```
// 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",
```

```
      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: {
```

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

// 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
    }
  }
])
```