

```
// Inserting data into the professor collection
```

```
db.professor.insertMany([
  { profid: 1, name: "Professor A", age: 40, rank_val: 1, research: "AI" },
  { profid: 2, name: "Professor B", age: 45, rank_val: 2, research: "Machine Learning" },
  { profid: 3, name: "Professor C", age: 38, rank_val: 3, research: "Data Science" }
])
```

```
// Inserting data into the projects collection
```

```
db.projects.insertMany([
  { pno: 1, sponsor: "UGC", sdate: ISODate("2006-01-01"), edate: ISODate("2008-12-31"),
    budget: 120000, p_investigator: 1 },
  { pno: 2, sponsor: "AICTE", sdate: ISODate("2008-05-01"), edate: ISODate("2011-04-30"),
    budget: 150000, p_investigator: 2 },
  { pno: 3, sponsor: "UGC", sdate: ISODate("2007-03-01"), edate: ISODate("2010-02-28"),
    budget: 90000, p_investigator: 3 },
  { pno: 4, sponsor: "UGC", sdate: ISODate("2023-01-01"), edate: ISODate("2023-12-31"),
    budget: 150000, p_investigator: 1 },
  { pno: 5, sponsor: "AICTE", sdate: ISODate("2023-06-01"), edate: ISODate("2024-05-31"),
    budget: 120000, p_investigator: 2 },
  { pno: 6, sponsor: "UGC", sdate: ISODate("2023-08-01"), edate: ISODate("2024-07-31"),
    budget: 120000, p_investigator: 1 },
  { pno: 7, sponsor: "AICTE", sdate: ISODate("2023-09-01"), edate: ISODate("2024-08-31"),
    budget: 150000, p_investigator: 2 },
  { pno: 8, sponsor: "UGC", sdate: ISODate("2023-10-01"), edate: ISODate("2024-09-30"),
    budget: 90000, p_investigator: 3 }
])
```

```
// Inserting data into the sworkson collection
```

```
db.sworkson.insertMany([
  { usn: 1001, pno: 1 },
  { usn: 1002, pno: 2 },
  { usn: 1003, pno: 3 }
])
```

```
// Inserting data into the pworkson collection
```

```
db.pworkson.insertMany([
  { profid: 1, pno: 1 },
  { profid: 3, pno: 1 },
  { profid: 2, pno: 2 },
  { profid: 3, pno: 2 },
  { profid: 3, pno: 3 },
  { profid: 1, pno: 4 },
  { profid: 3, pno: 4 },
  { profid: 2, pno: 5 },
])
```

```
{ profid: 3, pno: 5 },
{ profid: 1, pno: 6 },
{ profid: 3, pno: 6 },
{ profid: 2, pno: 7 },
{ profid: 3, pno: 7 },
{ profid: 1, pno: 8 },
{ profid: 2, pno: 8 },
{ profid: 3, pno: 8 }
])
```

// Inserting data into the student collection

```
db.student.insertMany([
  { usn: 1001, sname: "Student X", age: 25, degree: "MCA", profid: 1 },
  { usn: 1002, sname: "Student Y", age: 24, degree: "MPhil", profid: 2 },
  { usn: 1003, sname: "Student Z", age: 26, degree: "BE", profid: 3 }
])
```

// Professors without ongoing projects of more than 1 lakh

```
db.professor.aggregate([
  {
    $lookup: {
      from: "pworkson",
      localField: "profid",
      foreignField: "profid",
      as: "pworkson"
    }
  },
  {
    $lookup: {
      from: "projects",
      localField: "pworkson.pno",
```

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    foreignField: "pno",
    as: "projects"
  }
},
{
  $match: {
    $or: [
      { projects: { $size: 0 } },
      { "projects.budget": { $lte: 100000 } },
      { "projects.edate": { $lt: new Date() } }
    ]
  }
},
{
  $project: {
    _id: 0,
    name: 1
  }
}
])

```

// Graduate students, their professors, and project sponsors

```

db.student.aggregate([
  {
    $lookup: {
      from: "professor",
      localField: "profid",
      foreignField: "profid",
      as: "professor"
    }
  },
  {
    $lookup: {
      from: "projects",
      localField: "profid",
      foreignField: "p_investigator",
      as: "projects"
    }
  },
  {
    $unwind: "$professor"
  },
  {
    $project: {

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    _id: 0,
    student_name: "$sname",
    professor_name: "$professor.name",
    sponsor: "$projects.sponsor"
  }
}
])

```

// Professors and sum of budgets of projects started after 2005 but ended in 2010

```

db.professor.aggregate([
  {
    $lookup: {
      from: "projects",
      localField: "profid",
      foreignField: "p_investigator",
      as: "projects"
    }
  },
  {
    $unwind: "$projects"
  },
  {
    $match: {
      "projects.sdate": { $gte: new Date("2005-01-01") },
      "projects.edate": { $lte: new Date("2010-04-10") }
    }
  },
  {
    $group: {
      _id: "$name",
      totalBudget: { $sum: "$projects.budget" }
    }
  }
])

```

// Professors with total project worth greater than average project budget

```

db.professor.aggregate([
  {
    $lookup: {
      from: "projects",
      localField: "profid",
      foreignField: "p_investigator",
      as: "projects"
    }
  }
])

```

```

    },
    {
      $unwind: "$projects"
    },
    {
      $group: {
        _id: "$name",
        totalBudget: { $sum: "$projects.budget" }
      }
    },
    {
      $lookup: {
        from: "projects",
        let: { totalBudget: "$totalBudget" },
        pipeline: [
          {
            $group: {
              _id: null,
              avgBudget: { $avg: "$budget" }
            }
          }
        ],
        as: "averageBudget"
      }
    },
    {
      $match: {
        $expr: { $gt: ["$totalBudget", { $arrayElemAt: ["$averageBudget.avgBudget", 0] }] }
      }
    },
    {
      $project: {
        _id: 0,
        name: "$_id"
      }
    }
  ]
})

```

```

// Professors working on all projects
var allProjectsCount = db.projects.distinct("pno").length;
db.professor.aggregate([
  {
    $lookup: {
      from: "pworkson",

```

```

    localField: "profid",
    foreignField: "profid",
    as: "pworkson"
  }
},
{
  $lookup: {
    from: "projects",
    localField: "pworkson.pno",
    foreignField: "pno",
    as: "projects"
  }
},
{
  $addFields: {
    projectCount: { $size: "$projects" }
  }
},
{
  $match: {
    projectCount: allProjectsCount
  }
},
{
  $project: {
    _id: 0,
    name: 1
  }
}
])

```