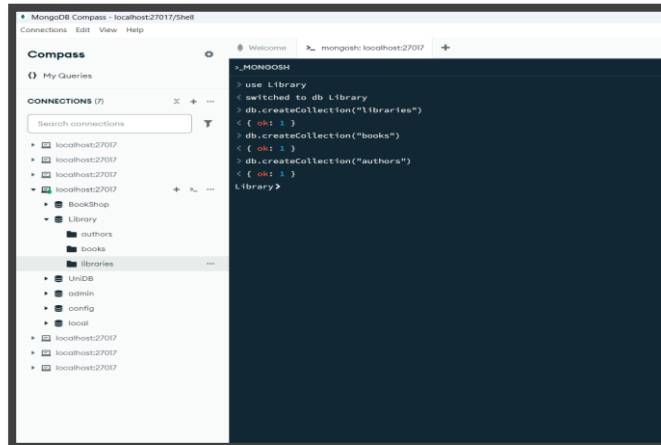


Q1. Create a Database Library:

```
>_MONGOSH
> use Library
< switched to db Library
Library>
```

Q2. Create Collections

- libraries:
- books:
- authors:



Q3. Insert Sample Document

Libraries:

```
> db.libraries.insertMany([
  {
    _id: ObjectId("60d5fbb2f295f5e2c4d5a8a1"),
    name: "Central Library",
    location: "Downtown"
  },
  {
    _id: ObjectId("60d5fbb2f295f5e2c4d5a8a2"),
    name: "Westside Branch",
    location: "Westside"
  }
])
acknowledged: true,
insertedIds: {
  '0': ObjectId('60d5fbb2f295f5e2c4d5a8a1'),
  '1': ObjectId('60d5fbb2f295f5e2c4d5a8a2')
}
```

Authors:

```
> db.authors.insertMany([
  {
    _id: ObjectId("60d5fd3ef295f5e2c4d5a8a4"),
    name: "Harper Lee",
    birth_year: 1926
  },
  {
    _id: ObjectId("60d5fd3ef295f5e2c4d5a8a6"),
    name: "George Orwell",
    birth_year: 1903
  },
  {
    _id: ObjectId("60d5fd3ef295f5e2c4d5a8a8"),
    name: "J.K. Rowling",
    birth_year: 1965
  },
  {
    _id: ObjectId("60d5fd3ef295f5e2c4d5a8a9"),
    name: "John Tiffany",
    birth_year: 1971
  }
])
```

```
< {
  acknowledged: true,
  insertedIds: {
    '0': ObjectId('60d5fd3ef295f5e2c4d5a8a4'),
    '1': ObjectId('60d5fd3ef295f5e2c4d5a8a6'),
    '2': ObjectId('60d5fd3ef295f5e2c4d5a8a8'),
    '3': ObjectId('60d5fd3ef295f5e2c4d5a8a9')
  }
}
```

Books:

```
> db.books.insertMany([
  {
    _id: ObjectId("60d5fc5ef295f5e2c4d5a8a3"),
    title: "To Kill a Mockingbird",
    library_id: ObjectId("60d5fbb2f295f5e2c4d5a8a1"),
    author_ids: [ObjectId("60d5fd3ef295f5e2c4d5a8a4")]
  },
  {
    _id: ObjectId("60d5fc5ef295f5e2c4d5a8a5"),
    title: "1984",
    library_id: ObjectId("60d5fbb2f295f5e2c4d5a8a2"),
    author_ids: [ObjectId("60d5fd3ef295f5e2c4d5a8a6")]
  },
  {
    _id: ObjectId("60d5fc5ef295f5e2c4d5a8a7"),
    title: "Harry Potter and the Philosopher's Stone",
    library_id: ObjectId("60d5fbb2f295f5e2c4d5a8a1"),
    author_ids: [
      ObjectId("60d5fd3ef295f5e2c4d5a8a8"),
      ObjectId("60d5fd3ef295f5e2c4d5a8a9")
    ]
  }
])
```

```
< {
  acknowledged: true,
  insertedIds: {
    '0': ObjectId('60d5fc5ef295f5e2c4d5a8a3'),
    '1': ObjectId('60d5fc5ef295f5e2c4d5a8a5'),
    '2': ObjectId('60d5fc5ef295f5e2c4d5a8a7')
  }
}
```

Q4. Find all books in the "Central Library":

```
> const centralId = db.libraries.findOne({ name: "Central Library" })._id
db.books.find({ library_id: centralId })
< {
  _id: ObjectId('60d5fc5ef295f5e2c4d5a8a1'),
  title: 'To Kill a Mockingbird',
  library_id: ObjectId('60d5fbb2f295f5e2c4d5a8a1'),
  author_ids: [
    ObjectId('60d5fd3ef295f5e2c4d5a8a4')
  ]
}
{
  _id: ObjectId('60d5fc5ef295f5e2c4d5a8a7'),
  title: 'Harry Potter and the Philosopher's Stone',
  library_id: ObjectId('60d5fbb2f295f5e2c4d5a8a1'),
  author_ids: [
    ObjectId('60d5fd3ef295f5e2c4d5a8a8'),
    ObjectId('60d5fd3ef295f5e2c4d5a8a9')
  ]
}
```

Q5. List all libraries along with the number of books they have:

```
> db.books.aggregate([
  { $group: { _id: "$library_id", bookCount: { $sum: 1 } } },
  { $lookup: {
    from: "libraries",
    localField: "_id",
    foreignField: "_id",
    as: "library"
  } },
  { $unwind: "$library" },
  { $project: { _id: 0, library: "$library.name", bookCount: 1 } }
])
< {
  bookCount: 2,
  library: 'Central Library'
}
{
  bookCount: 1,
  library: 'Westside Branch'
}
```

Q6. Find all books written by "J.K. Rowling":

```
> const authorId = db.authors.findOne({ name: "J.K. Rowling" })._id
db.books.find({ author_ids: authorId })
< {
  _id: ObjectId('60d5fc5ef295f5e2c4d5a8a7'),
  title: 'Harry Potter and the Philosopher's Stone',
  library_id: ObjectId('60d5fbb2f295f5e2c4d5a8a1'),
  author_ids: [
    ObjectId('60d5fd3ef295f5e2c4d5a8a8'),
    ObjectId('60d5fd3ef295f5e2c4d5a8a9')
  ]
}
```

Q7. List all authors along with the books they have written:

```
>_MONGODB
> db.authors.aggregate([
  {
    $lookup: {
      from: "books",
      localField: "_id",
      foreignField: "author_ids",
      as: "books"
    }
  },
  {
    $project: {
      name: 1,
      books: "$books.title"
    }
  }
])
```

```
>_MONGODB
< {
  _id: ObjectId('60d5fd3ef295f5e2c4d5a8a4'),
  name: 'Harper Lee',
  books: [
    'To Kill a Mockingbird'
  ]
}
{
  _id: ObjectId('60d5fd3ef295f5e2c4d5a8a6'),
  name: 'George Orwell',
  books: [
    '1984'
  ]
}
{
  _id: ObjectId('60d5fd3ef295f5e2c4d5a8a8'),
  name: 'J.K. Rowling',
  books: [
    'Harry Potter and the Philosopher's Stone'
  ]
}
{
  _id: ObjectId('60d5fd3ef295f5e2c4d5a8a9'),
  name: 'John Tiffany',
  books: [
    'Harry Potter and the Philosopher's Stone'
  ]
}
```

Q8. Find all books along with their authors' details:

```
> db.books.aggregate([
  {
    $lookup: {
      from: "authors",
      localField: "author_ids",
      foreignField: "_id",
      as: "authors"
    }
  },
  {
    $project: {
      title: 1,
      authors: { name: 1, birth_year: 1 }
    }
  }
])
```

```
> MONODOSH
< {
  "_id": ObjectId("60d5fc5ef295f5e2c4d5a8a7"),
  "title": "To Kill a Mockingbird",
  "authors": [
    {
      "name": "Harper Lee",
      "birth_year": 1926
    }
  ]
},
{
  "_id": ObjectId("60d5fc5ef295f5e2c4d5a8a5"),
  "title": "1984",
  "authors": [
    {
      "name": "George Orwell",
      "birth_year": 1903
    }
  ]
},
{
  "_id": ObjectId("60d5fc5ef295f5e2c4d5a8a7"),
  "title": "Harry Potter and the Philosopher's Stone",
  "authors": [
    {
      "name": "John Tiffany",
      "birth_year": 1971
    }
  ]
},
{
  "_id": ObjectId("60d5fbb2f295f5e2c4d5a8a1"),
  "title": "Central Library",
  "bookCount": 2
},
{
  "_id": ObjectId("60d5fbb2f295f5e2c4d5a8a2"),
  "title": "Westside Branch",
  "bookCount": 1
}
```

```
{
  "_id": ObjectId('60d5fc5ef295f5e2c4d5a8a7'),
  "title": "Harry Potter and the Philosopher's Stone",
  "authors": [
    {
      "name": "John Tiffany",
      "birth_year": 1971
    },
    {
      "name": "J.K. Rowling",
      "birth_year": 1965
    }
  ]
}
```

Q9. List all libraries and number of books they have, including libraries with no books:

```
> db.libraries.aggregate([
  {
    $lookup: {
      from: "books",
      localField: "_id",
      foreignField: "library_id",
      as: "books"
    }
  },
  {
    $project: {
      name: 1,
      bookCount: { $size: "$books" }
    }
  }
])
```

```
< {
  "_id": ObjectId('60d5fbb2f295f5e2c4d5a8a1'),
  "name": 'Central Library',
  "bookCount": 2
},
{
  "_id": ObjectId('60d5fbb2f295f5e2c4d5a8a2'),
  "name": 'Westside Branch',
  "bookCount": 1
}
```

Q10. Calculate average number of books per library:

```
> db.books.aggregate([
  {
    $group: { _id: "$library_id", count: { $sum: 1 } }
  },
  {
    $group: {
      _id: null,
      avgBooks: { $avg: "$count" }
    }
  }
])
< {
  _id: null,
  avgBooks: 1.5
}
```

Q11. Find all authors who have written more than one book:

```
> db.books.aggregate([
  { $unwind: "$author_ids" },
  { $group: { _id: "$author_ids", count: { $sum: 1 } } },
  { $match: { count: { $gt: 1 } } },
  {
    $lookup: {
      from: "authors",
      localField: "_id",
      foreignField: "_id",
      as: "author"
    }
  },
  { $unwind: "$author" },
  { $project: { _id: 0, name: "$author.name", count: 1 } }
])
```

Q12. Retrieve all books with their authors' names and the library they belong to:

```
> MONOGOSH
> db.books.aggregate([
  {
    $lookup: {
      from: "authors",
      localField: "author_ids",
      foreignField: "_id",
      as: "authors"
    }
  },
  {
    $lookup: {
      from: "libraries",
      localField: "library_id",
      foreignField: "_id",
      as: "library"
    }
  },
  {
    $unwind: "$library"
  },
  {
    $project: {
      title: 1,
      author_names: "$authors.name",
      library: "$library.name"
    }
  }
])
```

```
< [
  {
    _id: ObjectId('60d5fc5ef295f5e2c4d5a8a3'),
    title: 'To Kill a Mockingbird',
    author_names: [
      'Harper Lee'
    ],
    library: 'Central Library'
  },
  {
    _id: ObjectId('60d5fc5ef295f5e2c4d5a8a5'),
    title: '1984',
    author_names: [
      'George Orwell'
    ],
    library: 'Westside Branch'
  },
  {
    _id: ObjectId('60d5fc5ef295f5e2c4d5a8a7'),
    title: 'Harry Potter and the Philosopher's Stone',
    author_names: [
      'J.K. Rowling',
      'John Tiffany'
    ],
    library: 'Central Library'
  }
]
```

Q13. List all authors who have not written any books:

```
> db.authors.aggregate([
  {
    $lookup: {
      from: "books",
      localField: "_id",
      foreignField: "author_ids",
      as: "books"
    }
  },
  {
    $match: { books: { $eq: [] } }
  },
  {
    $project: { _id: 0, name: 1 }
  }
])
```