Map-Reduce

MapReduce is the data processing mechanism for condensing large amount of data into useful aggregated results. This task is executed by **MapReduce** command which subsequently perform **map** and **reduce** operations. **MapReduce** is used for processing large data sets. In straightforward terms, the **MapReduce** command takes two primary inputs, the mapper function, and the reducer function.

The **Mapper** function reads the collection of data and build the **Map** with the required fields that which are required to process and group them into one array. Subsequently, this **key-value** pair is fed into the **Reducer**, which futher transform the values. The two phases of Map/Reduce is:

1. **map** phase: filter / transform / convert data
2. **reduce** phase: perform aggregations over the data

Syntax

```
db.collectionName.mapReduce(
  function() {emit(key,value);},                    //here is the map operation
  function(key,values) {return reduceFunction}, {   //here is the reduce operation
    out: collection,
    query: document,
    sort: document,
    limit: number
  }
)
```

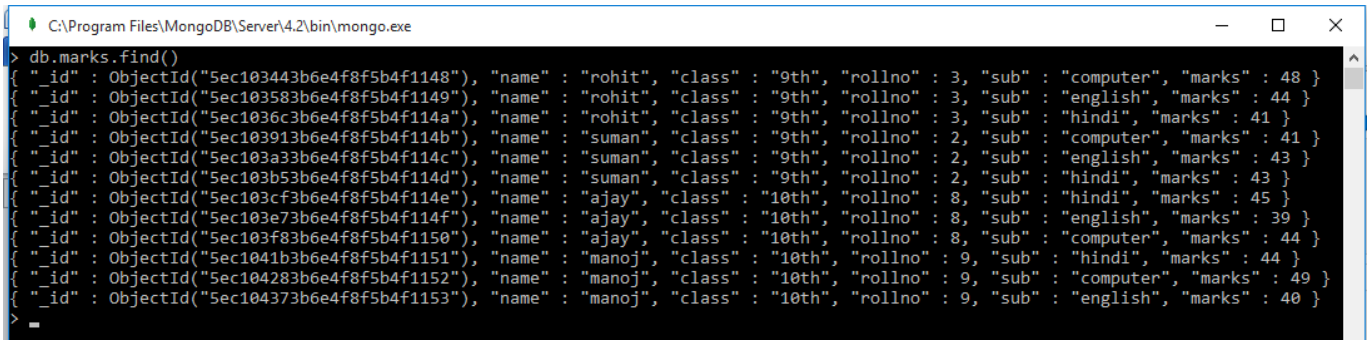
Where,

- **map** function maps a value with a key and emits a key-value pair. It's a JavaScript function
- **reduce** function reduces or groups all the documents having the same key. It's a JavaScript function
- **out** specifies the location of the map-reduce query result
- **query** specifies the optional selection criteria for selecting documents
- **sort** specifies the optional sort criteria i.e. ascending or descending
- **limit** specifies the optional maximum number of documents to be returned

The map-reduce function first queries the collection, then maps the result documents to emit key-value pairs, which is then reduced based on the keys that have multiple values.

Example:

Lets have the marks collection having the student name, roll, no, class and subject marks in each document.

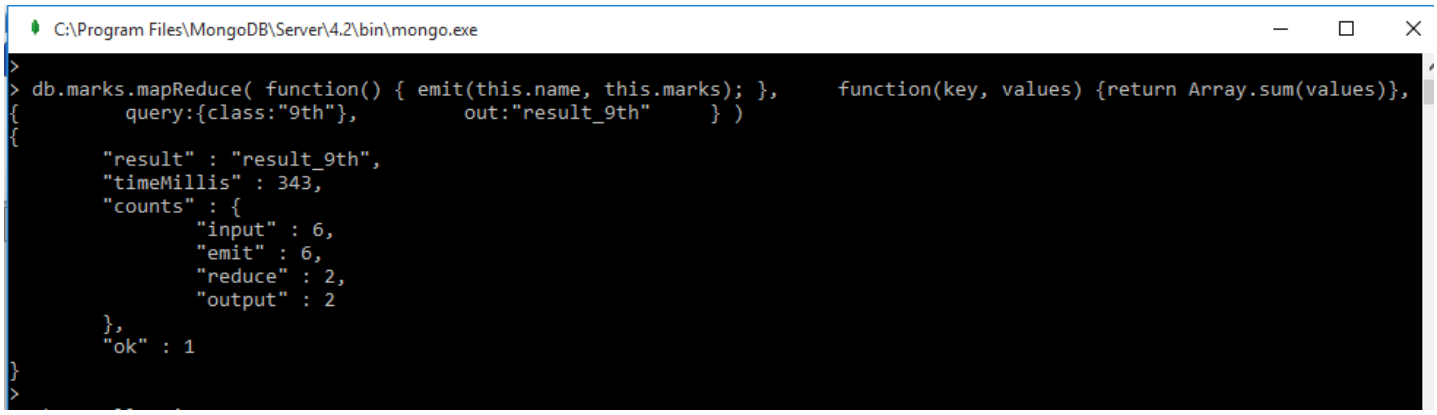


1. Now, we will use a mapReduce function on **marks** collection to select all sum of marks of all the students in class **9th**. The candidates of the class will be grouped based on the "**name"** and then the count the **marks** of each student. The output of the operation will be saved as collection "**result_9th".**

   The code will be

```
>db.marks.mapReduce(
  function() { emit(this.name,this.marks); },
  function(key, values) {return Array.sum(values)}, {
    query:{class:"9th"},
    out:"result_9th"
  }
)
```

As a result a new collection "result_9th" will be created and the same can be seen using show collections command. The documents in the newly created collection may be seen using find() command.



The result of the operation displays that

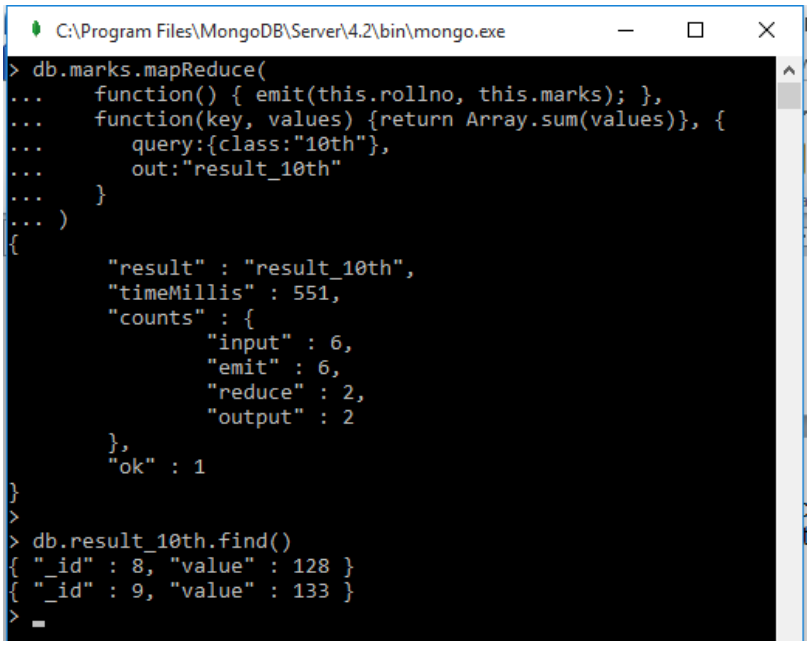
- Total 6 documents matched the query (class:“9th”),
- The map function emitted 6 documents with key-value pairs and
- Finally the reduce function grouped mapped documents having the same keys into 2 documents.

We may list the collections, and also see the documents in the collection :

```
>
> show collections
abc
college
marks
old
result
result_9th
result_totals
school
stock
store
>
> db.result_9th.find()
{ "_id" : "rohit", "value" : 133 }
{ "_id" : "suman", "value" : 127 }
```

2. Lets use mapReduce function on **marks** collection again to find sum of marks of all the students in class **10th**. The candidates of the class will be grouped based on the **rollno** and then the count their marks of each student. The output of the operation will be saved as collection “**result_10th”.**

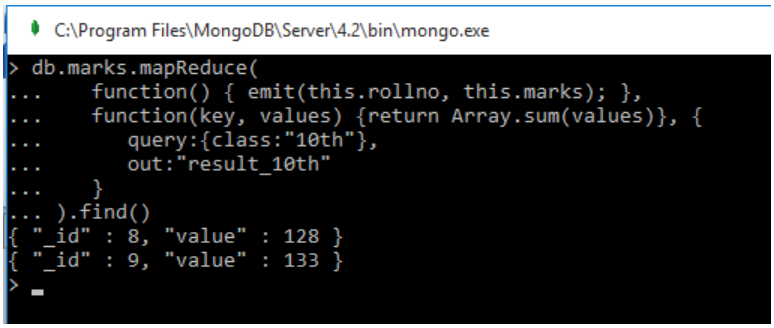
```
>db.marks.mapReduce(
  function() { emit(this.rollno, this.marks); },
  function(key, values) {return Array.sum(values)}, {
    query:{class:"10th"},
    out:"result_10th"
  }
)
```



Note:

- In above examples, the resulted documents are saved in the collection and we have to run find() command to show them.
- We can use find () command with the mapReducer command to display the resulted documents after the operation. The command for the this to find the result of 10th class is

```
>db.marks.mapReduce(
  function() { emit(this.rollno, this.marks); },
  function(key, values) {return Array.sum(values)}, {
    query:{class:"10th"},
    out:"result_10th"
  }
).find()
```



Assignments:

1. What is mapReduce? Explain the syntax.
2. Explain Map and Reduce operations in mapReduce with examples.