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Batch : Comps C'32

Subject : Advance Database Management System (ADBMS)

Experiment No 5 - Distributed Database Design

Aim : Perform Fragmentation (Range, List, Hash and Key) in DDBS design.

Write Ups :

26/10/2023	ADMS - Exp 5	Kareena Shah - 6000421024 Date of Submission - 26/10/2023 Date of Performance - 02/11/2023 Page No. Date ①
Aim : To Implement Fragmentation (Range, List, Key, Hash)		
Theory :		
Fragmentation		
(1) Fragmentation refers to the division of data & database objects into smaller, more manageable pieces		
(2) Fragmentation must be done in such a way that the database can be reconstructed from the fragments		
(3) There are two types of fragmentation :		
<ul style="list-style-type: none">• Horizontal Fragmentation• Vertical Fragmentation		
Horizontal Fragmentation		
It involves dividing a table into subsets of rows based on specific condition. It is useful for distributing data in distributed database. The fragments can be then reconstructed using simple union operation.		
Vertical Fragmentation		
This type divides a table into subsets of columns or attributes. Each subset contains a different set of attributes. It is used to improve query performance & manage data access. The fragments can then be reconstructed using JOIN operation.		
Mixed / Hybrid Fragmentation		
Mixed Fragmentation combines both horizontal & vertical		

Fragmentation allowing for more granular control over data distribution in complex distributed database systems. It is used when data needs to be distributed with different structures in various locations.

Partitioning

(1) It is a MySQL database feature that can be used to improve the performance & manageability of your database. It enables you to define groups of rows or index keys within a table according to some algorithm or scheme. You can store each group/fragment/partition in a separate space associated with a specific physical disk. One can use SQL statements to create the fragments & assign them to space.

Types :

- ⇒ Range Partitioning
- ⇒ List Partitioning
- ⇒ Key Partitioning
- ⇒ Hash Partitioning

Range Partitioning

Here data is partitioned based on a specific range of values for a chosen value/column. It is suitable for data that can be logically divided into non-overlapping ranges.

List Partitioning

Here, data is classified into partitions based on

specific values for a selected column. It defines a list of discrete values for this column & data rows are placed into partitions according to matching values.

Key Partitioning

Here, partition of data is done using a combination of columns. The data is divided based on a function of multiple columns & partitions are defined by the columns i.e. identified by the result of this function.

Hash Partitioning

This involves partitioning data based on a hash function applied to a chosen column.

Conclusion :

Implementing fragmentation using various techniques like range, list, key, hash partitioning is vital for optimizing database performance & data distribution.

These methods enhance data organization & retrieval, benefiting data availability, scalability, & performance.

MySQL Workbench

Local instance MySQL80

File Edit View Query Database Server Tools Scripting Help

Navigator

Filter objects

SCHMAS

- 6004210090
- dhaw
- coursea
- employeeeb
- husain
- husain69
- husain
- kreena
- kreena243
- kreena243
- kreena243
- kreena243
- new
- newschema
- paramdb
- sakila
- sonia
- sys
- university_239
- world

SQL File 1 SQL File 2 SQL File 3 SQL File 4 SQL File 5 SQL File 6 SQL File 7

Limit to 50000 rows

```
27 (14, 'Kelly White', 'Assistant Manager', 'IT', 80000),
28 (15, 'Larry Harris', 'IT Specialist', 'IT', 70000),
29 (16, 'Nelly Clark', 'Manager', 'Operations', 80000),
30 (17, 'Nancy Thompson', 'Assistant Manager', 'Operations', 70000),
31 (18, 'Oscar Garcia', 'Operations Specialist', 'Operations', 60000),
32 (19, 'Patricia Martinez', 'Manager', 'Customer Service', 75000),
33 (20, 'Robert Robinson', 'Customer Service Representative', 'Customer Service', 50000);
34
35 * ALTER TABLE usingRange PARTITION BY RANGE (ID) (
36 PARTITION p0 VALUES LESS THAN (5),
37 PARTITION p1 VALUES LESS THAN (11),
38 PARTITION p2 VALUES LESS THAN (16),
39 PARTITION p3 VALUES LESS THAN MAXVALUE
40 );
41
42 * SELECT * FROM usingRange PARTITION (p0);
43 * SELECT * FROM usingRange PARTITION (p1);
44 * SELECT * FROM usingRange PARTITION (p2);
45 * SELECT * FROM usingRange PARTITION (p3);
```

Result Grid

ID	Name	Position	Department	Salary
1	Kreena Shah	Manager	Sales	70000
2	Arya Smith	Assistant Manager	Sales	60000
3	Sakshi Johnson	Sales Representative	Sales	50000
4	Alice Williams	Manager	Marketing	80000
5	Bob Brown	Assistant Manager	Marketing	70000

usingRange 1 x

Output

Action Output

#	Time	Action	Message	Duration / Fetch
1	07:42:02	CREATE DATABASE kreena243	0 rows affected	0.031 sec
2	07:42:05	USE kreena243	0 rows affected	0.016 sec
3	07:42:08	CREATE TABLE usingRange (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary IN...	0 rows affected	0.062 sec
4	07:42:12	INSERT INTO usingRange (ID, Name, Position, Department, Salary) VALUES (1, 'Kreena Shah', 'Manager', 'Sales', 70000), (2, 'Arya Smith', 'Assistant M...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.047 sec
5	07:42:25	ALTER TABLE usingRange PARTITION BY RANGE (ID) (PARTITION p0 VALUES LESS THAN (5), PARTITION p1 VALUES LESS THAN (11), PARTITION p2 VALUES LESS THAN (16), PARTITION p3 VALUES LESS THAN MAXVALUE)	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.234 sec
6	07:42:28	SELECT * FROM usingRange PARTITION (p0) LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec

Object Info Session

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

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Limit to 50000 rows

```
27 (15, 'Larry Harris', 'IT Specialist', 'IT', 70000),
28 (16, 'Nelly Clark', 'Manager', 'Operations', 80000),
29 (17, 'Nancy Thompson', 'Assistant Manager', 'Operations', 70000),
30 (18, 'Oscar Garcia', 'Operations Specialist', 'Operations', 60000),
31 (19, 'Patricia Martinez', 'Manager', 'Customer Service', 75000),
32 (20, 'Robert Robinson', 'Customer Service Representative', 'Customer Service', 50000);
33
34 * ALTER TABLE usingList PARTITION BY LIST (ID) (
35 PARTITION p0 VALUES IN (1,2,3,4,5),
36 PARTITION p1 VALUES IN (6,7,8,9,10),
37 PARTITION p2 VALUES IN (11,12,13,14,15),
38 PARTITION p3 VALUES IN (16,17,18,19,20)
39 );
40
41 * SELECT * FROM usingList PARTITION (p0);
42 * SELECT * FROM usingList PARTITION (p1);
43 * SELECT * FROM usingList PARTITION (p2);
44 * SELECT * FROM usingList PARTITION (p3);
```

Result Grid

ID	Name	Position	Department	Salary
1	Kreena Shah	Manager	Sales	70000
2	Arya Smith	Assistant Manager	Sales	60000
3	Sakshi Johnson	Sales Representative	Sales	50000
4	Alice Williams	Manager	Marketing	80000
5	Bob Brown	Assistant Manager	Marketing	70000

usingList 1 x

Output

Action Output

#	Time	Action	Message	Duration / Fetch
1	07:42:02	CREATE DATABASE kreena243	0 rows affected	0.016 sec
2	07:42:05	USE kreena243	0 rows affected	0.062 sec
3	07:42:12	CREATE TABLE usingRange (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary IN...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.047 sec
4	07:42:25	ALTER TABLE usingRange PARTITION BY RANGE (ID) (PARTITION p0 VALUES LESS THAN (5), PARTITION p1 VALUES LESS THAN (11), PARTITION p2 VALUES LESS THAN (16), PARTITION p3 VALUES LESS THAN MAXVALUE)	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.234 sec
5	07:42:28	SELECT * FROM usingRange PARTITION (p0) LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec
6	07:43:57	USE kreena243	0 rows affected	0.000 sec
7	07:44:00	CREATE TABLE usingList (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary INT)	0 rows affected	0.047 sec
8	07:44:02	INSERT INTO usingList (ID, Name, Position, Department, Salary) VALUES (1, 'Kreena Shah', 'Manager', 'Sales', 70000), (2, 'Arya Smith', 'Assistant Man...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.015 sec
9	07:44:07	ALTER TABLE usingList PARTITION BY LIST (ID) (PARTITION p0 VALUES IN (1,2,3,4,5), PARTITION p1 VALUES IN (6,7,8,9,10), PARTITION p2 VALUES IN (11,12,13,14,15), PARTITION p3 VALUES IN (16,17,18,19,20))	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.234 sec
10	07:44:11	SELECT * FROM usingList PARTITION (p0) LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec

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Limit to 50000 rows

```
20 (8, 'Eva Wilson', 'Assistant Manager', 'HR', 65000),
21 (9, 'Frank Moore', 'HR Specialist', 'HR', 55000),
22 (10, 'Grace Taylor', 'Manager', 'Finance', 85000),
23 (11, 'Henry Anderson', 'Assistant Manager', 'Finance', 75000),
24 (12, 'Irene Thomas', 'Finance Specialist', 'Finance', 65000),
25 (13, 'Jack Jackson', 'Manager', 'IT', 90000),
26 (14, 'Kelly White', 'Assistant Manager', 'IT', 80000),
27 (15, 'Larry Harris', 'IT Specialist', 'IT', 70000),
28 (16, 'Molly Clark', 'Manager', 'Operations', 80000),
29 (17, 'Nancy Thompson', 'Assistant Manager', 'Operations', 70000),
30 (18, 'Oscar Garcia', 'Operations Specialist', 'Operations', 60000),
31 (19, 'Patricia Martinez', 'Manager', 'Customer Service', 75000),
32 (20, 'Robert Robinson', 'Customer Service Representative', 'Customer Service', 50000);
33
34 ALTER TABLE usingHash PARTITION BY HASH(ID)
35 PARTITIONS 4;
36
37 SELECT * FROM usingHash PARTITION (p0);
38 SELECT * FROM usingHash PARTITION (n1);
```

Result Grid

ID	Name	Position	Department	Salary
4	Alice Williams	Manager	Marketing	80000
8	Eva Wilson	Assistant Manager	HR	65000
12	Irene Thomas	Finance Specialist	Finance	65000
16	Molly Clark	Manager	Operations	80000
20	Robert Robinson	Customer Service Representative	Customer Service	50000

usingHash 1 x

Output

#	Time	Action	Message	Duration / Fetch
7	07:43:57	USE kreenaah243	0 rows affected	0.000 sec
8	07:44:00	CREATE TABLE usingHash (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary INT)	0 rows affected	0.047 sec
9	07:44:02	INSERT INTO usingHash ID, Name, Position, Department, Salary VALUES (1, 'Kreena Shah', 'Manager', 'Sales', 70000), (2, 'Aya Smith', 'Assistant M...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.015 sec
10	07:44:07	ALTER TABLE usingHash PARTITION BY LIST (ID) PARTITION p0 VALUES IN (1,2,3,4,5) PARTITION p1 VALUES IN (6,7,8,9,10) PARTITI...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.234 sec
11	07:44:11	SELECT * FROM usingHash PARTITION p0 LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec
12	07:44:30	USE kreenaah243	0 rows affected	0.000 sec
13	07:44:32	CREATE TABLE usingHash (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary I...	0 rows affected	0.047 sec
14	07:44:35	INSERT INTO usingHash ID, Name, Position, Department, Salary VALUES (1, 'Kreena Shah', 'Manager', 'Sales', 70000), (2, 'Aya Smith', 'Assistant M...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.031 sec
15	07:44:38	ALTER TABLE usingHash PARTITION BY HASH(ID) PARTITIONS 4	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.218 sec
16	07:44:43	SELECT * FROM usingHash PARTITION p0 LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec

Object Info Session

Type here to search

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24 (12, 'Irene Thomas', 'Finance Specialist', 'Finance', 65000),
25 (13, 'Jack Jackson', 'Manager', 'IT', 90000),
26 (14, 'Kelly White', 'Assistant Manager', 'IT', 80000),
27 (15, 'Larry Harris', 'IT Specialist', 'IT', 70000),
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31 (19, 'Patricia Martinez', 'Manager', 'Customer Service', 75000),
32 (20, 'Robert Robinson', 'Customer Service Representative', 'Customer Service', 50000);
33
34 ALTER TABLE usingKey PARTITION BY KEY()
35 PARTITIONS 4;
36
37 SELECT * FROM usingKey PARTITION (p0);
38 SELECT * FROM usingKey PARTITION (n1);
```

Result Grid

ID	Name	Position	Department	Salary
1	Kreena Shah	Manager	Sales	70000
5	Bob Brown	Assistant Manager	Marketing	70000
9	Frank Moore	HR Specialist	HR	55000
13	Jack Jackson	Manager	IT	90000
17	Nancy Thompson	Assistant Manager	Operations	70000

usingKey 1 x

Output

#	Time	Action	Message	Duration / Fetch
12	07:44:30	USE kreenaah243	0 rows affected	0.000 sec
13	07:44:32	CREATE TABLE usingHash (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary I...	0 rows affected	0.047 sec
14	07:44:35	INSERT INTO usingHash ID, Name, Position, Department, Salary VALUES (1, 'Kreena Shah', 'Manager', 'Sales', 70000), (2, 'Aya Smith', 'Assistant M...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.031 sec
15	07:44:38	ALTER TABLE usingHash PARTITION BY HASH(ID) PARTITIONS 4	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.219 sec
16	07:44:43	SELECT * FROM usingHash PARTITION p0 LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec
17	07:44:55	USE kreenaah243	0 rows affected	0.000 sec
18	07:44:56	CREATE TABLE usingKey (ID INT PRIMARY KEY, Name VARCHAR(50), Position VARCHAR(50), Department VARCHAR(50), Salary INT)	0 rows affected	0.047 sec
19	07:44:59	INSERT INTO usingHash ID, Name, Position, Department, Salary VALUES (1, 'Kreena Shah', 'Manager', 'Sales', 70000), (2, 'Aya Smith', 'Assistant M...	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.016 sec
20	07:45:02	ALTER TABLE usingKey PARTITION BY KEY() PARTITIONS 4	20 rows affected Records: 20 Duplicates: 0 Warnings: 0	0.250 sec
21	07:45:05	SELECT * FROM usingKey PARTITION p0 LIMIT 0, 50000	5 rows returned	0.000 sec / 0.000 sec

Object Info Session

Type here to search

07:45 02-11-2023