

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



LAB REPORT

on

BIG DATA ANALYTICS (20CS6PEBDA)

Submitted by

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in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING



B.M.S. COLLEGE OF ENGINEERING

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CERTIFICATE

This is to certify that the Lab work entitled “**BIG DATA ANALYTICS**” carried out by **Shashank Sharma (1BM19CS147)**, who is bonafide student of **B. M. S. College of Engineering**. It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **BIG DATA ANALYTICS - (20CS6PEBDA)** work prescribed for the said degree.

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Course Outcome

| | |
|-----|---|
| CO1 | Apply the concept of NoSQL, Hadoop or Spark for a given task |
| CO2 | Analyze the Big Data and obtain insight using data analytics mechanisms. |
| CO3 | Design and implement Big data applications by applying NoSQL, Hadoop or Spark |

1.MongoDB- CRUD Demonstration

1) Using MongoDB

```
> show dbs;
admin    0.000GB
config  0.000GB
local    0.000GB
> use myDB;
switched to db myDB
> db;
myDB
> db.createCollection("Student");
2022-06-06T16:47:20.532+0530 E QUERY    [thread1] SyntaxError: illegal character @(shell):1:20
> db.createCollection('Student');
{ "ok" : 1 }
```

i) Create a database for Students and Create a Student Collection (_id,Name, USN, Semester, Dept_Name, CGPA, Hobbies(Set)).

```
myDB
> db.createCollection("Student");
2022-06-06T16:47:20.532+0530 E QUERY    [thread1] SyntaxError: illegal character @(shell):1:20
> db.createCollection('Student');
{ "ok" : 1 }
> db.Student.insert({_id:1,Name:"Ravi", USN:"1BM19CS127",Sem:6,Dept_name:"CSE",CGPA:8.34,Hobbies:["Skating"]});
WriteResult({ "nInserted" : 1 })
> db.Student.insert({_id:2,Name:"Balaji", USN:"1BM19CS134",Sem:6,Dept_name:"CSE",CGPA:8.5,Hobbies:["Watching Documentaries"]});
WriteResult({ "nInserted" : 1 })
```

ii) Insert required documents to the collection.

```
> db.Student.insert({_id:5,Name:"Sagar", USN:"1BM20CS097",Sem:5,Dept_name:"ME",CGPA:7.95,Hobbies:["Collecting Coins"]});
WriteResult({ "nInserted" : 1 })
> db.Student.find();
{ "_id" : 1, "Name" : "Ravi", "USN" : "1BM19CS127", "Sem" : 6, "Dept_name" : "CSE", "CGPA" : 8.34, "Hobbies" : [ "Skating" ] }
{ "_id" : 2, "Name" : "Balaji", "USN" : "1BM19CS134", "Sem" : 6, "Dept_name" : "CSE", "CGPA" : 8.5, "Hobbies" : [ "Watching Documentaries" ] }
{ "_id" : 3, "Name" : "Skanda", "USN" : "1BM19CS137", "Sem" : 6, "Dept_name" : "CSE", "CGPA" : 8.85, "Hobbies" : [ "Solving Puzzles" ] }
{ "_id" : 4, "Name" : "Nagraj", "USN" : "1BM20CS137", "Sem" : 5, "Dept_name" : "CSE", "CGPA" : 9.25, "Hobbies" : [ "Stamp Collection" ] }
{ "_id" : 5, "Name" : "Sagar", "USN" : "1BM20CS097", "Sem" : 5, "Dept_name" : "ME", "CGPA" : 7.95, "Hobbies" : [ "Collecting Coins" ] }
```

iii) First Filter on “Dept_Name:CSE” and then group it on “Semester” and compute the Average CGPA for that semester and filter those documents where the “Avg_CGPA” is greater than 7.5.

```
db.Student.aggregate({$match:{Dept_name:"CSE"}},{ $group:{_id:"$Sem",Avg_CGPA:{$avg:"$CGPA"}}},{ $match:{Avg_CGPA:{$gt:7.5}}}).pretty();
```

```
> db.Student.aggregate({$match:{Dept_name:"CSE"}}
{ "_id" : 5, "Avg_CGPA" : 9.25 }
{ "_id" : 6, "Avg_CGPA" : 8.563333333333333 }
>
```

iv) Command used to export MongoDB JSON documents from “Student” Collection into the “Students” database into a CSV file “Output.txt”.

```
mongoexport --db myDB --collection Student --type=csv --out
C:\Users\skand\Desktop\Output.csv -f "_id,Name,USN,Sem,Dept_name,CGPA"
```

```
C:\Users\skand>mongoexport --db myDB --collection Student
2022-06-06T17:24:46.101+0530    connected to: localhost
2022-06-06T17:24:46.109+0530    exported 5 records
```

2. To drop a collection by the name “Student”.

```
db.Student.drop();
```

```
> db.Student.drop();
true
```

3. Insert the document for “AryanDavid” in to the Students collection only if it does not already exist in the collection. However, if it is already present in the collection, then update the document with new values. (Update his Hobbies from “Skating” to “Chess”.) Use “Update else insert” (if there is an existing document, it will attempt to update it, if there is no existing document then it will insert it).

```
db.Student.update({_id:3,StudName:"AryanDavid",Grade:"VII"},{$set:{Hobbies:"Skating"}},{upsert:true});
```

```
> db.Student.insert({_id:1,StudName:"MichelleJacintha",Grade:"VII",Hobbies:"InternetSurfing"});
WriteResult({ "nInserted" : 1 })
> db.Student.update({_id:3,StudName:"AryanDavid",Grade:"VII"},{$set:{Hobbies:"Skating"}},{upsert:true});
WriteResult({ "nMatched" : 0, "nUpserted" : 1, "nModified" : 0, "_id" : 3 })
> -
```

4. FIND METHOD

A. To search for documents from the “Students” collection based on certain search criteria.

```
db.Student.find({StudName:"Aryan David"});
```

```
> db.Student.find({StudName:"AryanDavid"});
{ "_id" : 3, "Grade" : "VII", "StudName" : "AryanDavid", "Hobbies" : "Skating" }
```

B. To display only the StudName and Grade from all the documents of the Students collection. The identifier_id should be suppressed and NOT displayed.

```
db.Student.find({}, {StudName:1,Grade:1,_id:0});
```

```
> db.Student.find({}, {StudName:1,Grade:1,_id:0});
{ "StudName" : "MichelleJacintha", "Grade" : "VII" }
{ "Grade" : "VII", "StudName" : "AryanDavid" }
```

C. To find those documents where the Grade is set to ‘VII’

```
db.Student.find({Grade:{ $eq:'VII'}}).pretty();
```

```

> db.Student.find({Grade:{$eq:'VII'}}).pretty();
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}
{
  "_id" : 3,
  "Grade" : "VII",
  "StudName" : "AryanDavid",
  "Hobbies" : "Skating"
}
>

```

D. To find those documents from the Students collection where the Hobbies is set to either 'Chess' or is set to 'Skating'.

db.Student.find({Hobbies :{ \$in: ['Chess','Skating']}}).pretty ();

```

> db.Student.find({Hobbies :{ $in: ['Chess','Skating']}}).pretty ();
{
  "_id" : 3,
  "Grade" : "VII",
  "StudName" : "AryanDavid",
  "Hobbies" : "Skating"
}
>

```

E. To find documents from the Students collection where the StudName begins with "M".

db.Student.find({StudName:/^M/}).pretty();

```

> db.Student.find({StudName:/^M/}).pretty();
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}

```

F. To find documents from the Students collection where the StudName has an "e" in any position.

db.Student.find({StudName:/e/}).pretty();

```

> db.Student.find({StudName:/e/}).pretty();
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}

```

G. To find the number of documents in the Students collection.

db.Student.count();

H. To sort the documents from the Students collection in the descending order of StudName.

db.Student.find().sort({StudName:-1}).pretty();

```
> db.Student.count();
2
> db.Student.find().sort({StudName:-1}).pretty();
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}
{
  "_id" : 3,
  "Grade" : "VII",
  "StudName" : "AryanDavid",
  "Hobbies" : "Skating"
}
```

I. Save Method :

Save() method will insert a new document, if the document with the _id does not exist. If it exists it will replace the existing document.

db.Students.save({StudName:"Vamsi", Grade:"VI"})

```
> db.Students.save({StudName:'Vamsi', Grade:'VI'});
WriteResult({ "nInserted" : 1 })
```

II. Add a new field to existing Document:

db.Students.update({_id:3},{ \$set:{Location:"Network"}})

III. Remove the field in an existing Document

db.Students.update({_id:3},{ \$unset:{Location:"Network"}})

```
> db.Student.update({_id:3},{ $set:{Location:'Network'}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.find();
{ "_id" : 1, "StudName" : "MichelleJacintha", "Grade" : "VII", "Hobbies" : "InternetSurfing" }
{ "_id" : 3, "Grade" : "VII", "StudName" : "AryanDavid", "Hobbies" : "Skating", "Location" : "Network" }
> db.Student.update({_id:3},{ $unset:{Location:'Network'}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.find();
{ "_id" : 1, "StudName" : "MichelleJacintha", "Grade" : "VII", "Hobbies" : "InternetSurfing" }
{ "_id" : 3, "Grade" : "VII", "StudName" : "AryanDavid", "Hobbies" : "Skating" }
>
```

To set a particular field value to NULL

db.Students.update({_id:3},{ \$set:{Location:null}})

```

> db.Student.update({_id:3},{ $set:{Location:null}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.find();
{ "_id" : 1, "StudName" : "MichelleJacintha", "Grade" : "VII", "Hobbies" : "InternetSurfing" }
{ "_id" : 3, "Grade" : "VII", "StudName" : "AryanDavid", "Hobbies" : "Skating", "Location" : null }
>

```

Sort the document in Ascending order

db.Students.find().sort({StudName:1}).pretty();

```

> db.Student.find().sort({StudName:1}).pretty();
{
  "_id" : 3,
  "Grade" : "VII",
  "StudName" : "AryanDavid",
  "Hobbies" : "Skating",
  "Location" : null
}
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}
>

```

Note:

for desending order : `db.Students.find().sort({StudName:-1}).pretty();`

2. Perform the following DB operations using Cassandra. (Employee DB)

1. Create a keyspace by name Employee

***create keyspace employee with replication = { 'class': 'SimpleStrategy' ,
'replication_factor' :1};***

2. Create a column family by name

Employee-Info with attributes

Emp_Id Primary Key, Emp_Name,

Designation, Date_of_Joining, Salary,

Dept_Name

create table employee_info(emp_id int,emp_name text, designation text, doj timestamp, salary double, dept_name text, primary key(emp_id,salary));

```
cqlsh:employee> DESCRIBE TABLE employee_info;  
  
CREATE TABLE employee.employee_info (  
    emp_id int,  
    salary double,  
    dept_name text,  
    designation text,  
    doj timestamp,  
    emp_name text,  
    PRIMARY KEY (emp_id, salary)  
) WITH CLUSTERING ORDER BY (salary ASC)  
    AND bloom_filter_fp_chance = 0.01  
    AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}  
    AND comment = ''  
    AND compaction = {'class': 'org.apache.cassandra.db.compaction'  
    AND compression = {'chunk_length_in_kb': '64', 'class': 'org.a  
    AND crc_check_chance = 1.0  
    AND dclocal_read_repair_chance = 0.1  
    AND default_time_to_live = 0  
    AND gc_grace_seconds = 864000  
    AND max_index_interval = 2048  
    AND memtable_flush_period_in_ms = 0  
    AND min_index_interval = 128  
    AND read_repair_chance = 0.0  
    AND speculative_retry = '99PERCENTILE';
```

3. Insert the values into the table in batch

BEGIN BATCH

***INSERT INTO employee_info(emp_id, emp_name, designation, doj, salary,
dept_name) VALUES (121, 'Ravi', 'Manager', '2012-03-29', 200000, 'RD')***

***INSERT INTO employee_info(emp_id, emp_name, designation, doj, salary,
dept_name) VALUES(122, 'David', 'Worker', '2013-02-27', 20000, 'Transport')***

APPLY BATCH;

```
cqlsh:employee> SELECT * FROM employee_info;
```

| emp_id | salary | dept_name | designation | doj | emp_name |
|--------|--------|--------------|-------------|---------------------------------|----------|
| 122 | 20000 | Maintainance | Employee | 2017-05-06 18:30:00.000000+0000 | Kiran |
| 121 | 2e+05 | RD | Manager | 2012-03-28 18:30:00.000000+0000 | Ravi |
| 142 | 10000 | RD | Intern | 2022-02-26 18:30:00.000000+0000 | Sanket |
| 142 | 20000 | Transport | Worker | 2013-02-26 18:30:00.000000+0000 | David |

4. Update Employee name and Department of Emp-Id 121

update employee_info set emp_name='Ravi S', dept_name='Research' where emp_id=121 AND salary=200000;

```
cqlsh:employee> update employee_info set emp_name='Ravi S', dept_name='Research' where emp_id=121 AND salary=200000;
cqlsh:employee> SELECT * FROM employee_info;
```

| emp_id | salary | dept_name | designation | doj | emp_name |
|--------|--------|--------------|-------------|---------------------------------|----------|
| 122 | 20000 | Maintainance | Employee | 2017-05-06 18:30:00.000000+0000 | Kiran |
| 121 | 2e+05 | Research | Manager | 2012-03-28 18:30:00.000000+0000 | Ravi S |
| 142 | 10000 | RD | Intern | 2022-02-26 18:30:00.000000+0000 | Sanket |
| 142 | 20000 | Transport | Worker | 2013-02-26 18:30:00.000000+0000 | David |

(4 rows)

5. Sort the details of Employee records based on salary

```
cqlsh:employee> paging off;
```

Disabled Query paging.

```
cqlsh:employee> SELECT * FROM employee.employee_info WHERE emp_id in (121,122,151,152) ORDER BY salary DESC ;
```

| emp_id | salary | dept_name | designation | doj | emp_name |
|--------|--------|-----------|-------------|---------------------------------|----------|
| 121 | 2e+05 | RD | Manager | 2012-03-28 18:30:00.000000+0000 | Ravi |
| 122 | 20000 | Transport | Worker | 2013-02-26 18:30:00.000000+0000 | David |
| 152 | 20000 | Packaging | Worker | 2019-05-22 18:30:00.000000+0000 | Rahul |
| 151 | 10000 | RD | Intern | 2022-03-28 18:30:00.000000+0000 | Sanket |

(4 rows)

6. Alter the schema of the table Employee_Info to add a column Projects which stores a set of Projects done by the corresponding Employee.

```
cqlsh:employee> alter table employee_info add projects set<text>;
cqlsh:employee> DESCRIBE TABLE employee_info;
```

```
CREATE TABLE employee.employee_info (
  emp_id int,
  salary double,
  dept_name text,
  designation text,
  doj timestamp,
  emp_name text,
  projects set<text>,
  PRIMARY KEY (emp_id, salary)
) WITH CLUSTERING ORDER BY (salary ASC)
  AND bloom_filter_fp_chance = 0.01
  AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
  AND comment = ''
  AND compaction = {'class': 'org.apache.cassandra.db.compaction.
  AND compression = {'chunk_length_in_kb': '64', 'class': 'org.ap
  AND crc_check_chance = 1.0
  AND dclocal_read_repair_chance = 0.1
  AND default_time_to_live = 0
  AND gc_grace_seconds = 864000
  AND max_index_interval = 2048
  AND memtable_flush_period_in_ms = 0
  AND min_index_interval = 128
  AND read_repair_chance = 0.0
  AND speculative_retry = '99PERCENTILE';
```

7. Update the altered table to add project names.

update employee_info set projects=projects+{'VGST'} where emp_id=121 AND salary=200000;

```
cqlsh:employee> update employee_info set projects=projects+{'VGST'} where emp_id=121 AND salary=200000;  
cqlsh:employee> select * from employee_info where emp_id=121 AND salary=200000;
```

| emp_id | salary | dept_name | designation | doj | emp_name | projects |
|--------|--------|-----------|-------------|---------------------------------|----------|----------|
| 121 | 2e+05 | Research | Manager | 2012-03-28 18:30:00.000000+0000 | Ravi S | {'VGST'} |

8. Create a TTL of 15 seconds to display the values of Employee

cqlsh:employee> INSERT INTO employee_info(emp_id, emp_name, designation, doj, salary, dept_name) VALUES(149, 'Saket', 'Developer', '2021-02-20', 100000, 'RD') USING TTL 15;
cqlsh:employee> select ttl(emp_name) from employee_info Where emp_id=149;

```
cqlsh:employee> select ttl(emp_name) from employee_info Where emp_id=149;  
  
  ttl(emp_name)  
-----  
              13  
  
(1 rows)  
cqlsh:employee>
```

3. Perform the following DB operations using Cassandra. (Library DB)

1. Create a keyspace by name Library

**CREATE KEYSPACE Library WITH
REPLICATION={ 'class': 'SimpleStrategy', 'replication_factor': 1};**

```
cqlsh> CREATE KEYSPACE Library WITH REPLICATION={ 'class': 'SimpleStrategy', 'replication_factor': 1};
cqlsh> describe keyspaces;

system_schema  system      system_distributed  system_traces
system_auth    library     employee
cqlsh>
```

2. Create a column family by name Library-Info with attributes

Stud_Id Primary Key,
Counter_value of type Counter,
Stud_Name, Book-Name, Book-Id,
Date_of_issue

create table library_details(stud_id int,counter_value counter,stud_name text,book_name text,date_of_issue timestamp,book_id int,primary key(stud_id,stud_name,book_name,date_of_issue,book_id));

```
cqlsh:library> describe table library_details;

CREATE TABLE library.library_details (
  stud_id int,
  stud_name text,
  book_name text,
  date_of_issue timestamp,
  book_id int,
  counter_value counter,
  PRIMARY KEY (stud_id, stud_name, book_name, date_of_issue, book_id)
) WITH CLUSTERING ORDER BY (stud_name ASC, book_name ASC, date_of_issue
  AND bloom_filter_fp_chance = 0.01
  AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
  AND comment = ''
  AND compaction = {'class': 'org.apache.cassandra.db.compaction.SizeT
  AND compression = {'chunk_length_in_kb': '64', 'class': 'org.apache.
  AND crc_check_chance = 1.0
  AND dclocal_read_repair_chance = 0.1
  AND default_time_to_live = 0
  AND gc_grace_seconds = 864000
  AND max_index_interval = 2048
  AND memtable_flush_period_in_ms = 0
  AND min_index_interval = 128
  AND read_repair_chance = 0.0
  AND speculative_retry = '99PERCENTILE';
```

3. Insert the values into the table in batch

```
update library_details set counter_value=counter_value+1
where stud_id=111 and stud_name='Ramesh' and book_name='ML' and date_of_issue='2021-11-09' and book_id=200;
update library_details set counter_value=counter_value+1
where stud_id=112 and stud_name='Prabhakar' and book_name='BDA' and
date_of_issue='2022-01-01' and book_id=300;
update library_details set counter_value=counter_value+1
where stud_id=113 and stud_name='Gopinath' and book_name='OOMD' and
date_of_issue='2021-06-01' and book_id=400;
```

```
cqlsh:library> update library_details set counter_value=counter_value+1
...
...
...
cqlsh:library> update library_details set counter_value=counter_value+1
...
...
...
cqlsh:library> update library_details set counter_value=counter_value+1
...
...
...
cqlsh:library> SELECT * FROM library_details;
```

| stud_id | stud_name | book_name | date_of_issue | book_id | counter_value |
|---------|-----------|-----------|---------------------------------|---------|---------------|
| 111 | Ramesh | ML | 2021-11-08 18:30:00.000000+0000 | 200 | 1 |
| 113 | Gopinath | OOMD | 2021-05-31 18:30:00.000000+0000 | 400 | 1 |
| 112 | Prabhakar | BDA | 2021-12-31 18:30:00.000000+0000 | 300 | 1 |

4. Display the details of the table created and increase the value of the counter

```
update library_details set counter_value=counter_value+1
where stud_id=112 and stud_name='Prabhakar' and book_name='BDA' and
date_of_issue='2021-12-31' and book_id=300;
```

```
cqlsh:library> SELECT * FROM library_details;
```

| stud_id | stud_name | book_name | date_of_issue | book_id | counter_value |
|---------|-----------|-----------|---------------------------------|---------|---------------|
| 111 | Ramesh | ML | 2021-11-08 18:30:00.000000+0000 | 200 | 1 |
| 113 | Gopinath | OOMD | 2021-05-31 18:30:00.000000+0000 | 400 | 1 |
| 112 | Prabhakar | BDA | 2021-12-31 18:30:00.000000+0000 | 300 | 2 |

5. Write a query to show that a student with id 112 has taken a book “BDA” 2 times.

```
select * from library_details where stud_id=112;
```

```
cqlsh:library> select * from library_details where stud_id=112;
```

| stud_id | stud_name | book_name | date_of_issue | book_id | counter_value |
|---------|-----------|-----------|---------------------------------|---------|---------------|
| 112 | Prabhakar | BDA | 2021-12-31 18:30:00.000000+0000 | 300 | 2 |

6. Export the created column to a csv file

copy library_details(stud_id,stud_name,book_name,book_id,date_of_issue,counter_value) to 'library.csv' ;

```
cqlsh:library> copy library_details(stud_id,stud_name,book_name,book_id,date_of_issue,counter_value) to 'library.csv' ;
Using 11 child processes

Starting copy of library.library_details with columns [stud_id, stud_name, book_name, book_id, date_of_issue, counter_value].
Processed: 3 rows; Rate:      3 rows/s; Avg. rate:      1 rows/s
3 rows exported to 1 files in 3.065 seconds.
cqlsh:library>
```

7. Import a given csv dataset from local file system into Cassandra column family
copy library_details(stud_id,stud_name,book_name,book_id,date_of_issue,counter_value) from 'library.csv' ;

```
cqlsh:library> copy library_details(stud_id,stud_name,book_name,book_id,date_of_issue,counter_value) from 'library.csv' ;
Using 11 child processes

Starting copy of library.library_details with columns [stud_id, stud_name, book_name, book_id, date_of_issue, counter_value].
Process ImportProcess-12:      1 rows/s; Avg. rate:      1 rows/s
PProcess ImportProcess-15:
TTProcess ImportProcess-13:
PPPPPTProcess ImportProcess-20:
Processed: 3 rows; Rate:      1 rows/s; Avg. rate:      1 rows/s
3 rows imported from 1 files in 2.889 seconds (0 skipped).
```

```
cqlsh:library> SELECT * FROM library_details;
```

| stud_id | stud_name | book_name | date_of_issue | book_id | counter_value |
|---------|-----------|-----------|---------------------------------|---------|---------------|
| 111 | Ramesh | ML | 2021-11-08 18:30:00.000000+0000 | 200 | 2 |
| 113 | Gopinath | OOMD | 2021-05-31 18:30:00.000000+0000 | 400 | 2 |
| 112 | Prabhakar | BDA | 2021-12-31 18:30:00.000000+0000 | 300 | 4 |

(3 rows)