الف)

۱)

از جمله تفاوت های پایگاه داده های sql و nosql می توان به موارد زیر اشاره کرد.

در sql مدل رابطه ای در پشت سیستم قرار دارد در حالی که در nosql ها چنین چیزی وجود ندارد.

Schema در پایگاه داده های sql از پیش مشخص و ثابت باید باشند در حالی که این مورد در nosql ها پویا و قابل تغییر است.

پایگاه داده MongoDb ، از نوع nosql بوده و Document Oriented می باشد.

---

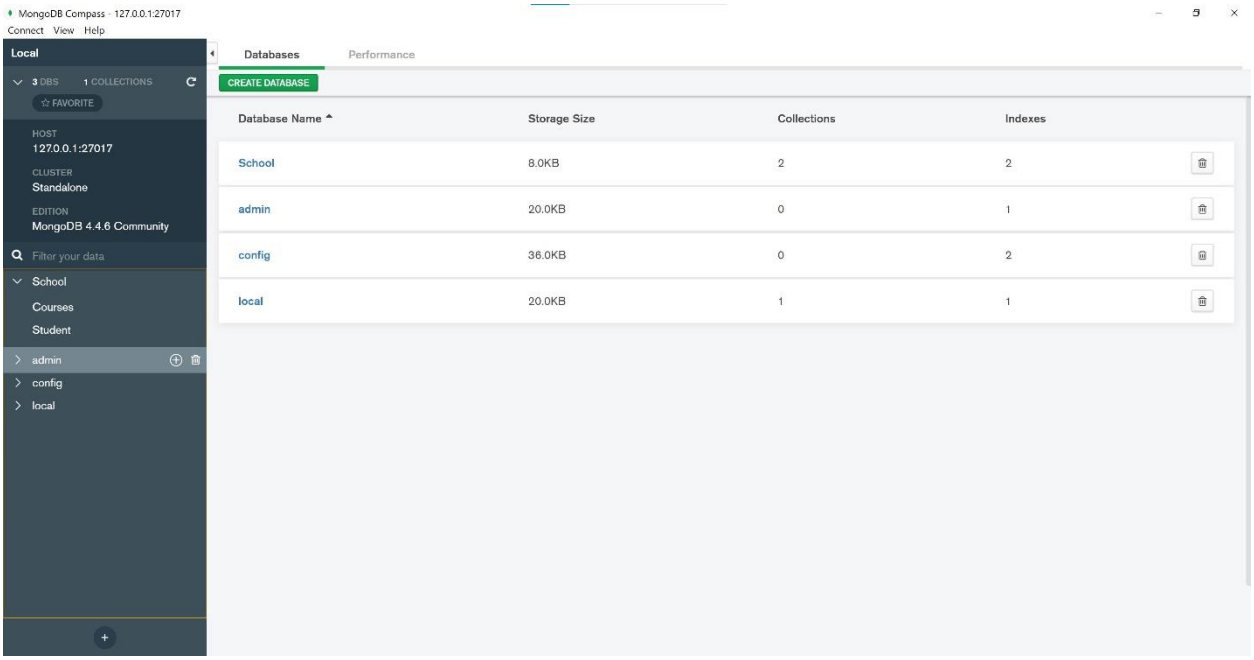
۲)

تصویر زیر نتایج اجرا را نشان می دهد

```
> use School
switched to db School
> show dbs
admin   0.000GB
config  0.000GB
local   0.000GB
> db
School
> db.createCollection('Student')
{ "ok" : 1 }
> db.createCollection('Courses')
{ "ok" : 1 }
> show collections
Courses
Student
> show vms
uncaught exception: Error: don't kn
shellHelper.show@src/mongo/shell/ut
shellHelper@src/mongo/shell/utils.j
@(shellhelp2):1:1
> show dbs
School  0.000GB
admin   0.000GB
config  0.000GB
local   0.000GB
>
```

به نظر تا قبل از اینکه چیزی وارد db نشود. آن db واقعا ساخته نمی شود به همین خاطر پس از ساخت کالکشن ها، School به لیست db ها نیز اضافه شده است.

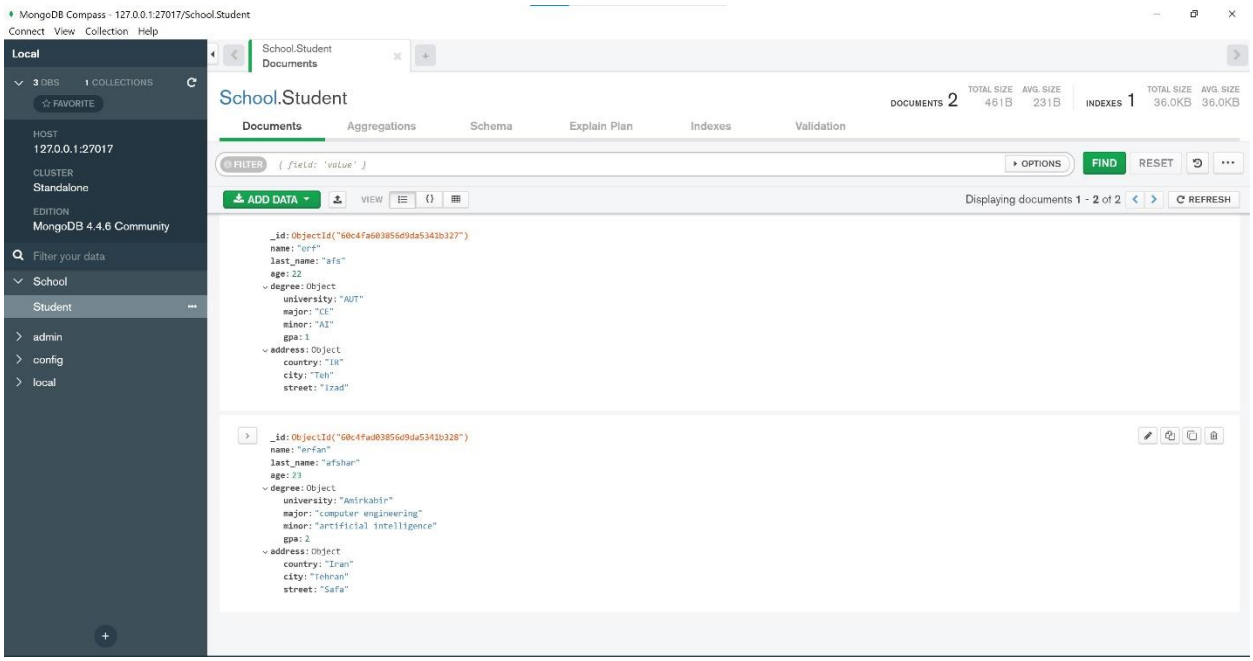
همین نتایج در compass نیز قابل مشاهده اند.



---

۳ و ۴)

```
> db.Student.insert({name: "erf", last_name: "afs", age: 22, degree:{university: "AUI", major: "CE", minor:"AI", gpa: 1.00}, address: {country: "IR", city: "Teh", street: "Izad"}})
WriteResult({ "nInserted" : 1 })
> db.Student.insert({name: "erfan", last_name: "afshar", age: 23, degree:{university: "Amirkabir", major: "computer engineering", minor:"artificial intelligence", gpa: 2.00}, address: {country: "Iran
", city: "Tehran", street: "Safa"}})
WriteResult({ "nInserted" : 1 })
> db.Student.find()
{ "_id" : ObjectId("60c4fa603856d9da5341b327"), "name" : "erf", "last_name" : "afs", "age" : 22, "degree" : { "university" : "AUI", "major" : "CE", "minor" : "AI", "gpa" : 1 }, "address" : { "country
" : "IR", "city" : "Teh", "street" : "Izad" } }
{ "_id" : ObjectId("60c4fad03856d9da5341b328"), "name" : "erfan", "last_name" : "afshar", "age" : 23, "degree" : { "university" : "Amirkabir", "major" : "computer engineering", "minor" : "artificial
intelligence", "gpa" : 2 }, "address" : { "country" : "Iran", "city" : "Tehran", "street" : "Safa" } }
> db.Courses.drop()
true
> show collections
Student
>
```


MongoDB Compass - 127.0.0.1:27017/School.Student
Connect View Collection Help
Local
3 DBS 1 COLLECTIONS
FAVORITE
HOST
127.0.0.1:27017
CLUSTER
Standalone
EDITION
MongoDB 4.4.6 Community
Filter your data
School
Student
admin
config
local
School.Student
Documents
School.Student
DOCUMENTS 2
TOTAL SIZE 461B
AVG. SIZE 231B
INDEXES 1
TOTAL SIZE 36.0KB
AVG. SIZE 36.0KB
Documents
Aggregations
Schema
Explain Plan
Indexes
Validation
FILTER
{ field: 'value' }
OPTIONS
FIND
RESET
ADD DATA
VIEW
Displaying documents 1 - 2 of 2
REFRESH
_id: ObjectId("60c4fa603856d9da5341b327")
name: "erf"
last_name: "afs"
age: 22
degree: Object
university: "AUT"
major: "CE"
minor: "AI"
gpa: 1
address: Object
country: "IR"
city: "Teh"
street: "izad"
_id: ObjectId("60c4fad03856d9da5341b328")
name: "erfan"
last_name: "afshar"
age: 23
degree: Object
university: "Amirkabir"
major: "computer engaineering"
minor: "artificial intelligence"
gpa: 2
address: Object
country: "Iran"
city: "Tehran"
street: "Safa"

(۵

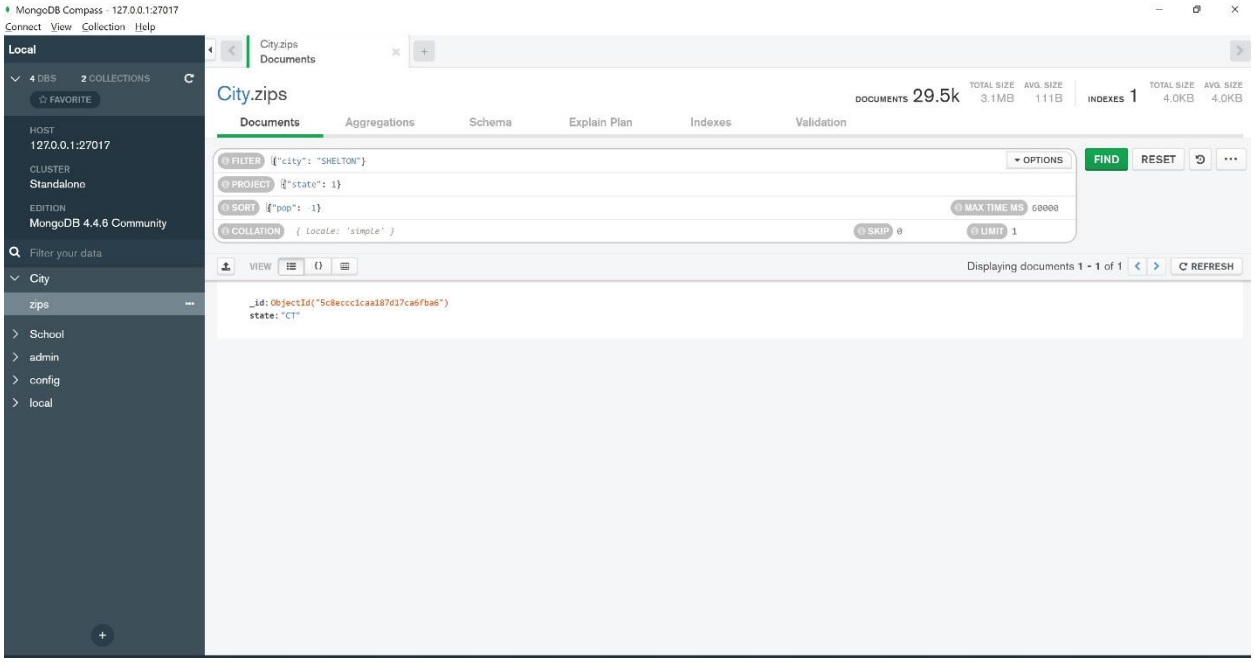
```
> db.Student.find().pretty()
{
        "_id" : ObjectId("60c4fa603856d9da5341b327"),
        "name" : "erf",
        "last_name" : "afs",
        "age" : 22,
        "degree" : {
                "university" : "AUT",
                "major" : "CE",
                "minor" : "AI",
                "gpa" : 1
        },
        "address" : {
                "country" : "IR",
                "city" : "Teh",
                "street" : "Izad"
        }
}
{
        "_id" : ObjectId("60c4fad03856d9da5341b328"),
        "name" : "erfan",
        "last_name" : "afshar",
        "age" : 23,
        "degree" : {
                "university" : "Amirkabir",
                "major" : "computer engineering",
                "minor" : "artificial intelligence",
                "gpa" : 2
        },
        "address" : {
                "country" : "Iran",
                "city" : "Tehran",
                "street" : "Safa"
        }
}
```

```
> db.Student.update({name: "erf"}, {$inc:{age:3}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.update({name: "erfan"}, {$unset:{age:1}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.find()
{ "_id" : ObjectId("60c4fa603856d9da5341b327"), "name" : "erf", "last_name" : "afs", "age" : 25, "degree" : { "university" : "AUT", "major" : "CE", "minor" : "AI", "gpa" : 1 }, "address" : { "country
" : "IR", "city" : "Teh", "street" : "Izad" } }
{ "_id" : ObjectId("60c4fad03856d9da5341b328"), "name" : "erfan", "last_name" : "afshar", "degree" : { "university" : "Amirkabir", "major" : "computer engineering", "minor" : "artificial intelligence
", "gpa" : 2 }, "address" : { "country" : "Iran", "city" : "Tehran", "street" : "Safa" } }
>
```

ب)

۶ و ۷ و ۸)

```
> db.zips.find({"city": "SHELTON"})
{ "_id" : ObjectId("5c8eccc1caa187d17ca6fba6"), "city" : "SHELTON", "zip" : "06484", "loc" : { "y" : 41.304689, "x" : 73.129439 }, "pop" : 35447, "state" : "CT" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca72a6e"), "city" : "SHELTON", "zip" : "68876", "loc" : { "y" : 40.771703, "x" : 98.743453 }, "pop" : 1256, "state" : "NE" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca75972"), "city" : "SHELTON", "zip" : "98584", "loc" : { "y" : 47.20863, "x" : 123.072862 }, "pop" : 19074, "state" : "WA" }
> db.zips.find({"city": "SHELTON"}).sort({"pop": -1})
{ "_id" : ObjectId("5c8eccc1caa187d17ca6fba6"), "city" : "SHELTON", "zip" : "06484", "loc" : { "y" : 41.304689, "x" : 73.129439 }, "pop" : 35447, "state" : "CT" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca75972"), "city" : "SHELTON", "zip" : "98584", "loc" : { "y" : 47.20863, "x" : 123.072862 }, "pop" : 19074, "state" : "WA" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca72a6e"), "city" : "SHELTON", "zip" : "68876", "loc" : { "y" : 40.771703, "x" : 98.743453 }, "pop" : 1256, "state" : "NE" }
> db.zips.find({"city": "SHELTON"}, {"state": 1}).sort({"pop": -1}).limit(1)
{ "_id" : ObjectId("5c8eccc1caa187d17ca6fba6"), "state" : "CT" }
```



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۹ و ۱۰)

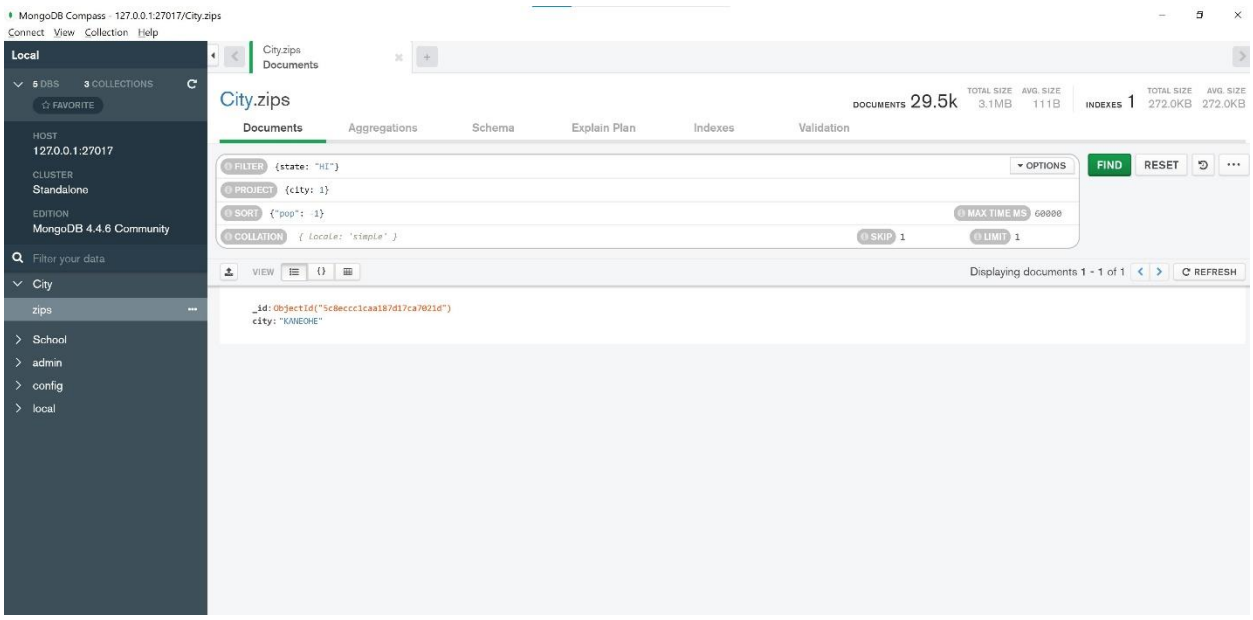
```
> db.zips.find({}, {"city": 1, "pop": 1}).sort({"pop": -1}).limit(10)
{ "_id" : ObjectId("5c8eccc1caa187d17ca7044d"), "city" : "CHICAGO", "pop" : 112047 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca7307f"), "city" : "BROOKLYN", "pop" : 111396 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca72fa0"), "city" : "NEW YORK", "pop" : 106564 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca72fa5"), "city" : "NEW YORK", "pop" : 100027 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6f39d"), "city" : "BELL GARDENS", "pop" : 99568 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca70447"), "city" : "CHICAGO", "pop" : 98612 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6f366"), "city" : "LOS ANGELES", "pop" : 96074 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca70466"), "city" : "CHICAGO", "pop" : 95971 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca70455"), "city" : "CHICAGO", "pop" : 94317 }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6f3db"), "city" : "NORWALK", "pop" : 94188 }
> db.zips.find($or: [{pop : {$lt: 100}}, {pop: {$gt: 100000}}])
uncaught exception: SyntaxError: missing ) after argument list :
@(shell):1:16
> db.zips.find({$or: [{pop : {$lt: 100}}, {pop: {$gt: 100000}}]})
{ "_id" : ObjectId("5c8eccc1caa187d17ca6eea3"), "city" : "ALLEN", "zip" : "36419", "loc" : { "y" : 31.624266, "x" : 87.66746 }, "pop" : 0, "state" : "AL" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6eebf"), "city" : "CARLTON", "zip" : "36515", "loc" : { "y" : 31.322449, "x" : 87.837793 }, "pop" : 30, "state" : "AL" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef1c"), "city" : "MORVIN", "zip" : "36762", "loc" : { "y" : 31.967305, "x" : 87.972897 }, "pop" : 24, "state" : "AL" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef65"), "city" : "CHEVAK", "zip" : "99563", "loc" : { "y" : 61.583982, "x" : 164.776457 }, "pop" : 0, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef67"), "city" : "CLARKS POINT", "zip" : "99569", "loc" : { "y" : 58.84921, "x" : 158.451241 }, "pop" : 68, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef6c"), "city" : "CHENEGA BAY", "zip" : "99574", "loc" : { "y" : 60.102558, "x" : 147.943316 }, "pop" : 96, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef6e"), "city" : "CROOKED CREEK", "zip" : "99575", "loc" : { "y" : 61.818072, "x" : 158.002483 }, "pop" : 1, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef71"), "city" : "EKWOK", "zip" : "99580", "loc" : { "y" : 59.362792, "x" : 157.478211 }, "pop" : 77, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef74"), "city" : "FALSE PASS", "zip" : "99583", "loc" : { "y" : 54.841028, "x" : 163.436845 }, "pop" : 68, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef75"), "city" : "EMMONAK", "zip" : "99581", "loc" : { "y" : 62.827404, "x" : 164.131298 }, "pop" : 0, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef77"), "city" : "GRAYLING", "zip" : "99590", "loc" : { "y" : 63.372013, "x" : 159.404907 }, "pop" : 0, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef8f"), "city" : "NAKNEK", "zip" : "99633", "loc" : { "y" : 58.885699, "x" : 156.705405 }, "pop" : 0, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef90"), "city" : "NIKOLSKI", "zip" : "99638", "loc" : { "y" : 52.988337, "x" : 168.788427 }, "pop" : 42, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef94"), "city" : "PEDRO BAY", "zip" : "99647", "loc" : { "y" : 59.92238, "x" : 153.821856 }, "pop" : 59, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef95"), "city" : "PILOT POINT", "zip" : "99649", "loc" : { "y" : 57.595193, "x" : 157.449272 }, "pop" : 63, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef99"), "city" : "PLATINUM", "zip" : "99651", "loc" : { "y" : 58.63364, "x" : 162.043201 }, "pop" : 4, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6ef9c"), "city" : "RUSSIAN MISSION", "zip" : "99657", "loc" : { "y" : 61.591302, "x" : 161.558413 }, "pop" : 0, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6efa4"), "city" : "PORT ALSWORTH", "zip" : "99653", "loc" : { "y" : 60.636416, "x" : 154.433803 }, "pop" : 7, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6efb4"), "city" : "SLEETMUTE", "zip" : "99668", "loc" : { "y" : 61.634555, "x" : 157.118284 }, "pop" : 0, "state" : "AK" }
{ "_id" : ObjectId("5c8eccc1caa187d17ca6efb5"), "city" : "TRAPPER CREEK", "zip" : "99683", "loc" : { "y" : 61.441361, "x" : 150.284455 }, "pop" : 20, "state" : "AK" }
Type "it" for more
```

(۱۱

```
> db.zips.find({"state": "NY"}).count()
1596
```

پ)

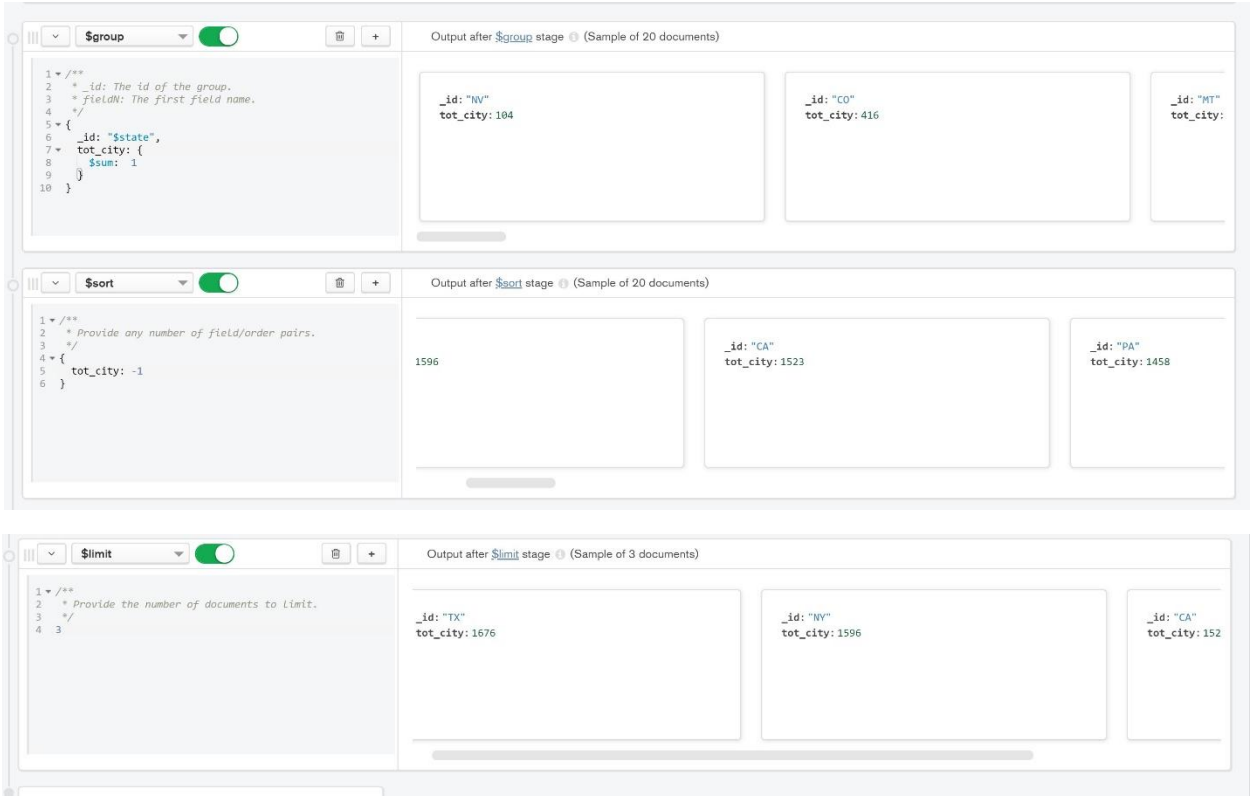
(۱۲



ت)

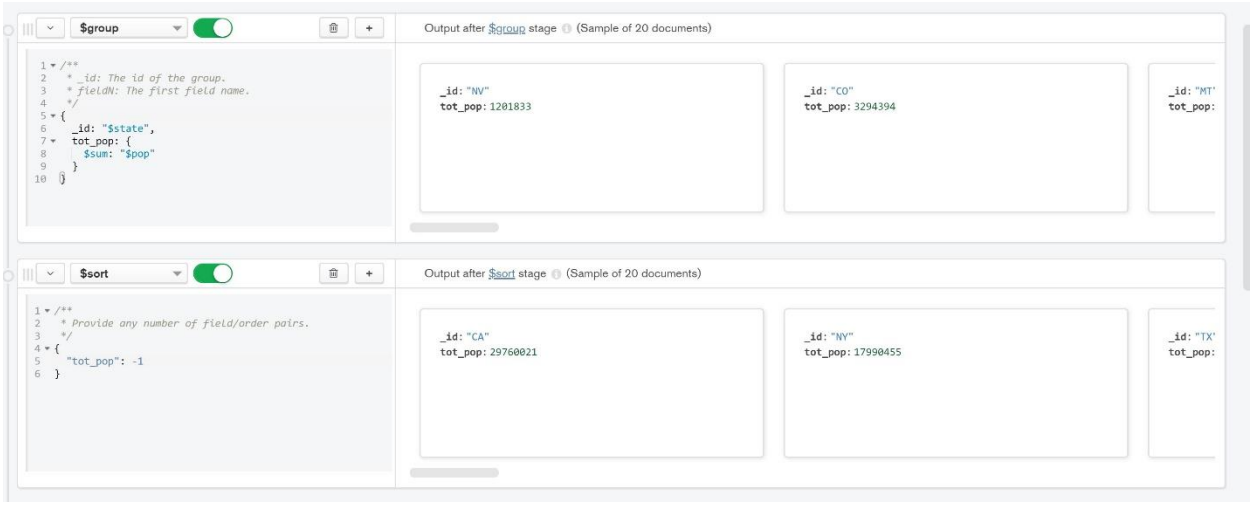
(۱۳

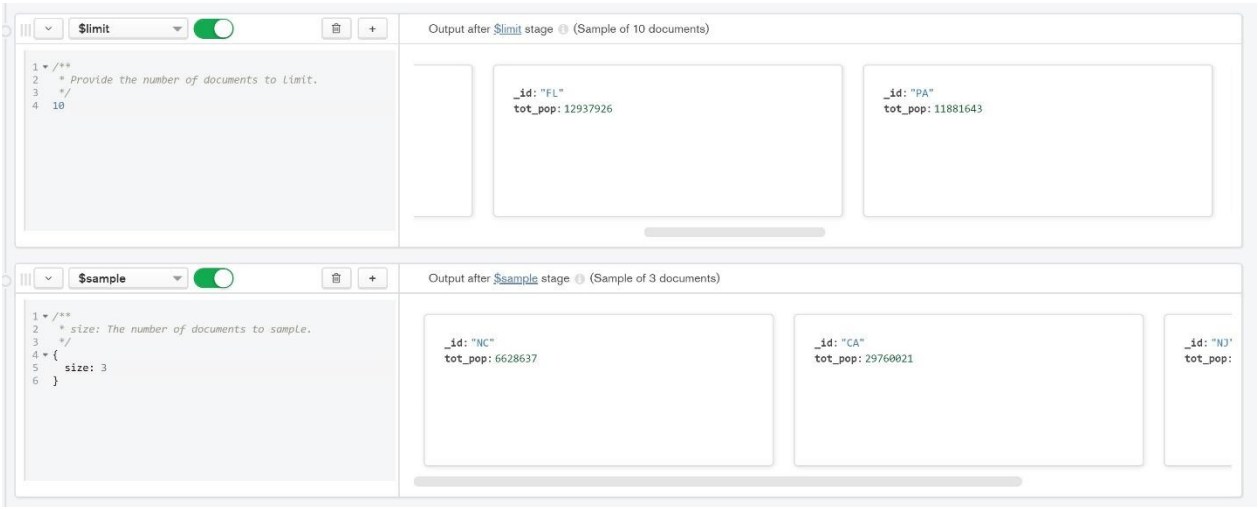
این خط لوله ۳ مرحله دارد. در مرحله اول با استفاده از group تعداد شهر های موجود در هر ایالت را بدست می آوریم. در مرحله دوم این نتایج را به صورت نزولی مرتب می کنیم. در انتها تعداد ۳ تا از آنها را نگه داشته و بقیه را حذف می کنیم.



(۱۴

این خط لوله ۴ مرحله دارد. در مرحله ۱ ایالت ها را گروه بندی کرده و جمعیت شهر های موجود در آنها را جمع می کنیم تا جمعیت کل ایالت بدست بیاید. سپس این خروجی را به صورت نزولی مرتب کرده و ۱۰ تای اول آنها را حفظ می کنیم. در انتها نیز با استفاده از sample یک نمونه ۳ تایی از این مجموعه ۱۰ تایی انتخاب می کنیم.


$group
/**
* _id: The id of the group.
* fieldN: The first field name.
*/
{
_id: "$state",
tot_pop: {
$sum: "$pop"
}
}
Output after $group stage (Sample of 20 documents)
_id: "NV"
tot_pop: 1201833
_id: "CO"
tot_pop: 3294394
$sort
/**
* Provide any number of field/order pairs.
*/
{
"tot_pop": -1
}
Output after $sort stage (Sample of 20 documents)
_id: "CA"
tot_pop: 29760021
_id: "NY"
tot_pop: 17990455


$limit
/**
* Provide the number of documents to limit.
*/
10
Output after $limit stage (Sample of 10 documents)
_id: "FL"
tot_pop: 12937926
_id: "PA"
tot_pop: 11881643
$sample
/**
* size: The number of documents to sample.
*/
{
size: 3
}
Output after $sample stage (Sample of 3 documents)
_id: "NC"
tot_pop: 6628637
_id: "CA"
tot_pop: 29760021