

# 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(
{
  attendance: { $gt: 85 },
  skills: { $all: ["MongoDB",
"Python"] }
},
{
  _id: 0,
  name: 1,
  department: 1
}
);
```

**Output:**

```
university> db.students.find(
... // Name: Junaid Khan Registration No: 1240258210
... {
...   attendance: { $gt: 85 },
...   skills: { $all: ["MongoDB", "Python"] }
... },
... {
...   _id: 0,
...   name: 1,
...   department: 1
... }
... );
university> |
```

**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(
[ {
  $project: {
    name: 1,
    totalCourses: { $size:
"$courses" }
  } },
{
  $match: {
totalCourses: { $gt: 2 } }
} ]
);
```

**Output:**

```
university> db.faculty.aggregate(
... // Name: Junaid Khan Registration No: 1240258210
... [
...   {
...     $project: {
...       name: 1,
...       totalCourses: { $size: "$courses" }
...     },
...     $match: { totalCourses: { $gt: 2 } }
...   }
... ]
... );
university> |
```

## 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( [  
  {  
    $lookup: {  
      from: "students",  
      localField: "student_id",  
      foreignField: "_id",  
      as: "studentInfo"  
    }  
  },  
  {  
    $lookup: {  
      from: "courses",  
      localField: "course_id",  
      foreignField: "_id",  
      as: "courseInfo"  
    }  
  },  
  {  
    $project: {  
      _id: 0,  
      studentName: { $arrayElemAt: ["$studentInfo.name", 0] },  
      courseTitles: "$courseInfo.title"  
    }  
  }  
]  
);
```

**Output:**

```

university> db.enrollments.aggregate(
...   // Name: Junaid Khan Registration No: 1240258210
...   [
...     {
...       $lookup: {
...         from: "students",
...         localField: "student_id",
...         foreignField: "_id",
...         as: "studentInfo"
...       }
...     },
...     {
...       $lookup: {
...         from: "courses",
...         localField: "course_id",
...         foreignField: "_id",
...         as: "courseInfo"
...       }
...     },
...     {
...       $project: {
...         _id: 0,
...         studentName: { $arrayElemAt: ["$studentInfo.name", 0] },
...         courseTitles: "$courseInfo.title"
...       }
...     }
...   ]
... );
...
... [
...   {
...     studentName: 'Alexandra Bailey',
...     courseTitles: [ 'Reactive neutral adapter' ]
...   },
... ]

```

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

**Solution:**

```
db.enrollments.aggregate( [
```

```
{
```

```
$group: {
  _id: "$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
    }
  }
}
];
```

**Output:**

```

university> db.enrollments.aggregate(
...   // Name: Junaid Khan Registration No: 1240258210
...   [
...     {
...       $group: {
...         _id: "$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: 68,
...     courseTitle: 'Balanced national function'
...   },
...   {
...     totalStudents: 1,

```

### 3. Grouping, Sorting, and Limiting:

**Q5.** Find the top 3 students with the highest average marks across all enrolled courses.

**Solution:**

```

db.enrollments.aggregate( [
  {
    $group: {
      _id: "$student_id",
      averageMarks: { $avg: "$marks" }
    }
  },
  {
    $sort: { averageMarks: -1 }
  },

```

```
{
  $limit:3
},
{ $lookup: {
  from: "students",
  localField: "_id",
  foreignField: "_id",
  as: "studentInfo"
}},
{ $project: {
  _id: 0,
  studentName: { $arrayElemAt: ["$studentInfo.name", 0] },
  averageMarks: 1
}
}
]
);
```

**Output:**

```

university> db.enrollments.aggregate(
...   // Name: Junaid Khan Registration No: 1240258210
...   [
...     {
...       $group: {
...         _id: "$student_id",
...         averageMarks: { $avg: "$marks" }
...       }
...     },
...     {
...       $sort: { averageMarks: -1 }
...     },
...     {
...       $limit: 3
...     },
...     {
...       $lookup: {
...         from: "students",
...         localField: "_id",
...         foreignField: "_id",
...         as: "studentInfo"
...       }
...     },
...     {
...       $project: {
...         _id: 0,
...         studentName: { $arrayElemAt: ["$studentInfo.name", 0] },
...         averageMarks: 1
...       }
...     }
...   ]
... );
...
[
  { averageMarks: 100, studentName: 'Diane Phillips' },
  { averageMarks: 98, studentName: 'Brandon Rios' },
  { averageMarks: 94, studentName: 'Larry Ramsey' }
]
university> |

```

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

**Solution:**

```

db.students.aggregate( [
  {

```

**Output:**

```

    $group: {
      _id: "$department",
      totalStudents: { $sum: 1 }
    },
    {
      $sort: { totalStudents: -1 }
    },
    {
      $limit: 1
    },
    {
      $project: {
        _id: 0,
        department: "$_id",
        totalStudents: 1
      }
    }
  ]
};

```

```

university> db.students.aggregate(
...   // Name: Junaid Khan Registration No: 1240258210
...   [
...     {
...       $group: {
...         _id: "$department",
...         totalStudents: { $sum: 1 }
...       }
...     },
...     {
...       $sort: { totalStudents: -1 }
...     },
...     {
...       $limit: 1
...     },
...     {
...       $project: {
...         _id: 0,
...         department: "$_id",
...         totalStudents: 1
...       }
...     }
...   ]
... );
[ { totalStudents: 23, department: 'Electrical' } ]
university> |

```

#### 4. Update, Insert, and Delete:

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

**Solution:**

**Output:**

```

db.students.updateMany(
{
  activities: "Hackathon"
},
{
  $set: { attendance: 100 }
}
);

```

```

university> db.students.updateMany(
...   // Name: Junaid Khan Registration No: 1240258210
...   {
...     activities: "Hackathon"
...   },
...   {
...     $set: { attendance: 100 }
...   }
... );
...
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 0,
  modifiedCount: 0,
  upsertedCount: 0
}
university> |

```

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



**Solution:**

```
db.activities.deleteMany(
{
  year: { $lt: 2022 }
}
);
```

**Output:**

```
university> db.activities.deleteMany(
... // Name: Junaid Khan Registration No: 1240258210
... {
...   year: { $lt: 2022 }
... }
... );
...
{ acknowledged: true, deletedCount: 0 }
university> |
```

**Q9.** Insert 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(
{ _id: "C150" },
{
  $set: { title: "Advanced
Data Structures", credits:
4 }
},
{ upsert: true }
);
```

**Output:**

```
university> db.courses.updateOne(
... // Name: Junaid Khan Registration No: 1240258210
... { _id: "C150" },
... {
...   $set: { title: "Advanced Data Structures", credits: 4 }
... },
... { upsert: true }
... );
...
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 0,
  upsertedCount: 0
}
university> |
```

**5. Array & Operator Usage:**

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

**Solution:**

```
db.students.find(
{
  $and: [
    { skills: "Python" },
    { skills: { $ne: "C++" } }
  ]
},
{
  _id: 0,
  name: 1,
  skills: 1
}
);
```

**Output:**

```
university> db.students.find(
... // Name: Junaid Khan Registration No: 1240258210
... {
...   skills: "Python",
...   skills: { $nin: ["C++"] }
... },
... {
...   _id: 0,
...   name: 1,
...   skills: 1
... }
... );
...
[
  { name: 'Bruce Blair', skills: [ 'MongoDB', 'Linux' ] },
  { name: 'Alexandra Bailey', skills: [ 'Research', 'AutoCAD' ] },
  { name: 'Kyle Hale', skills: [ 'Python', 'Java' ] },
  { name: 'Daniel Robinson', skills: [ 'JavaScript', 'Java' ] },
  { name: 'Tina Hodge', skills: [ 'SQL', 'Research' ] },
  { name: 'Anthony Zavala', skills: [ 'Java', 'Git' ] }
]
```

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

**Solution:****Output:**

```

db.students.find(
  {
    activities: { $all: ["Seminar",
"Hackathon"] }
  },
  {
    _id: 0,
    name: 1,
    activities: 1
  }
);

```

```

university> db.students.find(
... // Name: Junaid Khan Registration No: 1240258210
... {
...   activities: { $all: ["Seminar", "Hackathon"] }
... },
... {
...   _id: 0,
...   name: 1,
...   activities: 1
... }
... );
university> |

```

## 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.find(
{
  course_title: "Web Development",
  marks: { $gt: 80 },
  department: "Computer Science"
},
{
  _id: 0,
  student_id: 1,
  marks: 1,
  course_title: 1,
  department: 1
}
);

```

### Output:

```

university> db.enrollments.aggregate(
... // Name: Junaid Khan Registration No: 1240258210
... [
...   {
...     $lookup: {
...       from: "students",
...       localField: "student_id",
...       foreignField: "_id",
...       as: "studentInfo"
...     }
...   },
...   { $unwind: "$studentInfo" },
...   {
...     $lookup: {
...       from: "courses",
...       localField: "course_id",
...       foreignField: "_id",
...       as: "courseInfo"
...     }
...   },
...   { $unwind: "$courseInfo" },
...   {
...     $match: {
...       "studentInfo.department": "Computer Science",
...       "courseInfo.title": "Web Development",
...       marks: { $gt: 80 }
...     }
...   },
...   {
...     $project: {
...       _id: 0,
...       studentName: "$studentInfo.name",
...       marks: 1
...     }
...   }
... ]
... );
university> |

```

## **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( [
  {
    $lookup: {
      from: "courses",
      localField: "courses",
      foreignField: "_id",
      as: "courseInfo"
    }
  },
  { $unwind: "$courseInfo" },
  {
    $lookup: {
      from: "enrollments",
      localField: "courseInfo._id",
      foreignField: "course_id",
      as: "enrolledStudents"
    }
  },
  { $unwind: "$enrolledStudents" },
  {
    $lookup: {
      from: "students",
      localField: "enrolledStudents.student_id",
      foreignField: "_id",
      as: "studentInfo"
    }
  },
  {
    $project: {
      _id: 0,
      facultyName: "$name",
      studentName: { $arrayElemAt:
["$studentInfo.name",0] },
      marks: "$enrolledStudents.marks"
    }
  },
  {
    $group: {
      _id: { facultyName: "$facultyName", studentName: "$studentName" },
      averageMarks: { $avg: "$marks" }
    }
  },
  {
    $project: {
      _id: 0,
      facultyName: "$_id.facultyName",
      studentName: "$_id.studentName",
      averageMarks: 1
    }
  },
  {
    $sort: { facultyName: 1, studentName: 1 }
  }
]
);
```

## Output:

```
university> db.faculty.aggregate(  
...   // Name: Junaïd Khan Registration No: 1240258210  
...   [  
...     {  
...       $lookup: {  
...         from: "courses",  
...         localField: "courses",  
...         foreignField: "_id",  
...         as: "courseInfo"  
...       }  
...     },  
...     { $unwind: "$courseInfo" },  
...     {  
...       $lookup: {  
...         from: "enrollments",  
...         localField: "courseInfo._id",  
...         foreignField: "course_id",  
...         as: "enrolledStudents"  
...       }  
...     },  
...     { $unwind: "$enrolledStudents" },  
...     {  
...       $lookup: {  
...         from: "students",  
...         localField: "enrolledStudents.student_id",  
...         foreignField: "_id",  
...         as: "studentInfo"  
...       }  
...     },  
...     {  
...       $project: {
```

```

...     },
...     {
...         $unwind: "$enrolledStudents" },
...     {
...         $lookup: {
...             from: "students",
...             localField: "enrolledStudents.student_id",
...             foreignField: "_id",
...             as: "studentInfo"
...         }
...     },
...     {
...         $project: {
...             _id: 0,
...             facultyName: "$name",
...             studentName: { $arrayElemAt: ["$studentInfo.name", 0] },
...             marks: "$enrolledStudents.marks"
...         }
...     },
...     {
...         $group: {
...             _id: { facultyName: "$facultyName", studentName: "$studentName" },
...             averageMarks: { $avg: "$marks" }
...         }
...     },
...     {
...         $project: {
...             _id: 0,
...             facultyName: "$_id.facultyName",
...             studentName: "$_id.studentName",
...             averageMarks: 1
...         }
...     },
...     {
...         $sort: { facultyName: 1, studentName: 1 }
...     }
... ]
... );
...

```

university> |

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

**Solution:**

```
db.students.aggregate( [
  { $unwind: "$activities" },
  {
    $group: {
      _id: "$activities",
      totalParticipants: { $sum: 1 }
    }
  },
  { $sort: { totalParticipants: -1 } },
  { $limit: 1 },
  {
    $project: {
      _id: 0,
      activity: "$_id",
      totalParticipants: 1
    }
  }
]
);
```

**Output:**

```
university> db.students.aggregate(
... // Name: Junaid Khan Registration No: 1240258210
... [
...   { $unwind: "$activities" },
...   {
...     $group: {
...       _id: "$activities",
...       totalParticipants: { $sum: 1 }
...     }
...   },
...   { $sort: { totalParticipants: -1 } },
...   { $limit: 1 },
...   {
...     $project: {
...       _id: 0,
...       activity: "$_id",
...       totalParticipants: 1
...     }
...   }
... ]
... );
...
university> |
```