**Advanced Databases**

**MongoDB CA**

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1. **a. Setting up the cluster and replication**

   This cluster has three nodes connected to it.
   The three nodes are c19366191-1, c19366191-2, c19366191-3

   Rs.status() was used on the cluster

```
C:\Users\Windows>docker exec -it c19366191-1 mongosh --eval "rs.status()"
Current Mongosh Log ID: 63890bd8dd7ad1e29872b536
Connecting to:          mongodb://127.0.0.1:27017/?directConnection=true&serverSelectionTimeoutMS=2000&appName=mongosh+1.6.0
Using MongoDB:          6.0.3
Using Mongosh:          1.6.0
```

   Here it shows that it is connecting to MongoDB and which version it is currently using. It also shows the version of Mongosh and the log ID.

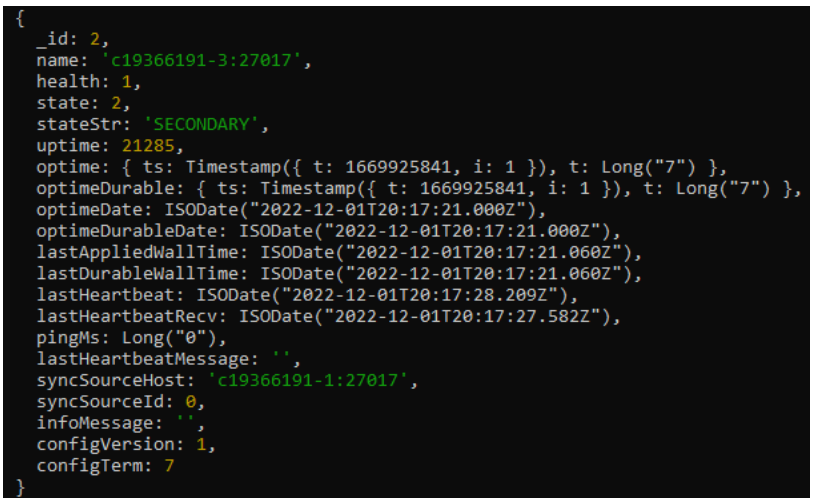
```
members: [
  {
    _id: 0,
    name: 'c19366191-1:27017',
    health: 1,
    state: 1,
    stateStr: 'PRIMARY',
    uptime: 6657,
    optime: { ts: Timestamp({ t: 1669935628, i: 1 }), t: Long("1") },
    optimeDate: ISODate("2022-12-01T23:00:28.000Z"),
    lastAppliedWallTime: ISODate("2022-12-01T23:00:28.958Z"),
    lastDurableWallTime: ISODate("2022-12-01T23:00:28.958Z"),
    syncSourceHost: '',
    syncSourceId: -1,
    infoMessage: '',
    electionTime: Timestamp({ t: 1669929287, i: 1 }),
    electionDate: ISODate("2022-12-01T21:14:47.000Z"),
    configVersion: 1,
    configTerm: 1,
    self: true,
    lastHeartbeatMessage: ''
  },
```

   This shows the different node members in the cluster. This node is called c19366191-1. It is a primary node. This node c19366191-1 is pointing to port number 27017.

```
  {
    _id: 1,
    name: 'c19366191-2:27017',
    health: 1,
    state: 2,
    stateStr: 'SECONDARY',
    uptime: 6361,
    optime: { ts: Timestamp({ t: 1669935628, i: 1 }), t: Long("1") },
    optimeDurable: { ts: Timestamp({ t: 1669935628, i: 1 }), t: Long("1") },
    optimeDate: ISODate("2022-12-01T23:00:28.000Z"),
    optimeDurableDate: ISODate("2022-12-01T23:00:28.000Z"),
    lastAppliedWallTime: ISODate("2022-12-01T23:00:28.958Z"),
    lastDurableWallTime: ISODate("2022-12-01T23:00:28.958Z"),
    lastHeartbeat: ISODate("2022-12-01T23:00:36.730Z"),
    lastHeartbeatRecv: ISODate("2022-12-01T23:00:36.873Z"),
    pingMs: Long("0"),
    lastHeartbeatMessage: '',
    syncSourceHost: 'c19366191-1:27017',
    syncSourceId: 0,
    infoMessage: '',
    configVersion: 1,
    configTerm: 1
  },
```

   In this node with an ID of 1, the name of it is c19366191-2 and this is a secondary node. This secondary node is pointing to the primary node, which is 27017.

Below is the third node with an ID of 2 and is a secondary node called c19366191-3. This third node is also pointing to the primary node, 27107.




**b. Create a replica set**

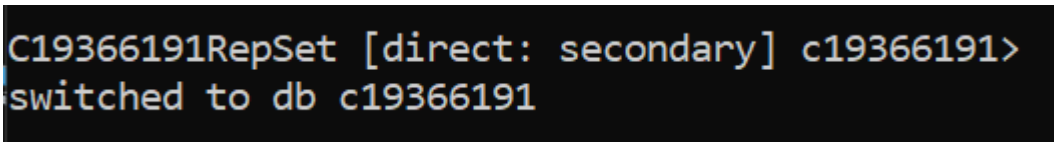
A replica set was created

docker exec -it c19366191-1 mongosh --eval
"rs.initiate({_id: \"C19366191RepSet\", members: [{_id: 0,
host: \"c19366191-1\"},{_id: 1, host: \"c19366191-2\"},{_id: 2,
host: \"c-19366191-3\"}]})"

this creates a replica set called C19366191RepSet

**c. Create a database**

A database called c19366191 was created:




**2. Porting the data to Mongo**

The python file called C19366191.py converts the data from Cassandra to mongodb.
This is a snip of some of the data that was inserted into the c19366191 database.
It finds the factresult tables data and presents it nicely using pretty().

```
c19366191RepSet [direct: primary] c19366191> db.factresults.find().pretty()
[
  {
    _id: ObjectId("63892581e6bb1865ad9c3b85"),
    player_sk: 5,
    p_name: 'McDonald',
    t_name: 'US Master',
    prize: 2600,
    rank: 3,
    year: 2014
  },
  {
    _id: ObjectId("63892587e6bb1865ad9c3b86"),
c19366191RepSet [direct: primary] c19366191>
    p_name: 'Ross',
    t_name: 'Chiinese Open',
    prize: 10400,
    rank: 10,
    year: 2014
  },
  {
    _id: ObjectId("6389258be6bb1865ad9c3b87"),
    player_sk: 1,
    p_name: 'Woods',
    t_name: 'Dubai Open',
    prize: 20800,
    rank: 2,
    year: 2014
  },
  {
    _id: ObjectId("6389258fe6bb1865ad9c3b88"),
    player_sk: 8,
    p_name: 'Bin',
    t_name: 'US Master',
    prize: 15600,
    rank: 1,
    year: 2014
  },
```

3. **Working with the Golf collection in MongoDB:**

   a. **Basic query on golf data involving a text field.**

   This is the query that was run and the output. It shows document information on tournaments with Irish open.

```
c19366191RepSet [direct: primary] c19366191> db.factresults.find({t_name: "Irish Open"})
[
  {
    _id: ObjectId("63892592e6bb1865ad9c3b89"),
    player_sk: 2,
    p_name: 'Smith',
    t_name: 'Irish Open',
    prize: 9000,
    rank: 2,
    year: 2014
  },
  {
    _id: ObjectId("63892595e6bb1865ad9c3b8a"),
    player_sk: 6,
    p_name: 'Baggio',
    t_name: 'Irish Open',
    prize: 6000,
    rank: 3,
    year: 2014
  }
]
```

   This is some of the explain stats output for this query

```
    winningPlan: {
      stage: 'COLLSCAN',
      filter: { t_name: { '$eq': 'Irish Open' } },
      direction: 'forward'
    },
    rejectedPlans: []
  },
  executionStats: {
    executionSuccess: true,
    nReturned: 2,
```

This query had to perform a collection scan and read all the documents because no optimisation has been applied.

This is showing that the mongodb was moving in a forward direction.

There are no rejected plans because there is no optimization applied.

The number of returned documents is 2.

```
      direction: 'forward',
      docsExamined: 7
    }
  },
  command: {
    find: 'factresults',
    filter: { t_name: 'Irish Open' },
    '$db': 'c19366191'
  },
```

Here it just shows that 7 documents were examined and factresults were found. Irish Open was filtered in the name and the database this was done on was c19366191.

**b. Adding a secondary index to golf data on a text field.**

The index that was created was below

```
c19366191RepSet [direct: primary] c19366191> db.factresults.createIndex({p_name:1})
p_name_11RepSet [direct: primary] c19366191> db.factresults.createIndex({p_name:1})
```

This index was created on the player's name.

This is the query that was done after the index was made

```
c19366191RepSet [direct: primary] c19366191> db.factresults.find({p_name: "Ross"})
[
  {
    _id: ObjectId("63892587e6bb1865ad9c3b86"),
    player_sk: 10,
    p_name: 'Ross',
    t_name: 'Chiinese Open',
    prize: 10400,
    rank: 10,
    year: 2014
  }
]
```

The output from explain stats on this query is below

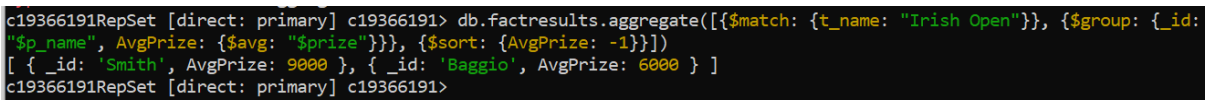




This shows that an index scan was done, and the index is called p_name_1. The direction is forward, and the rejected plans are nothing again. The docs that were examined are just 1 because the index was on player names, the search was done on player names.

4. **Working with aggregation in MongoDB:**
   a. **Create an aggregation pipeline**

The aggregation that was created is below:




This gets the average prize for the Irish open tournaments.


This is the output for the explain. The flow of this aggregate was collection scan, a few projections, and a filter. It returned 2 documents, and the direction is forward.

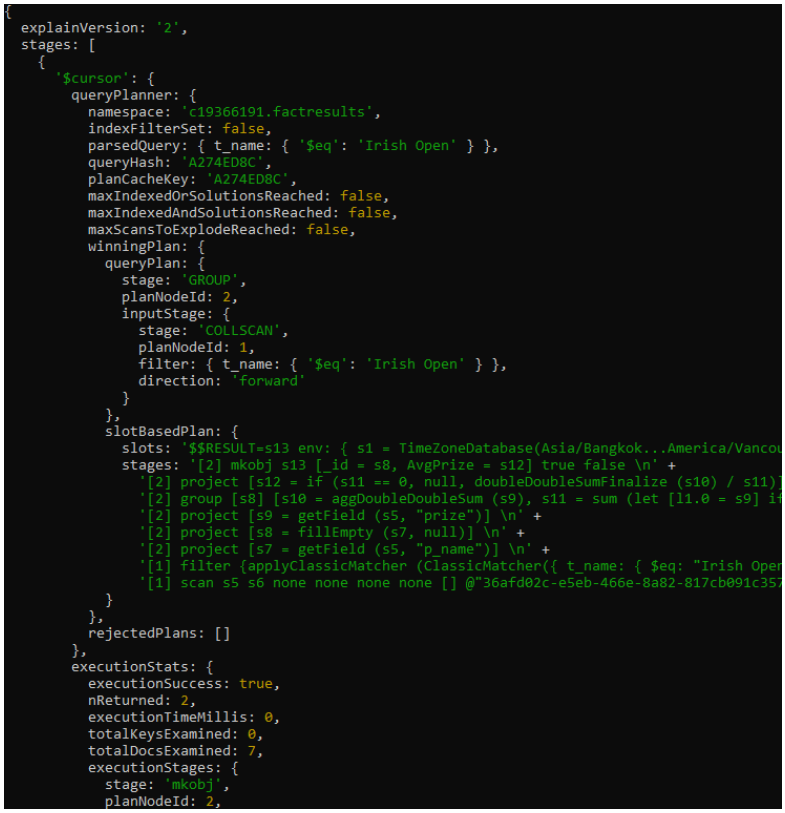
**b. Add relevant indexes and reorder your stages.**

These indexes were created to try and improve the performance.

```
c19366191RepSet [direct: primary] c19366191> db.factresults.createIndex({prize:1})
prize_1
c19366191RepSet [direct: primary] c19366191> db.factresults.getIndexes()
[
  { v: 2, key: { _id: 1 }, name: '_id_' },
  { v: 2, key: { p_name: 1 }, name: 'p_name_1' },
  { v: 2, key: { prize: 1 }, name: 'prize_1' }
]
```

The below screenshot is the output from the aggregate again.

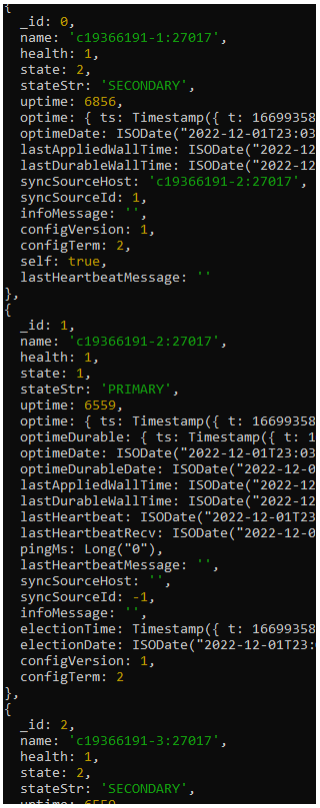
### c. Optimize the stage execution




This performed a collection scan, and the stages are detailed here. It performed a few projections and a filter, and it returned 2 rows. The direction on this one was forward. The number of docs that were examined were 7.

## 5. Replication working

The primary node was stopped. This was the c19366191-1 node.




From this it can see that once node 1 stopped, the second node, c19366191-2 became a primary node. The first node turned to a secondary node.