Date:07.04.2022

Third Year B. Tech., Sem VI 2021-22

4CS372 : Advanced Database System Lab

LA - 2 Submission

PRN No: 2019BTECS00064

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Batch: T2

Part 1 of 2

Title of assignment: Distributed Database Implementation

Distributed database implementation for bookstore

Consider a distributed database for a bookstore with 3 sites called site1, site2 and site3. Consider the following relations:
Books (ISBN, Author, Topic, TotalStock, Price)
BookStore (Storeno, City, State, ZipCode, InventoryValue)
Stock (Storeno, ISBN, Qty)
Total Stock is the total number of books in stock.
Now here in this distributed database for bookstore, we have fragmented the books according to the ISBN numbers into:
F1: Books: ISBN from 1001 to 1010
F2: Books: ISBN from 1021 to 1030
F3: Books: ISBN from 1031 to 1040
Similarly, Book Stores are divided according to their store number into
S1: BookStore: Storeno from 1 to 10
S2: BookStore: Storeno from 11 to 20

S3: BookStore: Storeno from 21 to 30

Perform

a. Now from Site3, we want to check on the total number of books available at each site
b. We are on site1 and we want to access the books on site3, site 2.
c. From site 2, we want to check the available copies of particular book with ISBN number in the bookstore. According to the ISBN number in which fragment it belongs, search in the respective database
d. Get the list of all the books available in the bookstore from any site.
e. Get the list of all the stores from any site.

Aim:

To implement distributed database system on three different physical sites.

Objectives:

- Configuration of master master replication site for distributed database system.
- Replicating database to all the sites.
- Performing read operations on distributed database systems from any site.

Theory:

A distributed database is basically a database that is not limited to one system, it is spread over different sites, i.e, on multiple computers or over a network of computers. A distributed database system is located on various sites that don't share physical components. This may be required when a particular database needs to be accessed by various users globally. It needs to be managed such that for the users it looks like one single database.

Types:

1. Homogeneous Database:
   In a homogeneous database, all different sites store database identically. The operating system, database management system, and the data structures used – all are the same at all sites. Hence, they're easy to manage.
2. Heterogeneous Database:
   In a heterogeneous distributed database, different sites can use different schema and software that can lead to problems in query processing and transactions. Also, a particular site might be completely unaware of the other sites. Different computers may use a different operating system, different database application. They may even use different data models for the database. Hence, translations are required for different sites to communicate.

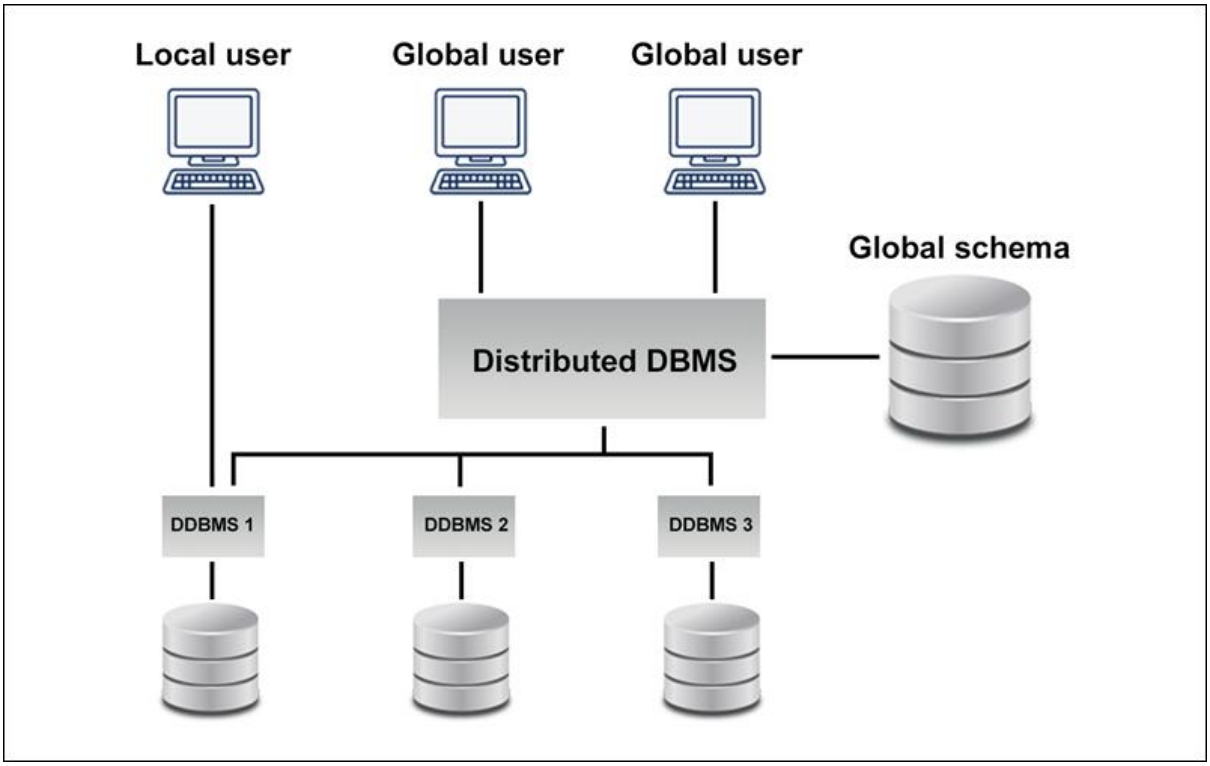
Distributed Data Storage:

There are 2 ways in which data can be stored on different sites. These are:

1. Replication –
   In this approach, the entire relationship is stored redundantly at 2 or more sites. If the entire database is available at all sites, it is a fully redundant database. Hence, in replication, systems maintain copies of data.
   This is advantageous as it increases the availability of data at different sites. Also, now query requests can be processed in parallel. However, it has certain disadvantages as well. Data needs to be constantly updated. Any change made at one site needs to be

recorded at every site that relation is stored or else it may lead to inconsistency. This is a lot of overhead. Also, concurrency control becomes way more complex as concurrent access now needs to be checked over a number of sites.

2. Fragmentation –
   In this approach, the relations are fragmented (i.e., they're divided into smaller parts) and each of the fragments is stored in different sites where they're required. It must be made sure that the fragments are such that they can be used to reconstruct the original relation (i.e, there isn't any loss of data).
   Fragmentation is advantageous as it doesn't create copies of data, consistency is not a problem.



Enter password: ********
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.28 MySQL Community Server - GPL

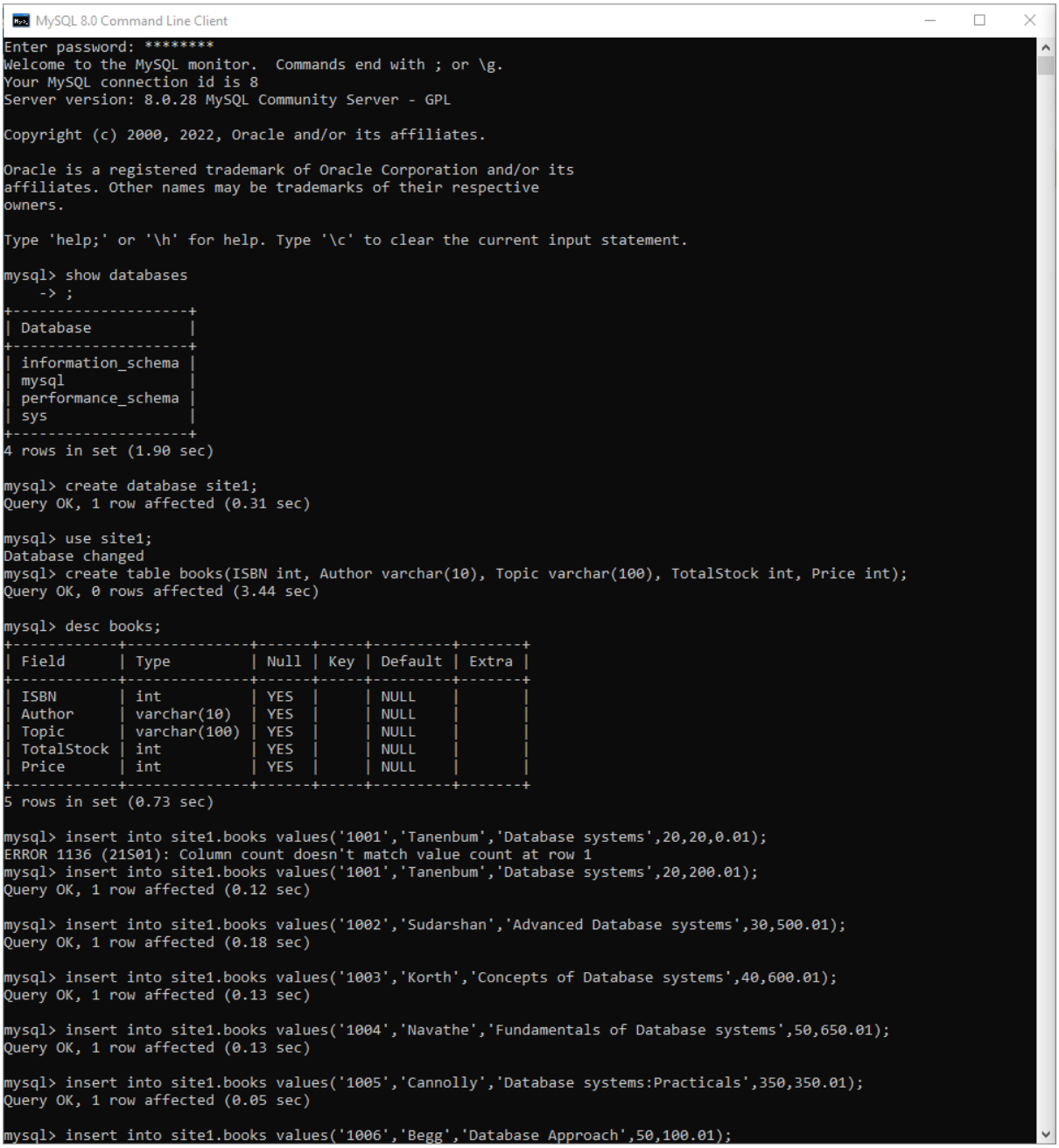
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

Creation of Database 1: site1

```
mysql> create database site1;
Query OK, 1 row affected (0.31 sec)

mysql> use site1;
Database changed
mysql> create table books(ISBN int, Author varchar(10), Topic
varchar(100), TotalStock int, Price int);
Query OK, 0 rows affected (3.44 sec)

mysql> desc books;
+------------+--------------+------+-----+---------+-------+
| Field      | Type         | Null | Key | Default | Extra |
+------------+--------------+------+-----+---------+-------+
| ISBN       | int          | YES  |     | NULL    |       |
| Author     | varchar(10)  | YES  |     | NULL    |       |
| Topic      | varchar(100) | YES  |     | NULL    |       |
| TotalStock | int          | YES  |     | NULL    |       |
| Price      | int          | YES  |     | NULL    |       |
+------------+--------------+------+-----+---------+-------+
5 rows in set (0.73 sec)

mysql> insert into site1.books values('1001','Tanenbum','Database
systems',20,20,0.01);
ERROR 1136 (21S01): Column count doesn't match value count at row 1
mysql> insert into site1.books values('1001','Tanenbum','Database
systems',20,200.01);
Query OK, 1 row affected (0.12 sec)

mysql> insert into site1.books values('1002','Sudarshan','Advanced
Database systems',30,500.01);
Query OK, 1 row affected (0.18 sec)
```

```
mysql> insert into site1.books values('1003','Korth','Concepts of
Database systems',40,600.01);
Query OK, 1 row affected (0.13 sec)

mysql> insert into site1.books values('1004','Navathe','Fundamentals of
Database systems',50,650.01);
Query OK, 1 row affected (0.13 sec)

mysql> insert into site1.books values('1005','Cannolly','Database
systems:Practicals',350,350.01);
Query OK, 1 row affected (0.05 sec)

mysql> insert into site1.books values('1006','Begg','Database
Approach',50,100.01);
Query OK, 1 row affected (0.09 sec)

mysql> insert into site1.books values('1007','Silberschatz','Database
Concepts',45,360);
ERROR 1406 (22001): Data too long for column 'Author' at row 1
mysql> insert into site1.books values('1007','Silberschat','Database
Concepts',45,360);
ERROR 1406 (22001): Data too long for column 'Author' at row 1
mysql> insert into site1.books values('1007','Silber','Database
Concepts',45,360);
Query OK, 1 row affected (0.06 sec)

mysql> insert into site1.books values('1008','Henry','Database &
Concepts',55,660);
Query OK, 1 row affected (0.14 sec)

mysql> select * from books;
+------+-----------+---------------------------------+------------+-------+
| ISBN | Author    | Topic                           | TotalStock | Price |
+------+-----------+---------------------------------+------------+-------+
| 1001 | Tanenbum  | Database systems                |         20 |   200 |
```

1002	Sudarshan	Advanced Database systems	30	500
1003	Korth	Concepts of Database systems	40	600
1004	Navathe	Fundamentals of Database systems	50	650
1005	Cannolly	Database systems:Practicals	350	350
1006	Begg	Database Approach	50	100
1007	Silber	Database Concepts	45	360
1008	Henry	Database & Concepts	55	660
+------+-----------+--------------------------------+------------+-------+
8 rows in set (0.01 sec)


MySQL 8.0 Command Line Client
Enter password: ********
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.28 MySQL Community Server - GPL
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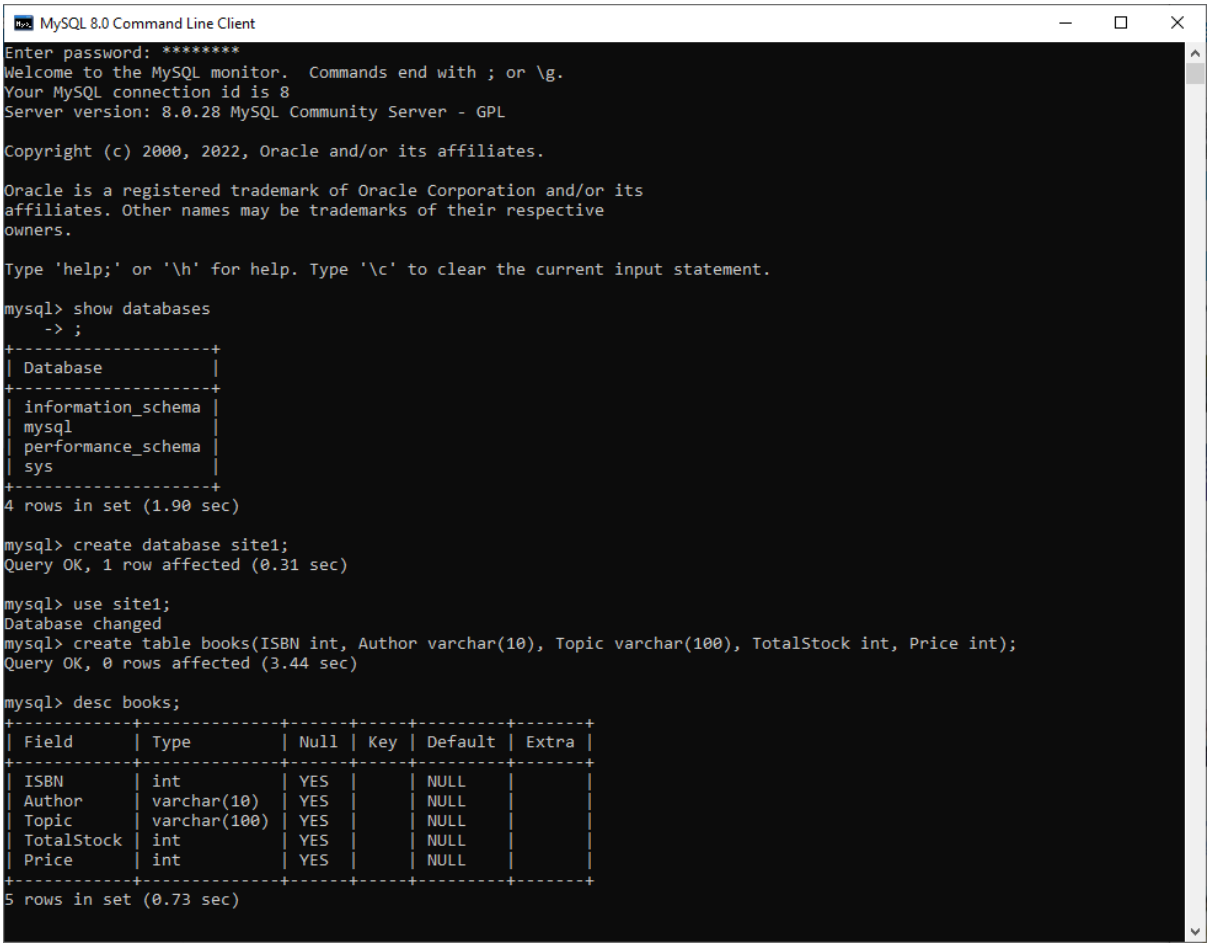
affiliates. Other names may be trademarks of their respective
owners.
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
mysql> show databases
-> ;
+--------------------+
| Database |
+--------------------+
| information_schema |
| mysql |
| performance_schema |
| sys |
+--------------------+
4 rows in set (1.90 sec)
mysql> create database site1;
Query OK, 1 row affected (0.31 sec)
mysql> use site1;
Database changed
mysql> create table books(ISBN int, Author varchar(10), Topic varchar(100), TotalStock int, Price int);
Query OK, 0 rows affected (3.44 sec)
mysql> desc books;
+------------+--------------+------+-----+---------+-------+
| Field | Type | Null | Key | Default | Extra |
+------------+--------------+------+-----+---------+-------+
ISBN	int	YES		NULL	
Author	varchar(10)	YES		NULL	
Topic	varchar(100)	YES		NULL	
TotalStock	int	YES		NULL	
Price	int	YES		NULL	
+------------+--------------+------+-----+---------+-------+
5 rows in set (0.73 sec)
mysql> insert into site1.books values('1001','Tanenbum','Database systems',20,20,0.01);
ERROR 1136 (21S01): Column count doesn't match value count at row 1
mysql> insert into site1.books values('1001','Tanenbum','Database systems',20,200.01);
Query OK, 1 row affected (0.12 sec)
mysql> insert into site1.books values('1002','Sudarshan','Advanced Database systems',30,500.01);
Query OK, 1 row affected (0.18 sec)
mysql> insert into site1.books values('1003','Korth','Concepts of Database systems',40,600.01);
Query OK, 1 row affected (0.13 sec)
mysql> insert into site1.books values('1004','Navathe','Fundamentals of Database systems',50,650.01);
Query OK, 1 row affected (0.13 sec)
mysql> insert into site1.books values('1005','Cannolly','Database systems:Practicals',350,350.01);
Query OK, 1 row affected (0.05 sec)
mysql> insert into site1.books values('1006','Begg','Database Approach',50,100.01);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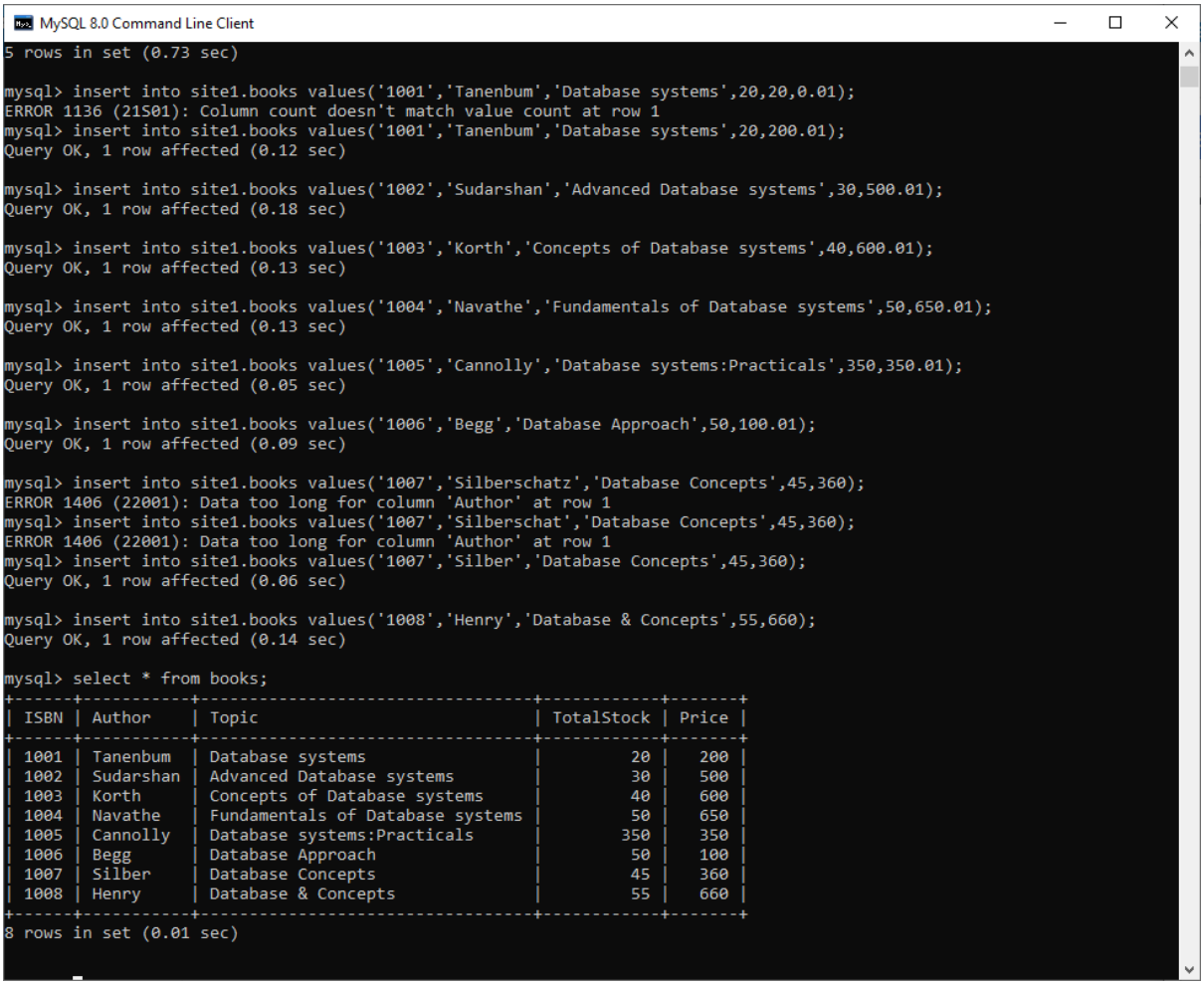
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
mysql> show databases
-> ;
+--------------------+
| Database |
+--------------------+
| information_schema |
| mysql |
| performance_schema |
| sys |
+--------------------+
4 rows in set (1.90 sec)
mysql> create database site1;
Query OK, 1 row affected (0.31 sec)
mysql> use site1;
Database changed
mysql> create table books(ISBN int, Author varchar(10), Topic varchar(100), TotalStock int, Price int);
Query OK, 0 rows affected (3.44 sec)
mysql> desc books;
+------------+--------------+------+-----+---------+-------+
| Field | Type | Null | Key | Default | Extra |
+------------+--------------+------+-----+---------+-------+
ISBN	int	YES		NULL	
Author	varchar(10)	YES		NULL	
Topic	varchar(100)	YES		NULL	
TotalStock	int	YES		NULL	
Price	int	YES		NULL	
+------------+--------------+------+-----+---------+-------+
5 rows in set (0.73 sec)



mysql> create table BookStore(Storeno int, City varchar(25), State varchar(100),Zipcode int,InventoryValue int);
Query OK, 0 rows affected (1.98 sec)

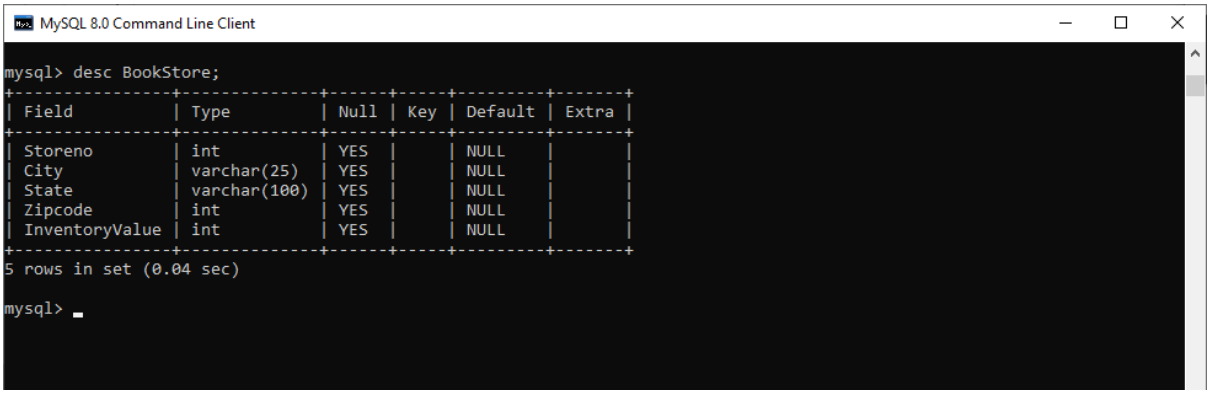
mysql> insert into site1.BookStore
values(1,'Nagpur','Maharashtra',442001,1234);
Query OK, 1 row affected (0.11 sec)

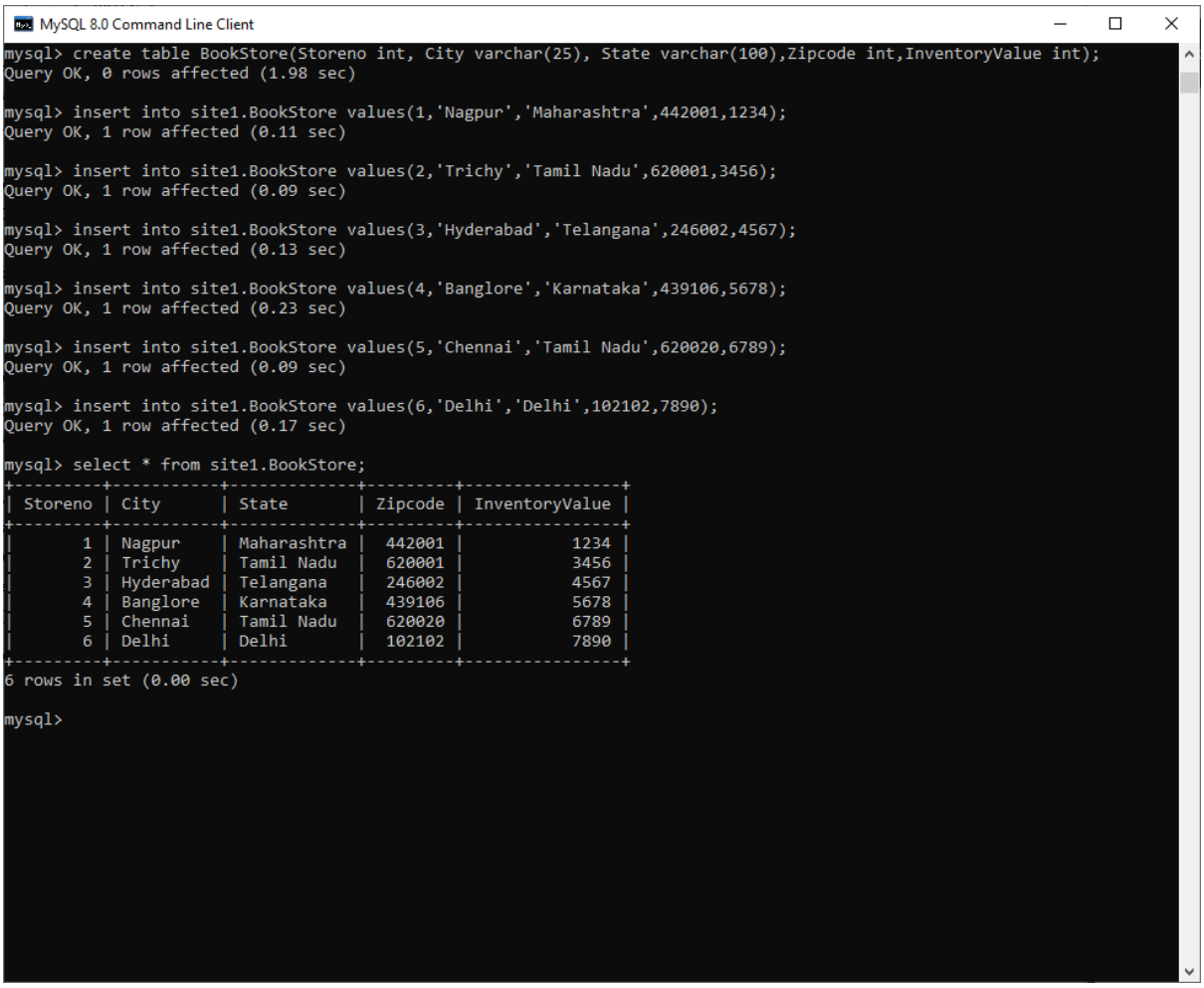
mysql> insert into site1.BookStore values(2,'Trichy','Tamil Nadu',620001,3456);
Query OK, 1 row affected (0.09 sec)

mysql> insert into site1.BookStore
values(3,'Hyderabad','Telangana',246002,4567);
Query OK, 1 row affected (0.13 sec)

mysql> insert into site1.BookStore
values(4,'Banglore','Karnataka',439106,5678);

```
Query OK, 1 row affected (0.23 sec)

mysql> insert into site1.BookStore values(5,'Chennai','Tamil
Nadu',620020,6789);
Query OK, 1 row affected (0.09 sec)

mysql> insert into site1.BookStore values(6,'Delhi','Delhi',102102,7890);
Query OK, 1 row affected (0.17 sec)

mysql> desc BookStore;
+----------------+-------------+------+-----+---------+-------+
| Field          | Type        | Null | Key | Default | Extra |
+----------------+-------------+------+-----+---------+-------+
| Storeno        | int         | YES  |     | NULL    |       |
| City           | varchar(25) | YES  |     | NULL    |       |
| State          | varchar(100) | YES  |     | NULL    |       |
| Zipcode        | int         | YES  |     | NULL    |       |
| InventoryValue | int         | YES  |     | NULL    |       |
+----------------+-------------+------+-----+---------+-------+
5 rows in set (0.04 sec)

mysql> select * from site1.BookStore;
+---------+-----------+-------------+---------+----------------+
| Storeno | City      | State       | Zipcode | InventoryValue |
+---------+-----------+-------------+---------+----------------+
|       1 | Nagpur    | Maharashtra |  442001 |           1234 |
|       2 | Trichy    | Tamil Nadu  |  620001 |           3456 |
|       3 | Hyderabad | Telangana   |  246002 |           4567 |
|       4 | Banglore  | Karnataka   |  439106 |           5678 |
|       5 | Chennai   | Tamil Nadu  |  620020 |           6789 |
|       6 | Delhi     | Delhi       |  102102 |           7890 |
+---------+-----------+-------------+---------+----------------+
6 rows in set (0.00 sec)
```





mysql> create table Stock(Storeno int,ISBN varchar(100),Qty int);
Query OK, 0 rows affected (0.66 sec)

mysql> desc stock;

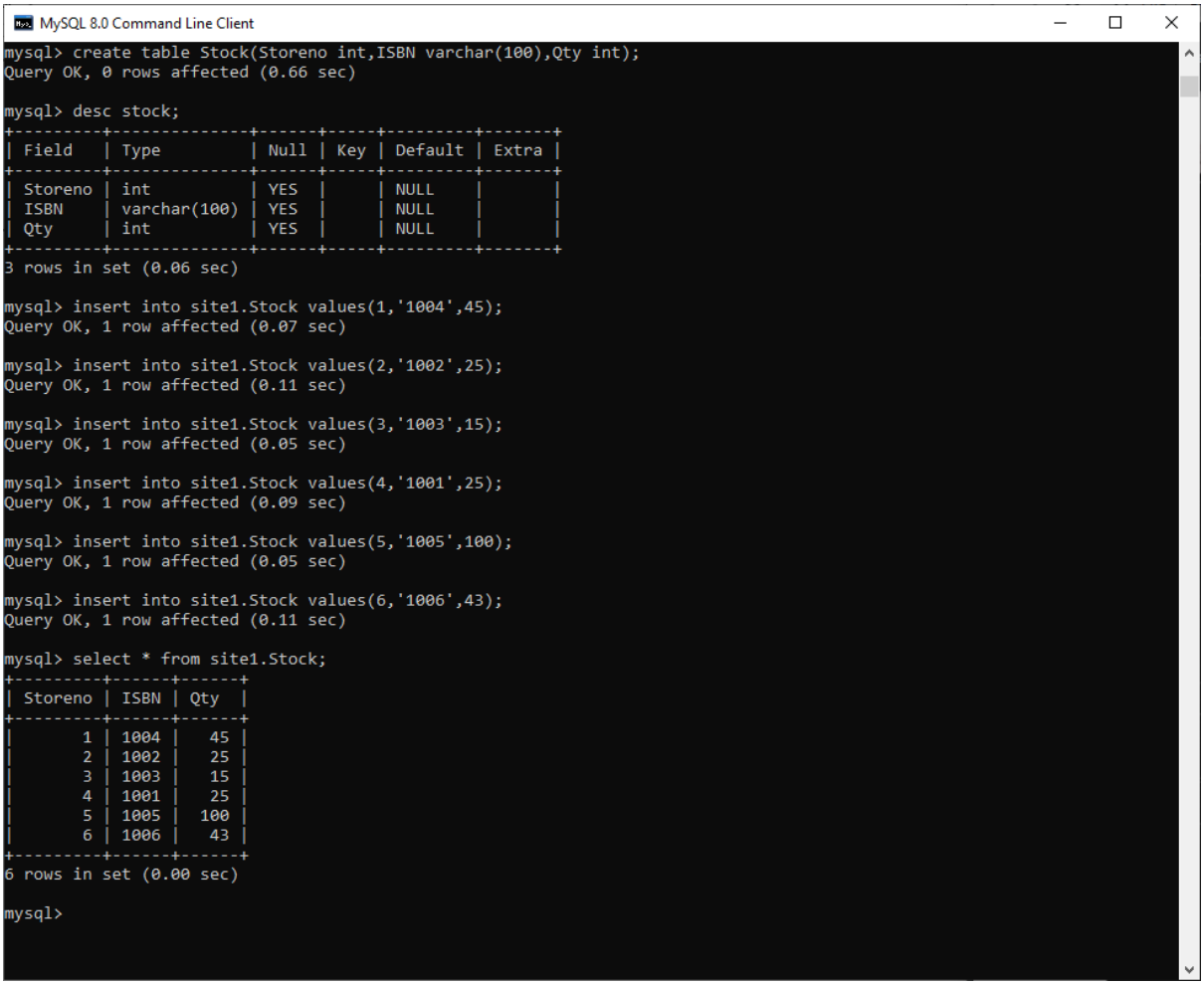
+---------+-------------+------+-----+---------+-------+

| Field | Type | Null | Key | Default | Extra |

+---------+-------------+------+-----+---------+-------+

| Storeno | int | YES | | NULL | |

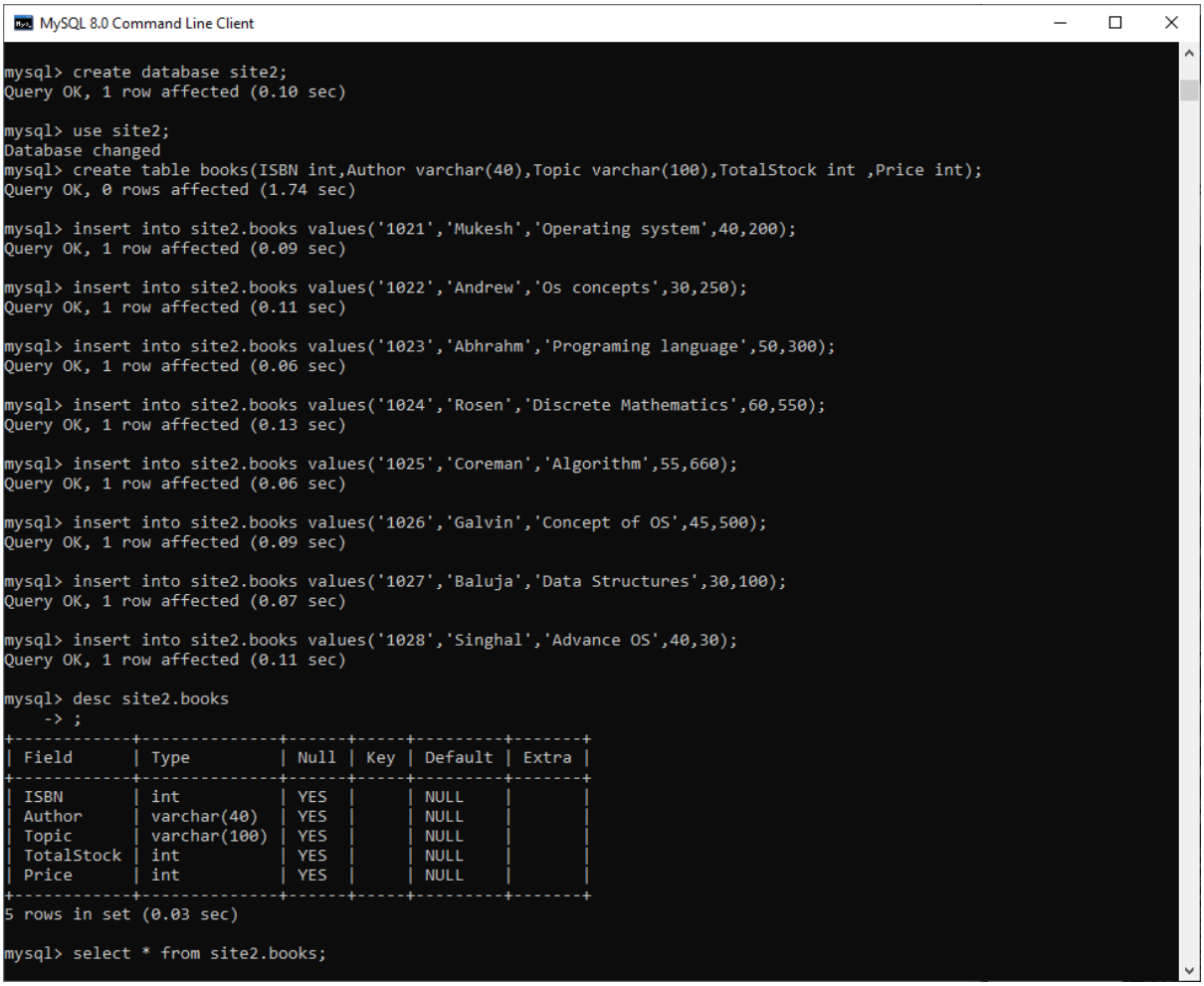
```
| ISBN    | varchar(100) | YES  |     | NULL    |       |
| Qty     | int          | YES  |     | NULL    |       |
+---------+--------------+------+-----+---------+-------+
3 rows in set (0.06 sec)

mysql> insert into site1.Stock values(1,'1004',45);
Query OK, 1 row affected (0.07 sec)

mysql> insert into site1.Stock values(2,'1002',25);
Query OK, 1 row affected (0.11 sec)

mysql> insert into site1.Stock values(3,'1003',15);
Query OK, 1 row affected (0.05 sec)

mysql> insert into site1.Stock values(4,'1001',25);
Query OK, 1 row affected (0.09 sec)

mysql> insert into site1.Stock values(5,'1005',100);
Query OK, 1 row affected (0.05 sec)

mysql> insert into site1.Stock values(6,'1006',43);
Query OK, 1 row affected (0.11 sec)

mysql> select * from site1.Stock;
+---------+------+------+
| Storeno | ISBN | Qty  |
+---------+------+------+
|       1 | 1004 |   45 |
|       2 | 1002 |   25 |
|       3 | 1003 |   15 |
|       4 | 1001 |   25 |
|       5 | 1005 |  100 |
|       6 | 1006 |   43 |
+---------+------+------+
6 rows in set (0.00 sec)
```

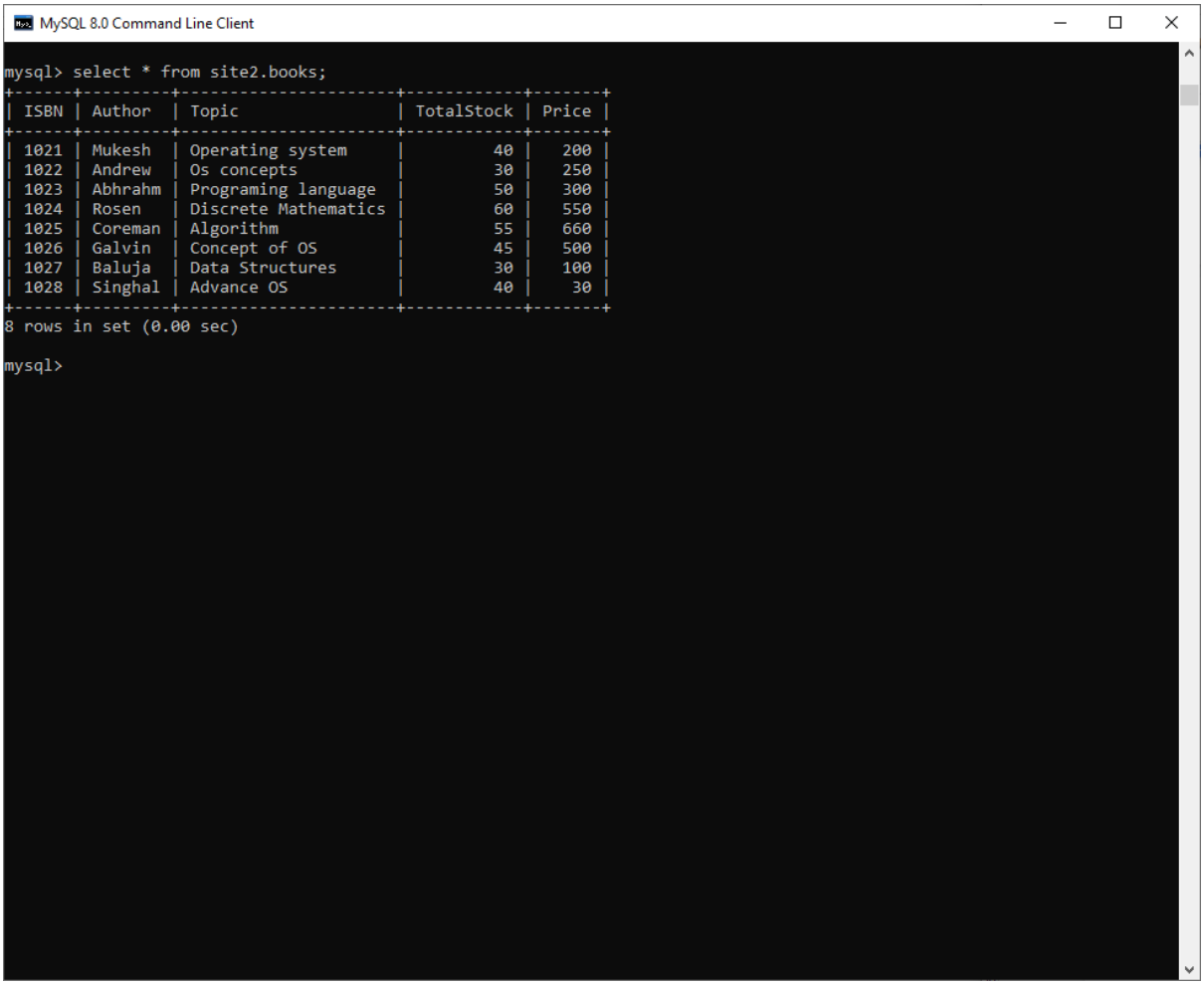

MySQL 8.0 Command Line Client
mysql> create table Stock(Storeno int,ISBN varchar(100),Qty int);
Query OK, 0 rows affected (0.66 sec)
mysql> desc stock;
+---------+-------------+------+-----+---------+-------+
| Field | Type | Null | Key | Default | Extra |
+---------+-------------+------+-----+---------+-------+
Storeno	int	YES		NULL	
ISBN	varchar(100)	YES		NULL	
Qty	int	YES		NULL	
+---------+-------------+------+-----+---------+-------+
3 rows in set (0.06 sec)
mysql> insert into site1.Stock values(1,'1004',45);
Query OK, 1 row affected (0.07 sec)
mysql> insert into site1.Stock values(2,'1002',25);
Query OK, 1 row affected (0.11 sec)
mysql> insert into site1.Stock values(3,'1003',15);
Query OK, 1 row affected (0.05 sec)
mysql> insert into site1.Stock values(4,'1001',25);
Query OK, 1 row affected (0.09 sec)
mysql> insert into site1.Stock values(5,'1005',100);
Query OK, 1 row affected (0.05 sec)
mysql> insert into site1.Stock values(6,'1006',43);
Query OK, 1 row affected (0.11 sec)
mysql> select * from site1.Stock;
+---------+------+------+
| Storeno | ISBN | Qty |
+---------+------+------+
1	1004	45
2	1002	25
3	1003	15
4	1001	25
5	1005	100
6	1006	43
+---------+------+------+
6 rows in set (0.00 sec)
mysql>

Creating database2: site2

```
mysql> create database site2;
Query OK, 1 row affected (0.10 sec)

mysql> use site2;
Database changed
mysql> create table books(ISBN int,Author varchar(40),Topic
varchar(100),TotalStock int ,Price int);
Query OK, 0 rows affected (1.74 sec)

mysql> insert into site2.books values('1021','Mukesh','Operating
system',40,200);
Query OK, 1 row affected (0.09 sec)

mysql> insert into site2.books values('1022','Andrew','Os
concepts',30,250);
Query OK, 1 row affected (0.11 sec)

mysql> insert into site2.books values('1023','Abhrahm','Programing
language',50,300);
Query OK, 1 row affected (0.06 sec)

mysql> insert into site2.books values('1024','Rosen','Discrete
Mathematics',60,550);
Query OK, 1 row affected (0.13 sec)

mysql> insert into site2.books
values('1025','Coreman','Algorithm',55,660);
Query OK, 1 row affected (0.06 sec)

mysql> insert into site2.books values('1026','Galvin','Concept of
OS',45,500);
Query OK, 1 row affected (0.09 sec)
```

```
mysql> insert into site2.books values('1027','Baluja','Data
Structures',30,100);
Query OK, 1 row affected (0.07 sec)

mysql> insert into site2.books values('1028','Singhal','Advance
OS',40,30);
Query OK, 1 row affected (0.11 sec)

mysql> desc site2.books
   -> ;
+------------+--------------+------+-----+---------+-------+
| Field      | Type         | Null | Key | Default | Extra |
+------------+--------------+------+-----+---------+-------+
| ISBN       | int          | YES  |     | NULL    |       |
| Author     | varchar(40)  | YES  |     | NULL    |       |
| Topic      | varchar(100) | YES  |     | NULL    |       |
| TotalStock | int          | YES  |     | NULL    |       |
| Price      | int          | YES  |     | NULL    |       |
+------------+--------------+------+-----+---------+-------+
5 rows in set (0.03 sec)

mysql> select * from site2.books;
+------+---------+---------------------+------------+-------+
| ISBN | Author  | Topic               | TotalStock | Price |
+------+---------+---------------------+------------+-------+
| 1021 | Mukesh  | Operating system    |         40 |   200 |
| 1022 | Andrew  | Os concepts         |         30 |   250 |
| 1023 | Abhrahm | Programing language |         50 |   300 |
| 1024 | Rosen   | Discrete Mathematics|         60 |   550 |
| 1025 | Coreman | Algorithm           |         55 |   660 |
| 1026 | Galvin  | Concept of OS       |         45 |   500 |
| 1027 | Baluja  | Data Structures     |         30 |   100 |
| 1028 | Singhal | Advance OS          |         40 |    30 |
+------+---------+---------------------+------------+-------+
8 rows in set (0.00 sec)
```


MySQL 8.0 Command Line Client
mysql> create database site2;
Query OK, 1 row affected (0.10 sec)
mysql> use site2;
Database changed
mysql> create table books(ISBN int,Author varchar(40),Topic varchar(100),TotalStock int ,Price int);
Query OK, 0 rows affected (1.74 sec)
mysql> insert into site2.books values('1021','Mukesh','Operating system',40,200);
Query OK, 1 row affected (0.09 sec)
mysql> insert into site2.books values('1022','Andrew','Os concepts',30,250);
Query OK, 1 row affected (0.11 sec)
mysql> insert into site2.books values('1023','Abhrahm','Programing language',50,300);
Query OK, 1 row affected (0.06 sec)
mysql> insert into site2.books values('1024','Rosen','Discrete Mathematics',60,550);
Query OK, 1 row affected (0.13 sec)
mysql> insert into site2.books values('1025','Coreman','Algorithm',55,660);
Query OK, 1 row affected (0.06 sec)
mysql> insert into site2.books values('1026','Galvin','Concept of OS',45,500);
Query OK, 1 row affected (0.09 sec)
mysql> insert into site2.books values('1027','Baluja','Data Structures',30,100);
Query OK, 1 row affected (0.07 sec)
mysql> insert into site2.books values('1028','Singhal','Advance OS',40,30);
Query OK, 1 row affected (0.11 sec)
mysql> desc site2.books
-> ;
+------------+-------------+------+-----+---------+-------+
| Field | Type | Null | Key | Default | Extra |
+------------+-------------+------+-----+---------+-------+
ISBN	int	YES		NULL	
Author	varchar(40)	YES		NULL	
Topic	varchar(100)	YES		NULL	
TotalStock	int	YES		NULL	
Price	int	YES		NULL	
+------------+-------------+------+-----+---------+-------+
5 rows in set (0.03 sec)
mysql> select * from site2.books;



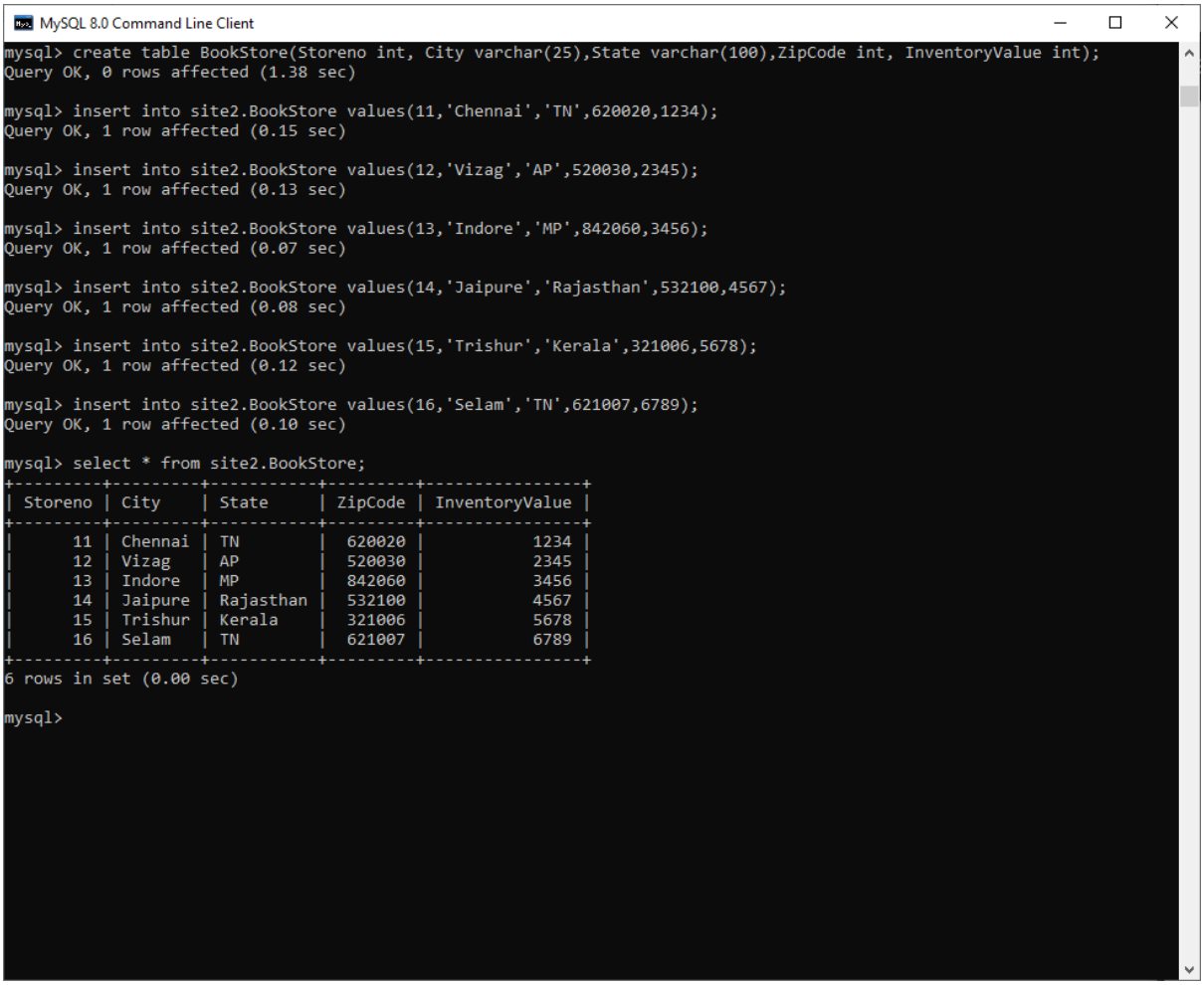
mysql> create table BookStore(Storeno int, City varchar(25),State varchar(100),ZipCode int, InventoryValue int);
Query OK, 0 rows affected (1.38 sec)

mysql> insert into site2.BookStore
values(11,'Chennai','TN',620020,1234);
Query OK, 1 row affected (0.15 sec)

mysql> insert into site2.BookStore values(12,'Vizag','AP',520030,2345);
Query OK, 1 row affected (0.13 sec)

mysql> insert into site2.BookStore values(13,'Indore','MP',842060,3456);
Query OK, 1 row affected (0.07 sec)

```
mysql> insert into site2.BookStore
values(14,'Jaipure','Rajasthan',532100,4567);
Query OK, 1 row affected (0.08 sec)

mysql> insert into site2.BookStore
values(15,'Trishur','Kerala',321006,5678);
Query OK, 1 row affected (0.12 sec)

mysql> insert into site2.BookStore values(16,'Selam','TN',621007,6789);
Query OK, 1 row affected (0.10 sec)

mysql> select * from site2.BookStore;
+---------+---------+-----------+---------+----------------+
| Storeno | City    | State     | ZipCode | InventoryValue |
+---------+---------+-----------+---------+----------------+
|      11 | Chennai | TN        |  620020 |           1234 |
|      12 | Vizag   | AP        |  520030 |           2345 |
|      13 | Indore  | MP        |  842060 |           3456 |
|      14 | Jaipure | Rajasthan |  532100 |           4567 |
|      15 | Trishur | Kerala    |  321006 |           5678 |
|      16 | Selam   | TN        |  621007 |           6789 |
+---------+---------+-----------+---------+----------------+
6 rows in set (0.00 sec)
```



mysql> create table Stock(Storeno int, ISBN varchar(100), Qty int);
Query OK, 0 rows affected (0.84 sec)

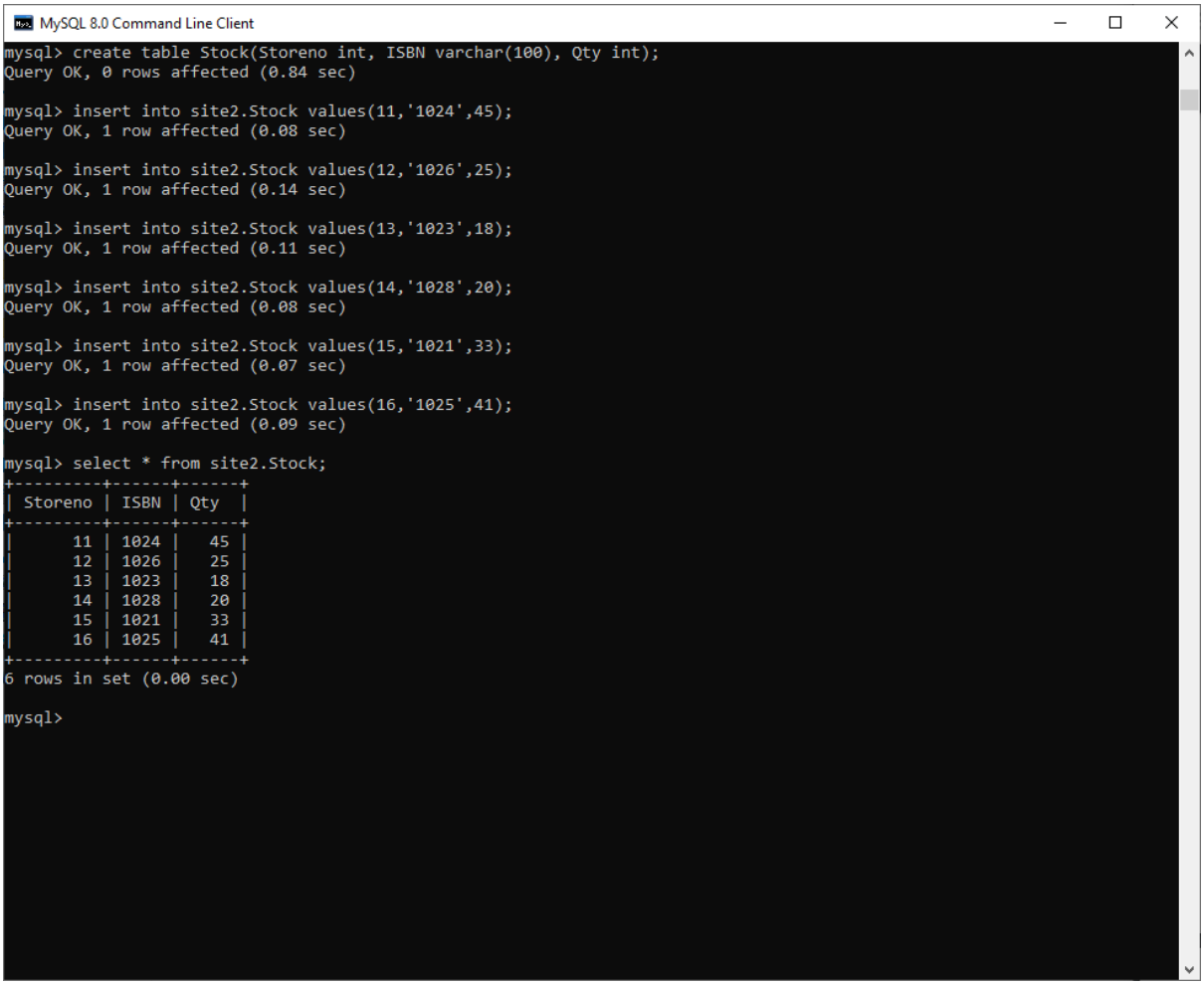
mysql> insert into site2.Stock values(11,'1024',45);
Query OK, 1 row affected (0.08 sec)

mysql> insert into site2.Stock values(12,'1026',25);
Query OK, 1 row affected (0.14 sec)

mysql> insert into site2.Stock values(13,'1023',18);
Query OK, 1 row affected (0.11 sec)

mysql> insert into site2.Stock values(14,'1028',20);
Query OK, 1 row affected (0.08 sec)

```
mysql> insert into site2.Stock values(15,'1021',33);
Query OK, 1 row affected (0.07 sec)

mysql> insert into site2.Stock values(16,'1025',41);
Query OK, 1 row affected (0.09 sec)

mysql> select * from site2.Stock;
+---------+------+------+
| Storeno | ISBN | Qty  |
+---------+------+------+
|      11 | 1024 |   45 |
|      12 | 1026 |   25 |
|      13 | 1023 |   18 |
|      14 | 1028 |   20 |
|      15 | 1021 |   33 |
|      16 | 1025 |   41 |
+---------+------+------+
6 rows in set (0.00 sec)
```


MySQL 8.0 Command Line Client
mysql> create table Stock(Storeno int, ISBN varchar(100), Qty int);
Query OK, 0 rows affected (0.84 sec)
mysql> insert into site2.Stock values(11,'1024',45);
Query OK, 1 row affected (0.08 sec)
mysql> insert into site2.Stock values(12,'1026',25);
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mysql> insert into site2.Stock values(15,'1021',33);
Query OK, 1 row affected (0.07 sec)
mysql> insert into site2.Stock values(16,'1025',41);
Query OK, 1 row affected (0.09 sec)
mysql> select * from site2.Stock;
+---------+------+------+
| Storeno | ISBN | Qty |
+---------+------+------+
11	1024	45
12	1026	25
13	1023	18
14	1028	20
15	1021	33
16	1025	41
+---------+------+------+
6 rows in set (0.00 sec)
mysql>

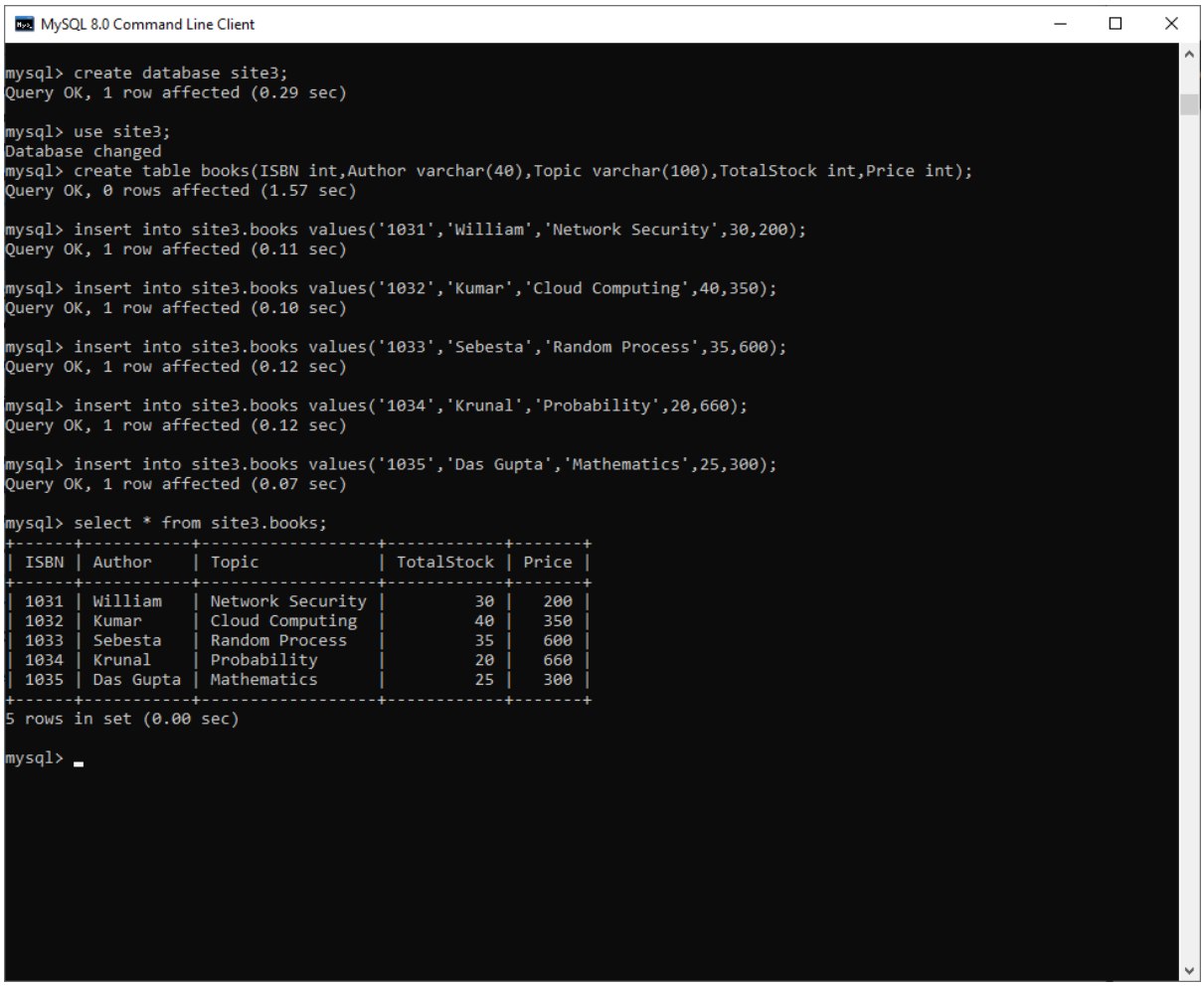
Creation of database 3: site3

```
mysql> create database site3;
Query OK, 1 row affected (0.29 sec)

mysql> use site3;
Database changed
mysql> create table books(ISBN int,Author varchar(40),Topic
varchar(100),TotalStock int,Price int);
Query OK, 0 rows affected (1.57 sec)

mysql> insert into site3.books values('1031','William','Network
Security',30,200);
Query OK, 1 row affected (0.11 sec)

mysql> insert into site3.books values('1032','Kumar','Cloud
Computing',40,350);
Query OK, 1 row affected (0.10 sec)

mysql> insert into site3.books values('1033','Sebesta','Random
Process',35,600);
Query OK, 1 row affected (0.12 sec)

mysql> insert into site3.books
values('1034','Krunal','Probability',20,660);
Query OK, 1 row affected (0.12 sec)

mysql> insert into site3.books values('1035','Das
Gupta','Mathematics',25,300);
Query OK, 1 row affected (0.07 sec)

mysql> select * from site3.books;
+------+-----------+-----------------+------------+-------+
| ISBN | Author    | Topic           | TotalStock | Price |
+------+-----------+-----------------+------------+-------+
```

1031	William	Network Security	30	200
1032	Kumar	Cloud Computing	40	350
1033	Sebesta	Random Process	35	600
1034	Krunal	Probability	20	660
1035	Das Gupta	Mathematics	25	300

+------+-----------+-----------------+------------+-------+

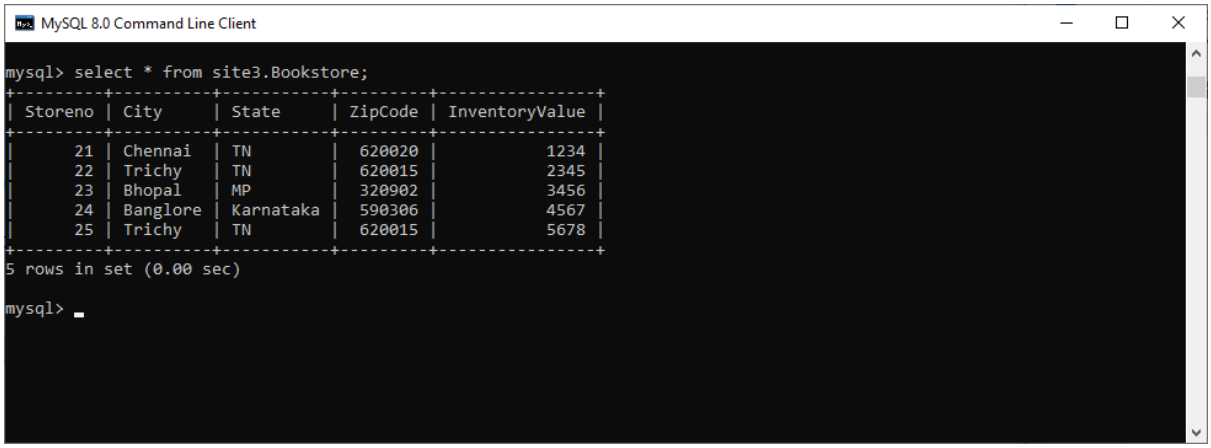
5 rows in set (0.00 sec)



mysql> create table BookStore(Storeno int,City varchar(25), State varchar(100),ZipCode int,InventoryValue int);
Query OK, 0 rows affected (0.62 sec)

mysql> insert into site3.BookStore
values(21,'Chennai','TN',620020,1234);
Query OK, 1 row affected (0.10 sec)

```
mysql> insert into site3.BookStore values(22,'Trichy','TN',620015,2345);
Query OK, 1 row affected (0.10 sec)

mysql> insert into site3.BookStore
values(23,'Bhopal','MP',320902,3456);
Query OK, 1 row affected (0.06 sec)

mysql> insert into site3.BookStore
values(24,'Banglore','Karnataka',590306,4567);
Query OK, 1 row affected (0.10 sec)

mysql> insert into site3.BookStore values(25,'Trichy','TN',620015,5678);
Query OK, 1 row affected (0.07 sec)
mysql> select * from site3.Bookstore;
+---------+----------+-----------+---------+---------------+
| Storeno | City     | State     | ZipCode | InventoryValue |
+---------+----------+-----------+---------+---------------+
|      21 | Chennai  | TN        |  620020 |          1234 |
|      22 | Trichy   | TN        |  620015 |          2345 |
|      23 | Bhopal   | MP        |  320902 |          3456 |
|      24 | Banglore | Karnataka |  590306 |          4567 |
|      25 | Trichy   | TN        |  620015 |          5678 |
+---------+----------+-----------+---------+---------------+
5 rows in set (0.00 sec)
```



mysql> create table Stock(Storeno int,ISBN varchar(100),Qty int);
Query OK, 0 rows affected (1.39 sec)

mysql> insert into site3.Stock values(21,'1031',25);
Query OK, 1 row affected (0.08 sec)

mysql> insert into site3.Stock values(22,'1032',38);
Query OK, 1 row affected (0.10 sec)

mysql> insert into site3.Stock values(23,'1033',32);
Query OK, 1 row affected (0.04 sec)

mysql> insert into site3.Stock values(24,'1034',12);
Query OK, 1 row affected (0.09 sec)

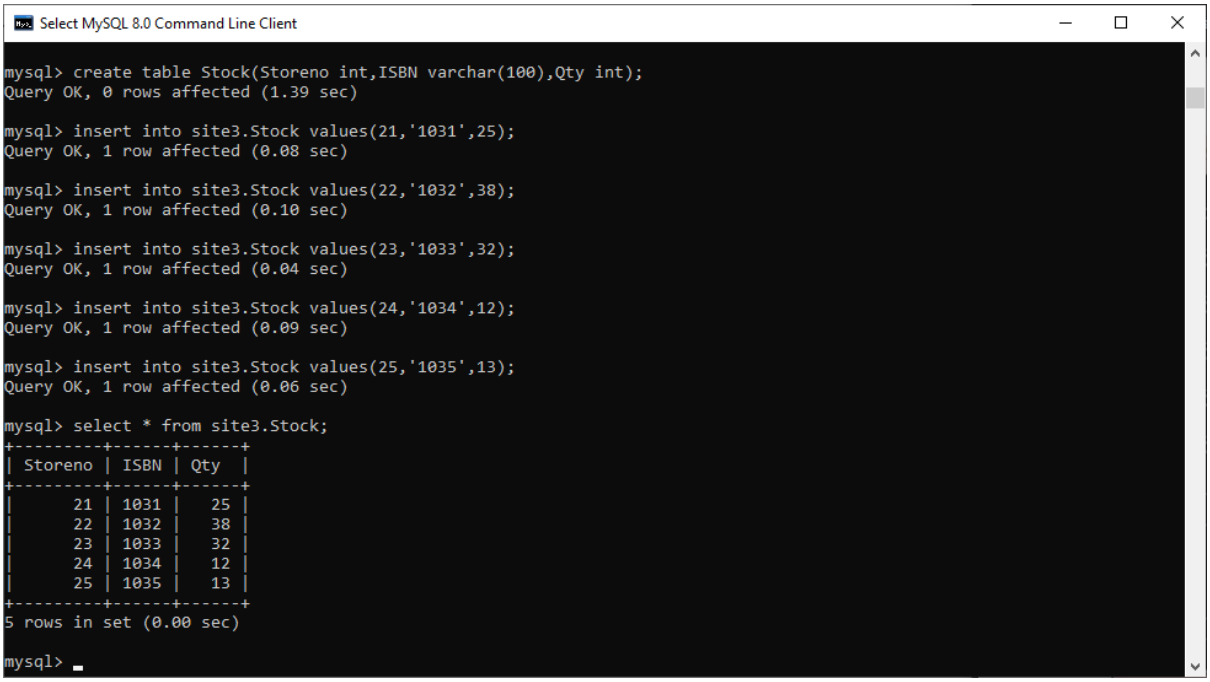
mysql> insert into site3.Stock values(25,'1035',13);
Query OK, 1 row affected (0.06 sec)

mysql> select * from site3.Stock;
+---------+------+------+
| Storeno | ISBN | Qty |
+---------+------+------+
21	1031	25
22	1032	38
23	1033	32
24	1034	12

| 25 | 1035 | 13 |

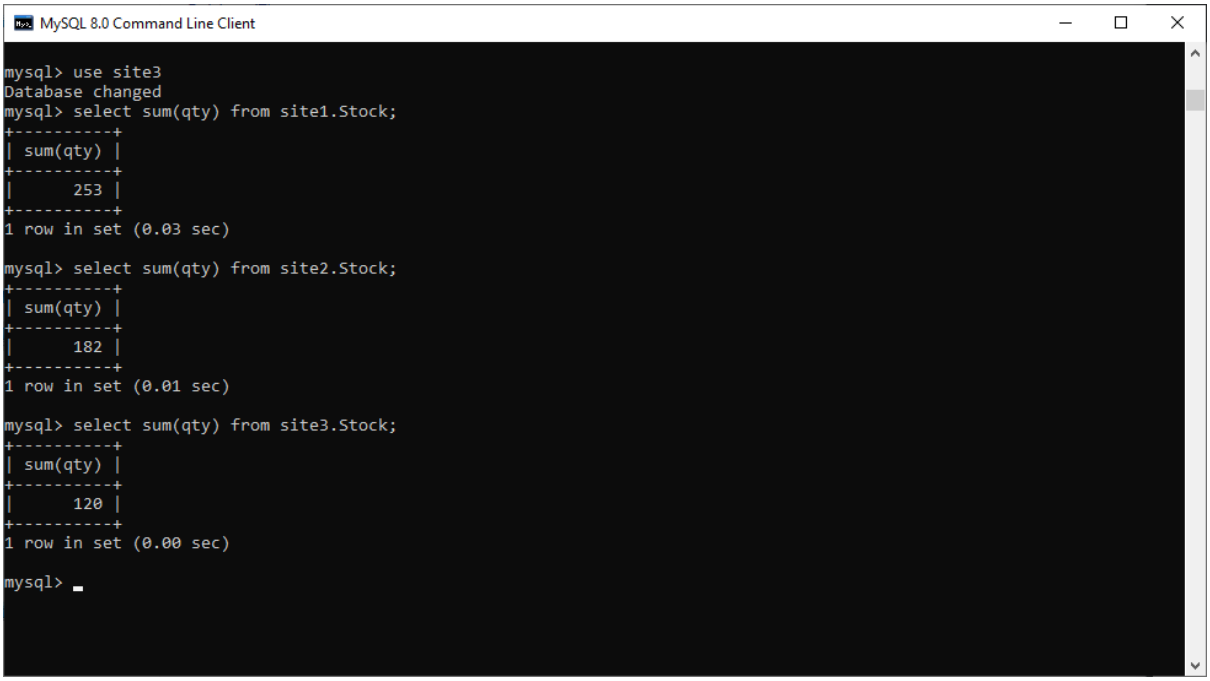
+---------+------+------+

5 rows in set (0.00 sec)



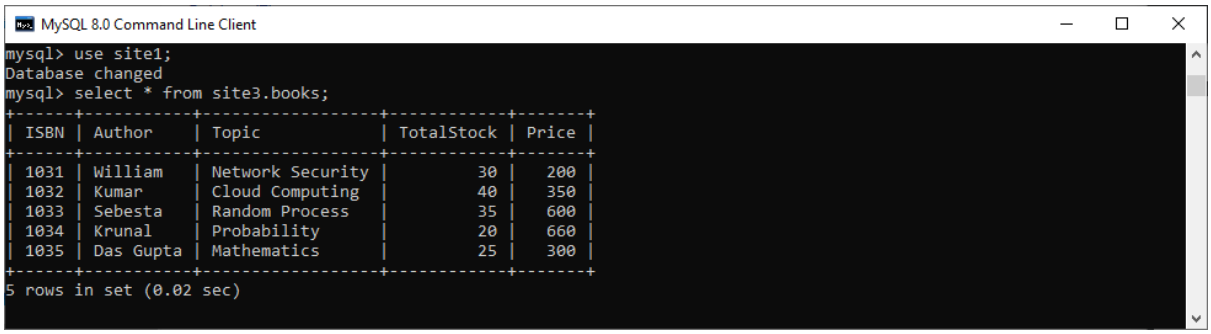
Now from site 3, we want to check total number of books on each site

```
mysql> use site3
Database changed
mysql> select sum(qty) from site1.Stock;
+----------+
| sum(qty) |
+----------+
|      253 |
+----------+
1 row in set (0.03 sec)

mysql> select sum(qty) from site2.Stock;
+----------+
| sum(qty) |
+----------+
|      182 |
+----------+
1 row in set (0.01 sec)

mysql> select sum(qty) from site3.Stock;
+----------+
| sum(qty) |
+----------+
|      120 |
+----------+
1 row in set (0.00 sec)
```


MySQL 8.0 Command Line Client
mysql> use site3
Database changed
mysql> select sum(qty) from site1.Stock;
+----------+
| sum(qty) |
+----------+
| 253 |
+----------+
1 row in set (0.03 sec)
mysql> select sum(qty) from site2.Stock;
+----------+
| sum(qty) |
+----------+
| 182 |
+----------+
1 row in set (0.01 sec)
mysql> select sum(qty) from site3.Stock;
+----------+
| sum(qty) |
+----------+
| 120 |
+----------+
1 row in set (0.00 sec)
mysql>

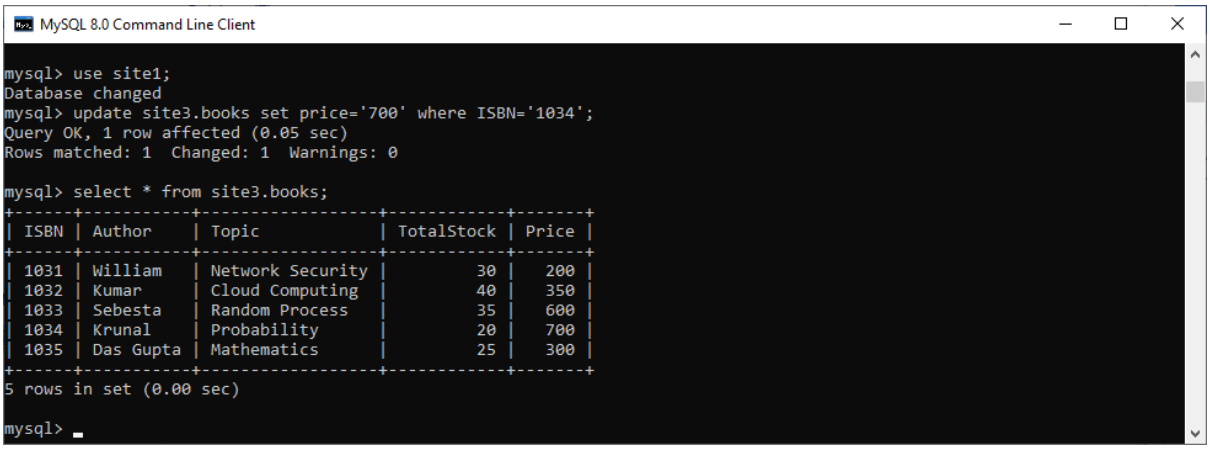
We are on site1 we want to access the books on site3,site2. Now it is possible using distributed database.

```
mysql> use site1;
Database changed
mysql> select * from site3.books;
+------+----------+-----------------+------------+-------+
| ISBN | Author   | Topic           | TotalStock | Price |
+------+----------+-----------------+------------+-------+
| 1031 | William  | Network Security |        30 |   200 |
| 1032 | Kumar    | Cloud Computing  |        40 |   350 |
| 1033 | Sebesta  | Random Process   |        35 |   600 |
| 1034 | Krunal   | Probability      |        20 |   660 |
| 1035 | Das Gupta | Mathematics     |        25 |   300 |
+------+----------+-----------------+------------+-------+
5 rows in set (0.02 sec)
```




```
mysql> use site1;
Database changed
mysql> update site3.books set price='700' where ISBN='1034';
Query OK, 1 row affected (0.05 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from site3.books;
+------+----------+-----------------+------------+-------+
| ISBN | Author   | Topic           | TotalStock | Price |
+------+----------+-----------------+------------+-------+
| 1031 | William  | Network Security |        30 |   200 |
```

1032	Kumar	Cloud Computing	40	350
1033	Sebesta	Random Process	35	600
1034	Krunal	Probability	20	700
1035	Das Gupta	Mathematics	25	300
+------+----------+-----------------+-----------+-------+
5 rows in set (0.00 sec)



From site2, we want to check the available copies of particular book with ISBN number in the bookstore. According to the ISBN number in which fragment it belongs, search in the respective database.

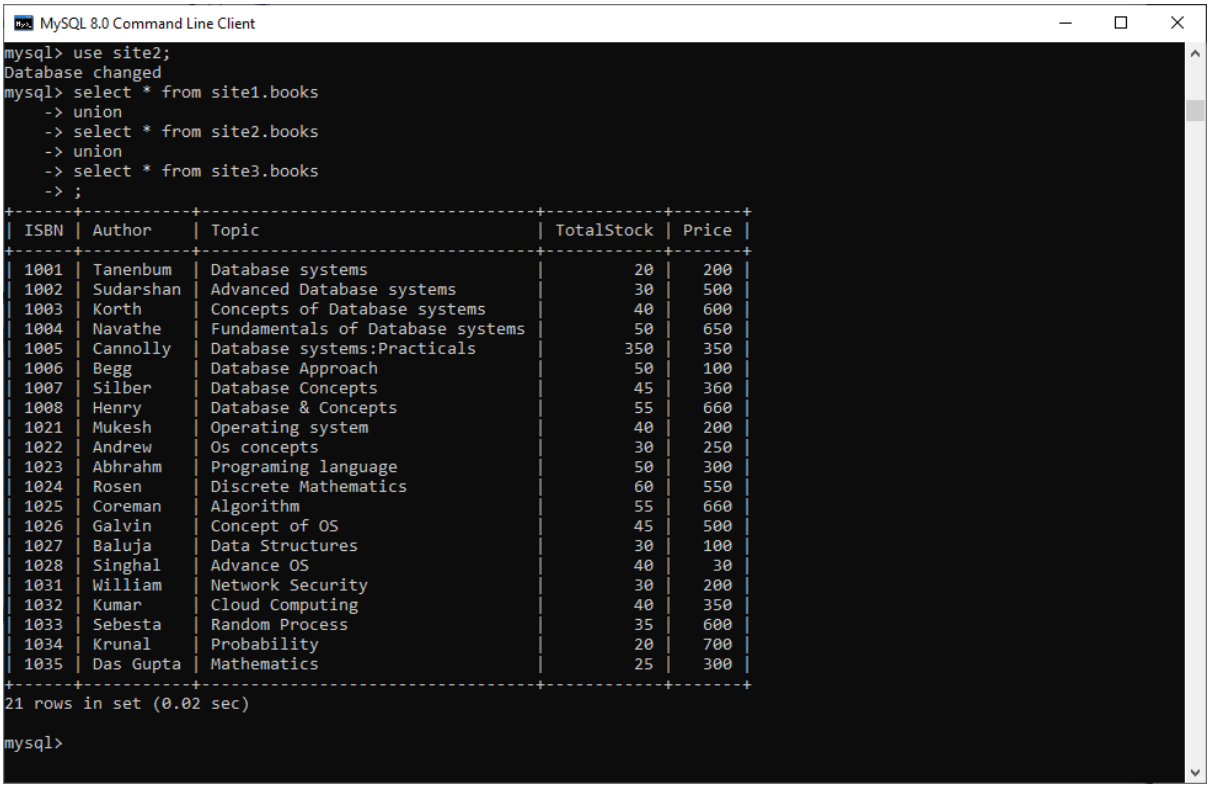
```
mysql> use site2;
Database changed
mysql> select Storeno, Qty from site3.Stock where ISBN='1034';
+---------+------+
| Storeno | Qty  |
+---------+------+
|      24 |   12 |
+---------+------+
1 row in set (0.02 sec)
```

Get the list of all the books available in the bookstore from any site

```
mysql> use site2;
Database changed
mysql> select * from site1.books
    -> union
    -> select * from site2.books
    -> union
    -> select * from site3.books
    -> ;
+------+----------+--------------------------------+-----------+-------+
| ISBN | Author   | Topic                          | TotalStock | Price |
+------+----------+--------------------------------+-----------+-------+
| 1001 | Tanenbum | Database systems               |        20 |   200 |
| 1002 | Sudarshan | Advanced Database systems     |        30 |   500 |
| 1003 | Korth    | Concepts of Database systems   |        40 |   600 |
| 1004 | Navathe  | Fundamentals of Database systems |      50 |   650
|
| 1005 | Cannolly | Database systems:Practicals    |       350 |   350 |
| 1006 | Begg     | Database Approach              |        50 |   100 |
| 1007 | Silber   | Database Concepts              |        45 |   360 |
| 1008 | Henry    | Database & Concepts            |        55 |   660 |
| 1021 | Mukesh   | Operating system               |        40 |   200 |
| 1022 | Andrew   | Os concepts                    |        30 |   250 |
| 1023 | Abhrahm  | Programing language            |        50 |   300 |
| 1024 | Rosen    | Discrete Mathematics           |        60 |   550 |
| 1025 | Coreman  | Algorithm                      |        55 |   660 |
| 1026 | Galvin   | Concept of OS                  |        45 |   500 |
| 1027 | Baluja   | Data Structures                |        30 |   100 |
| 1028 | Singhal  | Advance OS                     |        40 |    30 |
| 1031 | William  | Network Security               |        30 |   200 |
| 1032 | Kumar    | Cloud Computing                |        40 |   350 |
| 1033 | Sebesta  | Random Process                 |        35 |   600 |
| 1034 | Krunal   | Probability                    |        20 |   700 |
| 1035 | Das Gupta | Mathematics                   |        25 |   300 |
```

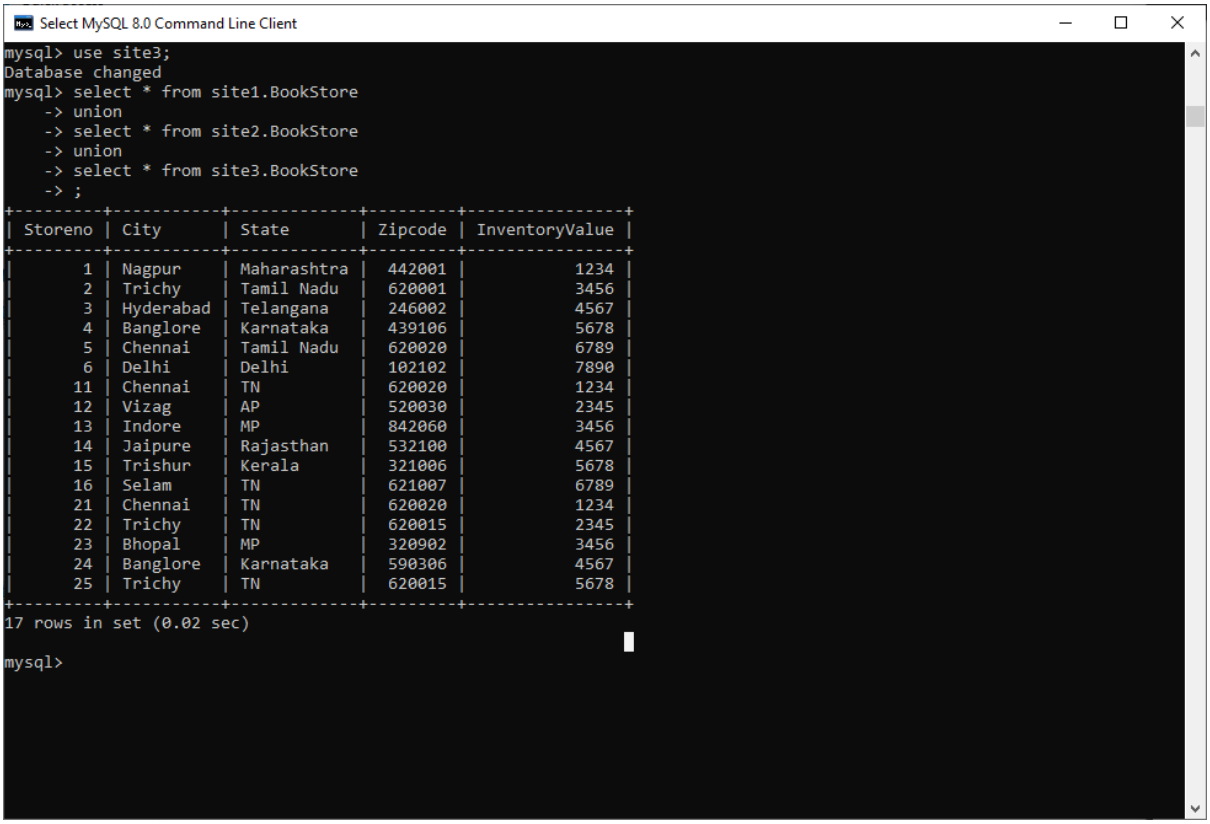
+------+----------+--------------------------------+------------+-------+

21 rows in set (0.02 sec)



Get the list of all the stores from any site.

```
mysql> use site3;
Database changed
mysql> select * from site1.BookStore
   -> union
   -> select * from site2.BookStore
   -> union
   -> select * from site3.BookStore
   -> ;
+---------+-----------+-------------+---------+---------------+
| Storeno | City      | State       | Zipcode | InventoryValue |
+---------+-----------+-------------+---------+---------------+
|       1 | Nagpur    | Maharashtra |  442001 |          1234 |
|       2 | Trichy    | Tamil Nadu  |  620001 |          3456 |
|       3 | Hyderabad | Telangana   |  246002 |          4567 |
|       4 | Banglore  | Karnataka   |  439106 |          5678 |
|       5 | Chennai   | Tamil Nadu  |  620020 |          6789 |
|       6 | Delhi     | Delhi       |  102102 |          7890 |
|      11 | Chennai   | TN          |  620020 |          1234 |
|      12 | Vizag     | AP          |  520030 |          2345 |
|      13 | Indore    | MP          |  842060 |          3456 |
|      14 | Jaipure   | Rajasthan   |  532100 |          4567 |
|      15 | Trishur   | Kerala      |  321006 |          5678 |
|      16 | Selam     | TN          |  621007 |          6789 |
|      21 | Chennai   | TN          |  620020 |          1234 |
|      22 | Trichy    | TN          |  620015 |          2345 |
|      23 | Bhopal    | MP          |  320902 |          3456 |
|      24 | Banglore  | Karnataka   |  590306 |          4567 |
|      25 | Trichy    | TN          |  620015 |          5678 |
+---------+-----------+-------------+---------+---------------+
17 rows in set (0.02 sec)
```



Conclusion:

Distributed database system uses master master replication and hence allows data to be accesses from all the nodes present in the cluster without having to store complete replication.