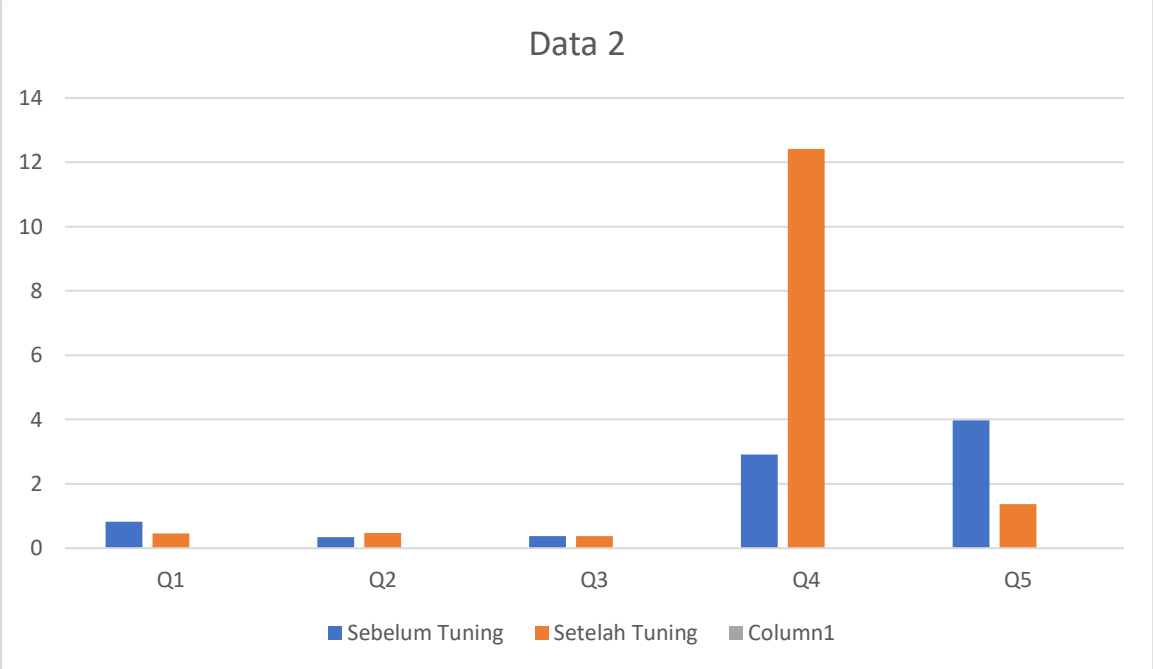
HASIL DAN PEMBAHASAN

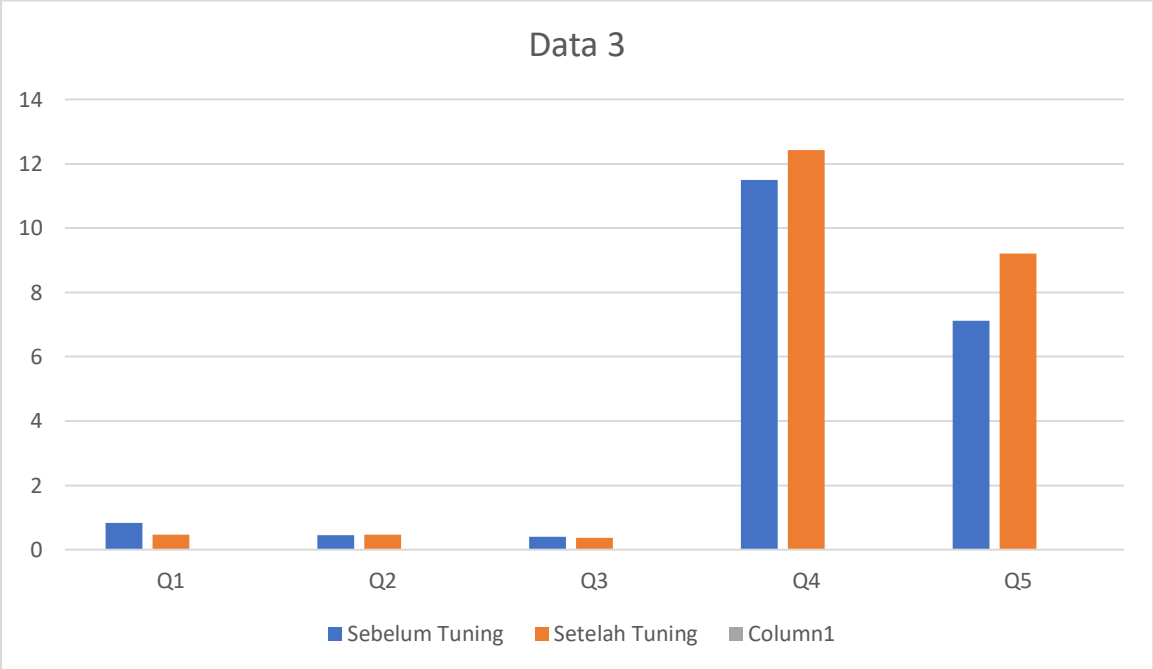
3.1 Tabel Hasil

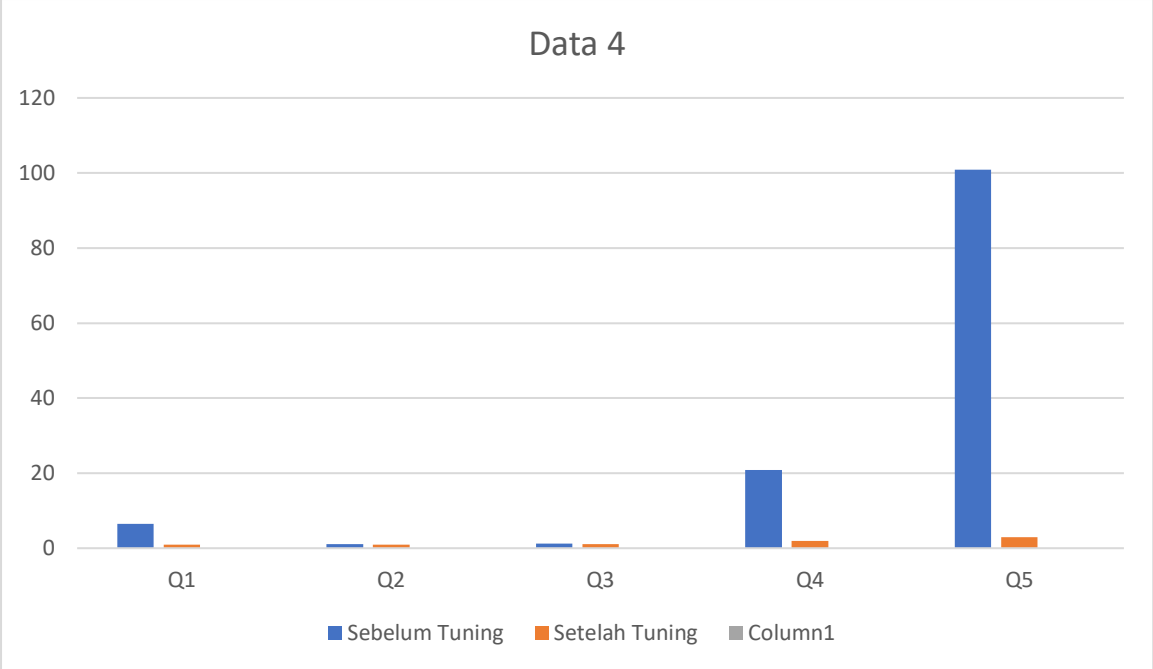
Data Soal	Waktu sebelum Tunning					Waktu sesudah Tunning				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
1	0.4302	0.7925	0.2697	1.4298	1.0459	0.2618	0.4381	0.2959	2.0351	1.3713
2	0.8159	0.3492	0.3692	2.911	3.9788	0.4666	0.4744	0.3705	12.4186	8.206
3	0.8282	0.4569	0.3974	11.4986	7.1155	0.4666	0.4744	0.3705	12.4186	8.206
4	6.5	1.1	1.2	20.9	100.9	0.9	1	1.1	1.9	3

3.2 Grafik Hasil



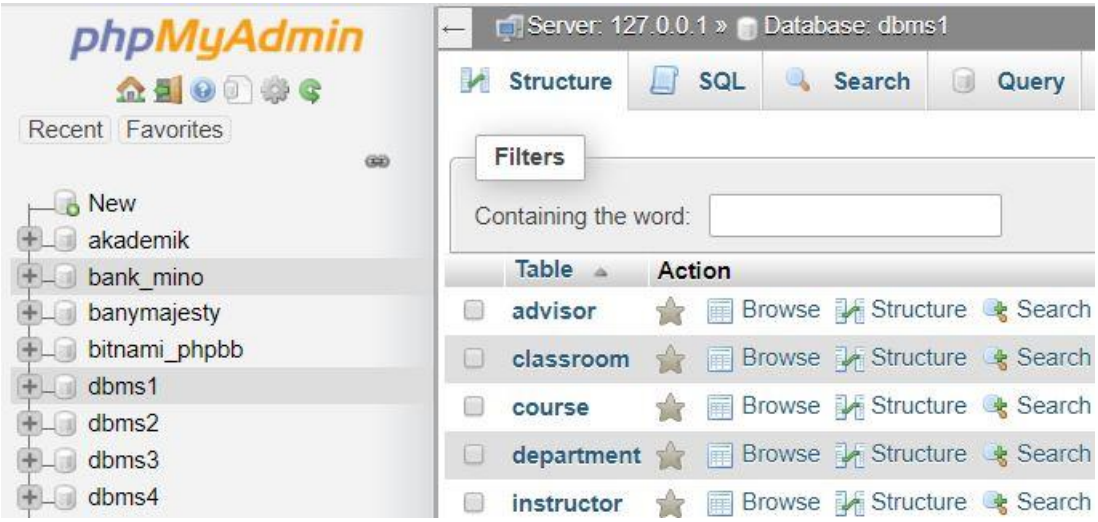

Data 2
14
12
10
8
6
4
2
0
Q1
Q2
Q3
Q4
Q5
Sebelum Tuning
Setelah Tuning
Column1


Data 3
14
12
10
8
6
4
2
0
Q1
Q2
Q3
Q4
Q5
Sebelum Tuning
Setelah Tuning
Column1



3.3 Penjelasan dan Kesimpulan

Dapat diambil kesimpulan bahwa dari hasil percobaan yang telah saya lakukan bahwa rata-rata performa yang lebih terlihat adalah pada Q1, Q2, dan Q3. Hal ini menunjukkan bahwa indexing yang saya gunakan kurang efisien bila diterapkan pada data yang berjumlah banyak seperti Q1 dan Q4. Tetapi pada data ke-4 menunjukkan bahwa query yang saya jalankan pada phpMyAdmin performa hasil tuning menunjukkan efisiensi yang baik. Untuk data 1, data 2, dan data 3 diperoleh dari terminal mysql yang dijalankan. Sedangkan pada data 4 dijalankan pada phpMyAdmin. Hal tersebut dikarenakan pada data 4 jika dijalankan pada terminal memiliki durasi waktu untuk mengeksekusi yang cukup lama, ketimbang dijalankan pada phpMyAdmin.



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