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Non-Relational Databases

MongoDB --- 2

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6 – MongoDB – Telephone Number Search

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- Let‘s generate telephone numbers!

```
function populatePhonebook(areaCode,quantity) {
  for(var i=0; i < quantity; i++) {

  // set phonenumber length (3 to 9 digits)
  var phoneNumberLength = 3+((Math.random() * 6) << 0);

  // generate Phonenumber and length adjustment
  var phoneNumber = 1+((Math.random() * Math.pow(10,phoneNumberLength)) << 0);
  phoneNumberLength = 1+Math.floor(Math.log(phoneNumber)/Math.log(10));
  if (phoneNumberLength<3) { continue; }


  // Make phonebook entry and save
  var num = areaCode * Math.pow(10,phoneNumberLength) + phoneNumber;

  db.phones.insert({
      _id: num,
      components: {
         areaCode: areaCode,
         phoneNumber : phoneNumber
      },
      display: areaCode + "/" + phoneNumber
    });
  } // End for-Loop
}
```

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- Basic Telephone Number Search
  - Search conditions
    - Search for 9281/455
    - Sort order: ascending area code and telephone number

```
db.phones.find(
    {display:"09281/455"}
)
```

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- General Telephone Number Search
  - Search conditions
    - Telephone number: 455
    - Area code: any
    - Sort order: ascending area code

```
db.phones.find(
   {"components.phoneNumber":455},{display:1,_id:0}
).sort({"components.areaCode":1})
```

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- Search telephone numbers of a limited digit range
  - Search conditions
    - All telephone numbers having exactly 3 digits
    - Sort order: ascending telephone number

```
var number_range = {}
number_range['$gte']=100
number_range['$lt']=1000

db.phones.find(
   {"components.phoneNumber":number_range},{display:1,_id:0}
).sort({"components.phoneNumber":1})
```

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- Search telephone numbers containing a given number sequence
  - Search conditions
    - Known sequence: 070
    - Sort order: ascending telephone number

```
db.phones.find(
   {display:/070/},{display:1,_id:0}
).sort({"components.phoneNumber":1})
```

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- Search telephone numbers ending with a given number sequence
  - Search conditions
    - Phone number last digits: 070
    - Sort order: ascending telephone number

```
db.phones.find(
    {display:/070$/},{display:1,_id:0}
).sort({"components.phoneNumber":1})
```

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- Search telephone numbers containing several given number sequences
  - Search conditions
    - Known digits: 070?5
    - Sort order: descending telephone number

```
db.phones.find(
   {display:/070.5/},{display:1,_id:0}
).sort({"components.phoneNumber":-1})
```

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- Search telephone numbers starting with a given number sequence
  - Search conditions
    - Phone number first digits: 201
    - Sort order: ascending telephone number

```
db.phones.find(
   {display:/\/201/},{display:1,_id:0}
).sort({"components.phoneNumber":1})
```

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- Search telephone numbers starting with a given number sequence and limited digits at first position
  - Search conditions
    - Startsequences: 200, 400 or 600
    - Sort order: ascending telephone number

```
db.phones.find(
   {display:/\/[246]00/},{display:1,_id:0}
).sort({"components.phoneNumber":1})
```

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- Search telephone numbers with know starting and ending digits
  - Search conditions
    - Start sequence: 20
    - End sequence: 13
    - Any number of digits between start sequence and end sequence
    - Sort order: ascending telephone number

```
db.phones.find(
   {display:/\/20(.*)13$/},{display:1,_id:0}
).sort({"components.phoneNumber":1})
```

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- Search Performance

  - Which indexes has a collection?
    - At creation time MongoDB creates automatically an index on objectIds (_id).
    - Get all indexes of a collection

      ```
      db.collection.getIndexes()
      ```

  - How can we accelerate?
    - A B-Tree-Index on field display would perhaps accelerate our search.
    - Use method explain() to get information about search behaviour.

      ```
      db.phones.find({display:"9281/455"})
                        .explain({verbose:"executionStats"})
      ```

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- Search Performance

  - Example output of method explain()

```
db.phones.find({display:/\/455/})
        .explain("executionStats")
{
...
"executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 2,
                "executionTimeMillis" : 42,
                "totalKeysExamined" : 0,
                "totalDocsExamined" : 18480,
...
}
```

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- Search Performance

  - Create an index on field „display“

```
db.phones.createIndex(
    {display:1},
    {unique:true}
)
```

  - Verify the search performance.
  - You should see that the newly created index is used!

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- Profiling Level

  - Profiling Level 1 stores only slow queries.
  - Profiling Level 2 stores all queries.
  - Profiling datastore: db.system.profile

  - Practical work:
    - Set profilingLevel to the value of 2.
    - Execute the query again.
    - Analyze the profiling data.

```
db.setProfilingLevel(2)
db.phones.find({display:/\/455/})
db.system.profile.find()
```

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- Search Performance

  - Create an index on „areaCode“ in the „background“.

```
db.phones.createIndex(
    {"components.areaCode":1},
    {background:1}
)
```

  - Get all indexes.

```
db.phones.getIndexes()
```

Literature

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- Sieben Wochen, sieben Datenbanken
  Moderne Datenbanken und die NoSQL-Bwegung
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