

Practical 1

- a) Import Database, understand Query execution plan using SQL Yog
- b) Analyze impact of index , type of index on query performance

a) Database Structure

- Database: *MySQL*
- Total data rows in table *ds_leaderboard*: *4,00,000*
- PC Configuration
 - : *Intel® Core™ i3-4130 CPU @ 3.40GHz × 4*
 - : *~ 4 GB RAM*

Table: *ds_leaderboard*

```
CREATE TABLE `ds_leaderboard` (  
  `id` Int( 11 ) AUTO_INCREMENT NOT NULL,  
  `name` VarChar( 64 ) CHARACTER SET utf8 COLLATE utf8_general_ci NOT NULL,  
  `email` VarChar( 254 ) CHARACTER SET utf8 COLLATE utf8_general_ci NOT NULL,  
  `organizer` VarChar( 256 ) CHARACTER SET utf8 COLLATE utf8_general_ci NOT NULL,  
  `score` Double( 22, 0 ) NOT NULL,  
  `time` VarChar( 16 ) CHARACTER SET utf8 COLLATE utf8_general_ci NOT NULL,  
  `country` VarChar( 128 ) CHARACTER SET utf8 COLLATE utf8_general_ci NOT NULL,  
  `language_id` Int( 11 ) NULL, PRIMARY KEY ( `id` )  
)  
CHARACTER SET = utf8  
COLLATE = utf8_general_ci  
ENGINE = InnoDB  
AUTO_INCREMENT = 400001;
```

Table:*ds_programminglanguage*

```
CREATE TABLE `ds_programminglanguage` (  
  `id` Int( 11 ) AUTO_INCREMENT NOT NULL,  
  `name` VarChar( 32 ) CHARACTER SET utf8 COLLATE utf8_general_ci NOT NULL,  
  `version` VarChar( 16 ) CHARACTER SET utf8 COLLATE utf8_general_ci NULL,  
  `release` Date NULL, PRIMARY KEY ( `id` )  
)  
CHARACTER SET = utf8  
COLLATE = utf8_general_ci  
ENGINE = InnoDB  
AUTO_INCREMENT = 13;
```

b) Impact of index

Case 1

```
select * from ds_leaderboard;
```

Query time	1.947 s
Index used	No index to be used because we are loading all data of all attribute(column)

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```

1 SELECT * FROM ds_leaderboard;
2 -- select * from ds_leaderboard where language_id=1;
3 -- select * from ds_leaderboard ignore index(pl) where language_id=1;
4 -- select name,language_id from ds_leaderboard where language_id between 1 and 5;
5 -- explain select * from ds_leaderboard where country='India' group by language_id
6

```

	id	name	email	organizer	score	time	country	language
1	1	Sue House	vdavis@gmail.com	Curry, Huerta and Hall	11.7438441758335	737:49	Somalia	
2	2	Steven Wood	woodardjohn@hotmail.com	Sims-Vasquez	74.9224979864862	1517:56	Wallis and Futuna	
3	3	Veronica Shah	kimberly89@lee-miller.biz	Sloan Ltd	81.3265081678492	1067:43	Martinique	
4	4	Andre Harris	martincharles@yahoo.com	Price-Hernandez	31.2614757376671	1981:56	Portugal	
5	5	Heather Sandoval	amber70@gmail.com	Underwood, Brown and Harper	30.9707343168683	1369:6	Sierra Leone	
6	6	Brian Bennett	mgriffin@hughes.org	Waller, Perez and Brown	69.8662269367928	713:54	Angola	
7	7	Martin Wiggins	taylor23@yahoo.com	Hernandez Group	36.9669307405489	1073:22	Iran	
8	8	Kimberly Diaz	bellmichael@gmail.com	Miller, Kennedy and Marshall	47.6901312027133	1720:12	Uruguay	

Number of records: 400000 Number of fields: 8 Query time: 1.947 second(s) ReadOnly

select * from ds_leaderboard; -- select * from ds_leaderboard where language_id=1; -- explain select * from ds_leaderboard where country='India' group by language_id

Logs (4) Tunes Warnings

16:28:49 Query time: 2.301 second(s), Number of affected records: 400000

16:28:49 Query has been executed

16:47:12 Query time: 1.947 second(s), Number of affected records: 400000

16:47:12 Query has been executed

Row: 5 Col: 22

Case 2.1 : with index

```
select * from ds_leaderboard where language_id=1;
```

Query time	234 ms
No. of records	33243
Index used	index on attribute language_id

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```

1 -- select * from ds_leaderboard;
2 SELECT * FROM ds_leaderboard WHERE language_id=1;
3
4

```

	id	name	email	organizer	score	time	country	language_id
1	1	Sue House	vdavis@gmail.com	Curry, Huerta and Hall	11.7438441758335	737:49	Somalia	1
2	2	Steven Wood	woodardjohn@hotmail.com	Sims-Vasquez	74.9224979864862	1517:56	Wallis and Futuna	1
3	7	Martin Wiggins	taylor23@yahoo.com	Hernandez Group	36.9669307405489	1073:22	Iran	1
4	12	Michael Matthews	torresangelica@gmail.com	Adams Group	12.6008728289934	429:15	Australia	1
5	19	Elizabeth Turner	joe81@woods-evans.net	Johnson, Cardenas and Flores	18.3342122671797	518:35	Denmark	1
6	21	Diane Morales	melanieking@gmail.com	Brown Inc	76.5064887241658	1310:25	Angola	1
7	31	James Reese	nichole83@yahoo.com	Davis, Bryan and Davenport	16.3858734306025	166:34	Vanuatu	1
8	40	Maria Walters	burnsmatthew@yahoo.com	Short, Taylor and Howard	58.5880273210233	1855:5	French Polynesia	1

Number of records: 33243 Number of fields: 8 Query time: 234 millisecond(s) ReadOnly

-- select * from ds_leaderboard; select * from ds_leaderboard where language_id=1;

Logs (5) Tunes (3) Warnings

15:06:30 select * from ds_leaderboard;

15:06:41 Query time: 14 millisecond(s), Number of affected records: 1

15:06:50 Query time: 1.906 second(s), Number of affected records: 400000

15:06:50 select * from ds_leaderboard;

15:08:38 Query time: 1 millisecond(s), Number of affected records: 1

15:09:30 Query time: 234 millisecond(s), Number of affected records: 33243

15:09:30 -- select * from ds_leaderboard;...

Row: 2 Col: 50

Case 2.2 : without index (forced to not to use)

```
select * from ds_leaderboard ignore index(pl) where language_id=1;
```

Query time	291 ms
No. of records	33243

Query time	291 ms
Index used	(No index) ignoring index on attribute language_id (index referred as p1)

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```
-- select * from ds_leaderboard;
SELECT * FROM ds_leaderboard IGNORE INDEX(p1) WHERE language_id=1;
```

id	name	email	organizer	score	time	country	language_id
1	Sue House	vdavis@gmail.com	Curry, Huerta and Hall	11.7438441758335	737:49	Somalia	1
2	Steven Wood	woodardjohn@hotmail.com	Sims-Vasquez	74.9224979864862	1517:56	Wallis and Futuna	1
3	Martin Wiggins	taylor23@yahoo.com	Hernandez Group	36.9669307405489	1073:22	Iran	1
12	Michael Matthews	torresangelica@gmail.com	Adams Group	12.6008728289934	429:15	Australia	1
19	Elizabeth Turner	joe81@woods-evans.net	Johnson, Cardenas and Flores	18.3342122671797	518:35	Denmark	1
21	Diane Morales	melanieking@gmail.com	Brown Inc	76.5064887241658	1310:25	Angola	1
31	James Reese	nichole83@yahoo.com	Davis, Bryan and Davenport	16.3858734306025	166:34	Vanuatu	1
40	Maria Walters	burnsmatthew@yahoo.com	Short, Taylor and Howard	58.5880273210233	1855:5	French Polynesia	1

Number of records: 33243 Number of fields: 8 Query time: 291 millisecond(s) ReadOnly

~ select * from ds_leaderboard; select * from ds_leaderboard ignore index(p1) where language_id=1;

Logs (8) Tunes (4) Warnings

15:08:38 Query time: 1 millisecond(s), Number of affected records: 1
 15:09:30 Query time: 234 millisecond(s), Number of affected records: 33243
 15:10:06 Query time: 2 millisecond(s), Number of affected records: 1
 15:11:09 Query time: 1 millisecond(s), Number of affected records: 1
 15:11:34 Query time: 291 millisecond(s), Number of affected records: 33243

Row: 2 Col: 1

Case 3.1 : with no index

```
select name,language_id from ds_leaderboard where language_id between 1 and 5;
```

Query time	215 ms
No. of records	166490
Index used	(No index used) (possible key on language_id)

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```
-- select * from ds_leaderboard;
-- select * from ds_leaderboard where language_id=1;
-- select * from ds_leaderboard ignore index(p1) where language_id=1;
SELECT NAME,language_id FROM ds_leaderboard WHERE language_id BETWEEN 1 AND 5;
```

name	language_id
1 Sue House	1
2 Steven Wood	1
3 Veronica Shah	2
4 Andre Harris	3
5 Heather Sandoval	4
6 Brian Bennett	3
7 Martin Wiggins	1
8 Kimberly Diaz	4

Number of records: 166490 Number of fields: 2 Query time: 215 millisecond(s) ReadOnly

~ select * from ds_leaderboard; -- select * from ds_leaderboard where languag...select name,language_id from ds_leaderboard where language_id between 1 and 5;

Logs (15) Tunes (6) Warnings

15:15:07 Query time: 179 millisecond(s), Number of affected records: 33243
 15:15:07 Query has been executed
 15:16:02 Query time: 224 millisecond(s), Number of affected records: 166490
 15:16:02 -- select * from ds_leaderboard;...
 15:16:11 Query time: 0 millisecond(s), Number of affected records: 1
 15:19:15 Query time: 215 millisecond(s), Number of affected records: 166490
 15:19:16 -- select * from ds_leaderboard;...

Row: 4 Col: 1

Case 3.2 : with index on language_id (force to use)

```
select name,language_id from ds_leaderboard use index(p1) where language_id between 1 and 5;
```

Query time	206 ms
No. of records	166490
Index used	forced to use index on language_id (pl)

Case 4.1 : using index on country

```
select * from ds_leaderboard where country='India';
```

Query time	20 ms
No. of records	1597
Index used	used index on country

Case 4.2 : without index (forced to ignore)

```
select * from ds_leaderboard ignore index(ctry) where country='India';
```

Query time	155 ms
No. of records	1597
Index used	forced to ignore index on country

Case 5.1 : using index on language_id and country

```
select * from ds_leaderboard where country='India' and language_id=1;
```

Query time	11 ms
No. of records	143
Index used	Using intersect(pl,ctry); index of language_id and country

The screenshot shows the Valentina Studio interface. The SQL editor contains the following query:

```
1 -- select * from ds_leaderboard;
2 -- explain select * from ds_leaderboard where language_id=1;
3 -- select * from ds_leaderboard ignore index(pl) where language_id=1;
4 -- select name, language_id from ds_leaderboard use index(pl) where language_id between 1 and 5;
5 -- select * from ds_leaderboard ignore index(pl,ctry) where country='India' and language_id=1;
6 SELECT * FROM ds_leaderboard WHERE country='India' AND language_id=1;
7
```

The results pane shows a table with 8 columns: id, name, email, organizer, score, time, country, and language_id. The first 8 rows are displayed, showing records for India with language_id 1.

The status bar indicates: Number of records: 143 Number of fields: 8 Query time: 11 millisecond(s) Read Only

The logs pane shows the following entries:

```
18:04:09 Query time: 1 millisecond(s), Number of affected records: 1
18:05:15 Query time: 22 millisecond(s), Number of affected records: 143
18:05:15 -- select * from ds_leaderboard;
18:05:28 Query time: 17 millisecond(s), Number of affected records: 143
18:05:28 -- select * from ds_leaderboard;
18:05:29 Query time: 11 millisecond(s), Number of affected records: 143
18:05:29 -- select * from ds_leaderboard;
```

Case 5.2 : force to ignore index on country

```
select * from ds_leaderboard ignore index(ctry) where country='India' and language_id=1;
```

Query time	42 ms
No. of records	143
Index used	Using index on language_id

Case 5.3 : force to ignore index on language_id

```
select * from ds_leaderboard ignore index(pl) where country='India' and language_id=1;
```

Query time	4 ms
No. of records	143
Index used	Using index on country

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```
1 -- select * from ds_leaderboard from ds_leaderboard;
2 -- explain select * from ds_leaderboard where language_id=1;
3 -- select * from ds_leaderboard ignore index(pl) where language_id=1;
4 -- select name,language_id from ds_leaderboard use index(pl) where language_id between 1 and 5;
5 -- select * from ds_leaderboard ignore index(pl,ctry) where country='India' and language_id=1;
6 SELECT * FROM ds_leaderboard IGNORE INDEX(pl) WHERE country='India' AND language_id=1;
7
```

	id	name	email	organizer	score	time	country	language_id
1	393	Richard Murphy	boydkatherine@yahoo.com	Welch-Shaffer	21.4371164985978	1862:54	India	1
2	4101	Thomas Parker	flemingmegan@yahoo.com	Gonzales-Carroll	76.8618552048044	789:52	India	1
3	8069	Jessica Brown	michael38@gmail.com	Campbell Inc	69.933694699874	474:19	India	1
4	8787	Amber Rogers	imoore@ewing-brown.com	Pratt-Parker	60.2671539081226	1225:3	India	1
5	9087	Tony Harrison	ronniewilliams@patterson.com	James Inc	27.4692030896114	23:50	India	1
6	15107	Joseph Wheeler	ywong@patton.info	Simon, Watson and Johnson	0.867502436641541	742:44	India	1
7	15932	Jose Bowman	soniawashington@stanley.info	Cardenas LLC	31.0586644030172	1525:51	India	1
8	17135	Jay Todd	todd48@moore.biz	Ward, Taylor and Cruz	18.1518710627562	761:1	India	1

Number of records: 143 Number of fields: 8 Query time: 4 millisecond(s) ReadOnly

```
-- select * from ds_leaderboard from ds_leaderboard; -- explain select * from ds_lead...t * from ds_leaderboard ignore index(pl) where country='India' and language_id=1;
```

All Logs (60) Tunes (20) Warnings

18:00:42 -- select * from ds_leaderboard from ds_leaderboard;...

18:00:43 Query time: 11 millisecond(s), Number of affected records: 143

18:00:43 -- select * from ds_leaderboard from ds_leaderboard;...

18:00:43 Query time: 3 millisecond(s), Number of affected records: 143

18:00:43 -- select * from ds_leaderboard from ds_leaderboard;...

18:00:43 Query time: 4 millisecond(s), Number of affected records: 143

18:00:43 -- select * from ds_leaderboard from ds_leaderboard;...

Row: 3 Col: 25

Case 5.4 without index

```
select * from ds_leaderboard ignore index(pl,ctry) where country='India' and language_id=1;
```

Query time	148 ms
No. of records	143
Index used	No index used; Forced to ignore index

The screenshot shows the Valentina Studio interface. The main window displays a SQL query in the editor:

```

1 -- select * from ds_leaderboard;
2 -- explain select * from ds_leaderboard where language_id=1;
3 -- select * from ds_leaderboard ignore index(pl) where language_id=1;
4 -- select name,language_id from ds_leaderboard use index(pl) where language_id between 1 and 5;
5 -- select * from ds_leaderboard ignore index(pl,ctry) where country='India' and language_id=1;
6 SELECT * FROM ds_leaderboard IGNORE INDEX(pl,ctry) WHERE country='India' AND language_id=1;
7

```

Below the query editor, the results are displayed in a table with 9 columns: id, name, email, organizer, score, time, country, language_id. The table contains 143 rows of data. The first few rows are:

id	name	email	organizer	score	time	country	language_id
1	393 Richard Murphy	boydkatherine@yahoo.com	Welch-Shaffer	21.4371164985978	1862:54	India	1
2	4101 Thomas Parker	flemingmegan@yahoo.com	Gonzales-Carroll	76.8618552048044	789:52	India	1
3	8069 Jessica Brown	michael38@gmail.com	Campbell Inc	69.933694699874	474:19	India	1
4	8787 Amber Rogers	imoore@ewing-brown.com	Pratt-Parker	60.2671539081226	1225:3	India	1
5	9087 Tony Harrison	ronniewilliams@patterson.com	James Inc	27.4692030896114	23:50	India	1

Below the table, the status bar indicates: Number of records: 143 Number of fields: 8 Query time: 148 millisecond(s) Read Only.

The bottom panel shows the Logs window with the following entries:

```

17:53:05 Query time: 2 millisecond(s), Number of affected records: 1
17:53:07 Query time: 5 millisecond(s), Number of affected records: 143
17:53:07 -- select * from ds_leaderboard;
17:54:08 Query time: 142 millisecond(s), Number of affected records: 143
17:54:08 -- select * from ds_leaderboard;
18:00:17 Query time: 148 millisecond(s), Number of affected records: 143
18:00:17 -- select * from ds_leaderboard;

```

Summary

In records of 4,00,000 entries 33,243 entries having *language_id* equals to 1 (As in Case 2) and just 1597 entries having *country* equals to India (As in Case 4) and only 143 entries having both (As in Case 5).

In case 5.1 query engine choose to use index of both attribute *language_id* (pl) and *country* (ctry) and intersection of it is displayed which took about 11 ms whereas when we forced to use only index on *country* the result took only 4 ms but for only using index on *language_id* it costs 148 ms