University of Petroleum

&

Energy Studies

SCHOOL OF COMPUTER SCIENCE

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Semester: 3

Experiment 11: To understand the concepts of Index.

Objective: Students will be able to implement the concept of index.

1. **Create table of table name: EMPLOYEES and add 6 rows**

Column Name	Data Type	Width	Attributes
Employee_id	Character	10	PK
First_Name	Character	30	NN
Last_Name	Character	30	NN
DOB	Date		
Salary	Number	25	NN
Department_id	Character	10	

Creating Table:

```
mysql> CREATE TABLE EMPLOYEES (
    ->     Employee_id CHAR(10) PRIMARY KEY,
    ->     First_Name CHAR(30) NOT NULL,
    ->     Last_Name CHAR(30) NOT NULL,
    ->     DOB DATE,
    ->     Salary DECIMAL(25,2) NOT NULL,
    ->     Department_id CHAR(10)
    -> );
Query OK, 0 rows affected (0.05 sec)
```

Inserting Data:

```
mysql> INSERT INTO EMPLOYEES (Employee_id, First_Name, Last_Name, DOB, Salary, Department_id)
    -> VALUES
    -> ('E001', 'John', 'Smith', '1985-01-01', 50000, 'D001'),
    -> ('E002', 'Alice', 'Johnson', '1990-02-15', 60000, 'D002'),
    -> ('E003', 'Bob', 'Williams', '1988-03-22', 55000, 'D001'),
    -> ('E004', 'Charlie', 'Brown', '1992-04-10', 45000, 'D003'),
    -> ('E005', 'David', 'Davis', '1984-06-30', 70000, 'D002'),
    -> ('E006', 'Eve', 'Martinez', '1995-07-19', 40000, 'D003');
Query OK, 6 rows affected (0.01 sec)
Records: 6  Duplicates: 0  Warnings: 0
```

2. **Execute the following index related queries:**
   a. **Create an index of name employee_idx on EMPLOYEES with column Last_Name, Department_id**

```
mysql> CREATE INDEX employee_idx ON EMPLOYEES (Last_Name, Department_id);
Query OK, 0 rows affected (0.05 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> SHOW INDEXES FROM EMPLOYEES;
+-----------+------------+--------------+--------------+---------------+-----------+-------------+----------+--------+------+------------
-------+---------+------------+
| Table     | Non_unique | Key_name     | Seq_in_index | Column_name   | Collation | Cardinality | Sub_part | Packed | Null | Index_type
omment | Visible | Expression |
+-----------+------------+--------------+--------------+---------------+-----------+-------------+----------+--------+------+------------
-------+---------+------------+
| employees |          0 | PRIMARY      |            1 | Employee_id   | A         |           6 |     NULL |   NULL |      | BTREE
       | YES     | NULL       |
| employees |          1 | employee_idx |            1 | Last_Name     | A         |           6 |     NULL |   NULL |      | BTREE
       | YES     | NULL       |
| employees |          1 | employee_idx |            2 | Department_id | A         |           6 |     NULL |   NULL | YES  | BTREE
       | YES     | NULL       |
+-----------+------------+--------------+--------------+---------------+-----------+-------------+----------+--------+------+------------
-------+---------+------------+
3 rows in set (0.02 sec)
```

   b. **Find the ROWID for the above table and create a unique index on employee_id column of the EMPLOYEES.**

```
mysql> CREATE UNIQUE INDEX employee_id_idx ON EMPLOYEES (Employee_id);
Query OK, 0 rows affected (0.06 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> SHOW INDEXES FROM EMPLOYEES WHERE Key_name = 'employee_id_idx';
+-----------+------------+-----------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+
--------+---------+------------+
| Table     | Non_unique | Key_name        | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_
comment | Visible | Expression |
+-----------+------------+-----------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+
--------+---------+------------+
| employees |          0 | employee_id_idx |            1 | Employee_id | A         |           6 |     NULL |   NULL |      | BTREE      |         |
       | YES     | NULL       |
+-----------+------------+-----------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+
--------+---------+------------+
1 row in set (0.01 sec)
```

   c. **Create a reverse index on employee_id column of the EMPLOYEES.**

```
mysql> ALTER TABLE EMPLOYEES ADD COLUMN Employee_id_reversed CHAR(10);
Query OK, 0 rows affected (0.04 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> UPDATE EMPLOYEES SET Employee_id_reversed = REVERSE(Employee_id);
Query OK, 6 rows affected (0.01 sec)
Rows matched: 6  Changed: 6  Warnings: 0

mysql> CREATE INDEX employee_reverse_idx ON EMPLOYEES (Employee_id_reversed);
Query OK, 0 rows affected (0.05 sec)
Records: 0  Duplicates: 0  Warnings: 0
```

Output:

```
mysql> SHOW INDEXES FROM EMPLOYEES;
+-----------+------------+---------------------+--------------+---------------------+-----------+-------------+----------+--------+------+---
------+---------------+---------+------------+
| Table     | Non_unique | Key_name            | Seq_in_index | Column_name         | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Co
mment | Index_comment | Visible | Expression |
+-----------+------------+---------------------+--------------+---------------------+-----------+-------------+----------+--------+------+---
------+---------------+---------+------------+
| employees |          0 | PRIMARY             |            1 | Employee_id         | A         |           6 |     NULL |   NULL |      | BTREE      |
       |               | YES     | NULL       |
| employees |          0 | employee_id_idx     |            1 | Employee_id         | A         |           6 |     NULL |   NULL |      | BTREE      |
       |               | YES     | NULL       |
| employees |          1 | employee_idx        |            1 | Last_Name           | A         |           6 |     NULL |   NULL |      | BTREE      |
       |               | YES     | NULL       |
| employees |          1 | employee_idx        |            2 | Department_id       | A         |           6 |     NULL |   NULL | YES  | BTREE      |
       |               | YES     | NULL       |
| employees |          1 | employee_reverse_idx |            1 | Employee_id_reversed | A         |           6 |     NULL |   NULL | YES  | BTREE      |
       |               | YES     | NULL       |
+-----------+------------+---------------------+--------------+---------------------+-----------+-------------+----------+--------+------+---
------+---------------+---------+------------+
5 rows in set (0.01 sec)
```

d. Create a unique and composite index on employee_id and check whether there is duplicity of tuples or not.

```
mysql> CREATE UNIQUE INDEX unique_employee_idx ON EMPLOYEES (Employee_id, Last_Name);
Query OK, 0 rows affected (0.06 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> SHOW INDEXES FROM EMPLOYEES;
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| Table     | Non_unique | Key_name              | Seq_in_index | Column_name          | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment | Visible | Expression |
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| employees |          0 | PRIMARY               |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | employee_id_idx       |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | unique_employee_idx   |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | unique_employee_idx   |            2 | Last_Name            | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_idx          |            1 | Last_Name            | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_idx          |            2 | Department_id        | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_reverse_idx  |            1 | Employee_id_reversed | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
7 rows in set (0.01 sec)
```

e. Create Function-based indexes defined on the SQL functions UPPER(column_name) or LOWER(column_name) to facilitate case-insensitive searches(on column Last_Name).

```
mysql> ALTER TABLE EMPLOYEES ADD COLUMN Lower_Last_Name VARCHAR(30) GENERATED ALWAYS AS (LOWER(Last_Name)) STORED;
Query OK, 6 rows affected (0.16 sec)
Records: 6  Duplicates: 0  Warnings: 0

mysql> CREATE INDEX lower_last_name_idx ON EMPLOYEES (Lower_Last_Name);
Query OK, 0 rows affected (0.06 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> SHOW INDEXES FROM EMPLOYEES;
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| Table     | Non_unique | Key_name              | Seq_in_index | Column_name          | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment | Visible | Expression |
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| employees |          0 | PRIMARY               |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | employee_id_idx       |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | unique_employee_idx   |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | unique_employee_idx   |            2 | Last_Name            | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_idx          |            1 | Last_Name            | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_idx          |            2 | Department_id        | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_reverse_idx  |            1 | Employee_id_reversed | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
| employees |          1 | lower_last_name_idx   |            1 | Lower_Last_Name      | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
8 rows in set (0.01 sec)
```

f. Drop the function-based index on column Last_Name.

```
mysql> DROP INDEX lower_last_name_idx ON EMPLOYEES;
Query OK, 0 rows affected (0.03 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> SHOW INDEXES FROM EMPLOYEES;
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| Table     | Non_unique | Key_name              | Seq_in_index | Column_name          | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment | Visible | Expression |
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| employees |          0 | PRIMARY               |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | employee_id_idx       |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | unique_employee_idx   |            1 | Employee_id          | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          0 | unique_employee_idx   |            2 | Last_Name            | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_idx          |            1 | Last_Name            | A         |           6 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_idx          |            2 | Department_id        | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
| employees |          1 | employee_reverse_idx  |            1 | Employee_id_reversed | A         |           6 |     NULL |   NULL | YES  | BTREE      |         |               | YES     | NULL       |
+-----------+------------+-----------------------+--------------+----------------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
7 rows in set (0.00 sec)
```