

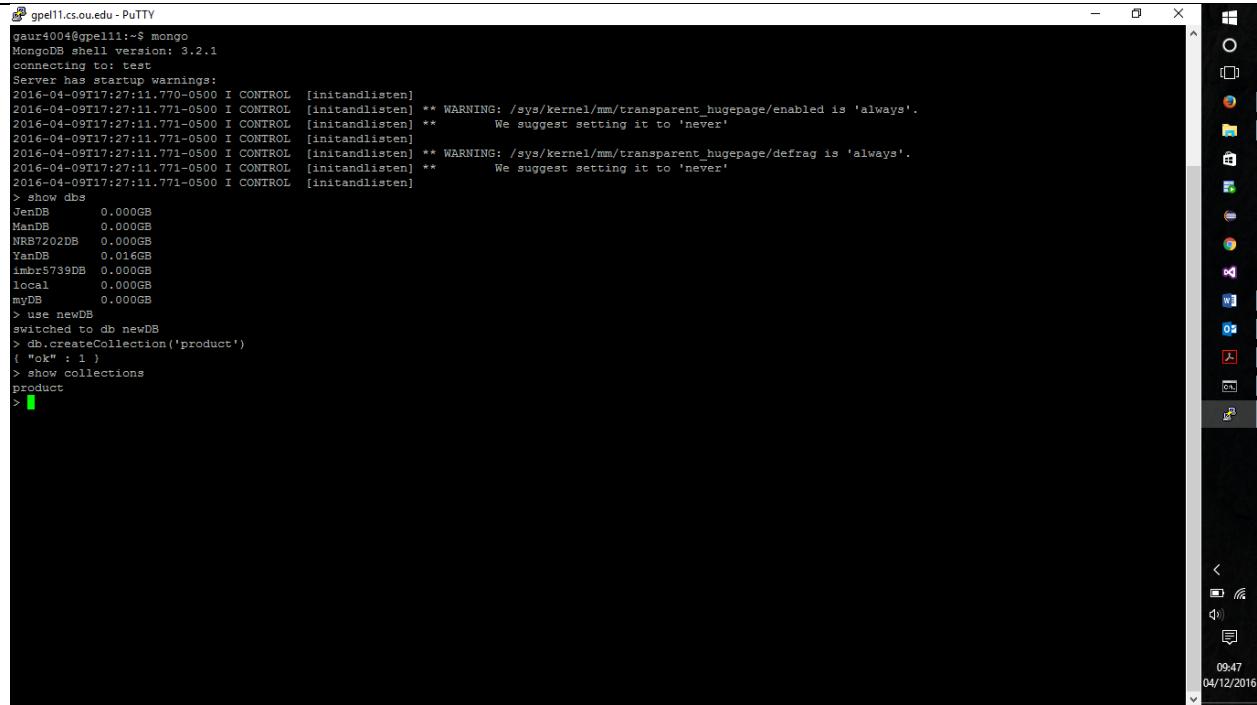
HW 3 REPORT

CS 5513 Adv. DBMS

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TASK 1 – CREATE COLLECTION

For this task, the command was → db.createCollection('product')



```
gaurav004@gpell1:~$ mongo
MongoDB shell version: 3.2.1
connecting to: test
Server has startup warnings:
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten]
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten]
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/defrag is 'always'.
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-09T17:27:11.771-0500 I CONTROL [initandlisten]
> show dbs
JenDB 0.000GB
ManDB 0.000GB
MR87202DB 0.000GB
YanDB 0.016GB
IMB15739DB 0.000GB
local 0.000GB
myDB 0.000GB
> use newDB
switched to db newDB
> db.createCollection('product')
{
  "ok" : 1
}
> show collections
product
>
```

TASK 2 – INDEX CREATION

In total, there were 6 queries (1 insertion, 4 selection and 1 deletion).

For the first query, since mongoDB has a default index on the '_id' field, therefore, no index seemed necessary.

For the second query, the 30 products can be fetched on any basis such as product type or regular price, screen resolution or even product id. The only way would be to index all columns which seems excessive and therefore no index was added for this query.

For the third query, a single index was created on the discounted price so that range query would be fast. I also confirmed the index use with the explain() function provided in mongoDB.

```
INDEX - db.product.createIndex({ 'price.discount' : -1}, {name:'idx_dscnt_prc'})
```

For the fourth query, a compound index was created on both brand and regular price so that a query that is fired using both attributes will use the index. Also, since the index will be only for digital cameras, to save space, a partial index was created filtering the index and creating it only for the documents having the product type as digital camera.

```
INDEX - db.product.createIndex( { 'brand' : 1, 'price.regular' : -1 }, { name : "idx_dgtl_cmr", partialfilterexpression : { 'product_type' : 'digital_camera' } } )
```

For the fifth query, again, partial compound index was created on hdd_type, hdd_size and OS so that finding SSD of certain type of certain OS will be fast. Please note that didn't create a FTS index on hdd_type because I have used it for the television query afterwards.

```
db.product.createIndex( {'hard_drive.hdd_type':1,'hard_drive.hdd_size.size':1, 'OS':1}, { name : "idx_hdd", partialfilterexpression : { 'product_type' : 'desktop_computer' } } )
```

For the sixth query, a FTS index was created on the attribute resolution so that the search for the resolutions will be fast (the resolutions are in text format because of the 'l's and the 'p's).

```
db.product.createIndex( {'resolution':'text'}, { name : 'idx_tv', partialfilterexpression : { 'product_type' : 'television' } } )
```

TASK 3 – INSERTION OF PRODUCTS

- Python was used to iterate through catalog and create a mongoDB script to insert the catalog in the database.
- Here is the output:

```
gaur4004@gpel11:~$ mongod --dbpath ~/hw3db/main/ --port 40041
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] MongoDB starting : pid=10174 port=40041 dbpath=/home/course/gaur4004/hw3db/main/ 64-bit h
ost=gpel11
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] git version: a14d55980c2cdc565d4704a7e3ad37e4e535c1b2
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] OpenSSL version: OpenSSL 1.0.1f 6 Jan 2014
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] allocator: tcmalloc
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] modules: none
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] build environment:
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] distmod: ubuntu1404
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] distarch: x86_64
2016-04-11T14:21:09.928-0500 I CONTROL [initandlisten] target_arch: x86_64
2016-04-11T14:21:09.929-0500 I CONTROL [initandlisten] options: { net: { port: 40041 }, storage: { dbPath: "/home/course/gaur4004/hw3db/main/" } }
2016-04-11T14:21:09.977-0500 I STORAGE [initandlisten] wiredtiger_open config: create,cache_size=18G/session_max=20000,eviction=(threads_max=4),
config_base=false,statistics=(fast),log=(enabled=true,archive=true,path=journal,compressor=snappy),file_manager=(close_idle_time=100000),checkpol
nt=(wait=60,log_size=2GB),statistics_log=(wait=0),
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten]
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** We suggest setting it to 'never'
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten]
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/defrag is 'always'.
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** We suggest setting it to 'never'
2016-04-11T14:21:10.228-0500 I FTDC [initandlisten] Initializing full-time diagnostic data capture with directory '/home/course/gaur4004/hw3d
b/main/diagnostic.data'
2016-04-11T14:21:10.228-0500 I NETWORK [HostnameCanonicalizationWorker] Starting hostname canonicalization worker
2016-04-11T14:21:10.276-0500 I NETWORK [initandlisten] Waiting for connections on port 40041
2016-04-11T14:21:37.986-0500 I NETWORK [initandlisten] connection accepted from 10.194.82.215:50102 #1 (1 connection now open)
2016-04-11T14:21:53.337-0500 I NETWORK [conn1] end connection 10.194.82.215:50102 (0 connections now open)
2016-04-11T14:22:54.262-0500 I NETWORK [initandlisten] connection accepted from 127.0.0.1:51222 #2 (1 connection now open)
2016-04-11T14:23:03.381-0500 I COMMAND [conn2] command myDB.product command: insert { insert: "product", documents: 1000, ordered: true } nins
erted:1000 keyUpdates:0 writeConflicts:0 numYields:0 reslen:25 locks:{ Global: { acquireCount: { r: 16, w: 16 } }, Database: { acquireCount: { w: 1
6 } }, Collection: { acquireCount: { w: 16 } } } protocol:op_command 172ms
2016-04-11T14:23:03.774-0500 I NETWORK [conn2] end connection 127.0.0.1:51222 (0 connections now open)

[service] 0:mongod*
```

The screenshot shows a Mac OS X desktop environment. A Dock on the left contains icons for Finder, Mail, Safari, and other applications. Two terminal windows are open side-by-side. The top window has a green title bar labeled "Terminal" and shows the command `mongo --host gpel11.cs.ou.edu:40041 myDB ~/Downloads/catalogInsertion.js` being run. The bottom window also has a green title bar labeled "Terminal" and shows the mongo shell running, including startup warnings about transparent hugepage settings and a command to find the first document in the product collection.

```

Terminal
gaur4004@gpel11:~$ mongo --host gpel11.cs.ou.edu:40041 myDB ~/Downloads/catalogInsertion.js
MongoDB shell version: 3.2.1
connecting to: gpel11.cs.ou.edu:40041/myDB
gaur4004@gpel11:~$ 

[client] 0:bash* "gpel11" 14:23 11-Apr-16
Terminal
gaur4004@gpel11:~$ mongo --host gpel11.cs.ou.edu:40041 myDB
MongoDB shell version: 3.2.1
connecting to: gpel11.cs.ou.edu:40041/myDB
Server has startup warnings:
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten]
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** We suggest setting it to 'never'
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten]
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/defrag is 'always'.
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten] ** We suggest setting it to 'never'
2016-04-11T14:21:10.226-0500 I CONTROL [initandlisten]
> show dbs
local 0.000GB
myDB 0.016GB
[client] 0: mongo* "gpel11" 14:26 11-Apr-16

```

Command: `mongo -host gpel11.cs.ou.edu:40041 myDB catalogInsertion.js`

Also, you could be in the mongo shell and could do:

Command : `load('./catalogInsertion.js')`

TASK 4 – IMPLEMENT QUERIES

```
QUERY 2 - db.product.find({'product_type': { $eq: 'television' }}).limit(30)
```

A screenshot of a Mac OS X desktop environment. On the left, there's a vertical dock containing icons for various applications like Finder, Mail, and Safari. The main window is a terminal window titled "Terminal". Inside the terminal, the command `> db.product.find({'product_type': { $eq: 'television' }}).limit(30)` is typed. The status bar at the bottom shows the path "[client] 0:mongo*" and the date/time "2014-04-11 14:28". The top right corner of the screen shows system status including battery level (64%), signal strength, and user name "Akshay Gaur".

```

Terminal
resolution": "4K", "price": { "discount": 8736.68, "regular": 9268.17 }, "frequency": "120Hz", "input_lag": "12ms", "three_d": "No 3D", "type": "Regular TV", "brand": "Sharp", "size": "40in" }
{ "_id": 87, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 61.53, "length": 27.93, "depth": 10.46 }, "resolution": "1080p", "price": { "discount": 1429.37, "regular": 1746.85 }, "frequency": "120Hz", "input_lag": "12ms", "three_d": "3D", "type": "Regular TV", "brand": "Vizio", "size": "40in" }
{ "_id": 106, "inputs": [ "HDMI", "USB" ], "product_type": "television", "shipping_size": { "breadth": 63.13, "length": 29.92, "depth": 14.39 }, "resolution": "480i", "price": { "discount": 1760.44, "regular": 2518.04 }, "frequency": "60Hz", "input_lag": "35ms", "three_d": "3D", "type": "SmartTV", "brand": "RCA", "size": "27in" }
{ "_id": 123, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 87.83, "length": 24.84, "depth": 17.13 }, "resolution": "1080i", "price": { "discount": 6257.39, "regular": 7427.48 }, "frequency": "120Hz", "input_lag": "23ms", "three_d": "3D", "type": "SmartTV", "brand": "Sony", "size": "24in" }
{ "_id": 128, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 99.69, "length": 57.44, "depth": 17.01 }, "resolution": "1080p", "price": { "discount": 876.83, "regular": 1966.38 }, "frequency": "120Hz", "input_lag": "12ms", "three_d": "No 3D", "type": "SmartTV", "brand": "Sharp", "size": "52in" }
{ "_id": 145, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 36.77, "length": 93.66, "depth": 18.67 }, "resolution": "4K", "price": { "discount": 1251.06, "regular": 3022.13 }, "frequency": "120Hz", "input_lag": "28ms", "three_d": "3D", "type": "Regular TV", "brand": "Toshiba", "size": "72in" }
{ "_id": 147, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 26.72, "length": 79.32, "depth": 17.91 }, "resolution": "1080i", "price": { "discount": 6381.79, "regular": 7108.63 }, "frequency": "120Hz", "input_lag": "18ms", "three_d": "3D", "type": "Regular TV", "brand": "RCA", "size": "52in" }
{ "_id": 149, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 83.6, "length": 79.8, "depth": 16.32 }, "resolution": "1080p", "price": { "discount": 968.42, "regular": 1782.92 }, "frequency": "60Hz", "input_lag": "23ms", "three_d": "No 3D", "type": "Regular TV", "brand": "Samsung", "size": "55in" }
{ "_id": 163, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 74.8, "length": 90.45, "depth": 19.66 }, "resolution": "480p", "price": { "discount": 6409.18, "regular": 9529.68 }, "frequency": "60Hz", "input_lag": "12ms", "three_d": "No 3D", "type": "Regular TV", "brand": "Toshiba", "size": "19in" }
{ "_id": 164, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 26.77, "length": 39.98, "depth": 19.11 }, "resolution": "720p", "price": { "discount": 3056.49, "regular": 5765.26 }, "frequency": "60Hz", "input_lag": "28ns", "three_d": "3D", "type": "Regular TV", "brand": "RCA", "size": "40in" }
{ "_id": 168, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 36.62, "length": 21.9, "depth": 11.37 }, "resolution": "720p", "price": { "discount": 2087.57, "regular": 5133.08 }, "frequency": "60Hz", "input_lag": "12ms", "three_d": "No 3D", "type": "Regular TV", "brand": "Vizio", "size": "27in" }
{ "_id": 173, "inputs": [ "HDMI", "USB" ], "product_type": "television", "shipping_size": { "breadth": 71.48, "length": 40.42, "depth": 14.85 }, "resolution": "480p", "price": { "discount": 3001.33, "regular": 6314.72 }, "frequency": "60Hz", "input_lag": "28ms", "three_d": "3D", "type": "Regular TV", "brand": "Sanyo", "size": "72in" }
{ "_id": 174, "inputs": [ "HDMI", "USB" ], "product_type": "television", "shipping_size": { "breadth": 53.19, "length": 85.56, "depth": 17.59 }, "resolution": "720p", "price": { "discount": 5963.55, "regular": 8286.65 }, "frequency": "120Hz", "input_lag": "23ms", "three_d": "3D", "type": "Regular TV", "brand": "Sharp", "size": "50in" }
Type "it" for more
> |
[client] 0:mongo*

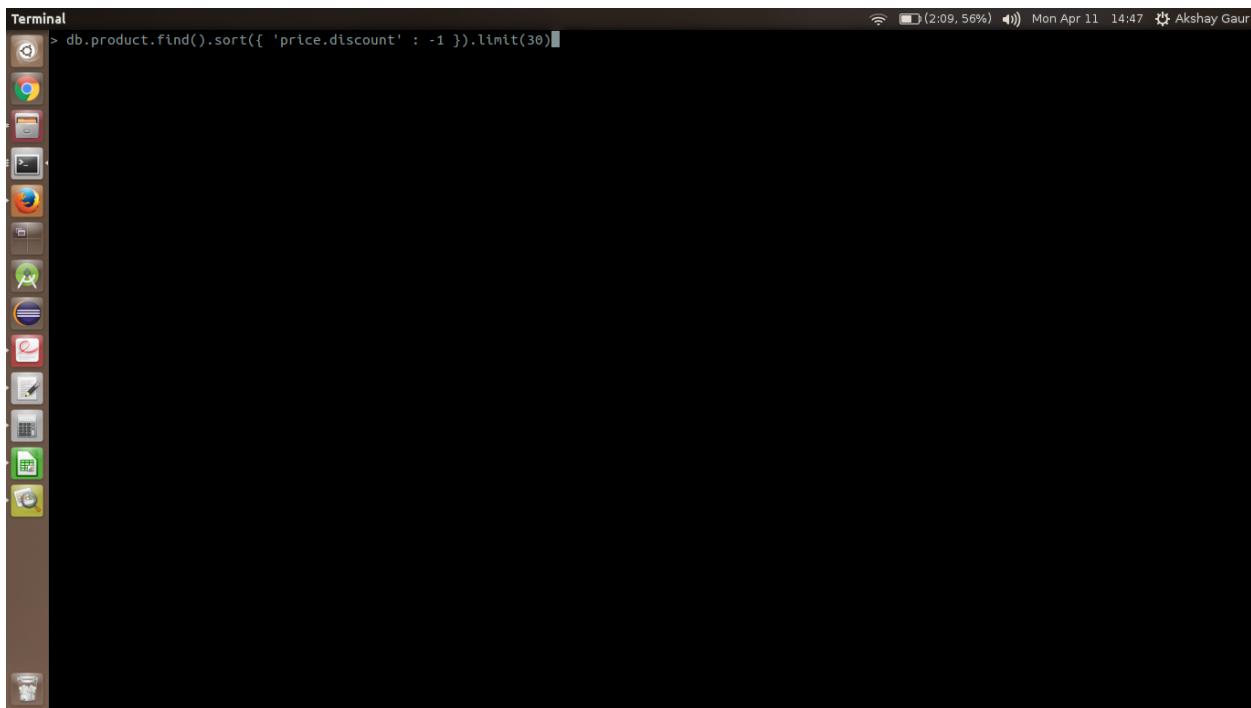
```

```

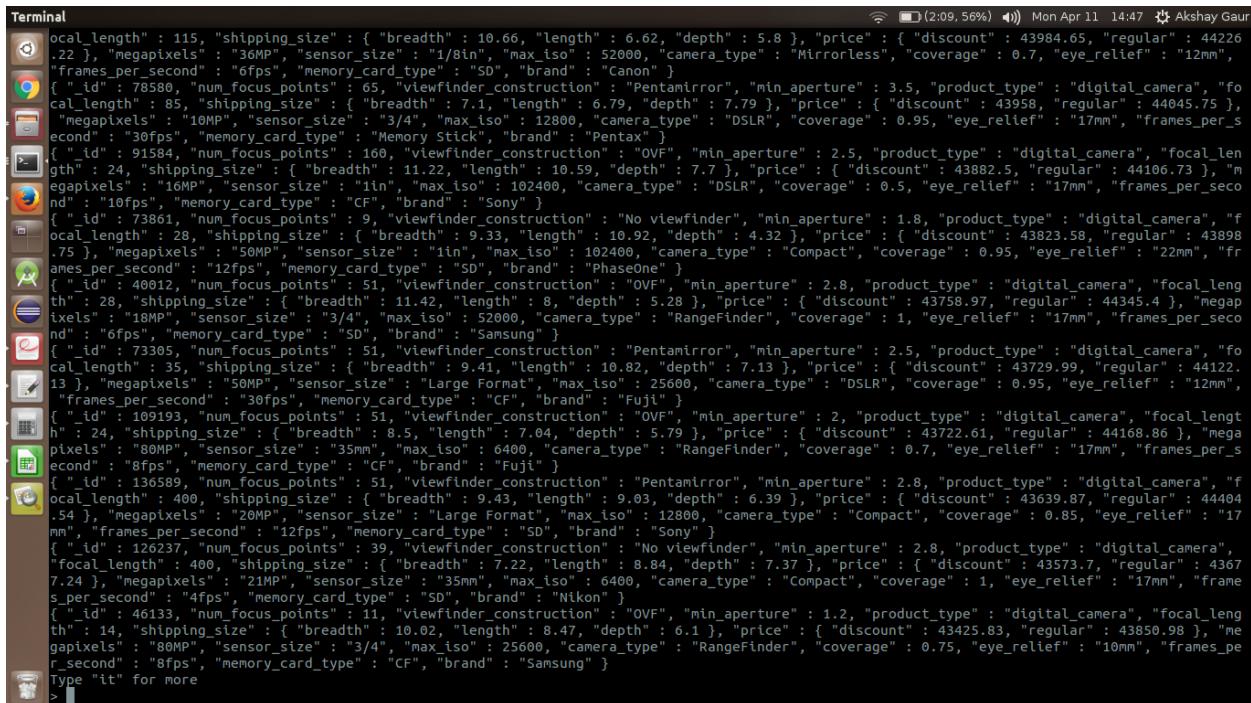
Terminal
> it
{ "_id": 183, "inputs": [ ], "product_type": "television", "shipping_size": { "breadth": 75.68, "length": 88.55, "depth": 14.74 }, "resolution": "1080i", "price": { "discount": 905.12, "regular": 1268.2 }, "frequency": "60Hz", "input_lag": "20ms", "three_d": "No 3D", "type": "SmartTV", "brand": "Emerson", "size": "42in" }
{ "_id": 186, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 25.21, "length": 55.71, "depth": 11 }, "resolution": "720p", "price": { "discount": 5984.33, "regular": 7574.02 }, "frequency": "60Hz", "input_lag": "18ms", "three_d": "3D", "type": "SmartTV", "brand": "Toshiba", "size": "32in" }
{ "_id": 189, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 56.39, "length": 91.51, "depth": 12.58 }, "resolution": "480i", "price": { "discount": 1226.77, "regular": 1551.75 }, "frequency": "60Hz", "input_lag": "23ms", "three_d": "No 3D", "type": "SmartTV", "brand": "Emerson", "size": "40in" }
{ "_id": 196, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 25.48, "length": 40.79, "depth": 17.88 }, "resolution": "720p", "price": { "discount": 4054.13, "regular": 6451.19 }, "frequency": "60Hz", "input_lag": "18ms", "three_d": "No 3D", "type": "SmartTV", "brand": "Toshiba", "size": "60in" }
{ "_id": 220, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 59.08, "length": 45.11, "depth": 15.05 }, "resolution": "8K", "price": { "discount": 2062.23, "regular": 2190.98 }, "frequency": "120Hz", "input_lag": "35ms", "three_d": "No 3D", "type": "SmartTV", "brand": "Sharp", "size": "60in" }
{ "_id": 222, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 33.26, "length": 69.15, "depth": 13.45 }, "resolution": "1080i", "price": { "discount": 0877.11, "regular": 7254.08 }, "frequency": "120Hz", "input_lag": "28ms", "three_d": "No 3D", "type": "Regular TV", "brand": "Samsung", "size": "48in" }
{ "_id": 226, "inputs": [ "HDMI", "USB" ], "product_type": "television", "shipping_size": { "breadth": 25.37, "length": 38.93, "depth": 15.64 }, "resolution": "1080p", "price": { "discount": 5367.15, "regular": 9732.36 }, "frequency": "120Hz", "input_lag": "18ms", "three_d": "3D", "type": "SmartTV", "brand": "Samsung", "size": "60in" }
{ "_id": 237, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 69.66, "length": 21.01, "depth": 16.4 }, "resolution": "1080p", "price": { "discount": 369.28, "regular": 462.1 }, "frequency": "120Hz", "input_lag": "20ms", "three_d": "3D", "type": "SmartTV", "brand": "Toshiba", "size": "52in" }
{ "_id": 240, "inputs": [ ], "product_type": "television", "shipping_size": { "breadth": 42.32, "length": 32.92, "depth": 10.01 }, "resolution": "1080i", "price": { "discount": 1605.99, "regular": 2111.85 }, "frequency": "120Hz", "input_lag": "20ms", "three_d": "3D", "type": "Regular TV", "brand": "Sony", "size": "52in" }
{ "_id": 246, "inputs": [ ], "product_type": "television", "shipping_size": { "breadth": 88.27, "length": 50.08, "depth": 16.92 }, "resolution": "720p", "price": { "discount": 1715.47, "regular": 3135.06 }, "frequency": "120Hz", "input_lag": "23ms", "three_d": "No 3D", "type": "Regular TV", "brand": "JVC", "size": "52in" }
> |
[client] 0:mongo*

```

```
QUERY 3 - db.product.find().sort({ 'price.discount' : -1 }).limit(30)
```



```
Terminal
> db.product.find().sort({ 'price.discount' : -1 }).limit(30)
```



```
local_length" : 115, "shipping_size" : { "breadth" : 10.66, "length" : 6.62, "depth" : 5.8 }, "price" : { "discount" : 43984.65, "regular" : 44226.22 }, "megapixels" : "36MP", "sensor_size" : "1/8in", "max_iso" : 52000, "camera_type" : "Mirrorless", "coverage" : 0.7, "eye_relief" : "12mm", "frames_per_second" : "6fps", "memory_card_type" : "SD", "brand" : "Canon" }
{ "_id" : 78580, "num_focus_points" : 65, "viewfinder_construction" : "Pentamirror", "min_aperture" : 3.5, "product_type" : "digital_camera", "focal_length" : 85, "shipping_size" : { "breadth" : 7.1, "length" : 6.79, "depth" : 7.79 }, "price" : { "discount" : 43958, "regular" : 44045.75 }, "megapixels" : "10MP", "sensor_size" : "3/4", "max_iso" : 12800, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "17mm", "frames_per_second" : "30fps", "memory_card_type" : "Memory Stick", "brand" : "Pentax" }
{ "_id" : 91584, "num_focus_points" : 160, "viewfinder_construction" : "OVF", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 11.22, "length" : 10.59, "depth" : 7.7 }, "price" : { "discount" : 43882.5, "regular" : 44106.73 }, "megapixels" : "16MP", "sensor_size" : "1in", "max_iso" : 102400, "camera_type" : "DSLR", "coverage" : 0.5, "eye_relief" : "17mm", "frames_per_second" : "10fps", "memory_card_type" : "CF", "brand" : "Sony" }
{ "_id" : 73861, "num_focus_points" : 9, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.8, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 9.33, "length" : 10.92, "depth" : 4.32 }, "price" : { "discount" : 43823.58, "regular" : 43898.75 }, "megapixels" : "50MP", "sensor_size" : "1in", "max_iso" : 102400, "camera_type" : "Compact", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "12fps", "memory_card_type" : "SD", "brand" : "PhaseOne" }
{ "_id" : 40012, "num_focus_points" : 51, "viewfinder_construction" : "OVF", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 11.42, "length" : 8, "depth" : 5.28 }, "price" : { "discount" : 43758.97, "regular" : 44345.4 }, "megapixels" : "18MP", "sensor_size" : "3/4", "max_iso" : 52000, "camera_type" : "RangeFinder", "coverage" : 1, "eye_relief" : "17mm", "frames_per_second" : "6fps", "memory_card_type" : "SD", "brand" : "Samsung" }
{ "_id" : 73305, "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 9.41, "length" : 10.82, "depth" : 7.13 }, "price" : { "discount" : 43729.99, "regular" : 44122.13 }, "megapixels" : "50MP", "sensor_size" : "Large Format", "max_iso" : 25600, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "12mm", "frames_per_second" : "30fps", "memory_card_type" : "CF", "brand" : "Fuji" }
{ "_id" : 109193, "num_focus_points" : 51, "viewfinder_construction" : "OVF", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 8.5, "length" : 7.04, "depth" : 5.79 }, "price" : { "discount" : 43722.61, "regular" : 44168.86 }, "megapixels" : "80MP", "sensor_size" : "35mm", "max_iso" : 6400, "camera_type" : "RangeFinder", "coverage" : 0.7, "eye_relief" : "17mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Fuji" }
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> █
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Terminal 2 (20:09, 56%) Mon Apr 11 14:47 Akshay Gaur
> it
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QUERY 4 - db.product.find({ 'brand': { $eq : 'Sony' }, 'price.regular' : { $gt:1000.0, $lt:1500.00 } }, { 'product_type' : { $eq : 'digital_camera' } })
db.product.find({ 'brand': { $eq : 'Canon' }, 'price.regular' : { $gt:500.0, $lt:1000.00 }, { 'product_type' : { $eq : 'digital_camera' } })
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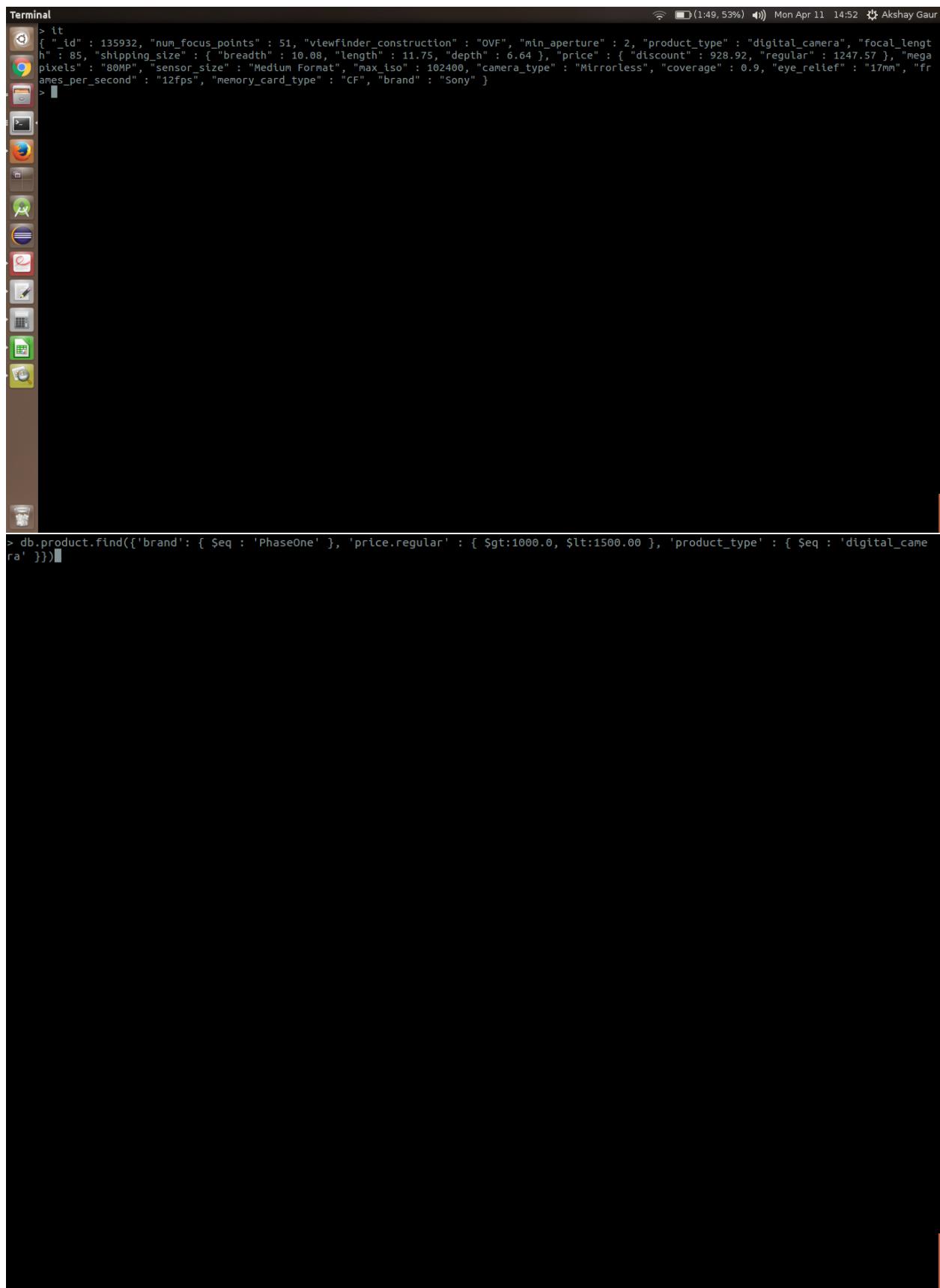
Terminal

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Terminal

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Type "it" for more



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{ "_id" : 92466, "num_focus_points" : 9, "viewfinder_construction" : "OVF", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 14, "shipping_size" : { "breadth" : 8.07, "length" : 9.34, "depth" : 5.97 }, "price" : { "discount" : 780.49, "regular" : 1109.59 }, "megapixels" : "18MP", "sensor_size" : "APS-C", "max_iso" : 25600, "camera_type" : "Compact", "coverage" : 0.75, "eye_relief" : "10mm", "frames_per_second" : "8fps", "memory_card_type" : "SD", "brand" : "PhaseOne" }
{ "_id" : 92548, "num_focus_points" : 160, "viewfinder_construction" : "OVF", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 85, "shipping_size" : { "breadth" : 10.89, "length" : 12, "depth" : 6.56 }, "price" : { "discount" : 1262.35, "regular" : 1376.59 }, "megapixels" : "24MP", "sensor_size" : "Medium Format", "max_iso" : 6400, "camera_type" : "Mirrorless", "coverage" : 0.85, "eye_relief" : "17mm", "frames_per_second" : "4fps", "memory_card_type" : "CF", "brand" : "PhaseOne" }
{ "_id" : 99991, "num_focus_points" : 9, "viewfinder_construction" : "OVF", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 300, "shipping_size" : { "breadth" : 10.77, "length" : 6.8, "depth" : 5.14 }, "price" : { "discount" : 521.28, "regular" : 1121.23 }, "megapixels" : "18MP", "sensor_size" : "APS-C", "max_iso" : 102400, "camera_type" : "Compact", "coverage" : 0.5, "eye_relief" : "10mm", "frames_per_second" : "30fps", "memory_card_type" : "SD", "brand" : "PhaseOne" }
Type "it" for more
> ■

```

```
> it
[{"_id": 100661, "num_focus_points": 9, "viewfinder_construction": "Pentamirror", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 400, "shipping_size": {"breadth": 10.36, "length": 7.13, "depth": 5.31}, "price": {"discount": 569.66, "regular": 1069.08}, "megapixels": "36MP", "sensor_size": "35mm", "max_iso": 12800, "camera_type": "DSLR", "coverage": 0.85, "eye_relief": "10mm", "frames_per_second": "30fps", "memory_card_type": "CF", "brand": "PhaseOne"}, {"_id": 103382, "num_focus_points": 9, "viewfinder_construction": "No viewfinder", "min_aperture": 1.2, "product_type": "digital_camera", "focal_length": 14, "shipping_size": {"breadth": 9.92, "length": 10.39, "depth": 6.21}, "price": {"discount": 590.9, "regular": 1153.85}, "megapixels": "36MP", "sensor_size": "1in", "max_iso": 12800, "camera_type": "RangeFinder", "coverage": 0.6, "eye_relief": "22mm", "frames_per_second": "4fps", "memory_card_type": "Memory Stick", "brand": "PhaseOne"}, {"_id": 111167, "num_focus_points": 160, "viewfinder_construction": "No viewfinder", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 10.94, "length": 7.92, "depth": 4.84}, "price": {"discount": 1149.15, "regular": 1314.55}, "megapixels": "16MP", "sensor_size": "Large Format", "max_iso": 102400, "camera_type": "RangeFinder", "coverage": 0.7, "eye_relief": "22mm", "frames_per_second": "8fps", "memory_card_type": "SD", "brand": "PhaseOne"}, {"_id": 119450, "num_focus_points": 65, "viewfinder_construction": "OVF", "min_aperture": 2.8, "product_type": "digital_camera", "focal_length": 50, "shipping_size": {"breadth": 9.34, "length": 8.02, "depth": 7.37}, "price": {"discount": 731.3, "regular": 1103.94}, "megapixels": "10MP", "sensor_size": "Large Format", "max_iso": 102400, "camera_type": "DSLR", "coverage": 0.85, "eye_relief": "10mm", "frames_per_second": "6fps", "memory_card_type": "SD", "brand": "PhaseOne"}, {"_id": 130252, "num_focus_points": 160, "viewfinder_construction": "OVF", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 28, "shipping_size": {"breadth": 10.24, "length": 11.04, "depth": 5.96}, "price": {"discount": 993.99, "regular": 1448.07}, "megapixels": "21MP", "sensor_size": "APS-C", "max_iso": 52000, "camera_type": "Mirrorless", "coverage": 0.9, "eye_relief": "22mm", "frames_per_second": "5fps", "memory_card_type": "Memory Stick", "brand": "PhaseOne"}, {"_id": 134069, "num_focus_points": 39, "viewfinder_construction": "No viewfinder", "min_aperture": 3.5, "product_type": "digital_camera", "focal_length": 20, "shipping_size": {"breadth": 11.6, "length": 8.16, "depth": 6.62}, "price": {"discount": 812.32, "regular": 1169.8}, "megapixels": "16MP", "sensor_size": "Large Format", "max_iso": 52000, "camera_type": "Mirrorless", "coverage": 0.6, "eye_relief": "17mm", "frames_per_second": "12fps", "memory_card_type": "Memory Stick", "brand": "PhaseOne"}, {"_id": 135628, "num_focus_points": 9, "viewfinder_construction": "Pentamirror", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 115, "shipping_size": {"breadth": 11.81, "length": 8.5, "depth": 5.92}, "price": {"discount": 844.03, "regular": 1127.13}, "megapixels": "22MP", "sensor_size": "3/4", "max_iso": 25600, "camera_type": "Mirrorless", "coverage": 0.7, "eye_relief": "17mm", "frames_per_second": "12fps", "memory_card_type": "Memory Stick", "brand": "PhaseOne"}]
```

```
> db.product.find({ 'brand': { $eq : 'Canon' }, 'price.regular' : { $gt:400.0, $lt:500.00 }, 'product_type' : { $eq : 'digital_camera' } })
{ "_id" : 16578, "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 11.2, "length" : 7.59, "depth" : 6.82 }, "price" : { "discount" : 260.06, "regular" : 429.46 }, "megapixels" : "24MP", "sensor_size" : "3/4", "max_iso" : 102400, "camera_type" : "RangeFinder", "coverage" : 1, "eye_relief" : "17mm", "frames_per_second" : "30fps", "memory_card_type" : "Memory Stick", "brand" : "Canon" }
{ "_id" : 64113, "num_focus_points" : 160, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.4, "product_type" : "digital_camera", "focal_length" : 85, "shipping_size" : { "breadth" : 11.37, "length" : 9.86, "depth" : 6.62 }, "price" : { "discount" : 387.12, "regular" : 484.28 }, "megapixels" : "80MP", "sensor_size" : "Medium Format", "max_iso" : 102400, "camera_type" : "RangeFinder", "coverage" : 0.7, "eye_relief" : "12mm", "frames_per_second" : "5fps", "memory_card_type" : "SD", "brand" : "Canon" }
{ "_id" : 80789, "num_focus_points" : 65, "viewfinder_construction" : "Pentaprism", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 10.66, "length" : 8.6, "depth" : 6.49 }, "price" : { "discount" : 393.99, "regular" : 406.6 }, "megapixels" : "36MP", "sensor_size" : "Medium Format", "max_iso" : 12800, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "8fps", "memory_card_type" : "SD", "brand" : "Canon" }
{ "_id" : 97829, "num_focus_points" : 160, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.4, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 8.91, "length" : 7.04, "depth" : 6.27 }, "price" : { "discount" : 262.16, "regular" : 495.59 }, "megapixels" : "18MP", "sensor_size" : "Large Format", "max_iso" : 6400, "camera_type" : "Mirrorless", "coverage" : 0.5, "eye_relief" : "12mm", "frames_per_second" : "5fps", "memory_card_type" : "Memory Stick", "brand" : "Canon" }
> █
```

QUERY 5 - db.product.find({ 'hard_drive.hdd_size.size' : { \$gt : 200 }, \$or : [{ 'OS' : { \$eq : 'Windows 8.1' } }, { 'OS' : { \$eq : 'Windows 10' } }] })

```
db.product.find({ 'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
db.product.find({ 'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
db.product.find({ 'hard_drive.hdd_size.size' : { $gt : 160 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
```

```
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] })
```

```

"23ms", "size" : "20in" }, "shipping_size" : { "breadth" : 11.13, "length" : 18.18, "depth" : 15.93 }, "num_cores" : "8cores", "price" : { "discount" : 557.68, "regular" : 861.43 }, "screen_size" : "19in", "brand" : "Asus", "display_type" : "Regular", "peripherals" : [ "mouse", "speakers" ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 320 }, "brand" : "Toshiba", "interface" : "PATA", "form_factor" : "laptop", "cache_size" : "128MB", "rpm" : "5400rpm", "hdd_type" : "HDD" }, "OS" : "Windows 8.1", "product_type" : "desktop_computer", "battery_duration" : "6hr" }
{ "_id" : 553, "computer_monitor" : { "resolution" : "1080i", "brand" : "Vizio", "frequency" : "120Hz", "type" : "3D", "input_lag" : "23ms", "size" : "24in" }, "shipping_size" : { "breadth" : 11.08, "length" : 19.85, "depth" : 15.48 }, "num_cores" : "4cores", "price" : { "discount" : 3291.53, "regular" : 6054.12 }, "screen_size" : "15in", "brand" : "Dell", "display_type" : "Retina", "peripherals" : [ "mouse" ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Seagate", "interface" : "SATA3", "form_factor" : "laptop", "cache_size" : "64MB", "rpm" : "5400rpm", "hdd_type" : "HDD" }, "OS" : "Windows 8.1", "product_type" : "desktop_computer", "battery_duration" : "8hr" }
{ "_id" : 560, "computer_monitor" : { "resolution" : "1080p", "brand" : "Dell", "frequency" : "120Hz", "type" : "3D", "input_lag" : "20ms", "size" : "21in" }, "shipping_size" : { "breadth" : 17.06, "length" : 19.07, "depth" : 19.17 }, "num_cores" : "6cores", "price" : { "discount" : 1542.52, "regular" : 3003.89 }, "screen_size" : "13in", "brand" : "Dell", "display_type" : "Retina", "peripherals" : [ ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 320 }, "brand" : "Samsung", "interface" : "PATA", "form_factor" : "desktop", "cache_size" : "32MB", "rpm" : "5400rpm", "hdd_type" : "HDD/SSD" }, "OS" : "Windows 10", "product_type" : "desktop_computer", "battery_duration" : "2hr" }
{ "_id" : 592, "computer_monitor" : { "resolution" : "1080p", "brand" : "Sony", "frequency" : "60Hz", "type" : "No 3D", "input_lag" : "28ms", "size" : "32in" }, "shipping_size" : { "breadth" : 11.48, "length" : 19.08, "depth" : 19.69 }, "num_cores" : "6cores", "price" : { "discount" : 1861.04, "regular" : 2233.31 }, "screen_size" : "11in", "brand" : "Dell", "display_type" : "Regular", "peripherals" : [ "keyboard" ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Seagate", "interface" : "SATA3", "form_factor" : "laptop", "cache_size" : "32MB", "rpm" : "5400rpm", "hdd_type" : "SSD" }, "OS" : "Windows 10", "product_type" : "desktop_computer", "battery_duration" : "4hr" }
{ "_id" : 620, "computer_monitor" : { "resolution" : "1080p", "brand" : "Philips", "frequency" : "60Hz", "type" : "No 3D", "input_lag" : "12ms", "size" : "32in" }, "shipping_size" : { "breadth" : 17.94, "length" : 15.72, "depth" : 14.63 }, "num_cores" : "4cores", "price" : { "discount" : 1985.13, "regular" : 2923.58 }, "screen_size" : "10in", "brand" : "Acer", "display_type" : "Regular", "peripherals" : [ "mouse", "keyboard" ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Toshiba", "interface" : "SATA", "form_factor" : "laptop", "cache_size" : "128MB", "rpm" : "5400rpm", "hdd_type" : "HDD/SSD" }, "OS" : "Windows 10", "product_type" : "desktop_computer", "battery_duration" : "8hr" }
{ "_id" : 628, "computer_monitor" : { "resolution" : "1080p", "brand" : "Vizio", "frequency" : "60Hz", "type" : "No 3D", "input_lag" : "12ms", "size" : "20in" }, "shipping_size" : { "breadth" : 19.94, "length" : 19.33, "depth" : 18.96 }, "num_cores" : "2cores", "price" : { "discount" : 1616.22, "regular" : 2536.4 }, "screen_size" : "10in", "brand" : "Gateway", "display_type" : "Regular", "peripherals" : [ ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Toshiba", "interface" : "SATA2", "form_factor" : "laptop", "cache_size" : "64MB", "rpm" : "7200rpm", "hdd_type" : "SSD" }, "OS" : "Windows 10", "product_type" : "desktop_computer", "battery_duration" : "4hr" }
{ "_id" : 651, "computer_monitor" : { "resolution" : "1080i", "brand" : "Sony", "frequency" : "60Hz", "type" : "No 3D", "input_lag" : "23ms", "size" : "27in" }, "shipping_size" : { "breadth" : 11.79, "length" : 15.56, "depth" : 13.22 }, "num_cores" : "2cores", "price" : { "discount" : 409.73, "regular" : 907.36 }, "screen_size" : "19in", "brand" : "Asus", "display_type" : "Regular", "peripherals" : [ ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Toshiba", "interface" : "PATA", "form_factor" : "desktop", "cache_size" : "128MB", "rpm" : "5400rpm", "hdd_type" : "SSD" }, "OS" : "Windows 8.1", "product_type" : "desktop_computer", "battery_duration" : "6hr" }
{ "_id" : 663, "computer_monitor" : { "resolution" : "4K", "brand" : "Philips", "frequency" : "120Hz", "type" : "3D", "input_lag" : "20ms", "size" : "19in" }, "shipping_size" : { "breadth" : 19.07, "length" : 19.62, "depth" : 16.43 }, "num_cores" : "2cores", "price" : { "discount" : 2172.16, "regular" : 2750.8 }, "screen_size" : "17in", "brand" : "Lenovo", "display_type" : "Regular", "peripherals" : [ ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Seagate", "interface" : "PATA", "form_factor" : "desktop", "cache_size" : "32MB", "rpm" : "7200rpm", "hdd_type" : "HDD" }, "OS" : "Windows 10", "product_type" : "desktop_computer", "battery_duration" : "6hr" }
{ "_id" : 708, "computer_monitor" : { "resolution" : "1080i", "brand" : "Dell", "frequency" : "60Hz", "type" : "3D", "input_lag" : "35ms", "size" : "20in" }, "shipping_size" : { "breadth" : 17.48, "length" : 15.8, "depth" : 10.87 }, "num_cores" : "2cores", "price" : { "discount" : 1863.15, "regular" : 2425.87 }, "screen_size" : "11in", "brand" : "Lenovo", "display_type" : "Regular", "peripherals" : [ ], "hard_drive" : { "hdd_size" : { "factor" : "GB", "size" : 250 }, "brand" : "Toshiba", "interface" : "SATA", "form_factor" : "laptop", "cache_size" : "32MB", "rpm" : "5400rpm", "hdd_type" : "HDD/SSD" }, "OS" : "Windows 8.1", "product_type" : "desktop_computer", "battery_duration" : "4hr" }
Type "it" for more
> ■

```

```
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] }).count()
4031
> █
```

```
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] }).count()
4031
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] }).count()
2064
> █
```

```
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] }).count()
4031
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] }).count()
2064
> db.product.find({'hard_drive.hdd_size.size' : { $gt : 160 }, $or : [ { 'os' : { $eq : 'Windows 8.1' } }, { 'os' : { $eq : 'Windows 10' } } ] }).count()
6036
> █
```

TASK 5 – QUERY 6

```
Query -
db.product.remove({ $text : {$search : "480i"},   'product_type': 'television' })
db.product.remove({ $text : {$search : "480p"},   'product_type': 'television' })
db.product.remove({ $text : {$search : "720i 720p 1080i 1080p"},   'product_type': 'television' })
```

```
> db.product.find({ 'product_type': 'television' }).count()
20036
> db.product.find({ $text : { $search : "480i"}, 'product_type': 'television' }).count()
2897
> db.product.remove({ $text : { $search : "480i"}, 'product_type': 'television' })
WriteResult({ "nRemoved" : 2897 })
> db.product.find({ 'product_type': 'television' }).count()
17139
> █
```

```
> db.product.find({ 'product_type': 'television' }).count()
20036
> db.product.find({ $text : {$search : "480i"}, 'product_type': 'television' }).count()
2897
> db.product.remove({ $text : {$search : "480i"}, 'product_type': 'television' })
WriteResult({ "nRemoved" : 2897 })
> db.product.find({ 'product_type': 'television' }).count()
17139
> db.product.find({ $text : {$search : "480p"}, 'product_type': 'television' }).count()
2860
> db.product.remove({ $text : {$search : "480p"}, 'product_type': 'television' })
WriteResult({ "nRemoved" : 2860 })
> db.product.find({ 'product_type': 'television' }).count()
14279
> █
```

```

> db.product.find({ 'product_type': 'television' }).count()
20036
> db.product.find({ $text : { $search : "480i"}, 'product_type': 'television' }).count()
2897
> db.product.remove({ $text : { $search : "480i"}, 'product_type': 'television' })
WriteResult({ "nRemoved" : 2897 })
> db.product.find({ 'product_type': 'television' }).count()
17139
> db.product.find({ $text : { $search : "480p"}, 'product_type': 'television' }).count()
2860
> db.product.remove({ $text : { $search : "480p"}, 'product_type': 'television' })
WriteResult({ "nRemoved" : 2860 })
> db.product.find({ 'product_type': 'television' }).count()
14279
> db.product.find({ $text : { $search : "480p"}, 'product_type': 'television' }).count()
0
> db.product.find({ $text : { $search : "720i 720p 1080i 1080p"}, 'product_type': 'television' }).count()
8610
> db.product.remove({ $text : { $search : "720i 720p 1080i 1080p"}, 'product_type': 'television' })
WriteResult({ "nRemoved" : 8610 })
> db.product.find({ 'product_type': 'television' }).count()
5669
> █

```

TASK 6 – SHARDING

The decision of how to shard was dependent upon what kind of queries were going to be run against the database. Seeing as the queries don't target any particular attribute in the db, it was very difficult to identify a single attribute which could be used as a shard key. In the end, it was decided that the shard key would be the '_id' that too as a 'hashed key'. This would allow the data to be distributed evenly throughout the shards and would keep the load to the minimum. The other choice was 'product_type' but in my testing, I found that using this key was putting more load on certain shards than other because if a particular category of product type were inserted again and again it would all go to one particular shard rather than being shared equally. Also, hashing would not work here because of weak cardinality.

There were 3 shards created with three configuration servers running.

CODE:

CONFIGSVR
gaur4004@gpel11:~\$ mongod --configsvr --port 40041 --dbpath ~/hw3db/configsvra
gaur4004@gpel12:~\$ mongod --configsvr --port 40042 --dbpath ~/hw3db/configsvrb
gaur4004@gpel13:~\$ mongod --configsvr --port 40043 --dbpath ~/hw3db/configsvrc

```

---MONGOS
gaur4004@gpel11:~$ mongos --port 40044 --configdb
gpel11.cs.ou.edu:40041, gpel12.cs.ou.edu:40042, gpel13.cs.ou.edu:40043

---SHARDS
gaur4004@gpel11:~$ mongod --port 40045 --dbpath ~/hw3db/sharda
gaur4004@gpel12:~$ mongod --port 40046 --dbpath ~/hw3db/shardb
gaur4004@gpel13:~$ mongod --port 40047 --dbpath ~/hw3db/shardc

---ADDING SHARDS
sh.addShard('gpel11.cs.ou.edu:40045')
sh.addShard('gpel12.cs.ou.edu:40046')
sh.addShard('gpel13.cs.ou.edu:40047')

---ENABLE SHARDING
sh.enableSharding('mydb')
sh.shardCollection('mydb.product', {'_id':'hashed'})

```

SCREENSHOTS:

```

Terminal
gaur4004@gpel11:~$ mongo --host gpel11.cs.ou.edu:40044
MongoDB shell version: 3.2.1
connecting to: gpel11.cs.ou.edu:40044/test
mongos> sh.addShard('gpel11.cs.ou.edu:40045')
{ "shardAdded" : "shard0000", "ok" : 1 }
mongos> sh.addShard('gpel12.cs.ou.edu:40046')
{ "shardAdded" : "shard0001", "ok" : 1 }
mongos> sh.addShard('gpel13.cs.ou.edu:40047')
{ "shardAdded" : "shard0002", "ok" : 1 }
mongos> db.printShardStatus()
2016-04-11T18:31:45.862-0500 E QUERY    [thread1] TypeError: db.printShardStatus is not a function :
@(shell):1:

mongos> db.printShardingStatus()
--- Sharding Status ---
sharding version: {
  "_id" : 1,
  "minCompatibleVersion" : 5,
  "currentVersion" : 6,
  "clusterId" : ObjectId("570c2ca56cce3eb2836f6bae")
}
shards:
  { "_id" : "shard0000", "host" : "gpel11.cs.ou.edu:40045" }
  { "_id" : "shard0001", "host" : "gpel12.cs.ou.edu:40046" }
  { "_id" : "shard0002", "host" : "gpel13.cs.ou.edu:40047" }
active mongoses:
  "3.2.1" : 1
balancer:
  Currently enabled: yes
  Currently running: no
  Failed balancer rounds in last 5 attempts: 0
  Migration Results for the last 24 hours:
    No recent migrations
databases:
mongos> 

[client] 0: mongo* "gpel11" 18:32 11-Apr-16

```

Terminal

```

mongos> sh.enablesharding('mydb')
{ "ok" : 1 }
mongos> sh.shardCollection('myDB.product', {'_id':'hashed'})
{ "code" : 26, "ok" : 0, "errmsg" : "database myDB not found" }
mongos> sh.shardCollection('mydb.product', {'_id':'hashed'})
{ "collectionsharded" : "mydb.product", "ok" : 1 }
mongos>

```

[client] 0:mongo*

Terminal

```

mongos> db.printShardingStatus()
--- Sharding Status ---
sharding version: {
  "_id" : 1,
  "minCompatibleVersion" : 5,
  "currentVersion" : 6,
  "clusterId" : ObjectId("570c2ca56cce3eb2836f6bae")
}
shards:
  { "_id" : "shard0000", "host" : "gpel11.cs.ou.edu:40045" }
  { "_id" : "shard0001", "host" : "gpel12.cs.ou.edu:40046" }
  { "_id" : "shard0002", "host" : "gpel13.cs.ou.edu:40047" }
active mongoses:
  "3.2.1" : 1
balancer:
  Currently enabled: yes
  Currently running: no
  Failed balancer rounds in last 5 attempts: 0
  Migration Results for the last 24 hours:
    2 : Success
databases:
  { "_id" : "mydb", "primary" : "shard0000", "partitioned" : true }
    mydb.product
      shard key: { "_id" : "hashed" }
      unique: false
      balancing: true
      chunks:
        shard0000      2
        shard0001      2
        shard0002      2
      { "_id" : { "$minKey" : 1 } } --> { "_id" : NumberLong("-6148914691236517204") } on : shard0000 Timestamp(3, 2)
      { "_id" : NumberLong("-6148914691236517204") } --> { "_id" : NumberLong("-3074457345618258602") } on : shard0000 Timestamp(3, 3)
      { "_id" : NumberLong("-3074457345618258602") } --> { "_id" : NumberLong(0) } on : shard0001 Timestamp(3, 4)
      { "_id" : NumberLong(0) } --> { "_id" : NumberLong("3074457345618258602") } on : shard0001 Timestamp(3, 5)
      { "_id" : NumberLong("3074457345618258602") } --> { "_id" : NumberLong("6148914691236517204") } on : shard0002 Timestamp(3, 6)
      { "_id" : NumberLong("6148914691236517204") } --> { "_id" : { "$maxKey" : 1 } } on : shard0002 Timestamp(3, 7)

```

mongos>

[client] 0:mongo*

```

Terminal [client] @:mongo* "gpel11" 18:38 11-Apr-15
sharding version: {
    "_id": 1,
    "minCompatibleVersion": 5,
    "currentVersion": 6,
    "clusterId": ObjectId("570c2ca56cce3eb2836f6bae")
}
shards:
    { "_id": "shard0000", "host": "gpel11.cs.ou.edu:40045" }
    { "_id": "shard0001", "host": "gpel12.cs.ou.edu:40046" }
    { "_id": "shard0002", "host": "gpel13.cs.ou.edu:40047" }
active mongoses:
    "3.2.1" : 1
balancer:
    Currently enabled: yes
    Currently running: no
    Failed balancer rounds in last 5 attempts: 0
    Migration Results for the last 24 hours:
        2 : Success
databases:
    { "_id": "mydb", "primary": "shard0000", "partitioned": true }
        mydb.product
            shard key: { "_id": "hashed" }
            unique: false
            balancing: true
            chunks:
                shard0000 2
                shard0001 2
                shard0002 2
                { "_id": { "$minKey": 1 } } --> { "_id": NumberLong("-6148914691236517204" ) } on : shard0000 Timestamp(3, 2)
                { "_id": NumberLong("-6148914691236517204" ) } --> { "_id": NumberLong("-3074457345618258602" ) } on : shard0000 Timestamp(3, 3)
                { "_id": NumberLong("-3074457345618258602" ) } --> { "_id": NumberLong(0) } on : shard0001 Timestamp(3, 4)
                { "_id": NumberLong(0) } --> { "_id": NumberLong("3074457345618258602" ) } on : shard0001 Timestamp(3, 5)
                { "_id": NumberLong("3074457345618258602" ) } --> { "_id": NumberLong("6148914691236517204" ) } on : shard0002 Timestamp(3, 6)
                { "_id": NumberLong("6148914691236517204" ) } --> { "_id": { "$maxKey": 1 } } on : shard0002 Timestamp(3, 7)

mongos> load('./Downloads/catalogInsertion.js')
true
mongos>
[client] @:mongo* "gpel11" 18:38 11-Apr-15
Terminal [client] @:mongo* "gpel11" 18:45 11-Apr-15
db.product.count()
0
> db.product.count()
33592
> █
db.product.count()
0
> db.product.count()
33159
>
db.product.count()
0
> db.product.count()
33249
>
db.product.count()
0
> db.product.count()
33249
>

```

TASK 7 – QUERIES AFTER SHARDING

Note: Same queries were run which were run before sharding and all of them returned the same response.

Terminal

```
mongos> db.product.find({'product_type': { $eq: 'television' }}).limit(30)
db.product.count()
0
> db.product.count()
33592
>

db.product.count()
0
> db.product.count()
33159
>

db.product.count()
0
> db.product.count()
33249
>
```

client 0:mongo*

Terminal

```
ipping_size": { "breadth": 96.82, "length": 25.81, "depth": 10.64 },
"resolution": "8K", "price": { "discount": 3898.28, "regular": 4667.14 },
"frequency": "120Hz", "input_lag": "23ms", "three_d": "No 3D",
"type": "SmartTV", "brand": "Panasonic", "size": "48in" }
{ "_id": 513, "inputs": [ ], "product_type": "television", "shipping_size": { "breadth": 93.66, "length": 92.43, "depth": 14.53 },
"resolution": "8K", "price": { "discount": 1424.33, "regular": 2387.94 },
"frequency": "120Hz", "input_lag": "12ms", "three_d": "3D", "type": "Regular TV", "brand": "JVC", "size": "42in" }
{ "_id": 537, "inputs": [ "HDMI", "USB" ], "product_type": "television",
"shipping_size": { "breadth": 72.87, "length": 58.26, "depth": 18.47 },
"resolution": "1080p", "price": { "discount": 1589.1, "regular": 2370.77 },
"frequency": "120Hz", "input_lag": "20ms", "three_d": "3D",
"type": "SmartTV", "brand": "Sony", "size": "72in" }
{ "_id": 541, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 43.93, "length": 85.9, "depth": 11.8 },
"resolution": "480i", "price": { "discount": 3565.45, "regular": 4382.79 },
"frequency": "120Hz", "input_lag": "20ms", "three_d": "3D", "type": "Regular TV", "brand": "JVC", "size": "72in" }
{ "_id": 581, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 30.3, "length": 66.77, "depth": 11.83 },
"resolution": "720p", "price": { "discount": 1860.65, "regular": 2701.62 },
"frequency": "120Hz", "input_lag": "12ms", "three_d": "No 3D",
"type": "Regular TV", "brand": "Toshiba", "size": "48in" }
{ "_id": 635, "inputs": [ "HDMI" ], "product_type": "television", "shipping_size": { "breadth": 54.82, "length": 88.03, "depth": 19.33 },
"resolution": "4K", "price": { "discount": 6731.38, "regular": 9776.35 },
"frequency": "120Hz", "input_lag": "23ms", "three_d": "No 3D",
"type": "Regular TV", "brand": "RCA", "size": "32in" }
{ "_id": 672, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 42.4, "length": 31.51, "depth": 11.23 },
"resolution": "480i", "price": { "discount": 1107.61, "regular": 1829.96 },
"frequency": "60Hz", "input_lag": "20ms", "three_d": "3D", "type": "SmartTV", "brand": "RCA", "size": "40in" }
{ "_id": 678, "inputs": [ "USB" ], "product_type": "television", "shipping_size": { "breadth": 73.92, "length": 77.93, "depth": 16.97 },
"resolution": "480p", "price": { "discount": 3695.7, "regular": 5366.98 },
"frequency": "60Hz", "input_lag": "23ms", "three_d": "3D", "type": "Regular TV", "brand": "Westinghouse", "size": "46in" }
mongos>
```

client 0:mongo*

Terminal

```
mongos> db.product.find().sort({ 'price.discount' : -1 }).limit(30)
```

```
db.product.count()
0
> db.product.count()
33592
>
```

```
db.product.count()
0
> db.product.count()
33159
>
```

```
db.product.count()
0
> db.product.count()
33249
>
```

[client] 0: mongo*

Terminal

```
{ "_id" : 73305, "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 9.41, "length" : 10.82, "depth" : 7.13 }, "price" : { "discount" : 43729.99, "regular" : 44122.13 }, "megapixels" : "50MP", "sensor_size" : "Large Format", "max_iso" : 25600, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "12mm", "frames_per_second" : "30fps", "memory_card_type" : "CF", "brand" : "Fujifilm" }
{ "_id" : 109193, "num_focus_points" : 51, "viewfinder_construction" : "OVF", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 8.5, "length" : 7.04, "depth" : 5.79 }, "price" : { "discount" : 43722.61, "regular" : 44168.86 }, "megapixels" : "80MP", "sensor_size" : "35mm", "max_iso" : 6400, "camera_type" : "RangeFinder", "coverage" : 0.7, "eye_relief" : "17mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Fujifilm" }
{ "_id" : 136589, "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 400, "shipping_size" : { "breadth" : 9.43, "length" : 9.03, "depth" : 6.39 }, "price" : { "discount" : 43639.87, "regular" : 44404.54 }, "megapixels" : "20MP", "sensor_size" : "Large Format", "max_iso" : 12800, "camera_type" : "Compact", "coverage" : 0.85, "eye_relief" : "17mm", "frames_per_second" : "12fps", "memory_card_type" : "SD", "brand" : "Sony" }
{ "_id" : 126237, "num_focus_points" : 39, "viewfinder_construction" : "No viewfinder", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 400, "shipping_size" : { "breadth" : 7.22, "length" : 8.84, "depth" : 7.37 }, "price" : { "discount" : 43573.7, "regular" : 43677.24 }, "megapixels" : "21MP", "sensor_size" : "35mm", "max_iso" : 6400, "camera_type" : "Compact", "coverage" : 1, "eye_relief" : "17mm", "frames_per_second" : "4fps", "memory_card_type" : "SD", "brand" : "Nikon" }
{ "_id" : 46133, "num_focus_points" : 11, "viewfinder_construction" : "OVF", "min_aperture" : 1.2, "product_type" : "digital_camera", "focal_length" : 14, "shipping_size" : { "breadth" : 10.02, "length" : 8.47, "depth" : 6.1 }, "price" : { "discount" : 43425.83, "regular" : 43850.98 }, "megapixels" : "80MP", "sensor_size" : "3/4", "max_iso" : 25600, "camera_type" : "RangeFinder", "coverage" : 0.75, "eye_relief" : "10mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Samsung" }
Type "it" for more
```

mongos> [client] 0: mongo*

Terminal

```
db.product.count()
0
> db.product.count()
33592
>
```

```
db.product.count()
0
> db.product.count()
33159
>
```

```
db.product.count()
0
> db.product.count()
33249
>
```

```
db.product.count()
0
> db.product.count()
33159
>
```

```
db.product.count()
0
> db.product.count()
33249
>
```

"opel11" 18:51 11-Apr-16

Terminal

```
mongos> db.product.count()
0
> db.product.count()
33592
>
```

```
db.product.count()
0
> db.product.count()
33159
>
```

```
db.product.count()
0
> db.product.count()
33249
>
```

```
db.product.count()
0
> db.product.count()
33159
>
```

```
db.product.count()
0
> db.product.count()
33249
>
```

"opel11" 18:52 11-Apr-16

Terminal akshay@Desktop-Akshay : Mon Apr 11 : 06:53:28

```

S mongo --host gpel11.cs.ou.edu:40044 mydb
MongoDB shell version: 3.2.4
connecting to: gpel11.cs.ou.edu:40044/mydb
mongos> db.product.find({'brand': { $eq: 'Sony' }, 'price.regular': { $gt:1000.0, $lt:1500.00 }, 'product_type': { $eq: 'digital_camera' }})
[{"_id": 979, "num_focus_points": 51, "viewfinder_construction": "Pentaprism", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 35, "shipping_size": {"breadth": 9.29, "length": 11.02, "depth": 5.11}, "price": {"discount": 1221.03, "regular": 1247.36}, "megapixels": "24MP", "sensor_size": "1/8in", "max_iso": 52000, "camera_type": "DSLR", "coverage": 0.95, "eye_relief": "12mm", "frames_per_second": "6fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 18970, "num_focus_points": 9, "viewfinder_construction": "Pentaprism", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 24, "shipping_size": {"breadth": 9.29, "length": 11.2, "depth": 5.82}, "price": {"discount": 887.8, "regular": 1244.86}, "megapixels": "22MP", "sensor_size": "35mm", "max_iso": 52000, "camera_type": "Compact", "coverage": 0.75, "eye_relief": "17mm", "frames_per_second": "30fps", "memory_card_type": "SD", "brand": "Sony"}, {"_id": 21346, "num_focus_points": 160, "viewfinder_construction": "Pentaprism", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 50, "shipping_size": {"breadth": 11.95, "length": 10.08, "depth": 6.22}, "price": {"discount": 1148.24, "regular": 1412.26}, "megapixels": "10MP", "sensor_size": "Large Format", "max_iso": 25000, "camera_type": "DSLR", "coverage": 0.6, "eye_relief": "12mm", "frames_per_second": "8fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 53649, "num_focus_points": 39, "viewfinder_construction": "Pentamirror", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 300, "shipping_size": {"breadth": 9.63, "length": 6.78, "depth": 7.59}, "price": {"discount": 1207.66, "regular": 1257.83}, "megapixels": "18MP", "sensor_size": "1/8in", "max_iso": 102400, "camera_type": "Compact", "coverage": 0.9, "eye_relief": "10mm", "frames_per_second": "4fps", "memory_card_type": "SD", "brand": "Sony"}, {"_id": 54985, "num_focus_points": 11, "viewfinder_construction": "Pentamirror", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 9.65, "length": 6.41, "depth": 4.85}, "price": {"discount": 1307.32, "regular": 1348.86}, "megapixels": "36MP", "sensor_size": "3/4", "max_iso": 25000, "camera_type": "RangeFinder", "coverage": 0.7, "eye_relief": "10mm", "frames_per_second": "10fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 83167, "num_focus_points": 65, "viewfinder_construction": "Pentamirror", "min_aperture": 3.5, "product_type": "digital_camera", "focal_length": 20, "shipping_size": {"breadth": 9.62, "length": 6.33, "depth": 6.65}, "price": {"discount": 1316.73, "regular": 1433.67}, "megapixels": "21MP", "sensor_size": "Large Format", "max_iso": 102400, "camera_type": "DSLR", "coverage": 0.95, "eye_relief": "17mm", "frames_per_second": "8fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 89222, "num_focus_points": 100, "viewfinder_construction": "Pentaprism", "min_aperture": 3.5, "product_type": "digital_camera", "focal_length": 300, "shipping_size": {"breadth": 8.69, "length": 10.94, "depth": 6.9}, "price": {"discount": 824.78, "regular": 1011.37}, "megapixels": "12MP", "sensor_size": "Large Format", "max_iso": 12800, "camera_type": "Mirrorless", "coverage": 1, "eye_relief": "17mm", "frames_per_second": "8fps", "memory_card_type": "Memory Stick", "brand": "Sony"}, {"_id": 120083, "num_focus_points": 160, "viewfinder_construction": "Pentamirror", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 20, "shipping_size": {"breadth": 7.93, "length": 11.22, "depth": 7.87}, "price": {"discount": 692.27, "regular": 1164.14}, "megapixels": "18MP", "sensor_size": "Medium Format", "max_iso": 12800, "camera_type": "Mirrorless", "coverage": 0.7, "eye_relief": "17mm", "frames_per_second": "12fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 129573, "num_focus_points": 65, "viewfinder_construction": "OVF", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 50, "shipping_size": {"breadth": 8.37, "length": 10.54, "depth": 4.6}, "price": {"discount": 1040.52, "regular": 1408.82}, "megapixels": "22MP", "sensor_size": "APS-C", "max_iso": 52000, "camera_type": "DSLR", "coverage": 0.75, "eye_relief": "10mm", "frames_per_second": "8fps", "memory_card_type": "SD", "brand": "Sony"},

Terminal akshay@Desktop-Akshay : Mon Apr 11 18:54:43 (243.73%) Akshay Gaur


```

mongos> db.product.find({'brand': { $eq: 'Canon' }, 'price.regular': { $gt:500.0, $lt:1000.00 }, 'product_type': { $eq: 'digital_camera' }})
[{"_id": 3633, "num_focus_points": 39, "viewfinder_construction": "No viewfinder", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 11.12, "length": 11.36, "depth": 6.14}, "price": {"discount": 593.26, "regular": 683.3}, "megapixels": "20MP", "sensor_size": "35mm", "max_iso": 12800, "camera_type": "Mirrorless", "coverage": 0.7, "eye_relief": "10mm", "frames_per_second": "6fps", "memory_card_type": "Memory Stick", "brand": "Canon"}, {"_id": 7204, "num_focus_points": 9, "viewfinder_construction": "OVF", "min_aperture": 2.8, "product_type": "digital_camera", "focal_length": 28, "shipping_size": {"breadth": 10.3, "length": 7.27, "depth": 6.56}, "price": {"discount": 517.64, "regular": 802.09}, "megapixels": "16MP", "sensor_size": "1/8in", "max_iso": 52000, "camera_type": "RangeFinder", "coverage": 0.9, "eye_relief": "12mm", "frames_per_second": "10fps", "memory_card_type": "CF", "brand": "Canon"}, {"_id": 15690, "num_focus_points": 20, "viewfinder_construction": "No viewfinder", "min_aperture": 1.8, "product_type": "digital_camera", "focal_length": 115, "shipping_size": {"breadth": 7.25, "length": 10.62, "depth": 7.16}, "price": {"discount": 691.66, "regular": 896.3}, "megapixels": "22MP", "sensor_size": "Large Format", "max_iso": 12800, "camera_type": "Compact", "coverage": 0.6, "eye_relief": "17mm", "frames_per_second": "6fps", "memory_card_type": "SD", "brand": "Canon"}, {"_id": 43673, "num_focus_points": 51, "viewfinder_construction": "OVF", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 24, "shipping_size": {"breadth": 7.21, "length": 10.48, "depth": 6.93}, "price": {"discount": 430.16, "regular": 886.45}, "megapixels": "50MP", "sensor_size": "Medium Format", "max_iso": 102400, "camera_type": "Mirrorless", "coverage": 0.5, "eye_relief": "17mm", "frames_per_second": "6fps", "memory_card_type": "SD", "brand": "Canon"}, {"_id": 44301, "num_focus_points": 51, "viewfinder_construction": "No viewfinder", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 300, "shipping_size": {"breadth": 8.1, "length": 9.58, "depth": 6.51}, "price": {"discount": 371.14, "regular": 600.98}, "megapixels": "18MP", "sensor_size": "APS-C", "max_iso": 25000, "camera_type": "DSLR", "coverage": 0.5, "eye_relief": "22mm", "frames_per_second": "12fps", "memory_card_type": "CF", "brand": "Canon"}, {"_id": 54992, "num_focus_points": 9, "viewfinder_construction": "No viewfinder", "min_aperture": 3.5, "product_type": "digital_camera", "focal_length": 28, "shipping_size": {"breadth": 8.43, "length": 7.83, "depth": 5.83}, "price": {"discount": 481.94, "regular": 868.8}, "megapixels": "36MP", "sensor_size": "3/4", "max_iso": 6400, "camera_type": "Compact", "coverage": 0.9, "eye_relief": "22mm", "frames_per_second": "8fps", "memory_card_type": "SD", "brand": "Canon"}, {"_id": 71542, "num_focus_points": 39, "viewfinder_construction": "Pentamirror", "min_aperture": 1.2, "product_type": "digital_camera", "focal_length": 115, "shipping_size": {"breadth": 8.26, "length": 10.89, "depth": 7.15}, "price": {"discount": 715.26, "regular": 940.52}, "megapixels": "16MP", "sensor_size": "1in", "max_iso": 6400, "camera_type": "DSLR", "coverage": 0.5, "eye_relief": "22mm", "frames_per_second": "6fps", "memory_card_type": "SD", "brand": "Canon"}, {"_id": 92685, "num_focus_points": 11, "viewfinder_construction": "Pentamirror", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 10.68, "length": 10.73, "depth": 7.28}, "price": {"discount": 421, "regular": 827.66}, "megapixels": "21MP", "sensor_size": "APS-C", "max_iso": 12800, "camera_type": "Mirrorless", "coverage": 1, "eye_relief": "10mm", "frames_per_second": "30fps", "memory_card_type": "Memory Stick", "brand": "Canon"}, {"_id": 98987, "num_focus_points": 65, "viewfinder_construction": "Pentaprism", "min_aperture": 3.5, "product_type": "digital_camera", "focal_length": 115, "shipping_size": {"breadth": 10.1, "length": 6.79, "depth": 6.83}, "price": {"discount": 783.4, "regular": 800.66}, "megapixels": "80MP", "sensor_size": "APS-C", "max_iso": 6400, "camera_type": "Compact", "coverage": 0.95, "eye_relief": "12mm", "frames_per_second": "5fps", "memory_card_type": "Memory Stick", "brand": "Canon"}, {"_id": 100278, "num_focus_points": 65, "viewfinder_construction": "Pentamirror", "min_aperture": 2.8, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 8.31, "length": 7.89, "depth": 6.39}, "price": {"discount": 369.85, "regular": 915.37}, "megapixels": "21MP", "sensor_size": "Large Format", "max_iso": 12800, "camera_type": "Mirrorless", "coverage": 0.9, "eye_relief": "10mm", "frames_per_second": "8fps", "memory_card_type": "SD", "brand": "Canon"}]
```


```

Terminal

```
mongos> db.product.find({'brand': { '$eq': 'Canon' }, 'price.regular' : { '$gt:400.0, '$lt:500.00 }, 'product_type' : { '$eq : 'digital_camera' }})
[{"_id": 80789, "num_focus_points": 65, "viewfinder_construction": "Pentaprism", "min_aperture": 2.5, "product_type": "digital_camera", "focal_length": 24, "shipping_size": {"breadth": 10.66, "length": 8.6, "depth": 6.49}, "price": {"discount": 393.99, "regular": 406.6}, "megapixels": "36MP", "sensor_size": "Medium Format", "max_iso": 12800, "camera_type": "DSLR", "coverage": 0.95, "eye_relief": "22mm", "frames_per_second": "8fps", "memory_card_type": "SD", "brand": "Canon"}, {"_id": 97829, "num_focus_points": 160, "viewfinder_construction": "No viewfinder", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 35, "shipping_size": {"breadth": 8.91, "length": 7.04, "depth": 6.27}, "price": {"discount": 262.16, "regular": 495.59}, "megapixels": "18MP", "sensor_size": "Large Format", "max_iso": 6400, "camera_type": "Mirrorless", "coverage": 0.5, "eye_relief": "12mm", "frames_per_second": "5fps", "memory_card_type": "Memory Stick", "brand": "Canon"}, {"_id": 16578, "num_focus_points": 51, "viewfinder_construction": "Pentamirror", "min_aperture": 2.5, "product_type": "digital_camera", "focal_length": 24, "shipping_size": {"breadth": 11.2, "length": 7.59, "depth": 6.82}, "price": {"discount": 260.06, "regular": 429.46}, "megapixels": "24MP", "sensor_size": "3/4\"", "max_iso": 102400, "camera_type": "RangeFinder", "coverage": 1, "eye_relief": "17mm", "frames_per_second": "30fps", "memory_card_type": "Memory Stick", "brand": "Canon"}, {"_id": 64113, "num_focus_points": 160, "viewfinder_construction": "No viewfinder", "min_aperture": 1.4, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 11.37, "length": 9.86, "depth": 6.62}, "price": {"discount": 387.12, "regular": 484.28}, "megapixels": "80MP", "sensor_size": "Medium Format", "max_iso": 102400, "camera_type": "RangeFinder", "coverage": 0.7, "eye_relief": "12mm", "frames_per_second": "5fps", "memory_card_type": "SD", "brand": "Canon"}]
mongos>
```

Terminal

```
mongos> db.product.find({'hard_drive.hdd_size.size' : { '$gt : 200 }, $or : [ { 'OS' : { '$eq : 'Windows 8.1' } }, { 'OS' : { '$eq : 'Windows 10' } } ] }).count()
4031
mongos>
```

The image shows a dual-terminal setup on a Linux desktop. Both terminals are running MongoDB shell (mongos>) and executing the same command to find documents in the 'product' collection where the 'hard_drive.hdd_size.size' field is greater than or equal to 200, ordered by 'OS'. The results show two distinct counts: 4031 for 'Windows 8.1' and 2064 for 'Windows 10'. In the second terminal, the command is modified to find documents where 'hard_drive.hdd_size.size' is greater than or equal to 160, resulting in a count of 6036.

```
mongos> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
4031
mongos> db.product.find({'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
2064
mongos>

mongos> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
4031
mongos> db.product.find({'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
2064
mongos> db.product.find({'hard_drive.hdd_size.size' : { $gt : 160 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
6036
mongos>
```

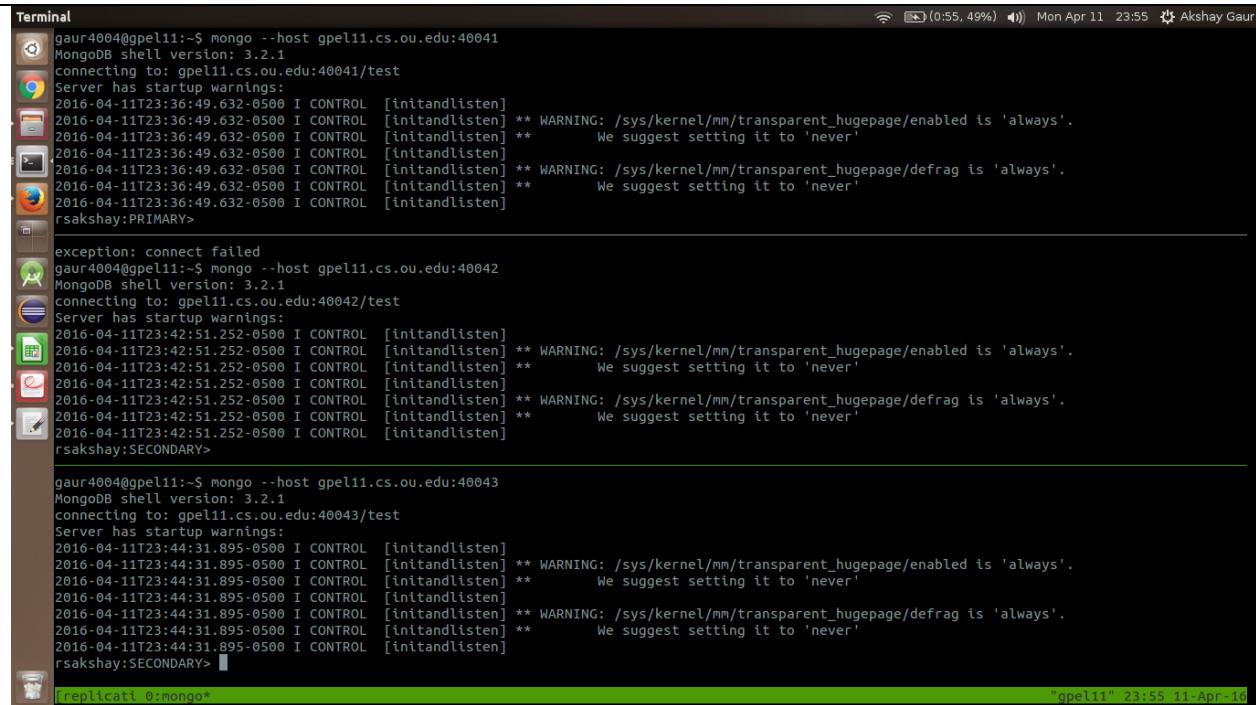
TASK 8 – REPLICATION

Three replicas were used to implement this so that if one fails, there is at least one primary and one secondary left.

```
---CREATE DIRECTORIES
mkdir -p ./hw3db/rs1 ./hw3db/rs2 ./hw3db/rs3

---CREATE REPLICA SET SERVICES
mongod --port 40041 --dbpath ~/hw3db/rs1 --replSet rsakshay (gpel11)
mongod --port 40042 --dbpath ~/hw3db/rs2 --replSet rsakshay (gpel11)
mongod --port 40043 --dbpath ~/hw3db/rs3 --replSet rsakshay (gpel11)

---ADD REPLICAS
rs.add('gpel11.cs.ou.edu:40042')
rs.add('gpel11.cs.ou.edu:40043')
```



The screenshot shows a terminal window titled "Terminal" with a red border. The window displays the command-line interface for MongoDB. At the top right, there is a status bar showing battery level (0:55, 49%), signal strength, and the date and time (Mon Apr 11 23:55). The terminal itself shows the execution of the provided shell commands, which create directories, start MongoDB services, and add them to a replica set. The output includes several warning messages about kernel settings like transparent hugepages and defrag. The session ends with a prompt "rsakshay:SECONDARY>" and a timestamp "gpel11" 23:55 11-Apr-15.

```
gaur4004@gpel11:~$ mongo --host gpel11.cs.ou.edu:40041
MongoDB shell version: 3.2.1
connecting to: gpel11.cs.ou.edu:40041/test
Server has startup warnings:
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten]
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten]
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/defrag is 'always'.
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-11T23:36:49.632-0500 I CONTROL [initandlisten]
rsakshay:PRIMARY>

exception: connect failed
gaur4004@gpel11:~$ mongo --host gpel11.cs.ou.edu:40042
MongoDB shell version: 3.2.1
connecting to: gpel11.cs.ou.edu:40042/test
Server has startup warnings:
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten]
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten]
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/defrag is 'always'.
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-11T23:42:51.252-0500 I CONTROL [initandlisten]
rsakshay:SECONDARY>

gaur4004@gpel11:~$ mongo --host gpel11.cs.ou.edu:40043
MongoDB shell version: 3.2.1
connecting to: gpel11.cs.ou.edu:40043/test
Server has startup warnings:
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten]
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/enabled is 'always'.
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten]
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten] ** WARNING: /sys/kernel/mm/transparent_hugepage/defrag is 'always'.
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten] **           We suggest setting it to 'never'
2016-04-11T23:44:31.895-0500 I CONTROL [initandlisten]
rsakshay:SECONDARY>
```

```

Terminal rsakshay:PRIMARY> db.getMongo().getDB("rs").getCollection("config").find()
{
    "_id" : 1,
    "name" : "gpel11.cs.ou.edu:40042",
    "health" : 1,
    "state" : 2,
    "stateStr" : "SECONDARY",
    "uptime" : 135,
    "optime" : {
        "ts" : Timestamp(1460436225, 1),
        "t" : NumberLong(1)
    },
    "optimeDate" : ISODate("2016-04-12T04:43:45Z"),
    "lastHeartbeat" : ISODate("2016-04-12T04:45:11.319Z"),
    "lastHeartbeatRecv" : ISODate("2016-04-12T04:45:10.317Z"),
    "pingMs" : NumberLong(0),
    "syncingTo" : "gpel11:40041",
    "configVersion" : 3
},
{
    "_id" : 2,
    "name" : "gpel11.cs.ou.edu:40043",
    "health" : 1,
    "state" : 2,
    "stateStr" : "SECONDARY",
    "uptime" : 38,
    "optime" : {
        "ts" : Timestamp(1460436225, 1),
        "t" : NumberLong(1)
    },
    "optimeDate" : ISODate("2016-04-12T04:43:45Z"),
    "lastHeartbeat" : ISODate("2016-04-12T04:45:11.346Z"),
    "lastHeartbeatRecv" : ISODate("2016-04-12T04:45:08.388Z"),
    "pingMs" : NumberLong(0),
    "configVersion" : 3
},
],
"ok" : 1
}
rsakshay:PRIMARY>

```

Terminal rsakshay:PRIMARY> rs.status()

```

{
    "set" : "rsakshay",
    "date" : ISODate("2016-04-12T04:45:11.568Z"),
    "myState" : 1,
    "term" : NumberLong(1),
    "heartbeatIntervalMillis" : NumberLong(2000),
    "members" : [
        {
            "_id" : 0,
            "name" : "gpel11:40041",
            "health" : 1,
            "state" : 1,
            "stateStr" : "PRIMARY",
            "uptime" : 505,
            "optime" : {
                "ts" : Timestamp(1460436225, 1),
                "t" : NumberLong(1)
            },
            "optimeDate" : ISODate("2016-04-12T04:43:45Z"),
            "electionTime" : Timestamp(1460435998, 2),
            "electionDate" : ISODate("2016-04-12T04:39:58Z"),
            "configVersion" : 3,
            "self" : true
        },
        {
            "_id" : 1,
            "name" : "gpel11.cs.ou.edu:40042",
            "health" : 1,
            "state" : 2,
            "stateStr" : "SECONDARY",
            "uptime" : 135,
            "optime" : {
                "ts" : Timestamp(1460436225, 1),
                "t" : NumberLong(1)
            },
            "optimeDate" : ISODate("2016-04-12T04:43:45Z"),
            "lastHeartbeat" : ISODate("2016-04-12T04:45:11.319Z"),
            "lastHeartbeatRecv" : ISODate("2016-04-12T04:45:10.317Z"),
            "pingMs" : NumberLong(0),
            "syncingTo" : "gpel11:40041",
            "configVersion" : 3
        }
    ]
}

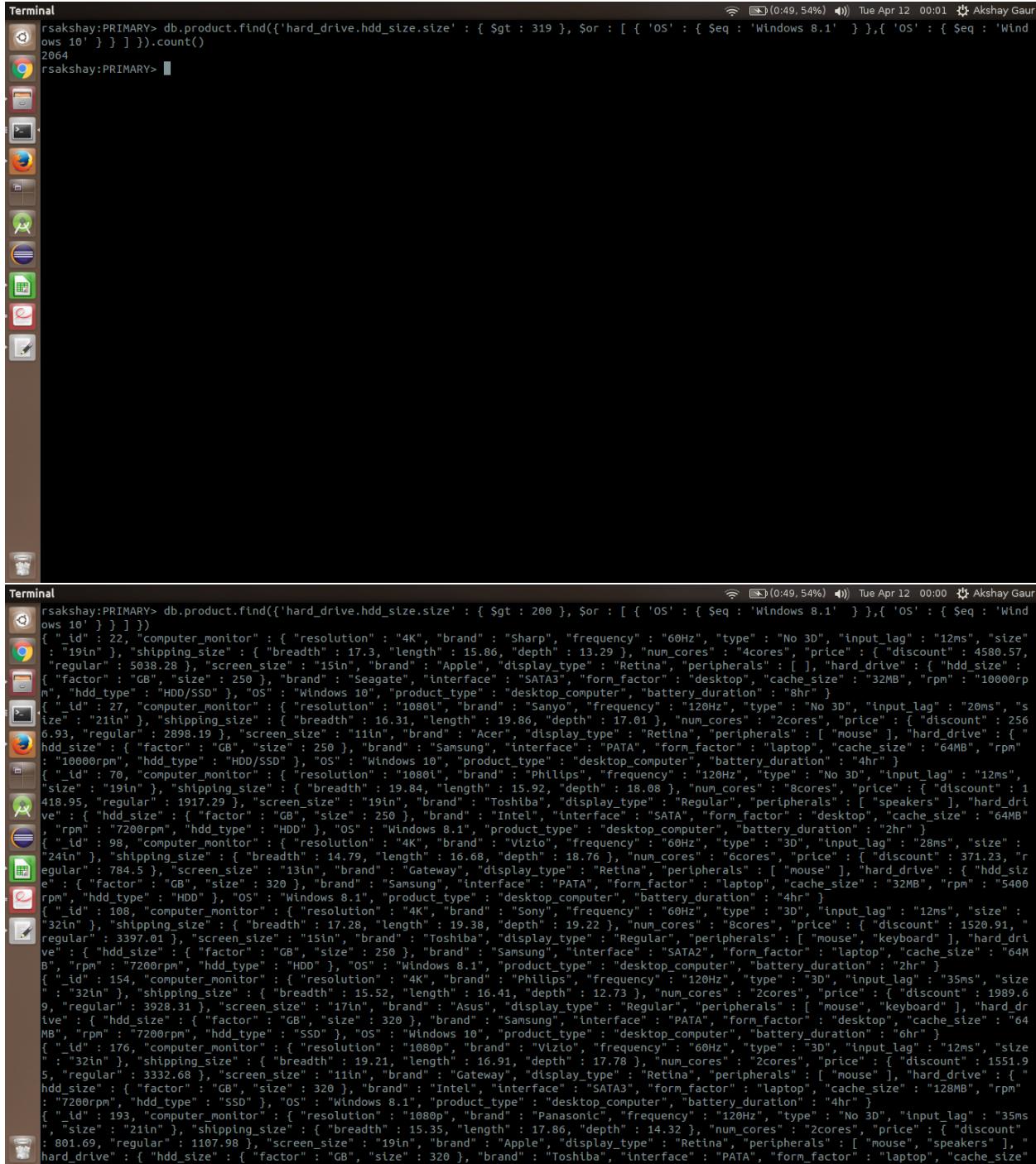
```

Terminal

```
        "info" : "run rs.initiate(...) if not yet done for the set",
        "ok" : 0,
        "errmsg" : "no replset config has been received",
        "code" : 94
    }
> rs.initiate()
{
    "info2" : "no configuration specified. Using a default configuration for the set",
    "me" : "gpel11:40041",
    "ok" : 1
}
rsakshay:SECONDARY> rs.status()
{
    "set" : "rsakshay",
    "date" : ISODate("2016-04-12T04:40:04.941Z"),
    "myState" : 1,
    "term" : NumberLong(1),
    "heartbeatIntervalMillis" : NumberLong(2000),
    "members" : [
        {
            "_id" : 0,
            "name" : "gpel11:40041",
            "health" : 1,
            "state" : 1,
            "stateStr" : "PRIMARY",
            "uptime" : 198,
            "optime" : {
                "ts" : Timestamp(1460435999, 1),
                "t" : NumberLong(1)
            },
            "optimeDate" : ISODate("2016-04-12T04:39:59Z"),
            "infoMessage" : "could not find member to sync from",
            "electionTime" : Timestamp(1460435998, 2),
            "electionDate" : ISODate("2016-04-12T04:39:58Z"),
            "configVersion" : 1,
            "self" : true
        }
    ],
    "ok" : 1
}
rsakshay:PRIMARY>
```

TASK 9 – QUERIES AFTER REPLICATION

Note : the exact same queries which were run earlier were run here also. The same results were obtained.



```
rsakshay:PRIMARY> db.product.find({'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
2064
rsakshay:PRIMARY>

Terminal
rsakshay:PRIMARY> db.product.find({'hard_drive.hdd_size.size' : { $gt : 319 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] }).count()
2064
rsakshay:PRIMARY>

Terminal
rsakshay:PRIMARY> db.product.find({'hard_drive.hdd_size.size' : { $gt : 200 }, $or : [ { 'OS' : { $eq : 'Windows 8.1' } }, { 'OS' : { $eq : 'Windows 10' } } ] })
[{"_id": 22, "computer_monitor": {"resolution": "4K", "brand": "Sharp", "frequency": "60Hz", "type": "No 3D", "input_lag": "12ms", "size": "19in"}, "shipping_size": {"breadth": 17.3, "length": 15.86, "depth": 13.29}, "num_cores": "4cores", "price": {"discount": 4580.57, "regular": 5038.28}, "screen_size": "15in", "brand": "Apple", "display_type": "Retina", "peripherals": [], "hard_drive": {"hdd_size": "GB", "size": 250}, "interface": "SATA3", "form_factor": "desktop", "cache_size": "32MB", "rpm": "10000rpm", "hdd_type": "HDD/SSD"}, {"OS": "Windows 10", "product_type": "desktop_computer", "battery_duration": "8hr"}, {"_id": 27, "computer_monitor": {"resolution": "1080i", "brand": "Sanyo", "frequency": "120Hz", "type": "No 3D", "input_lag": "20ms", "size": "21in"}, "shipping_size": {"breadth": 16.31, "length": 19.86, "depth": 17.01}, "num_cores": "2cores", "price": {"discount": 256.93, "regular": 2898.19}, "screen_size": "11in", "brand": "Acer", "display_type": "Retina", "peripherals": ["mouse"], "hard_drive": {"hdd_size": "GB", "size": 250}, "interface": "PATA", "form_factor": "laptop", "cache_size": "64MB", "rpm": "10000rpm", "hdd_type": "HDD/SSD"}, {"OS": "Windows 10", "product_type": "desktop_computer", "battery_duration": "4hr"}, {"_id": 70, "computer_monitor": {"resolution": "1080i", "brand": "Philips", "frequency": "120Hz", "type": "No 3D", "input_lag": "12ms", "size": "19in"}, "shipping_size": {"breadth": 19.84, "length": 15.92, "depth": 18.08}, "num_cores": "8cores", "price": {"discount": 1418.95, "regular": 1917.29}, "screen_size": "19in", "brand": "Toshiba", "display_type": "Regular", "peripherals": ["speakers"], "hard_drive": {"hdd_size": "GB", "size": 250}, "interface": "SATA", "form_factor": "desktop", "cache_size": "64MB", "rpm": "7200rpm", "hdd_type": "HDD"}, {"OS": "Windows 8.1", "product_type": "desktop_computer", "battery_duration": "2hr"}, {"_id": 98, "computer_monitor": {"resolution": "4K", "brand": "Vizio", "frequency": "60Hz", "type": "3D", "input_lag": "28ms", "size": "24in"}, "shipping_size": {"breadth": 14.79, "length": 16.68, "depth": 18.76}, "num_cores": "6cores", "price": {"discount": 371.23, "regular": 784.5}, "screen_size": "18in", "brand": "Gateway", "display_type": "Retina", "peripherals": ["mouse"], "hard_drive": {"hdd_size": "GB", "size": 320}, "interface": "PATA", "form_factor": "laptop", "cache_size": "32MB", "rpm": "5400rpm", "hdd_type": "HDD"}, {"OS": "Windows 8.1", "product_type": "desktop_computer", "battery_duration": "4hr"}, {"_id": 108, "computer_monitor": {"resolution": "4K", "brand": "Sony", "frequency": "60Hz", "type": "3D", "input_lag": "12ms", "size": "32in"}, "shipping_size": {"breadth": 17.28, "length": 19.38, "depth": 19.22}, "num_cores": "8cores", "price": {"discount": 1520.91, "regular": 3397.01}, "screen_size": "15in", "brand": "Toshiba", "display_type": "Regular", "peripherals": ["mouse", "keyboard"], "hard_drive": {"hdd_size": "GB", "size": 250}, "interface": "SATA2", "form_factor": "laptop", "cache_size": "64MB", "rpm": "7200rpm", "hdd_type": "SSD"}, {"OS": "Windows 8.1", "product_type": "desktop_computer", "battery_duration": "2hr"}, {"_id": 154, "computer_monitor": {"resolution": "4K", "brand": "Philips", "frequency": "120Hz", "type": "3D", "input_lag": "35ms", "size": "32in"}, "shipping_size": {"breadth": 15.52, "length": 16.41, "depth": 12.73}, "num_cores": "2cores", "price": {"discount": 1989.69, "regular": 3928.31}, "screen_size": "17in", "brand": "Asus", "display_type": "Regular", "peripherals": ["mouse", "keyboard"], "hard_drive": {"hdd_size": {"factor": "GB", "size": 320}, "brand": "Samsung", "interface": "PATA", "form_factor": "desktop", "cache_size": "64MB", "rpm": "7200rpm", "hdd_type": "SSD"}, {"OS": "Windows 10", "product_type": "desktop_computer", "battery_duration": "6hr"}, {"_id": 176, "computer_monitor": {"resolution": "1080p", "brand": "Vizio", "frequency": "60Hz", "type": "3D", "input_lag": "12ms", "size": "32in"}, "shipping_size": {"breadth": 19.21, "length": 16.91, "depth": 17.78}, "num_cores": "2cores", "price": {"discount": 1551.95, "regular": 3332.68}, "screen_size": "11in", "brand": "Gateway", "display_type": "Retina", "peripherals": ["mouse"], "hard_drive": {"hdd_size": {"factor": "GB", "size": 320}, "brand": "Intel", "interface": "SATA3", "form_factor": "laptop", "cache_size": "128MB", "rpm": "7200rpm", "hdd_type": "SSD"}, {"OS": "Windows 8.1", "product_type": "desktop_computer", "battery_duration": "4hr"}, {"_id": 193, "computer_monitor": {"resolution": "1080p", "brand": "Panasonic", "frequency": "120Hz", "type": "No 3D", "input_lag": "35ms", "size": "21in"}, "shipping_size": {"breadth": 15.35, "length": 17.86, "depth": 14.32}, "num_cores": "2cores", "price": {"discount": 801.69, "regular": 1107.98}, "screen_size": "19in", "brand": "Apple", "display_type": "Retina", "peripherals": ["mouse", "speakers"], "hard_drive": {"hdd_size": {"factor": "GB", "size": 320}, "brand": "Toshiba", "interface": "PATA", "form_factor": "laptop", "cache_size": "64MB", "rpm": "7200rpm", "hdd_type": "SSD"}, {"OS": "Windows 8.1", "product_type": "desktop_computer", "battery_duration": "4hr"}]
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```
Terminal rsakshay:PRIMARY> db.product.find({{"brand": { $eq : 'Canon' }, 'price.regular' : { $gt:500.0, $lt:1000.00 }, 'product_type' : { $eq : 'digital_camera' }}}) { "_id" : 3633, "num_focus_points" : 39, "viewfinder_construction" : "No viewfinder", "min_aperture" : 3.8, "product_type" : "digital_camera", "focal_length" : 85, "shipping_size" : { "breadth" : 11.12, "length" : 11.36, "depth" : 6.14 }, "price" : { "discount" : 593.26, "regular" : 683.3 }, "megapixels" : "20MP", "sensor_size" : "35mm", "max_iso" : 12800, "camera_type" : "Mirrorless", "coverage" : 0.7, "eye_relief" : "16mm", "frames_per_second" : "6fps", "memory_card_type" : "Memory Stick", "brand" : "Canon" } { "_id" : 7204, "num_focus_points" : 9, "viewfinder_construction" : "OVF", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 10.3, "length" : 7.27, "depth" : 6.56 }, "price" : { "discount" : 517.64, "regular" : 802.09 }, "megapixels" : "16MP", "sensor_size" : "1/8in", "max_iso" : 52000, "camera_type" : "RangeFinder", "coverage" : 0.9, "eye_relief" : "12mm", "frames_per_second" : "10fps", "memory_card_type" : "CF", "brand" : "Canon" } { "_id" : 8617, "num_focus_points" : 160, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 50, "shipping_size" : { "breadth" : 8.05, "length" : 6.57, "depth" : 6.84 }, "price" : { "discount" : 621.95, "regular" : 630.64 }, "megapixels" : "21MP", "sensor_size" : "1in", "max_iso" : 25600, "camera_type" : "Compact", "coverage" : 0.75, "eye_relief" : "10mm", "frames_per_second" : "10fps", "memory_card_type" : "SD", "brand" : "Canon" } { "_id" : 14081, "num_focus_points" : 9, "viewfinder_construction" : "Pentamirror", "min_aperture" : 1.2, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 11.06, "length" : 8.37, "depth" : 6.23 }, "price" : { "discount" : 714.13, "regular" : 917.56 }, "megapixels" : "20MP", "sensor_size" : "1in", "max_iso" : 6400, "camera_type" : "Mirrorless", "coverage" : 0.5, "eye_relief" : "22mm", "frames_per_second" : "12fps", "memory_card_type" : "Memory Stick", "brand" : "Canon" } { "_id" : 15690, "num_focus_points" : 39, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.8, "product_type" : "digital_camera", "focal_length" : 115, "shipping_size" : { "breadth" : 7.25, "length" : 10.62, "depth" : 7.16 }, "price" : { "discount" : 691.66, "regular" : 896.33 }, "megapixels" : "22MP", "sensor_size" : "Large Format", "max_iso" : 12800, "camera_type" : "Compact", "coverage" : 0.6, "eye_relief" : "17mm", "frames_per_second" : "6fps", "memory_card_type" : "SD", "brand" : "Canon" } { "_id" : 20209, "num_focus_points" : 39, "viewfinder_construction" : "Pentaprism", "min_aperture" : 3.5, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 8.55, "length" : 9.22, "depth" : 5.15 }, "price" : { "discount" : 441.6, "regular" : 525.67 }, "megapixels" : "18MP", "sensor_size" : "Large Format", "max_iso" : 6400, "camera_type" : "Mirrorless", "coverage" : 0.75, "eye_relief" : "12mm", "frames_per_second" : "10fps", "memory_card_type" : "CF", "brand" : "Canon" } { "_id" : 22433, "num_focus_points" : 11, "viewfinder_construction" : "No viewfinder", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 300, "shipping_size" : { "breadth" : 9.01, "length" : 10.84, "depth" : 7.13 }, "price" : { "discount" : 426.27, "regular" : 816.94 }, "megapixels" : "80MP", "sensor_size" : "35mm", "max_iso" : 102400, "camera_type" : "Compact", "coverage" : 1, "eye_relief" : "22mm", "frames_per_second" : "10fps", "memory_card_type" : "SD", "brand" : "Canon" } { "_id" : 41463, "num_focus_points" : 39, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 7.51, "length" : 10.65, "depth" : 6.75 }, "price" : { "discount" : 681.05, "regular" : 908.51 }, "megapixels" : "20MP", "sensor_size" : "3/4", "max_iso" : 6400, "camera_type" : "RangeFinder", "coverage" : 0.75, "eye_relief" : "10mm", "frames_per_second" : "10fps", "memory_card_type" : "Memory Stick", "brand" : "Canon" } { "_id" : 43073, "num_focus_points" : 51, "viewfinder_construction" : "OVF", "min_aperture" : 1.4, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 7.21, "length" : 10.48, "depth" : 6.93 }, "price" : { "discount" : 430.16, "regular" : 886.45 }, "megapixels" : "50MP", "sensor_size" : "Medium Format", "max_iso" : 102400, "camera_type" : "Mirrorless", "coverage" : 0.5, "eye_relief" : "17mm", "frames_per_second" : "6fps", "memory_card_type" : "SD", "brand" : "Canon" } { "_id" : 44301, "num_focus_points" : 51, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.4, "product_type" : "digital_camera", "focal_length" : 300, "shipping_size" : { "breadth" : 8.1, "length" : 9.58, "depth" : 6.51 }, "price" : { "discount" : 371.14, "regular" : 600.69 }, "megapixels" : "18MP", "sensor_size" : "APS-C", "max_iso" : 25600, "camera_type" : "DSLR", "coverage" : 0.5, "eye_relief" : "22mm", "frames_per_second" : "10fps", "memory_card_type" : "SD", "brand" : "Canon" } Terminal rsakshay:PRIMARY> db.product.find({{"brand": { $eq : 'Sony' }, 'price.regular' : { $gt:1000.0, $lt:1500.00 }, 'product_type' : { $eq : 'digital_camera' }}}) { "_id" : 979, "num_focus_points" : 51, "viewfinder_construction" : "Pentaprism", "min_aperture" : 3.8, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 9.29, "length" : 11.02, "depth" : 5.11 }, "price" : { "discount" : 1221.03, "regular" : 1247.36 }, "megapixels" : "24MP", "sensor_size" : "1/8in", "max_iso" : 52000, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "12mm", "frames_per_second" : "4fps", "memory_card_type" : "CF", "brand" : "Sony" } { "_id" : 10889, "num_focus_points" : 65, "viewfinder_construction" : "No viewfinder", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 300, "shipping_size" : { "breadth" : 7.81, "length" : 6.48, "depth" : 5.28 }, "price" : { "discount" : 722.04, "regular" : 1029.83 }, "megapixels" : "18MP", "sensor_size" : "3/4", "max_iso" : 102400, "camera_type" : "Mirrorless", "coverage" : 0.6, "eye_relief" : "22mm", "frames_per_second" : "4fps", "memory_card_type" : "CF", "brand" : "Sony" } { "_id" : 18970, "num_focus_points" : 9, "viewfinder_construction" : "Pentaprism", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 9.29, "length" : 11.2, "depth" : 5.82 }, "price" : { "discount" : 887.8, "regular" : 1244.86 }, "megapixels" : "22MP", "sensor_size" : "35mm", "max_iso" : 52000, "camera_type" : "Compact", "coverage" : 0.75, "eye_relief" : "17mm", "frames_per_second" : "30fps", "memory_card_type" : "SD", "brand" : "Sony" } { "_id" : 21346, "num_focus_points" : 160, "viewfinder_construction" : "Pentaprism", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 50, "shipping_size" : { "breadth" : 11.95, "length" : 10.08, "depth" : 6.22 }, "price" : { "discount" : 1148.24, "regular" : 1412.26 }, "megapixels" : "10MP", "sensor_size" : "Large Format", "max_iso" : 25600, "camera_type" : "DSLR", "coverage" : 0.6, "eye_relief" : "12mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Sony" } { "_id" : 31728, "num_focus_points" : 9, "viewfinder_construction" : "Pentaprism", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 400, "shipping_size" : { "breadth" : 10.38, "length" : 10.21, "depth" : 4.47 }, "price" : { "discount" : 663.76, "regular" : 1297.67 }, "megapixels" : "18MP", "sensor_size" : "Large Format", "max_iso" : 102400, "camera_type" : "Mirrorless", "coverage" : 1, "eye_relief" : "17mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Sony" } { "_id" : 33477, "num_focus_points" : 9, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 14, "shipping_size" : { "breadth" : 8.01, "length" : 6.74, "depth" : 6.03 }, "price" : { "discount" : 1263.21, "regular" : 1352.85 }, "megapixels" : "22MP", "sensor_size" : "3/4", "max_iso" : 102400, "camera_type" : "Compact", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "4fps", "memory_card_type" : "SD", "brand" : "Sony" } { "_id" : 37416, "num_focus_points" : 160, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.2, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 10.27, "length" : 7.01, "depth" : 4.17 }, "price" : { "discount" : 1046.36, "regular" : 1076.29 }, "megapixels" : "20MP", "sensor_size" : "3/4", "max_iso" : 52000, "camera_type" : "Mirrorless", "coverage" : 0.85, "eye_relief" : "22mm", "frames_per_second" : "4fps", "memory_card_type" : "SD", "brand" : "Sony" } { "_id" : 49380, "num_focus_points" : 65, "viewfinder_construction" : "Pentaprism", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 85, "shipping_size" : { "breadth" : 9.63, "length" : 6.44, "depth" : 6.42 }, "price" : { "discount" : 870.11, "regular" : 1016.28 }, "megapixels" : "24MP", "sensor_size" : "Medium Format", "max_iso" : 6400, "camera_type" : "Compact", "coverage" : 1, "eye_relief" : "22mm", "frames_per_second" : "5fps", "memory_card_type" : "Memory Stick", "brand" : "Sony" } { "_id" : 51300, "num_focus_points" : 39, "viewfinder_construction" : "Pentaprism", "min_aperture" : 1.8, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 10.19, "length" : 7.12, "depth" : 6.81 }, "price" : { "discount" : 1420.97, "regular" : 1468.92 }, "megapixels" : "20MP", "sensor_size" : "Medium Format", "max_iso" : 12800, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "4fps", "memory_card_type" : "SD", "brand" : "Sony" } { "_id" : 53049, "num_focus_points" : 39, "viewfinder_construction" : "Pentamirror", "min_aperture" : 3.8, "product_type" : "digital_camera", "focal_length" : 300, "shipping_size" : { "breadth" : 9.63, "length" : 6.78, "depth" : 7.59 }, "price" : { "discount" : 1207.66, "regular" : 1257.83 }, "megapixels" : "18MP", "sensor_size" : "1/8in", "max_iso" : 102400, "camera_type" : "Compact", "coverage" : 0.9, "eye_relief" : "10mm", "frames_per_second" : "4fps", "memory_card_type" : "SD", "brand" : "Sony" }
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Terminal

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rakshay:PRIMARY> db.product.find().sort({ 'price.discount' : -1 }).limit(30)
{
  "_id" : 67625, "num_focus_points" : 51, "viewfinder_construction" : "Pentaprism", "min_aperture" : 3.5, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 11.87, "length" : 6.06, "depth" : 6.05 }, "price" : { "discount" : 44859.71, "regular" : 44971.16 }, "megapixels" : "20MP", "sensor_size" : "35mm", "max_iso" : 25600, "camera_type" : "Mirrorless", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "4fps", "memory_card_type" : "Memory Stick", "brand" : "Pentax" }
{
  "_id" : 140135, "num_focus_points" : 65, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 115, "shipping_size" : { "breadth" : 9.46, "length" : 6.9, "depth" : 4.81 }, "price" : { "discount" : 44677.45, "regular" : 44782.57 }, "megapixels" : "10MP", "sensor_size" : "Large Format", "max_iso" : 6400, "camera_type" : "Mirrorless", "coverage" : 0.5, "eye_relief" : "12mm", "frames_per_second" : "12fps", "memory_card_type" : "SD", "brand" : "Canon" }
{
  "_id" : 54716, "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 3.8, "product_type" : "digital_camera", "focal_length" : 200, "shipping_size" : { "breadth" : 11.54, "length" : 8.49, "depth" : 5.51 }, "price" : { "discount" : 44587.15, "regular" : 44736.86 }, "megapixels" : "20MP", "sensor_size" : "3/4\"", "max_iso" : 6400, "camera_type" : "Compact", "coverage" : 0.85, "eye_relief" : "10mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Panasonic" }
{
  "_id" : 133212, "num_focus_points" : 65, "viewfinder_construction" : "OVF", "min_aperture" : 3.5, "product_type" : "digital_camera", "focal_length" : 200, "shipping_size" : { "breadth" : 8.75, "length" : 11.17, "depth" : 4.82 }, "price" : { "discount" : 44409.9, "regular" : 44679.15 }, "megapixels" : "22MP", "sensor_size" : "APS-C", "max_iso" : 25600, "camera_type" : "Compact", "coverage" : 0.5, "eye_relief" : "10mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Mamiya" }
{
  "_id" : 55122, "num_focus_points" : 160, "viewfinder_construction" : "Pentaprism", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 7.82, "length" : 9.37, "depth" : 5.47 }, "price" : { "discount" : 44389.93, "regular" : 44497.61 }, "megapixels" : "24MP", "sensor_size" : "35mm", "max_iso" : 12800, "camera_type" : "RangeFinder", "coverage" : 0.85, "eye_relief" : "22mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "PhaseOne" }
{
  "_id" : 59413, "num_focus_points" : 160, "viewfinder_construction" : "No viewfinder", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 115, "shipping_size" : { "breadth" : 9.45, "length" : 8.53, "depth" : 5.27 }, "price" : { "discount" : 44335.19, "regular" : 44468.57 }, "megapixels" : "12MP", "sensor_size" : "35mm", "max_iso" : 25600, "camera_type" : "RangeFinder", "coverage" : 0.6, "eye_relief" : "12mm" , "frames_per_second" : "5fps", "memory_card_type" : "SD", "brand" : "Fuji" }
{
  "_id" : 124056, "num_focus_points" : 9, "viewfinder_construction" : "No viewfinder", "min_aperture" : 3.5, "product_type" : "digital_camera", "focal_length" : 200, "shipping_size" : { "breadth" : 8.13, "length" : 7.27, "depth" : 5.24 }, "price" : { "discount" : 44164.24, "regular" : 44588.08 }, "megapixels" : "20MP", "sensor_size" : "35mm", "max_iso" : 12800, "camera_type" : "Mirrorless", "coverage" : 0.7, "eye_relief" : "10mm", "frames_per_second" : "6fps", "memory_card_type" : "CF", "brand" : "Maniya" }
{
  "_id" : 84216, "num_focus_points" : 9, "viewfinder_construction" : "OVF", "min_aperture" : 1.2, "product_type" : "digital_camera", "focal_length" : 400, "shipping_size" : { "breadth" : 8.07, "length" : 6.83, "depth" : 4.82 }, "price" : { "discount" : 44158.57, "regular" : 44172.65 }, "megapixels" : "36MP", "sensor_size" : "3/4\"", "max_iso" : 6400, "camera_type" : "Mirrorless", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "5fps", "memory_card_type" : "CF", "brand" : "PhaseOne" }
{
  "_id" : 53307, "num_focus_points" : 39, "viewfinder_construction" : "No viewfinder", "min_aperture" : 3.8, "product_type" : "digital_camera", "focal_length" : 200, "shipping_size" : { "breadth" : 10.69, "length" : 7.56, "depth" : 6.85 }, "price" : { "discount" : 44109.1, "regular" : 44862.55 }, "megapixels" : "12MP", "sensor_size" : "APS-C", "max_iso" : 25600, "camera_type" : "Compact", "coverage" : 0.6, "eye_relief" : "12mm", "frames_per_second" : "12fps", "memory_card_type" : "Memory Stick", "brand" : "PhaseOne" }
{
  "_id" : 9794, "num_focus_points" : 160, "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.2, "product_type" : "digital_camera", "focal_length" : 300, "shipping_size" : { "breadth" : 8.28, "length" : 10.54, "depth" : 4.62 }, "price" : { "discount" : 43997.95, "regular" : 44898.35 }, "megapixels" : "36MP", "sensor_size" : "1/8in", "max_iso" : 12800, "camera_type" : "Compact", "coverage" : 1, "eye_relief" : "10mm", "frames_per_second" : "6fps", "memory_card_type" : "Memory Stick", "brand" : "PhaseOne" }

```

Terminal

```
rakshay:PRIMARY> db.product.find({ 'product_type': { '$eq': 'television' }}).limit(30)
{
  "_id" : 25, "inputs" : [ ], "product_type" : "television", "shipping_size" : { "breadth" : 41.3, "length" : 58.92, "depth" : 12.74 }, "resolution" : "720p", "price" : { "discount" : 210.29, "regular" : 346.17 }, "frequency" : "120Hz", "input_lag" : "23ms", "three_d" : "No 3D", "type" : "Regular TV", "brand" : "Emerson", "size" : "36in" }
{
  "_id" : 34, "inputs" : [ "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 24.82, "length" : 72.47, "depth" : 17 }, "resolution" : "720p", "price" : { "discount" : 1021.05, "regular" : 1390.55 }, "frequency" : "120Hz", "input_lag" : "23ms", "three_d" : "3D", "type" : "SmartTV", "brand" : "Panasonic", "size" : "60in" }
{
  "_id" : 36, "inputs" : [ "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 49.56, "length" : 64.81, "depth" : 11.77 }, "resolution" : "4K", "price" : { "discount" : 2978.89, "regular" : 5594.74 }, "frequency" : "120Hz", "input_lag" : "23ms", "three_d" : "No 3D", "type" : "Regular TV", "brand" : "JVC", "size" : "40in" }
{
  "_id" : 53, "inputs" : [ "HDMI", "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 64.42, "length" : 85.39, "depth" : 11.05 }, "resolution" : "480p", "price" : { "discount" : 7480.56, "regular" : 7742.41 }, "frequency" : "120Hz", "input_lag" : "20ms", "three_d" : "3D", "type" : "SmartTV", "brand" : "Emerson", "size" : "75in" }
{
  "_id" : 77, "inputs" : [ "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 51.82, "length" : 53.99, "depth" : 17.59 }, "resolution" : "8K", "price" : { "discount" : 2113.86, "regular" : 2412.8 }, "frequency" : "120Hz", "input_lag" : "28ms", "three_d" : "No 3D", "type" : "SmartTV", "brand" : "Sanyo", "size" : "42in" }
{
  "_id" : 81, "inputs" : [ "HDMI", "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 29.38, "length" : 23.24, "depth" : 18.45 }, "resolution" : "480p", "price" : { "discount" : 1230.86, "regular" : 1594.84 }, "frequency" : "120Hz", "input_lag" : "18ms", "three_d" : "3D", "type" : "Regular TV", "brand" : "RCA", "size" : "24in" }
{
  "_id" : 82, "inputs" : [ "HDMI", "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 84.89, "length" : 67.76, "depth" : 10.75 }, "resolution" : "4K", "price" : { "discount" : 3966.96, "regular" : 4810.72 }, "frequency" : "60Hz", "input_lag" : "18ms", "three_d" : "No 3D", "type" : "SmartTV", "brand" : "Emerson", "size" : "55in" }
{
  "_id" : 83, "inputs" : [ "HDMI" ], "product_type" : "television", "shipping_size" : { "breadth" : 23.31, "length" : 20.12, "depth" : 12.25 }, "resolution" : "4K", "price" : { "discount" : 8736.68, "regular" : 9268.17 }, "frequency" : "120Hz", "input_lag" : "12ms", "three_d" : "No 3D", "type" : "Regular TV", "brand" : "Sharp", "size" : "40in" }
{
  "_id" : 87, "inputs" : [ "HDMI" ], "product_type" : "television", "shipping_size" : { "breadth" : 61.53, "length" : 27.93, "depth" : 10.46 }, "resolution" : "1080p", "price" : { "discount" : 1429.37, "regular" : 1746.85 }, "frequency" : "120Hz", "input_lag" : "12ms", "three_d" : "3D", "type" : "Regular TV", "brand" : "Vizio", "size" : "40in" }
{
  "_id" : 106, "inputs" : [ "HDMI", "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 63.13, "length" : 29.92, "depth" : 14.39 }, "resolution" : "480p", "price" : { "discount" : 1760.44, "regular" : 2518.04 }, "frequency" : "60Hz", "input_lag" : "35ms", "three_d" : "3D", "type" : "SmartTV", "brand" : "RCA", "size" : "27in" }
{
  "_id" : 123, "inputs" : [ "HDMI" ], "product_type" : "television", "shipping_size" : { "breadth" : 87.83, "length" : 24.84, "depth" : 17.13 }, "resolution" : "1080t", "price" : { "discount" : 6257.39, "regular" : 7427.48 }, "frequency" : "120Hz", "input_lag" : "23ms", "three_d" : "3D", "type" : "SmartTV", "brand" : "Sony", "size" : "24in" }
{
  "_id" : 128, "inputs" : [ "HDMI" ], "product_type" : "television", "shipping_size" : { "breadth" : 99.69, "length" : 57.44, "depth" : 17.01 }, "resolution" : "1080p", "price" : { "discount" : 876.83, "regular" : 1966.38 }, "frequency" : "120Hz", "input_lag" : "12ms", "three_d" : "No 3D", "type" : "SmartTV", "brand" : "Sharp", "size" : "52in" }
{
  "_id" : 145, "inputs" : [ "HDMI" ], "product_type" : "television", "shipping_size" : { "breadth" : 36.77, "length" : 93.66, "depth" : 18.67 }, "resolution" : "4K", "price" : { "discount" : 1251.06, "regular" : 3022.13 }, "frequency" : "120Hz", "input_lag" : "28ms", "three_d" : "3D", "type" : "Regular TV", "brand" : "Toshiba", "size" : "72in" }
{
  "_id" : 147, "inputs" : [ "USB" ], "product_type" : "television", "shipping_size" : { "breadth" : 26.72, "length" : 79.32, "depth" : 17.91 }, "type" : "SmartTV", "brand" : "Toshiba", "size" : "43in" }

```

TASK 10 – PRIMARY NODE FAILURE SIMULATION

In the screenshot (in two parts because the output couldn't fit in one screenshot) below, you can see that the previous primary has been disconnected. And the other two are both secondary.

```
rsakshay:SECONDARY> rs.status()
{
    "set" : "rsakshay",
    "date" : ISODate("2016-04-12T05:07:00.857Z"),
    "myState" : 2,
    "term" : NumberLong(1),
    "heartbeatIntervalMillis" : NumberLong(2000),
    "members" : [
        {
            "_id" : 0,
            "name" : "gpel11:40041",
            "health" : 0,
            "state" : 0,
            "stateStr" : "(not reachable/healthy)",
            "uptime" : 0,
            "optime" : {
                "ts" : Timestamp(0, 0),
                "t" : NumberLong(-1)
            },
            "optimeDate" : ISODate("1970-01-01T00:00:00Z"),
            "lastHeartbeat" : ISODate("2016-04-12T05:07:00.584Z"),
            "lastHeartbeatRecv" : ISODate("2016-04-12T05:06:53.599Z"),
            "pingMs" : NumberLong(0),
            "lastHeartbeatMessage" : "Connection refused",
            "configVersion" : -1
        },
        {
            "_id" : 1,
            "name" : "gpel11.cs.ou.edu:40042",
            "health" : 1,
            "state" : 2,
            "stateStr" : "SECONDARY",
            "uptime" : 1452,
            "optime" : {
                "ts" : Timestamp(1460436572, 20000),
                "t" : NumberLong(1)
            },
            "optimeDate" : ISODate("2016-04-12T04:49:32Z"),
            "infoMessage" : "could not find member to sync from",
            "configVersion" : 3,
            "self" : true
        }
    ],
    "pingMs" : NumberLong(0),
    "lastHeartbeatMessage" : "Connection refused",
    "configVersion" : -1
},
{
    "_id" : 1,
    "name" : "gpel11.cs.ou.edu:40042",
    "health" : 1,
    "state" : 2,
    "stateStr" : "SECONDARY",
    "uptime" : 1452,
    "optime" : {
        "ts" : Timestamp(1460436572, 20000),
        "t" : NumberLong(1)
    },
    "optimeDate" : ISODate("2016-04-12T04:49:32Z"),
    "infoMessage" : "could not find member to sync from",
    "configVersion" : 3,
    "self" : true
},
{
    "_id" : 2,
    "name" : "gpel11.cs.ou.edu:40043",
    "health" : 1,
    "state" : 2,
    "stateStr" : "SECONDARY",
    "uptime" : 1348,
    "optime" : {
        "ts" : Timestamp(1460436572, 20000),
        "t" : NumberLong(1)
    },
    "optimeDate" : ISODate("2016-04-12T04:49:32Z"),
    "lastHeartbeat" : ISODate("2016-04-12T05:07:00.583Z"),
    "lastHeartbeatRecv" : ISODate("2016-04-12T05:06:58.879Z"),
    "pingMs" : NumberLong(0),
    "configVersion" : 3
}
],
"ok" : 1
}
rsakshay:SECONDARY>
```

In the screenshot (in two parts again) below, you can see the new primary has been voted:

```
Terminal rsakshay:SECONDARY> rs.status()
{
    "set" : "rsakshay",
    "date" : ISODate("2016-04-12T05:09:44.273Z"),
    "myState" : 2,
    "term" : NumberLong(2),
    "syncingTo" : "gpel11.cs.ou.edu:40043",
    "heartbeatIntervalMillis" : NumberLong(2000),
    "members" : [
        {
            "_id" : 0,
            "name" : "gpel11:40041",
            "health" : 0,
            "state" : 8,
            "stateStr" : "(not reachable/healthy)",
            "uptime" : 0,
            "optime" : {
                "ts" : Timestamp(0, 0),
                "t" : NumberLong(-1)
            },
            "optimeDate" : ISODate("1970-01-01T00:00:00Z"),
            "lastHeartbeat" : ISODate("2016-04-12T05:09:43.674Z"),
            "lastHeartbeatRecv" : ISODate("2016-04-12T05:06:53.599Z"),
            "pingMs" : NumberLong(0),
            "lastHeartbeatMessage" : "Connection refused",
            "configVersion" : -1
        },
        {
            "_id" : 1,
            "name" : "gpel11.cs.ou.edu:40042",
            "health" : 1,
            "state" : 2,
            "stateStr" : "SECONDARY",
            "uptime" : 1616,
            "optime" : {
                "ts" : Timestamp(1460437624, 2),
                "t" : NumberLong(2)
            },
            "optimeDate" : ISODate("2016-04-12T05:07:04Z"),
            "syncingTo" : "gpel11.cs.ou.edu:40043",
            "configVersion" : 3,
            "self" : true
        },
        {
            "_id" : 2,
            "name" : "gpel11.cs.ou.edu:40043",
            "health" : 1,
            "state" : 1,
            "stateStr" : "PRIMARY",
            "uptime" : 1511,
            "optime" : {
                "ts" : Timestamp(1460437624, 2),
                "t" : NumberLong(2)
            },
            "optimeDate" : ISODate("2016-04-12T05:07:04Z"),
            "lastHeartbeat" : ISODate("2016-04-12T05:09:42.632Z"),
            "lastHeartbeatRecv" : ISODate("2016-04-12T05:09:42.420Z"),
            "pingMs" : NumberLong(0),
            "electionTime" : Timestamp(0, 0),
            "electionDate" : ISODate("1970-01-01T00:00:00Z"),
            "configVersion" : 3
        }
    ],
    "ok" : 1
}
rsakshay:SECONDARY>
```

In the screenshots below, the output of the queries is shown:

```
Terminal
MongoDB [PRIMARY]> db.product.find({brand: { $eq : "Sony" }, price.regular : { $gt:1000.0, $lt:1500.00 }, product_type : { $eq : "digital_camera" } })
[{"_id": 979, "num_focus_points": 51, "viewfinder_construction": "Pentaprism", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 35, "shipping_size": {"breadth": 9.29, "length": 11.02, "depth": 5.11}, "price": {"discount": 1221.03, "regular": 1247.36}, "megapixels": "24MP", "sensor_size": "1/8in", "max_iso": 52000, "camera_type": "DSLR", "coverage": 0.95, "eye_relief": "12mm", "frames_per_second": "6fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 10889, "num_focus_points": 65, "viewfinder_construction": "No viewfinder", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 300, "shipping_size": {"breadth": 7.81, "length": 6.48, "depth": 5.28}, "price": {"discount": 722.04, "regular": 1029.83}, "megapixels": "18MP", "sensor_size": "3/4", "max_iso": 102400, "camera_type": "Mirrorless", "coverage": 0.6, "eye_relief": "22mm", "frames_per_second": "4fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 18970, "num_focus_points": 9, "viewfinder_construction": "Pentaprism", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 24, "shipping_size": {"breadth": 9.29, "length": 11.2, "depth": 5.82}, "price": {"discount": 887.8, "regular": 1244.86}, "megapixels": "22MP", "sensor_size": "35mm", "max_iso": 52000, "camera_type": "Compact", "coverage": 0.75, "eye_relief": "17mm", "frames_per_second": "30fps", "memory_card_type": "SD", "brand": "Sony"}, {"_id": 21346, "num_focus_points": 100, "viewfinder_construction": "Pentaprism", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 50, "shipping_size": {"breadth": 11.95, "length": 10.08, "depth": 6.22}, "price": {"discount": 1148.24, "regular": 1412.26}, "megapixels": "10MP", "sensor_size": "Large Format", "max_iso": 25600, "camera_type": "DSLR", "coverage": 0.6, "eye_relief": "12mm", "frames_per_second": "8fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 31728, "num_focus_points": 9, "viewfinder_construction": "Pentaprism", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 400, "shipping_size": {"breadth": 10.38, "length": 10.21, "depth": 4.47}, "price": {"discount": 663.76, "regular": 1297.67}, "megapixels": "18MP", "sensor_size": "Large Format", "max_iso": 102400, "camera_type": "Mirrorless", "coverage": 1, "eye_relief": "17mm", "frames_per_second": "8fps", "memory_card_type": "CF", "brand": "Sony"}, {"_id": 33477, "num_focus_points": 9, "viewfinder_construction": "Pentamirror", "min_aperture": 2.8, "product_type": "digital_camera", "focal_length": 14, "shipping_size": {"breadth": 8.01, "length": 6.74, "depth": 6.03}, "price": {"discount": 1263.21, "regular": 1352.85}, "megapixels": "22MP", "sensor_size": "3/4", "max_iso": 102400, "camera_type": "Compact", "coverage": 0.95, "eye_relief": "22mm", "frames_per_second": "4fps", "memory_card_type": "SD", "brand": "Sony"}, {"_id": 37416, "num_focus_points": 160, "viewfinder_construction": "No viewfinder", "min_aperture": 1.2, "product_type": "digital_camera", "focal_length": 24, "shipping_size": {"breadth": 10.27, "length": 7.01, "depth": 4.17}, "price": {"discount": 1046.36, "regular": 1076.29}, "megapixels": "20MP", "sensor_size": "3/4", "max_iso": 52000, "camera_type": "Mirrorless", "coverage": 0.85, "eye_relief": "22mm", "frames_per_second": "4fps", "memory_card_type": "SD", "brand": "Sony"}, {"_id": 49380, "num_focus_points": 65, "viewfinder_construction": "Pentaprism", "min_aperture": 2, "product_type": "digital_camera", "focal_length": 85, "shipping_size": {"breadth": 9.63, "length": 6.44, "depth": 6.42}, "price": {"discount": 870.11, "regular": 1016.28}, "megapixels": "24MP", "sensor_size": "Medium Format", "max_iso": 6400, "camera_type": "Compact", "coverage": 1, "eye_relief": "22mm", "frames_per_second": "5fps", "memory_card_type": "Memory Stick", "brand": "Sony"}, {"_id": 51300, "num_focus_points": 39, "viewfinder_construction": "Pentaprism", "min_aperture": 1.8, "product_type": "digital_camera", "focal_length": 28, "shipping_size": {"breadth": 10.19, "length": 7.12, "depth": 6.81}, "price": {"discount": 1420.97, "regular": 1468.92}, "megapixels": "20MP", "sensor_size": "Medium Format", "max_iso": 12800, "camera_type": "DSLR", "coverage": 0.95, "eye_relief": "22mm", "frames_per_second": "4fps", "memory_card_type": "SD", "brand": "Sony"}, {"_id": 53649, "num_focus_points": 39, "viewfinder_construction": "Pentamirror", "min_aperture": 3.8, "product_type": "digital_camera", "focal_length": 300, "shipping_size": {"breadth": 9.63, "length": 6.78, "depth": 7.59}, "price": {"discount": 1207.66, "regular": 1257.83}, "megapixels": "18MP", "sensor_size": "1/8in", "max_iso": 102400, "camera_type": "Compact", "coverage": 0.9, "eye_relief": "10mm", "frames_per_second": "8fps", "memory_card_type": "CF", "brand": "Sony"}]
```

```

Terminal (1:11, 62%) Tue Apr 12 00:12 Akshay Gaur
[{"_id": "local_length" : 115, "shipping_size" : { "breadth" : 10.66, "length" : 6.62, "depth" : 5.8 }, "price" : { "discount" : 43984.65, "regular" : 44226.22 }, "megapixels" : "36MP", "sensor_size" : "1/8in", "max_iso" : 52000, "camera_type" : "Mirrorless", "coverage" : 0.7, "eye_relief" : "12mm", "frames_per_second" : "6fps", "memory_card_type" : "SD", "brand" : "Canon" },
{"_id": "cal_length" : 85, "shipping_size" : { "breadth" : 7.1, "length" : 6.79, "depth" : 7.79 }, "price" : { "discount" : 43958, "regular" : 44045.75 }, "megapixels" : "10MP", "sensor_size" : "3/4", "max_iso" : 12800, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "17mm", "frames_per_second" : "30fps", "memory_card_type" : "Memory Stick", "brand" : "Pentax" },
{"_id": "num_focus_points" : 160, "viewfinder_construction" : "OVF", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 11.22, "length" : 10.59, "depth" : 7.7 }, "price" : { "discount" : 43882.5, "regular" : 44106.73 }, "megapixels" : "10MP", "sensor_size" : "1in", "max_iso" : 102400, "camera_type" : "DSLR", "coverage" : 0.5, "eye_relief" : "17mm", "frames_per_second" : "10fps", "memory_card_type" : "CF", "brand" : "Sony" },
{"_id": "viewfinder_construction" : "No viewfinder", "min_aperture" : 1.8, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 9.33, "length" : 10.92, "depth" : 4.32 }, "price" : { "discount" : 43823.58, "regular" : 43898.75 }, "megapixels" : "50MP", "sensor_size" : "1in", "max_iso" : 102400, "camera_type" : "Compact", "coverage" : 0.95, "eye_relief" : "22mm", "frames_per_second" : "12fps", "memory_card_type" : "SD", "brand" : "PhaenoOne" },
{"_id": "num_focus_points" : 51, "viewfinder_construction" : "OVF", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 28, "shipping_size" : { "breadth" : 11.42, "length" : 8, "depth" : 5.28 }, "price" : { "discount" : 43758.97, "regular" : 44345.4 }, "megapixels" : "18MP", "sensor_size" : "3/4", "max_iso" : 52000, "camera_type" : "RangeFinder", "coverage" : 1, "eye_relief" : "17mm", "frames_per_second" : "6fps", "memory_card_type" : "SD", "brand" : "Samsung" },
{"_id": "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.5, "product_type" : "digital_camera", "focal_length" : 35, "shipping_size" : { "breadth" : 9.41, "length" : 10.82, "depth" : 7.13 }, "price" : { "discount" : 43729.99, "regular" : 44122.13 }, "megapixels" : "50MP", "sensor_size" : "Large Format", "max_iso" : 25600, "camera_type" : "DSLR", "coverage" : 0.95, "eye_relief" : "12mm", "frames_per_second" : "30fps", "memory_card_type" : "CF", "brand" : "Fuji" },
{"_id": "num_focus_points" : 51, "viewfinder_construction" : "OVF", "min_aperture" : 2, "product_type" : "digital_camera", "focal_length" : 24, "shipping_size" : { "breadth" : 8.5, "length" : 7.04, "depth" : 5.79 }, "price" : { "discount" : 43722.61, "regular" : 44168.86 }, "megapixels" : "80MP", "sensor_size" : "35mm", "max_iso" : 6400, "camera_type" : "RangeFinder", "coverage" : 0.7, "eye_relief" : "17mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Fuji" },
{"_id": "num_focus_points" : 51, "viewfinder_construction" : "Pentamirror", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 400, "shipping_size" : { "breadth" : 9.43, "length" : 9.03, "depth" : 6.39 }, "price" : { "discount" : 43639.87, "regular" : 44004.54 }, "megapixels" : "20MP", "sensor_size" : "Large Format", "max_iso" : 12800, "camera_type" : "Compact", "coverage" : 0.85, "eye_relief" : "17mm", "frames_per_second" : "12fps", "memory_card_type" : "SD", "brand" : "Sony" },
{"_id": "num_focus_points" : 39, "viewfinder_construction" : "No viewfinder", "min_aperture" : 2.8, "product_type" : "digital_camera", "focal_length" : 400, "shipping_size" : { "breadth" : 7.22, "length" : 8.84, "depth" : 7.37 }, "price" : { "discount" : 43573.7, "regular" : 43677.24 }, "megapixels" : "21MP", "sensor_size" : "35mm", "max_iso" : 6400, "camera_type" : "Compact", "coverage" : 1, "eye_relief" : "17mm", "frames_per_second" : "4fps", "memory_card_type" : "SD", "brand" : "Nikon" },
{"_id": "num_focus_points" : 11, "viewfinder_construction" : "OVF", "min_aperture" : 1.2, "product_type" : "digital_camera", "focal_length" : 14, "shipping_size" : { "breadth" : 10.02, "length" : 8.47, "depth" : 6.1 }, "price" : { "discount" : 43425.83, "regular" : 43850.98 }, "megapixels" : "80MP", "sensor_size" : "3/4", "max_iso" : 25600, "camera_type" : "RangeFinder", "coverage" : 0.75, "eye_relief" : "10mm", "frames_per_second" : "8fps", "memory_card_type" : "CF", "brand" : "Samsung" }
Type "it" for more
rsakshay:PRIMARY>

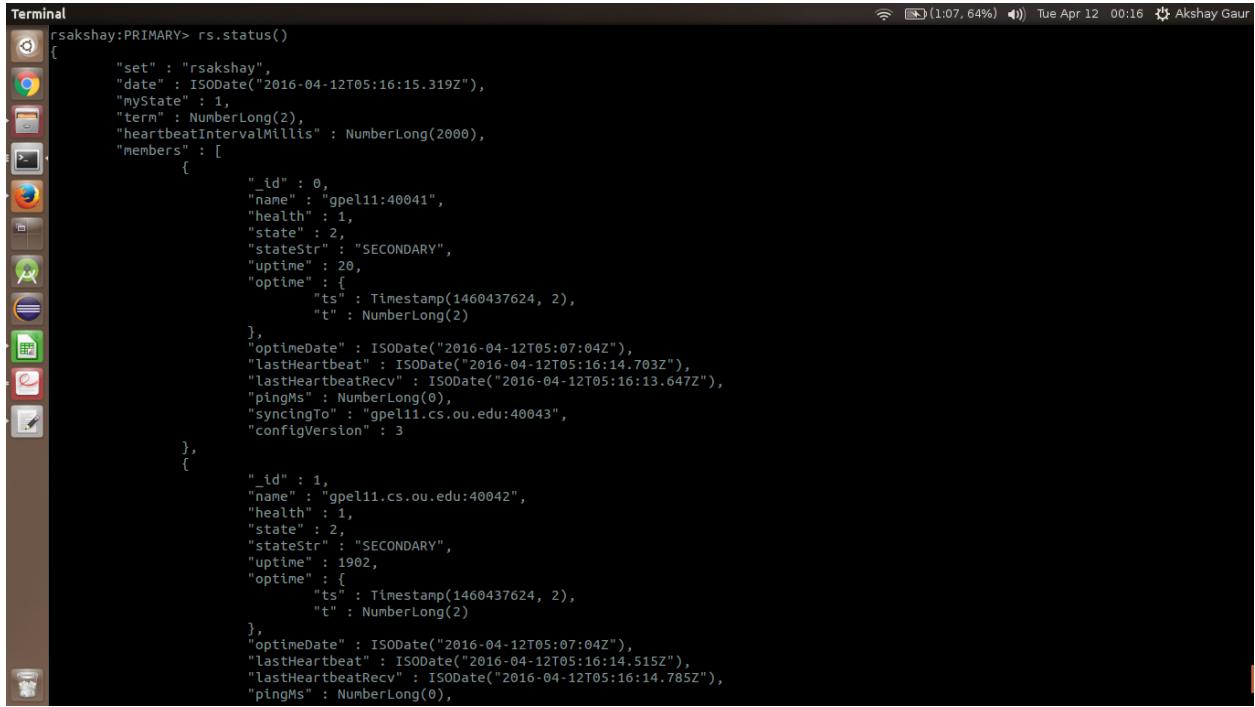
```

```

Terminal (1:13, 61%) Tue Apr 12 00:11 Akshay Gaur
{
    "lastHeartbeatRecv" : ISODate("2016-04-12T05:10:52.658Z"),
    "pingMs" : NumberLong(0),
    "syncingTo" : "gpelii.cs.ou.edu:40043",
    "configVersion" : 3
},
{
    "_id" : 2,
    "name" : "gpelii.cs.ou.edu:40043",
    "health" : 1,
    "state" : 1,
    "statestr" : "PRIMARY",
    "uptime" : 1585,
    "optime" : {
        "ts" : Timestamp(1460437624, 2),
        "t" : NumberLong(2)
    },
    "optimeDate" : ISODate("2016-04-12T05:07:04Z"),
    "electionTime" : Timestamp(1460437624, 1),
    "electionDate" : ISODate("2016-04-12T05:07:04Z"),
    "configVersion" : 3,
    "self" : true
},
{
    "ok" : 1
}
rsakshay:PRIMARY> db.product.find({ 'product_type': { $eq: 'television' } }).limit(30)
rsakshay:PRIMARY> use mydb
switched to db mydb
rsakshay:PRIMARY> db.product.find({ 'product_type': { $eq: 'television' } }).limit(30)
{
    "_id" : 36,
    "inputs" : [ "USB" ],
    "product_type" : "television",
    "shipping_size" : { "breadth" : 49.56, "length" : 64.81, "depth" : 11.77 },
    "resolution" : "4K",
    "price" : { "discount" : 2978.89, "regular" : 5594.74 },
    "frequency" : "120Hz",
    "input_lag" : "12ms",
    "three_d" : "No 3D",
    "type" : "Regular TV",
    "brand" : "JVC",
    "size" : "40in"
},
{
    "_id" : 53,
    "inputs" : [ "HDMI", "USB" ],
    "product_type" : "television",
    "shipping_size" : { "breadth" : 64.42, "length" : 85.39, "depth" : 11.05 },
    "resolution" : "480i",
    "price" : { "discount" : 7480.56, "regular" : 7742.41 },
    "frequency" : "120Hz",
    "input_lag" : "20ms",
    "three_d" : "3D",
    "type" : "SmartTV",
    "brand" : "Emerson",
    "size" : "75in"
},
{
    "_id" : 25,
    "inputs" : [ ],
    "product_type" : "television",
    "shipping_size" : { "breadth" : 41.3, "length" : 58.92, "depth" : 12.74 },
    "resolution" : "720p",
    "price" : { "discount" : 210.29, "regular" : 346.17 },
    "frequency" : "120Hz",
    "input_lag" : "23ms",
    "three_d" : "No 3D",
    "type" : "Regular TV",
    "brand" : "Emerson",
    "size" : "36in"
},
{
    "_id" : 82,
    "inputs" : [ "HDMI", "USB" ],
    "product_type" : "television",
    "shipping_size" : { "breadth" : 84.89, "length" : 67.76, "depth" : 10.75 },
    "resolution" : "4K",
    "price" : { "discount" : 3966.96, "regular" : 4810.72 },
    "frequency" : "60Hz",
    "input_lag" : "18ms",
    "three_d" : "No 3D",
    "type" : "SmartTV",
    "brand" : "Emerson",
    "size" : "55in"
}

```

Also, when I added back the previously removed replica set, it was added back as secondary and not primary which was as per expectation.



The screenshot shows a terminal window titled "Terminal" on a Linux desktop. The window displays the output of a MongoDB command: `rsakshay:PRIMARY> rs.status()`. The output shows a replica set named "rsakshay" with two members. The first member, with _id 0, is the primary, running on "gpel11:40041". It has been in this state since April 12, 2016, at 05:16:15.319Z. The second member, with _id 1, is a secondary, running on "gpel11.cs.ou.edu:40042". It has been in this state since April 12, 2016, at 05:16:14.703Z. Both members have been pinged successfully. The terminal window is part of a desktop environment with a dock containing icons for various applications like a browser, file manager, and terminal.

```
rsakshay:PRIMARY> rs.status()
{
  "set" : "rsakshay",
  "date" : ISODate("2016-04-12T05:16:15.319Z"),
  "myState" : 1,
  "term" : NumberLong(2),
  "heartbeatIntervalMillis" : NumberLong(2000),
  "members" : [
    {
      "_id" : 0,
      "name" : "gpel11:40041",
      "health" : 1,
      "state" : 2,
      "stateStr" : "SECONDARY",
      "uptime" : 20,
      "optime" : {
        "ts" : Timestamp(1460437624, 2),
        "t" : NumberLong(2)
      },
      "optimeDate" : ISODate("2016-04-12T05:07:04Z"),
      "lastHeartbeat" : ISODate("2016-04-12T05:16:14.703Z"),
      "lastHeartbeatRecv" : ISODate("2016-04-12T05:16:13.647Z"),
      "pingMs" : NumberLong(0),
      "syncingTo" : "gpel11.cs.ou.edu:40043",
      "configVersion" : 3
    },
    {
      "_id" : 1,
      "name" : "gpel11.cs.ou.edu:40042",
      "health" : 1,
      "state" : 2,
      "stateStr" : "SECONDARY",
      "uptime" : 1902,
      "optime" : {
        "ts" : Timestamp(1460437624, 2),
        "t" : NumberLong(2)
      },
      "optimeDate" : ISODate("2016-04-12T05:07:04Z"),
      "lastHeartbeat" : ISODate("2016-04-12T05:16:14.515Z"),
      "lastHeartbeatRecv" : ISODate("2016-04-12T05:16:14.785Z"),
      "pingMs" : NumberLong(0)
    }
  ]
}
```