

DBMSL

Assignment B2: MongoDB Aggregation and Indexing

PROBLEM STATEMENT:

Design and Develop MongoDB Queries using aggregation and indexing with suitable example using MongoDB

```
pict@pict-OptiPlex-SFF-Plus-7010:~$ mongosh 10.10.11.156/te31485db -u te31485
Enter password: *****
Current Mongosh Log ID:      653a02a309b636856df52f3d
Connecting to:
mongodb://<credentials>@10.10.11.156:27017/te31485db?directConnection=true&appName=mongosh+2.0.1
Using MongoDB:      7.0.2
Using Mongosh:      2.0.1
mongosh 2.0.2 is available for download: https://www.mongodb.com/try/download/shell
```

For mongosh info see: <https://docs.mongodb.com/mongodb-shell/>

The server generated these startup warnings when booting

2023-10-26T08:59:52.884+05:30: Using the XFS filesystem is strongly recommended with the WiredTiger storage engine. See <http://dochub.mongodb.org/core/prodnotes-filesystem>

2023-10-26T08:59:55.653+05:30: Access control is not enabled for the database. Read and write access to data and configuration is unrestricted

2023-10-26T08:59:55.654+05:30: vm.max_map_count is too low

```
te31485db> show collections
```

```
sample
teachers
```

```
te31485db> db.teachers.createIndex({ name: 1 }, { unique: true })
name_1
te31485db>
```

```
te31485db> db.teachers.find({
...  deptname: "Computer Science",
...  "experience.teaching": { $gt: 5 },
... })
[
  {
    _id: ObjectId("6539fddc2068c08d2f8080d7"),
    name: 'John Smith',
    qualifications: 'Ph.D. in Computer Science',
```

```

    deptno: 101,
    deptname: 'Computer Science',
    designation: 'Associate Professor',
    experience: { industry: 5, teaching: 8 },
    salary: { basic: 75000, TA: 5000, DA: 3000, HRA: 7000 },
    date_of_joining: ISODate("2020-01-15T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Machine Learning, Data Science'
  }
]
te31485db> .hint({ deptname: 1, "experience.teaching": 1 })
Invalid REPL keyword
te31485db> .explain("executionStats")
Invalid REPL keyword
te31485db> db.teachers.find({
...   deptname: "Computer Science",
...   "experience.teaching": { $gt: 5 },
... }).hint({ deptname: 1, "experience.teaching": 1 }).explain("executionStats")

te31485db> db.teachers.createIndex({ deptname: 1, "experience.teaching": 1 });
deptname_1_experience.teaching_1
te31485db>

te31485db>

te31485db> db.teachers.find({ deptname: "Computer Science", "experience.teaching": { $gt: 5 } }).hint({
deptname: 1, "experience.teaching": 1 }).explain("executionStats")
{
  explainVersion: '2',
  queryPlanner: {
    namespace: 'te31485db.teachers',
    indexFilterSet: false,
    parsedQuery: {
      '$and': [
        { deptname: { '$eq': 'Computer Science' } },
        { 'experience.teaching': { '$gt': 5 } }
      ]
    },
  },
  queryHash: '9931165E',
  planCacheKey: '006CA2BD',
  maxIndexedOrSolutionsReached: false,
  maxIndexedAndSolutionsReached: false,
  maxScansToExplodeReached: false,
  winningPlan: {
    queryPlan: {
      stage: 'FETCH',
      planNodeId: 2,
      inputStage: {
        stage: 'IXSCAN',
        planNodeId: 1,
        keyPattern: { deptname: 1, 'experience.teaching': 1 },
        indexName: 'deptname_1_experience.teaching_1',
        isMultiKey: false,
        multiKeyPaths: { deptname: [], 'experience.teaching': [] },
        isUnique: false,
        isSparse: false,
        isPartial: false,
        indexVersion: 2,
        direction: 'forward',

```

```

    indexBounds: {
      deptname: [ ["Computer Science", "Computer Science"] ],
      'experience.teaching': [ '(5, inf.0)' ]
    }
  },
  slotBasedPlan: {
    slots: '$$RESULT=s11 env: { s3 = 1698300779206 (NOW), s1 =
    TimeZoneDatabase(GMT...Indian/Kerguelen) (timeZoneDB), s2 = Nothing (SEARCH_META), s10 =
    {"deptname" : 1, "experience.teaching" : 1}, s5 =
    KS(3C436F6D707574657220536369656E6365002B0AFE04), s6 =
    KS(3C436F6D707574657220536369656E63650033FFFFFFFFFFFFFFFFFE04) }',
    stages: '[2] nlj inner [] [s4, s7, s8, s9, s10] \n' +
      ' left \n' +
      '   [1] cfilter {(exists(s5) && exists(s6))} \n' +
      '   [1] ixseek s5 s6 s9 s4 s7 s8 [] @"4b90a87e-a978-4335-9e68-a3eb7e3b4cc3"
    @"deptname_1_experience.teaching_1" true \n' +
      ' right \n' +
      '   [2] limit 1 \n' +
      '   [2] seek s4 s11 s12 s7 s8 s9 s10 [] @"4b90a87e-a978-4335-9e68-a3eb7e3b4cc3" true false \n'
  },
  rejectedPlans: []
},
executionStats: {
  executionSuccess: true,
  nReturned: 1,
  executionTimeMillis: 3,
  totalKeysExamined: 1,
  totalDocsExamined: 1,
  executionStages: {
    stage: 'nlj',
    planNodeId: 2,
    nReturned: 1,
    executionTimeMillisEstimate: 0,
    opens: 1,
    closes: 1,
    saveState: 0,
    restoreState: 0,
    isEOF: 1,
    totalDocsExamined: 1,
    totalKeysExamined: 1,
    collectionScans: 0,
    collectionSeeks: 1,
    indexScans: 0,
    indexSeeks: 1,
    indexesUsed: [ 'deptname_1_experience.teaching_1' ],
    innerOpens: 1,
    innerCloses: 1,
    outerProjects: [],
    outerCorrelated: [ Long("4"), Long("7"), Long("8"), Long("9"), Long("10") ],
    outerStage: {
      stage: 'cfilter',
      planNodeId: 1,
      nReturned: 1,
      executionTimeMillisEstimate: 0,
      opens: 1,
      closes: 1,
      saveState: 0,
      restoreState: 0,
    }
  }
}

```

```

isEOF: 1,
numTested: 1,
filter: '(exists(s5) && exists(s6))',
inputStage: {
  stage: 'ixseek',
  planNodeId: 1,
  nReturned: 1,
  executionTimeMillisEstimate: 0,
  opens: 1,
  closes: 1,
  saveState: 0,
  restoreState: 0,
  isEOF: 1,
  indexName: 'deptname_1_experience.teaching_1',
  keysExamined: 1,
  seeks: 1,
  numReads: 2,
  indexKeySlot: 9,
  recordIdSlot: 4,
  snapshotIdSlot: 7,
  indexIdSlot: 8,
  outputSlots: [],
  indexKeysToInclude: '00000000000000000000000000000000',
  seekKeyLow: 's5',
  seekKeyHigh: 's6'
},
},
innerStage: {
  stage: 'limit',
  planNodeId: 2,
  nReturned: 1,
  executionTimeMillisEstimate: 0,
  opens: 1,
  closes: 1,
  saveState: 0,
  restoreState: 0,
  isEOF: 1,
  limit: 1,
  inputStage: {
    stage: 'seek',
    planNodeId: 2,
    nReturned: 1,
    executionTimeMillisEstimate: 0,
    opens: 1,
    closes: 1,
    saveState: 0,
    restoreState: 0,
    isEOF: 0,
    numReads: 1,
    recordSlot: 11,
    recordIdSlot: 12,
    seekKeySlot: 4,
    snapshotIdSlot: 7,
    indexIdSlot: 8,
    indexKeySlot: 9,
    indexKeyPatternSlot: 10,
    fields: [],
    outputSlots: []
  }
}
}

```

```

    }
  },
  command: {
    find: 'teachers',
    filter: {
      deptname: 'Computer Science',
      'experience.teaching': { '$gt': 5 }
    },
    hint: { deptname: 1, 'experience.teaching': 1 },
    '$db': 'te31485db'
  },
  serverInfo: {
    host: 'student-OptiPlex-3020',
    port: 27017,
    version: '7.0.2',
    gitVersion: '02b3c655e1302209ef046da6ba3ef6749dd0b62a'
  },
  serverParameters: {
    internalQueryFacetBufferSizeBytes: 104857600,
    internalQueryFacetMaxOutputDocSizeBytes: 104857600,
    internalLookupStageIntermediateDocumentMaxSizeBytes: 104857600,
    internalDocumentSourceGroupMaxMemoryBytes: 104857600,
    internalQueryMaxBlockingSortMemoryUsageBytes: 104857600,
    internalQueryProhibitBlockingMergeOnMongoS: 0,
    internalQueryMaxAddToSetBytes: 104857600,
    internalDocumentSourceSetWindowFieldsMaxMemoryBytes: 104857600,
    internalQueryFrameworkControl: 'trySbeEngine'
  },
  ok: 1
}
te31485db>

te31485db> db.teachers.aggregate([
... {
...   $match: { "salary.basic": { $gt: 80000 } },
... },
... {
...   $project: { name: 1, qualifications: 1, _id: 0 },
... },
... ])
[
  { name: 'Sarah Johnson', qualifications: 'M.Sc. in Chemistry' },
  {
    name: 'Michael Clark',
    qualifications: 'M.Tech in Mechanical Engineering'
  },
  { name: 'Olivia Smith', qualifications: 'M.Sc. in Physics' },
  { name: 'Ava Wilson', qualifications: 'M.Sc. in Psychology' },
  {
    name: 'James Taylor',
    qualifications: 'M.Tech in Chemical Engineering'
  }
]
te31485db>

te31485db>

te31485db> db.teachers.aggregate([
... {
...   $group: {

```

```

...   _id: "$deptname",
...   avgTeachingExperience: { $avg: "$experience.teaching" },
... },
... },
... {
...   $project: {
...     department: "$_id",
...     avgTeachingExperience: 1,
...     _id: 0,
...   },
... },
... ])
[
  { avgTeachingExperience: 8, department: 'Biology' },
  { avgTeachingExperience: 5, department: 'History' },
  { avgTeachingExperience: 14, department: 'Physics' },
  { avgTeachingExperience: 12, department: 'Chemistry' },
  { avgTeachingExperience: 10, department: 'Mechanical Engineering' },
  { avgTeachingExperience: 4, department: 'English' },
  { avgTeachingExperience: 8, department: 'Computer Science' },
  { avgTeachingExperience: 4, department: 'Civil Engineering' },
  { avgTeachingExperience: 11, department: 'Psychology' },
  { avgTeachingExperience: 10, department: 'Chemical Engineering' },
  { avgTeachingExperience: 5, department: 'Electrical Engineering' }
]

```

te31485db>

te31485db>

```

te31485db> db.teachers.aggregate([
... {
...   $sort: { "salary.basic": -1 },
... },
... {
...   $limit: 3,
... },
... ])
[
  {
    _id: ObjectId("6539fe062068c08d2f8080dc"),
    name: 'Olivia Smith',
    qualifications: 'M.Sc. in Physics',
    deptno: 108,
    deptname: 'Physics',
    designation: 'Professor',
    experience: { industry: 12, teaching: 14 },
    salary: { basic: 95000, TA: 6000, DA: 3700, HRA: 8500 },
    date_of_joining: ISODate("2013-02-12T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Quantum Mechanics, Astrophysics'
  },
  {
    _id: ObjectId("6539fe062068c08d2f8080e0"),
    name: 'Ava Wilson',
    qualifications: 'M.Sc. in Psychology',
    deptno: 112,
    deptname: 'Psychology',
    designation: 'Professor',
    experience: { industry: 10, teaching: 11 },
    salary: { basic: 92000, TA: 5900, DA: 3600, HRA: 7800 },
  }
]

```

```

    date_of_joining: ISODate("2012-12-01T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Cognitive Psychology, Abnormal Psychology'
  },
  {
    _id: ObjectId("6539fe062068c08d2f8080d8"),
    name: 'Sarah Johnson',
    qualifications: 'M.Sc. in Chemistry',
    deptno: 104,
    deptname: 'Chemistry',
    designation: 'Professor',
    experience: { industry: 15, teaching: 12 },
    salary: { basic: 90000, TA: 6000, DA: 3500, HRA: 8000 },
    date_of_joining: ISODate("2010-06-15T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Organic Chemistry'
  }
]
te31485db>

```

te31485db>

```

te31485db> db.teachers.aggregate([
... {
...   $match: { "experience.teaching": { $gte: 10 } },
... },
... ])
[
  {
    _id: ObjectId("6539fe062068c08d2f8080d8"),
    name: 'Sarah Johnson',
    qualifications: 'M.Sc. in Chemistry',
    deptno: 104,
    deptname: 'Chemistry',
    designation: 'Professor',
    experience: { industry: 15, teaching: 12 },
    salary: { basic: 90000, TA: 6000, DA: 3500, HRA: 8000 },
    date_of_joining: ISODate("2010-06-15T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Organic Chemistry'
  },
  {
    _id: ObjectId("6539fe062068c08d2f8080d9"),
    name: 'Michael Clark',
    qualifications: 'M.Tech in Mechanical Engineering',
    deptno: 105,
    deptname: 'Mechanical Engineering',
    designation: 'Professor',
    experience: { industry: 8, teaching: 10 },
    salary: { basic: 85000, TA: 5500, DA: 3000, HRA: 7500 },
    date_of_joining: ISODate("2015-04-20T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Thermodynamics, Fluid Mechanics'
  },
  {
    _id: ObjectId("6539fe062068c08d2f8080dc"),
    name: 'Olivia Smith',
    qualifications: 'M.Sc. in Physics',
    deptno: 108,
    deptname: 'Physics',

```

```

    designation: 'Professor',
    experience: { industry: 12, teaching: 14 },
    salary: { basic: 95000, TA: 6000, DA: 3700, HRA: 8500 },
    date_of_joining: ISODate("2013-02-12T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Quantum Mechanics, Astrophysics'
  },
  {
    _id: ObjectId("6539fe062068c08d2f8080e0"),
    name: 'Ava Wilson',
    qualifications: 'M.Sc. in Psychology',
    deptno: 112,
    deptname: 'Psychology',
    designation: 'Professor',
    experience: { industry: 10, teaching: 11 },
    salary: { basic: 92000, TA: 5900, DA: 3600, HRA: 7800 },
    date_of_joining: ISODate("2012-12-01T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Cognitive Psychology, Abnormal Psychology'
  },
  {
    _id: ObjectId("6539fe062068c08d2f8080e1"),
    name: 'James Taylor',
    qualifications: 'M.Tech in Chemical Engineering',
    deptno: 113,
    deptname: 'Chemical Engineering',
    designation: 'Professor',
    experience: { industry: 10, teaching: 10 },
    salary: { basic: 82000, TA: 5400, DA: 3100, HRA: 6800 },
    date_of_joining: ISODate("2017-04-18T00:00:00.000Z"),
    appointment_nature: 'Permanent',
    area_of_expertise: 'Chemical Process Design'
  }
]
te31485db>

te31485db>

te31485db> db.teachers.countDocuments({})
11
te31485db>

te31485db>

te31485db> db.teachers.distinct("deptname")
[
  'Biology',
  'Chemical Engineering',
  'Chemistry',
  'Civil Engineering',
  'Computer Science',
  'Electrical Engineering',
  'English',
  'History',
  'Mechanical Engineering',
  'Physics',
  'Psychology'
]
te31485db>

```


te31485db>

```
te31485db> db.teachers.aggregate([
... {
...   $match: { deptname: "Computer Science" },
... },
... {
...   $group: {
...     _id: null,
...     totalSalary: { $sum: { $sum: ["$salary.basic", "$salary.TA", "$salary.DA", "$salary.HRA"] } },
...   },
... },
... ])
[ { _id: null, totalSalary: 90000 } ]
te31485db>
```

te31485db>

te31485db>

31485 Ashwin Taras