PROJECT

1. Complex Filters & Projections

Q1. List the names and departments of students who have more than 85% attendance and are skilled in both "MongoDB" and "Python".

Solution:-

```
db.students.find(
//Name- Sneha Singh, University Roll No- 1240258448
 {
   attendance: { $gt: 85 },
   skills: { $all: ["MongoDB", "Python"] }
 },
 {
   _id: 0,
   name: 1,
   department: 1
 }
);
```

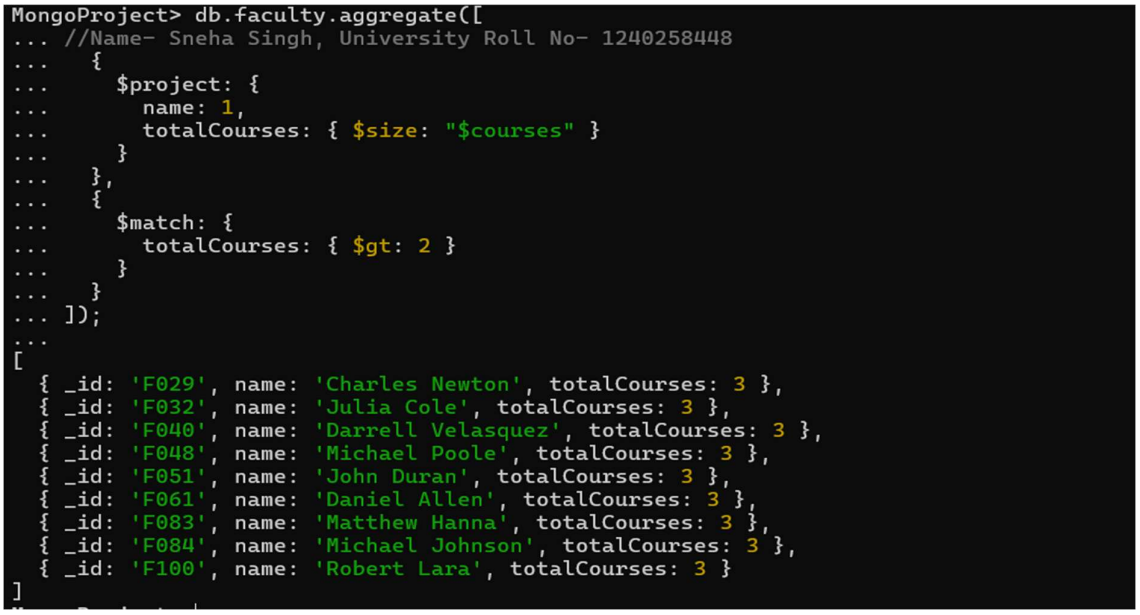
Output:-

Q2. Show all faculty who are teaching more than 2 courses. Display their names and the total number of courses they teach.

Solution:-

```
db.faculty.aggregate([
//Name- Sneha Singh, University Roll No- 1240258448
  {
    $project: {
      name: 1,
      totalCourses: { $size: "$courses" }
    }
  },
  {
    $match: {
      totalCourses: { $gt: 2 }
    }
  }
]);
```

Output:-



```
MongoProject> db.faculty.aggregate([
... //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     $project: {
...       name: 1,
...       totalCourses: { $size: "$courses" }
...     }
...   },
...   {
...     $match: {
...       totalCourses: { $gt: 2 }
...     }
...   }
... ]);
...
[
  { _id: 'F029', name: 'Charles Newton', totalCourses: 3 },
  { _id: 'F032', name: 'Julia Cole', totalCourses: 3 },
  { _id: 'F040', name: 'Darrell Velasquez', totalCourses: 3 },
  { _id: 'F048', name: 'Michael Poole', totalCourses: 3 },
  { _id: 'F051', name: 'John Duran', totalCourses: 3 },
  { _id: 'F061', name: 'Daniel Allen', totalCourses: 3 },
  { _id: 'F083', name: 'Matthew Hanna', totalCourses: 3 },
  { _id: 'F084', name: 'Michael Johnson', totalCourses: 3 },
  { _id: 'F100', name: 'Robert Lara', totalCourses: 3 }
]
```

2. Joins ($lookup) and Aggregations

Q3. Write a query to show each student's name along with the course titles they are enrolled in (use $lookup between enrollments, students, and courses).

Solution:

```
db.enrollments.aggregate([
//Name- Sneha Singh, University Roll No- 1240258448
{
   $lookup: {
     from: "students",
     localField: "student_id",
     foreignField: "_id",
     as: "student_info"
   }  },
 { $unwind: "$student_info" },
 {
   $lookup: {
     from: "courses",
     localField: "course_id",
     foreignField: "_id",
     as: "course_info"
   }  },
 { $unwind: "$course_info" },
 {
   $project: {
     _id: 0,
     student_name: "$student_info.name",
     course_title: "$course_info.title"
   } } ]  );
```

```
MongoProject> db.enrollments.aggregate([
...     //Name- Sneha Singh, University Roll No- 1240258448
... {
...     $lookup: {
...       from: "students",
...       localField: "student_id",
...       foreignField: "_id",
...       as: "student_info"
...     }   },
...   { $unwind: "$student_info" },
...   {
...     $lookup: {
...       from: "courses",
...       localField: "course_id",
...       foreignField: "_id",
...       as: "course_info"
...     }   },
...   { $unwind: "$course_info" },
...   {
...     $project: {
...       _id: 0,
...       student_name: "$student_info.name",
...       course_title: "$course_info.title"
...     }  }  ]  );
...
[
  {
    student_name: 'Alexandra Bailey',
    course_title: 'Reactive neutral adapter'
  },
  {
    student_name: 'Megan Taylor',
    course_title: 'Sharable bifurcated paradigm'
  },
  {
    student_name: 'Alejandro Hart',
    course_title: 'Focused user-facing paradigm'
  },
  {
    student_name: 'Timothy Sparks',
    course_title: 'Focused user-facing paradigm'
  },
  {
    student_name: 'Juan Morris',
    course_title: 'Balanced asynchronous framework'
  },
  {
    student_name: 'Donna Morgan',
    course_title: 'Organic optimal product'
  },
  {
    student_name: 'Patricia Scott',
    course_title: 'Fully-configurable responsive solution'
```

Q4. For each course, display the course title, number of students enrolled, and average marks (use $group).

Solution:

```
db.enrollments.aggregate(  [
//Name- Sneha Singh, University Roll No- 1240258448
  {
    $group: {
      _id: "$course_id",
      totalStudents: { $sum: 1 },
      averageMarks: { $avg: "$marks" }
    }
  },
  {
    $lookup: {
      from: "courses",
      localField: "_id",
      foreignField: "_id",
      as: "courseInfo"
    }
  },
  {
    $project: {
      _id: 0,
      courseTitle: { $arrayElemAt: ["$courseInfo.title", 0] },
      totalStudents: 1,
      averageMarks: 1
    }
  }
]);
```

```
MongoProject> db.enrollments.aggregate(  [
...     //Name- Sneha Singh, University Roll No- 1240258448
...     {
...       $group: {
...         _id: "$course_id",
...         totalStudents: { $sum: 1 },
...         averageMarks: { $avg: "$marks" }
...       }
...     },
...     {
...       $lookup: {
...         from: "courses",
...         localField: "_id",
...         foreignField: "_id",
...         as: "courseInfo"
...       }
...     },
...     {
...       $project: {
...         _id: 0,
...         courseTitle: { $arrayElemAt: ["$courseInfo.title", 0] },
...         totalStudents: 1,
...         averageMarks: 1
...       }
...     }
...   ]);
...
[
  {
    totalStudents: 2,
    averageMarks: 94.5,
    courseTitle: 'Total tangible moderator'
  },
  {
    totalStudents: 1,
    averageMarks: 67,
    courseTitle: 'Focused multi-state encoding'
  },
  {
    totalStudents: 3,
    averageMarks: 92.33333333333333,
    courseTitle: 'Persevering asynchronous hub'
  },
  {
    totalStudents: 1,
    averageMarks: 67,
    courseTitle: 'Configurable global framework'
  },
  {
    totalStudents: 1,
    averageMarks: 92,
    courseTitle: 'Innovative mobile process improvement'
  },
```

3. Grouping, Sorting, and Limiting

Q.5 Find the top 3 students with the highest average marks across all enrolled courses

Solution:

```
db.enrollments.aggregate([
        //Name- Sneha Singh, University Roll No- 1240258448
 {
  $group: {
   _id: "$student_id",
   averageMarks: { $avg: "$marks" }
  } },
 {
  $lookup: {
   from: "students",
   localField: "_id",
   foreignField: "_id",
   as: "student_info"
  }  },
 {  $unwind: "$student_info"    },
 {
  $project: {
   _id: 0,
   student_id: "$_id",
   name: "$student_info.name",
   department: "$student_info.department",
   averageMarks: { $round: ["$averageMarks", 2] }
  }   },
```

```
    {   $sort: { averageMarks: -1 }   },
    { $limit: 3  }
  ] );
```

Output:-

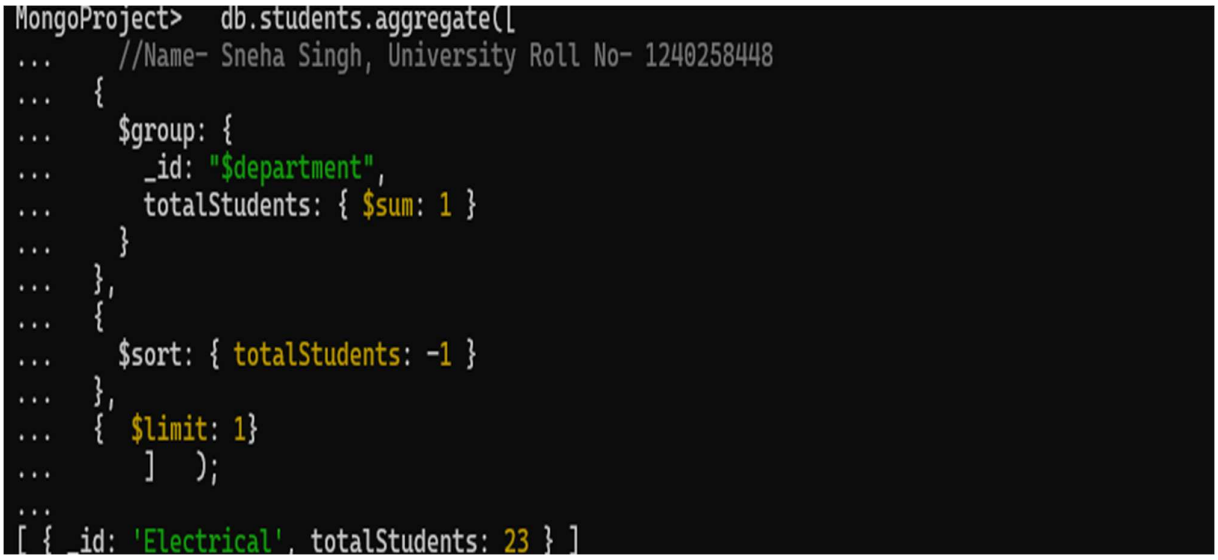
```
MongoProject> db.enrollments.aggregate([
...             //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     $group: {
...       _id: "$student_id",
...       averageMarks: { $avg: "$marks" }
...     }  },
...   {
...     $lookup: {
...       from: "students",
...       localField: "_id",
...       foreignField: "_id",
...       as: "student_info"
...     }   },
...   {  $unwind: "$student_info"    },
...   {
...     $project: {
...       _id: 0,
...       student_id: "$_id",
...       name: "$student_info.name",
...       department: "$student_info.department",
...       averageMarks: { $round: ["$averageMarks", 2] }
...     }    },
...   {   $sort: { averageMarks: -1 }   },
...   { $limit: 3  }
... ] );
...
\[
  {
    student_id: 'S080',
    name: 'Diane Phillips',
    department: 'Civil',
    averageMarks: 100
  },
  {
    student_id: 'S046',
    name: 'Brandon Rios',
    department: 'Biotechnology',
    averageMarks: 98
  },
  {
    student_id: 'S041',
    name: 'Christopher Benson',
    department: 'Electrical',
    averageMarks: 94
  }
]
```

Q6. Count how many students are in each department. Display the department with the highest number of students.

Solution:

```
db.students.aggregate([
      //Name- Sneha Singh, University Roll No- 1240258448
{
  $group: {
    _id: "$department",
    totalStudents: { $sum: 1 }
  }
},
{
  $sort: { totalStudents: -1 }
},
{  $limit: 1}
   ]   );
```

Output:-



4. Update, Upsert, and Delete

Q7. Update attendance to 100% for all students who won any "Hackathon"

Solution:

```
db.students.updateMany(
        //Name- Sneha Singh, University Roll No- 1240258448
  {
    _id: {
      $in: db.activities.distinct("student_id", { type: "Hackathon", position: "Winner" })
    }
  },
  { $set: { attendance: 100 } }
);
```

Output:-

```
MongoProject> db.students.updateMany(
...             //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     _id: {
...       $in: db.activities.distinct("student_id", { type: "Hackathon", position: "Winner" })
...     }
...   },
...   { $set: { attendance: 100 } }
... );
...
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 9,
  modifiedCount: 9,
  upsertedCount: 0
}
```

Q8. Delete all student activity records where the activity year is before 2022

Solution:

```
db.activities.deleteMany(
//Name- Sneha Singh, University Roll No- 1240258448
  { year: { $lt: 2022 } }
);
```

Output:-

```
MongoProject>   db.activities.deleteMany(
...     //Name- Sneha Singh, University Roll No- 1240258448
...   { year: { $lt: 2022 } }
... );
...
{ acknowledged: true, deletedCount: 0 }
```

Q9. Upsert a course record for "Data Structures" with ID "C150" and credits 4—if it doesn't exist, insert it; otherwise update its title to "Advanced Data Structures".

Solution:

```
db.courses.updateOne(
        //Name- Sneha Singh, University Roll No- 1240258448

  { _id: "C150" },
  { $set: { title: "Advanced Data Structures", credits: 4 } },
  { upsert: true }
);
```

Output:-

```
MongoProject> db.courses.updateOne(
...             //Name- Sneha Singh, University Roll No- 1240258448
...
...   { _id: "C150" },
...   { $set: { title: "Advanced Data Structures", credits: 4 } },
...   { upsert: true }
... );
...
{
  acknowledged: true,
  insertedId: 'C150',
  matchedCount: 0,
  modifiedCount: 0,
  upsertedCount: 1
}
```

5.Array & Operator Usage

Q10. Find all students who have "Python" as a skill but not "C++"

Solution:

```
db.students.find(
//Name- Sneha Singh, University Roll No- 1240258448
  {
    skills: { $all: ["Python"], $ne: "C++" }
  }
);
```

Output:-

```
MongoProject> db.students.find(
... //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     skills: { $all: ["Python"], $ne: "C++" }
...   }
... );
...
...
[
  {
    _id: 'S004',
    name: 'Kyle Hale',
    dob: '2000-10-20',
    department: 'Electrical',
    skills: [ 'Python', 'Java' ],
    attendance: 79.78
  },
  {
    _id: 'S008',
    name: 'Cody Whitehead',
    dob: '2003-11-25',
    department: 'Biotechnology',
    skills: [ 'JavaScript', 'Python' ],
    attendance: 100
  },
  {
    _id: 'S009',
    name: 'Thomas Jackson',
    dob: '2002-10-25',
    department: 'Electrical',
    skills: [ 'Python', 'AutoCAD' ],
    attendance: 96.64
  },
  {
    _id: 'S012',
    name: 'Steven Wong',
    dob: '2003-09-06',
    department: 'Biotechnology',
    skills: [ 'MongoDB', 'Python' ],
    attendance: 100
  },
  {
    _id: 'S015',
```

Q11. Return names of students who participated in "Seminar" and "Hackathon" both.

Solution:

```
        db.activities.aggregate([
        //Name- Sneha Singh, University Roll No- 1240258448
 {
   $group: {
     _id: "$student_id",
     activities: { $addToSet: "$type" }
   } },
 {
   $match: {
     activities: { $all: ["Seminar", "Hackathon"] }
   } },
 {
   $lookup: {
     from: "students",
     localField: "_id",
     foreignField: "_id",
     as: "student_details"
   }
 },
 {
   $project: {
     _id: 0,
     name: { $arrayElemAt: ["$student_details.name", 0] }
   }  } ]);
```

Output:-

```
MongoProject> db.activities.aggregate([
...     //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     $group: {
...       _id: "$student_id",
...       activities: { $addToSet: "$type" }
...     } },
...   {
...     $match: {
...       activities: { $all: ["Seminar", "Hackathon"] }
...     } },
...   {
...     $lookup: {
...       from: "students",
...       localField: "_id",
...       foreignField: "_id",
...       as: "student_details"
...     }
...   },
...   {
...     $project: {
...       _id: 0,
...       name: { $arrayElemAt: ["$student_details.name", 0] }
...     }  } ]);
...
[
  { name: 'Adam Solomon' },
  { name: 'Lydia Day' },
  { name: 'Carlos Bryant' },
  { name: 'Taylor Webb' },
  { name: 'Patricia Scott' }
]
```

6.Subdocuments and Nested Conditions

Q12. Find students who scored more than 80 in "Web Development" only if they belong to the "Computer Science" department.

Solution:

```
db.enrollments.aggregate([
//Name- Sneha Singh, University Roll No- 1240258448

 {
  $lookup: {
   from: "students",
   localField: "student_id",
   foreignField: "_id",
   as: "student_info"
  }
 },
 { $unwind: "$student_info" },
 {
  $lookup: {
   from: "courses",
   localField: "course_id",
   foreignField: "_id",
   as: "course_info"
  }
 },
 { $unwind: "$course_info" },
 {
  $match: {
   "course_info.title": "Web development",
   "student_info.department": "Computer Science",
   marks: { $gt: 80 }
```

```
    }
  },
  {
    $project: {
      _id: 0,
      student_name: "$student_info.name",
      department: "$student_info.department",
      course: "$course_info.title",
      marks: 1
    }
  }
]);
```

Output:-

```
MongoProject> db.enrollments.aggregate([
... //Name- Sneha Singh, University Roll No- 1240258448
...
...   {
...     $lookup: {
...       from: "students",
...       localField: "student_id",
...       foreignField: "_id",
...       as: "student_info"
...     }
...   },
...   { $unwind: "$student_info" },
...   {
...     $lookup: {
...       from: "courses",
...       localField: "course_id",
...       foreignField: "_id",
...       as: "course_info"
...     }
...   },
...   { $unwind: "$course_info" },
...   {
...     $match: {
...       "course_info.title": "Web development",
...       "student_info.department": "Computer Science",
...       marks: { $gt: 80 }
...     }
...   },
...   {
...     $project: {
...       _id: 0,
...       student_name: "$student_info.name",
...       department: "$student_info.department",
...       course: "$course_info.title",
...       marks: 1
...     }
...   }
... ]);
...
```

7.Advanced Aggregation (Challenge Level)

Q13. For each faculty member, list the names of all students enrolled in their courses along with average marks per student per faculty.

Solution:

```
db.faculty.aggregate([
//Name- Sneha Singh, University Roll No- 1240258448
{
  $lookup: {
    from: "courses",
    localField: "_id",
    foreignField: "faculty_id",
    as: "course_info"
  } },
{ $unwind: "$course_info" },
{
  $lookup: {
    from: "enrollments",
    localField: "course_info._id",
    foreignField: "course_id",
    as: "enroll_info"
  } },
{ $unwind: "$enroll_info" },
{
  $lookup: {
    from: "students",
    localField: "enroll_info.student_id",
    foreignField: "_id",
```

```
    as: "student_info"
  } },
{ $unwind: "$student_info" },
{
  $group: {
    _id: {
      faculty_id: "$_id",
      faculty_name: "$name",
      student_name: "$student_info.name"
    },
    avg_marks: { $avg: "$enroll_info.marks" }
  } },
{
  $group: {
    _id: {
      faculty_id: "$_id.faculty_id",
      faculty_name: "$_id.faculty_name"
    },
    students: {
      $push: {
        student_name: "$_id.student_name",
        average_marks: { $round: ["$avg_marks", 2] }
      }  }  } },
{ $project: {
    _id: 0,
    faculty_name: "$_id.faculty_name",
```

students: 1 }

}]);

Output:-

```
MongoProject> db.faculty.aggregate([
...     //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     $lookup: {
...       from: "courses",
...       localField: "_id",
...       foreignField: "faculty_id",
...       as: "course_info"
...     } },
...   { $unwind: "$course_info" },
...   {
...     $lookup: {
...       from: "enrollments",
...       localField: "course_info._id",
...       foreignField: "course_id",
...       as: "enroll_info"
...     } },
...   { $unwind: "$enroll_info" },
...   {
...     $lookup: {
...       from: "students",
...       localField: "enroll_info.student_id",
...       foreignField: "_id",
...       as: "student_info"
...     } },
...   { $unwind: "$student_info" },
...   {
...     $group: {
...       _id: {
...         faculty_id: "$_id",
...         faculty_name: "$name",
...         student_name: "$student_info.name"
...       },
...       avg_marks: { $avg: "$enroll_info.marks" }
...     } },
...   {
...     $group: {
...       _id: {
...         faculty_id: "$_id.faculty_id",
...         faculty_name: "$_id.faculty_name"
...       },
...       students: {
...         $push: {
...           student_name: "$_id.student_name",
...           average_marks: { $round: ["$avg_marks", 2] }
...         }   }   } },
...   { $project: {
```

```
..    { $project: {
..       _id: 0,
..       faculty_name: "$_id.faculty_name",
..       students: 1   }
..     } ] );
...
[
  {
    students: [
      { student_name: 'Ronald Trevino', average_marks: 93 },
      { student_name: 'Tracey Young', average_marks: 67 }
    ],
    faculty_name: 'Maxwell Harrison'
  },
  {
    students: [
      { student_name: 'Ariana Ward', average_marks: 91 },
      { student_name: 'Joseph Brown', average_marks: 52 }
    ],
    faculty_name: 'Michele Hines'
  },
  {
    students: [
      { student_name: 'Vincent Norris', average_marks: 86 },
      { student_name: 'David Taylor', average_marks: 65 }
    ],
    faculty_name: 'Sandra Decker'
  },
  {
    students: [
      { student_name: 'Thomas Jackson', average_marks: 82 },
      { student_name: 'Benjamin White', average_marks: 91 },
      { student_name: 'Donna Spencer', average_marks: 81 }
    ],
    faculty_name: 'Jacqueline Miller'
  },
  {
    students: [
      { student_name: 'Christopher Benson', average_marks: 94 },
      { student_name: 'Marie Wilson', average_marks: 61 },
      { student_name: 'Travis Johnson', average_marks: 73 },
      { student_name: 'Thomas Jackson', average_marks: 85 }
    ],
    faculty_name: 'Kelly Huang'
  },
  {
    students: [ { student_name: 'Jessica Galvan', average_marks: 64 } ],
    faculty_name: 'Kathryn Young'
```

Q14. Show the most popular activity type (e.g., Hackathon, Seminar, etc.) by number of student participants.

Solution:

```
db.activities.aggregate([
        //Name- Sneha Singh, University Roll No- 1240258448
 {
  $group: {
   _id: "$type",
   totalParticipants: { $addToSet: "$student_id" }
  } },
 {
  $project: {
   _id: 1,
   participantCount: { $size: "$totalParticipants" }
  } },
 {
  $sort: { participantCount: -1 }
 },
 {
  $limit: 1
 } ] );
```

Output:-

```
MongoProject> db.activities.aggregate([
... //Name- Sneha Singh, University Roll No- 1240258448
...   {
...     $group: {
...       _id: "$type",
...       totalParticipants: { $addToSet: "$student_id" }
...     } },
...   {
...     $project: {
...       _id: 1,
...       participantCount: { $size: "$totalParticipants" }
...     } },
...   {
...     $sort: { participantCount: -1 }
...   },
...   {
...     $limit: 1
...   } ] );
...
[ { _id: 'Hackathon', participantCount: 29 } ]
MongoProject>
```