APAC

Simplify Data Processing with the MongoDB Aggregation Framework

Environment Setup:
mdb.link/instruqt-jedee

MongoDB
Build & Learn Workshops Series

Hi, I'm Wen Jie!

Teo Wen Jie

- Senior Developer Advocate at MongoDB
- Software Engineer / Tech Lead in both public and private sectors
- Full-stack but hates frontend work
- > 50 Design Reviews in a year

Connect with me on LinkedIn

Skill Badge Benefits

Formal Validation

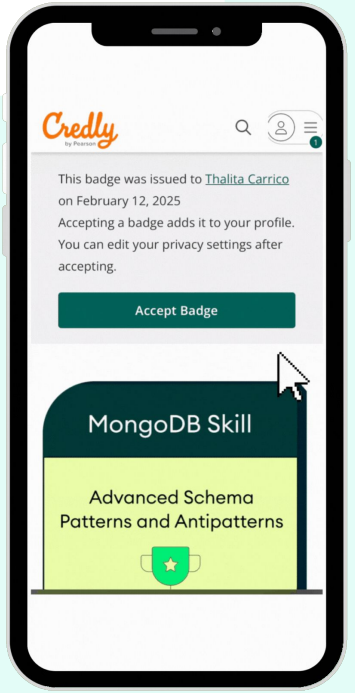
Provide a way to quickly learn and validate specific MongoDB skills

Elevate in current roles and increase appeal for future positions.

Career Advancement

Digital Badges

Showcase achievements with a Credly badge and inclusion in the Talent Directory.



Agenda

📘**A brief overview of MongoDB Document Model**

📘 MongoDB Query API

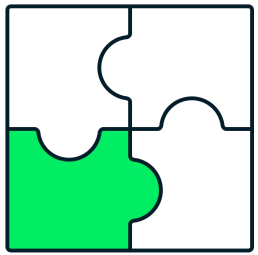
- CRUD
- Aggregation Framework

📘 Common Aggregation Stages

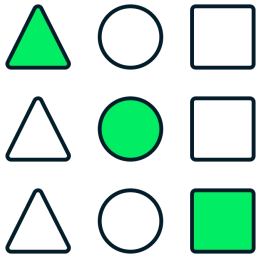
- 👐 Simple pipelines
- 👐 Arrays, counting, and sorting
- 👐 Joins & working with results

🎖️ Skill Badge Challenge

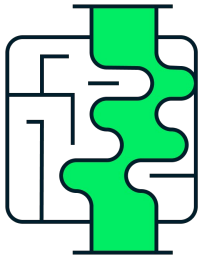
Core MongoDB design concepts



Embedding



Arrays



Polymorphism

MongoDB document

```
{
  _id: "9781602833364",
  title: "Brave New World",
  category: "books",
  price: 14.99,
  author: "Aldous Huxley",
  genres: [ "science fiction", "novel" ],
  reviews: [
     { name: "John", text: "Amazing!" },
     { name: "Jane", text: "Incredible book!" }
  ]
}
```

Related documents are stored together in **collections**.

Related documents are stored together in **collections**.

Collections can be **polymorphic**—storing documents with different shapes.

```
{
  _id: "9781602833364",
  title: "Brave New World",
  author: "Aldous Huxley",
  type: "print",
  condition: "excellent"
}
```

```
{
  _id: "9798354502691",
  title: "Frankenstein",
  author: "Mary Shelley",
  type: "e-book",
  format: "epub",
  fileSizeMB: 2.5,
  supportedDevices: [
      "Kindle",
      "iPad",
      "Android",
      "PC"
  ]
}
```

When modeling data for MongoDB, **your workload should drive your data model.**

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📘 A brief overview of last week's session

📘 **MongoDB Query API**

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- Aggregation Framework

📘 Common Aggregation Stages

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- 👐 Arrays, counting, and sorting
- 👐 Joins & working with results

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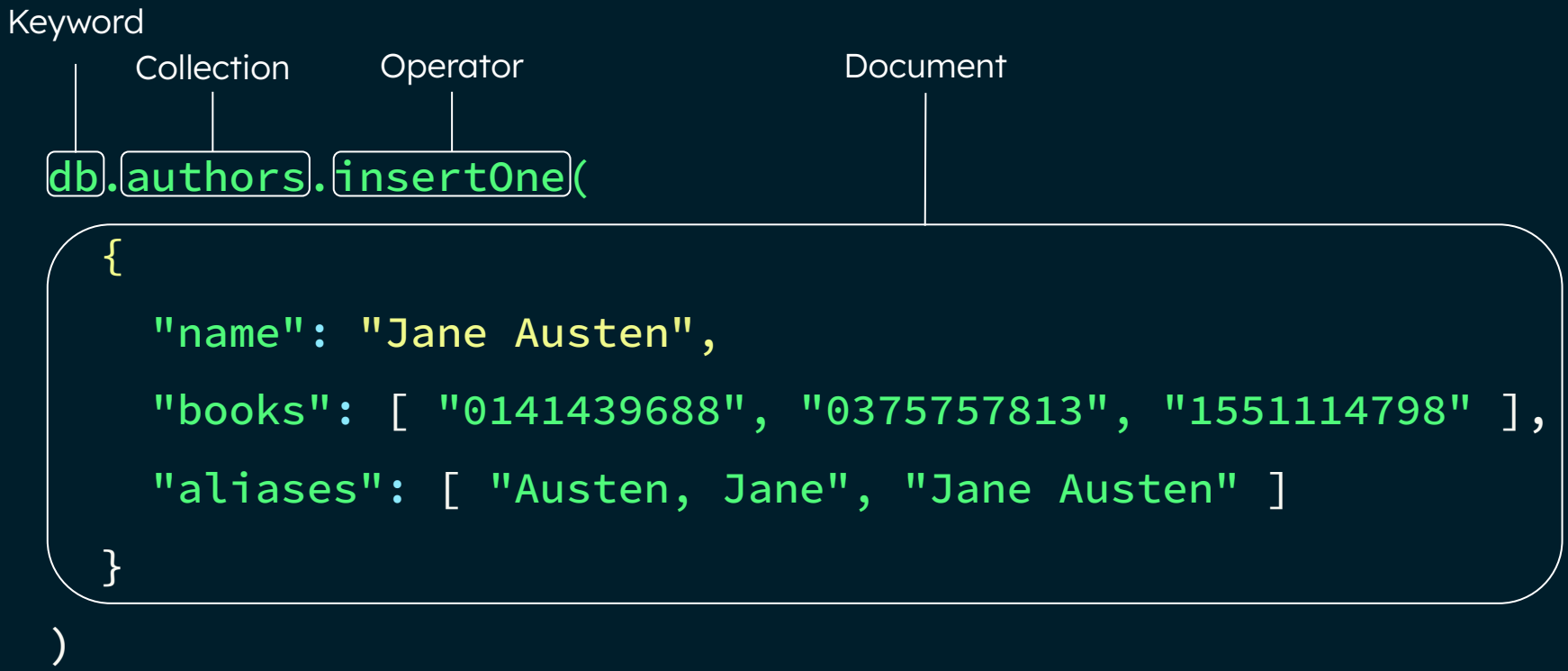
🎖️ Skill Badge Challenge

MongoDB Query API Syntax Structure



Create

```
db.authors.insertOne({
    "name": "Jane Austen",
    "books": [ "0141439688", "0375757813", "1551114798" ],
    "aliases": [ "Austen, Jane", "Jane Austen" ]
})
```

```
db.authors.insertMany([{...},{...},...])
```

Read

```
db.authors.find({
    "name": "Jane Austen"
})
```

```
db.authors.findOne({...})
```

Update

```
db.authors.updateOne(
    { name: "Jane Austin" },
    { $set:
       { name: "Jane Austen" }
    }
)
db.authors.update({...},{...})
```

Delete

```
db.authors.deleteOne(
    { name: "Jane Austen" }
)

db.authors.deleteMany({...})
```

MongoDB Query API Syntax Structure


```
// Example MongoDB find command

db.collection.find(
  { age: { $gte: 25 } },  // query or filter: where age is greater than or equal to 25
  {
    projection: { name: 1, age: 1 },  // options
    sort: { age: -1 },
    limit: 10
  }
);
```

Check out the MongoDB docs for more details

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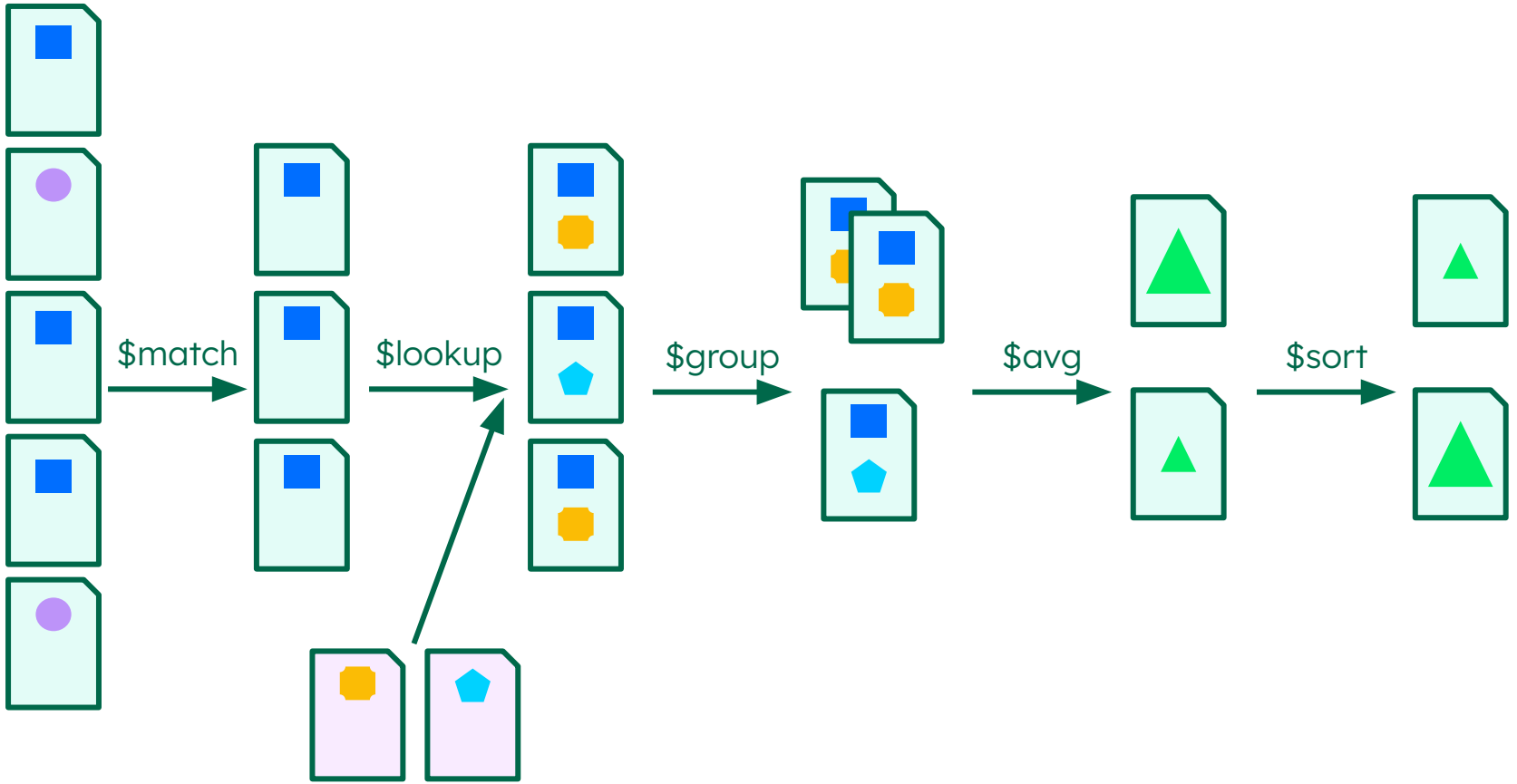
The **aggregation framework** allows you to transform and analyze your data in real time.

Multi-stage aggregation pipelines

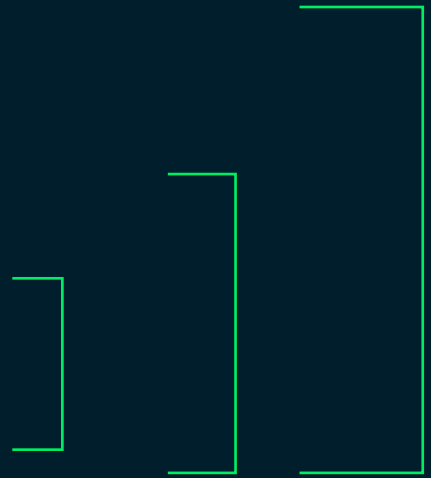


SQL vs Aggregation Pipelines

Get authors' bios with books that have an average rating greater than 4

Get authors' bios with books that have an average rating greater than 4-star

```
SELECT
       authors.name,
       authors.bio
FROM
       library.authors authors
       JOIN library.author_book author_book_join
       ON authors.id = author_book_join.author_id
       JOIN (
           SELECT books.id
           FROM library.books books
           JOIN library.reviews reviews ON books.id = reviews.book_id
           GROUP BY books.id
           HAVING AVG(reviews.rating) > 4
       ) five_star_books ON author_book_join.book_id = five_star_books.id;
```

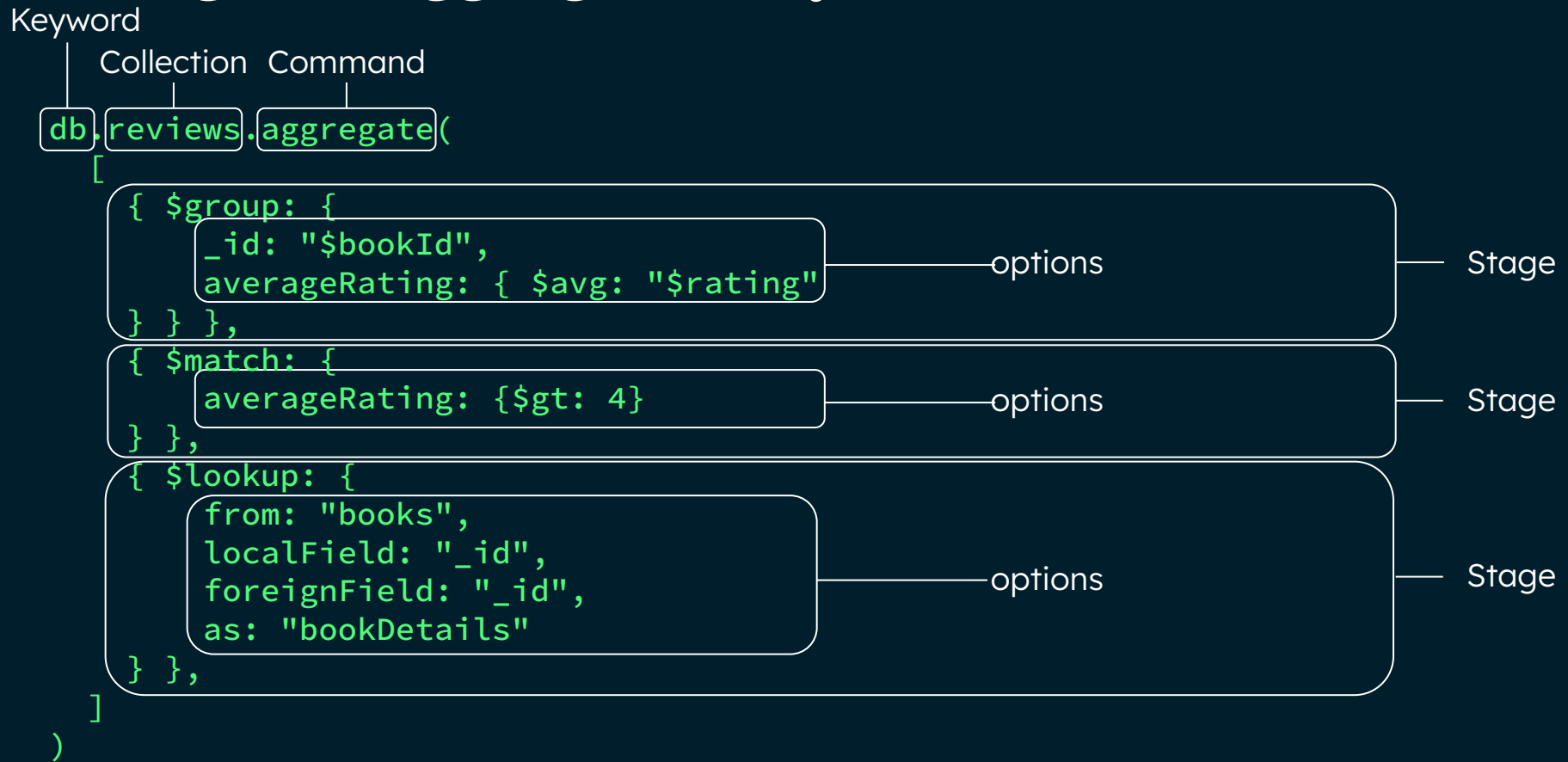


Comparing SQL JOINs and aggregation

```
db.reviews.aggregate([
  { $group: {
        _id: "$bookId",
        averageRating: {
          $avg: "$rating",
        },
      },
  },
  { $match: { averageRating: {$gt: 4} } },
  { $lookup: {
        from: "authors",
        localField: "_id",
        foreignField: "books",
        as: "author",
      },
  },
  {$addFields: {
    bio: "$author.bio"
  }},
])
```

Structure of an Aggregation Pipeline

MongoDB Aggregation Syntax Structure



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🎖️ Skill Badge Challenge

$match

```
db.books.aggregate([
  {
    $match: {
      pages: 100
    }
  }
]);
```

```
_id: "0393037959"
title : "Stalking the Shark: Pressure and Passion on the Pro Golf Tour"
pages : 100
```

```
_id: "0757300383"
title : "Chicken Soup for the Soul Christmas Treasury for Kids: A Story a Day f…"
pages : 100
```

```
_id: "0867193751"
title : "DORI STORIES"
pages : 100
```

```
_id: "088961184X"
title : "Bat Had Blue Eyes, The"
pages : 100
```

```
_id: "1880284545"
title : "ANOTHER FINE MESS"
pages : 100
```

```
_id: "1881943135"
title : "COMPLETE SLAVE"
pages : 100
```

$project

```
db.books.aggregate([
  {
    $project: {
      title: 1,
      cover: 1
    }
  }
]);
```

```
_id: "0002005018"
title : "Clara Callan: A novel"
cover : "https://images.isbndb.com/covers/50/12/9780002005012.jpg"
```

```
_id: "0002244705"
title : "Charity"
cover : "https://images.isbndb.com/covers/47/01/9780002244701.jpg"
```

```
_id: "0002251000"
title : "NBA: The Official Fan's Guide"
cover : "https://images.isbndb.com/covers/10/06/9780002251006.jpg"
```

```
_id: "0002253402"
title : "Anita and me"
cover : "https://images.isbndb.com/covers/34/06/9780002253406.jpg"
```

```
_id: "0002554062"
title : "Shadow maker: The life of Gwendolyn MacEwen"
cover : "https://images.isbndb.com/covers/40/60/9780002554060.jpg"
```

```
_id: "0002554119"
title : "Labyrinth of Desire: Women, Passion, and Romantic Obsession"
cover : "https://images.isbndb.com/covers/41/14/9780002554114.jpg"
```

$project

```
db.books.aggregate([
  {
    $project: {
      title: 1,
      cover: 1,
      _id: 0
    }
  }
]);
```

```
title : "Clara Callan: A novel"
cover : "https://images.isbndb.com/covers/50/12/9780002005012.jpg"
```

```
title : "Charity"
cover : "https://images.isbndb.com/covers/47/01/9780002244701.jpg"
```

```
title : "NBA: The Official Fan's Guide"
cover : "https://images.isbndb.com/covers/10/06/9780002251006.jpg"
```

```
title : "Anita and me"
cover : "https://images.isbndb.com/covers/34/06/9780002253406.jpg"
```

```
title : "Shadow maker: The life of Gwendolyn MacEwen"
cover : "https://images.isbndb.com/covers/40/60/9780002554060.jpg"
```

```
title : "Labyrinth of Desire: Women, Passion, and Romantic Obsession"
cover : "https://images.isbndb.com/covers/41/14/9780002554114.jpg"
```

$limit

```
db.books.aggregate([
  {
    $limit: 3
  }
]);
```

```
_id: "0002005018"
title : "Clara Callan: A novel"
cover : "https://images.isbndb.com/covers/50/12/9780002005012.jpg"
```

```
_id: "0002244705"
title : "Charity"
cover : "https://images.isbndb.com/covers/47/01/9780002244701.jpg"
```

```
_id: "0002251000"
title : "NBA: The Official Fan's Guide"
cover : "https://images.isbndb.com/covers/10/06/9780002251006.jpg"
```

Quick Demo

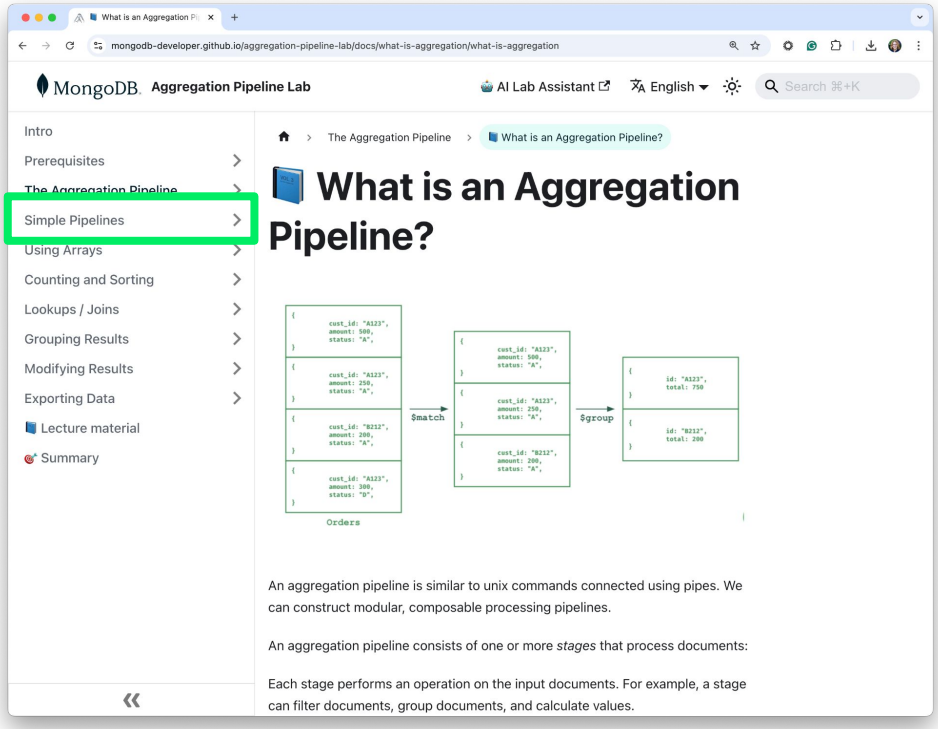
mdb.link/instruqt-jedee

Exercise 1.
Simple pipelines

Environment:
mdb.link/instruqt-jedee

Lab:
mdb.link/agg-lab-simple

Unsure? Need more information?
Ask the instructors!



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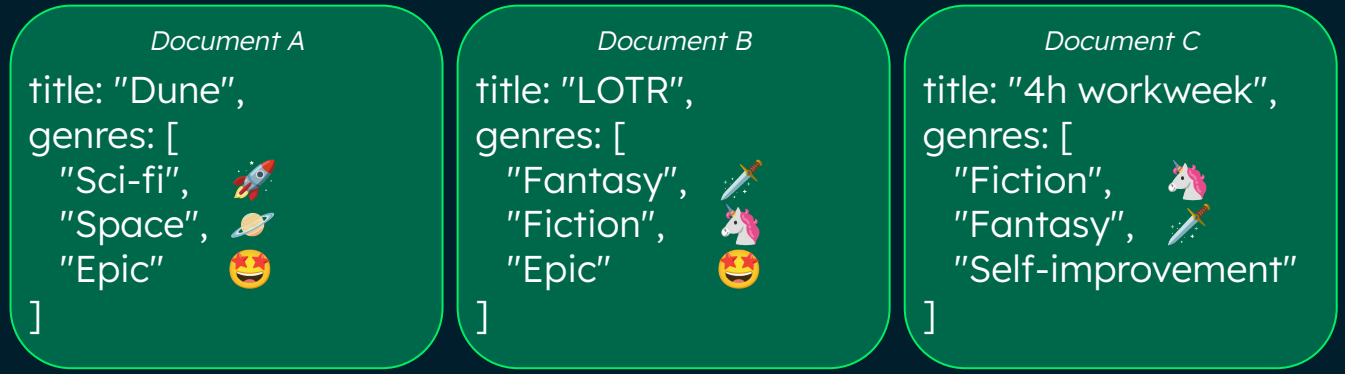
🎖️ Skill Badge Challenge

Array Matching

Arrays of Strings



You may want to find documents with an array based on:

- **a single element**
- **multiple elements**
- **exact match of an array**

and so on...

Guess which documents would be returned?

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

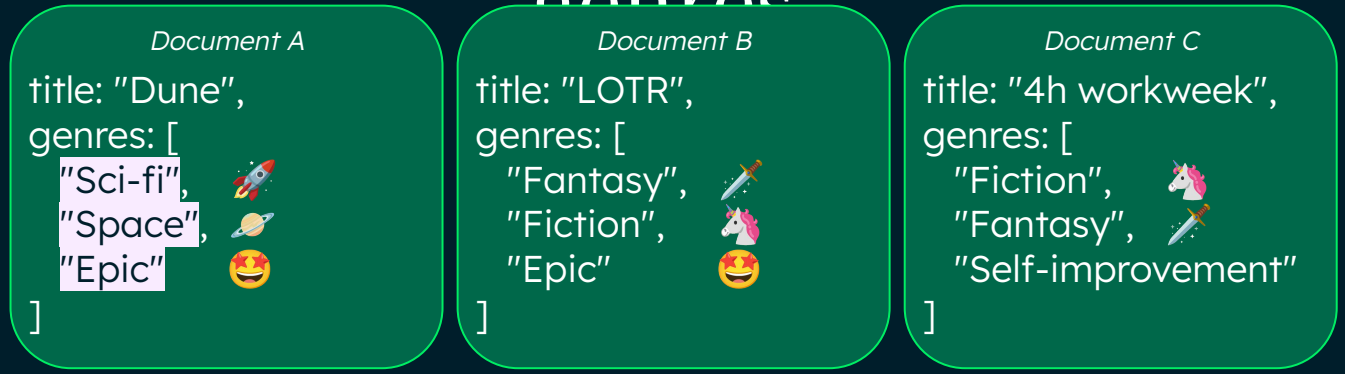
title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: ["Sci-fi", "Space", "Epic"]
    }
  }
]);
```

Find books with exactly those genres




```
db.books.aggregate([{
    $match: {
      genres: ["Sci-fi", "Space", "Epic"]
    }
  }
]);
```

Guess which documents would be returned?

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: 'Epic'
    }
  }
]);
```

Find books with **one** genre

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: 'Epic'
    }
  }
]);
```

Guess which documents would be returned?

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: { $all: ["Fantasy", "Fiction"] }
    }
  }
]);
```

Find books with all two genres

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: { $all: ["Fantasy", "Fiction"] }
    }
  }
]);
```

Guess which documents would be returned?

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: { $in: ["Fantasy", "Epic"] }
    }
  }
]);
```

Find books with **either** genre

Document A

title: "Dune",
genres: [
"Sci-fi", 🚀
"Space", 🪐
"Epic" 🤩
]

Document B

title: "LOTR",
genres: [
"Fantasy", 🗡️
"Fiction", 🦄
"Epic" 🤩
]

Document C

title: "4h workweek",
genres: [
"Fiction", 🦄
"Fantasy", 🗡️
"Self-improvement"
]

```
db.books.aggregate([{
    $match: {
      genres: { $in: ["Fantasy", "Epic"] }
    }
  }
]);
```

Aggregation Stages

Search Inside Objects

```
attr: [
  {
    key: 'edition',
    value: '1st'
  },
  {
    key: 'msrp',
    value: 6.99
  },
  {
    key: 'isbn',
    value: '0765342502'
  },
  …
]
```

The Attribute Pattern in action!

```
title: "Dune",
attr: [
  {
    key: "edition",
    value: "1st"
  },
  ...
]
```

```
title: "LOTR",
attr: [
  {
    key: "edition",
    value: "10th"
  },
  ...
]
```

```
title: "4h workweek",
attr: [
  {
    key: "msrp",
    value: "10"
  },
  ...
]
```

Find all books that have an "edition" attribute

```
title: "Dune",
attr: [
  {
    key: "edition",
    value: "1st"
  },
  ...
]
```

```
title: "LOTR",
attr: [
  {
    key: "edition",
    value: "10th"
  },
  ...
]
```

```
title: "4h workweek",
attr: [
  {
    key: "msrp",
    value: "10"
  },
  ...
]
```

```
db.books.aggregate([
    $match: {
        "attributes.key": "edition"
    }
]);
```

Find all books that are 1st edition (simplified)

```
title: "Dune",
attr: [
  {
    key: "edition",
    value: "1st"
  },
  ...
]
```

```
title: "LOTR",
attr: [
  {
    key: "edition",
    value: "10th"
  },
  ...
]
```

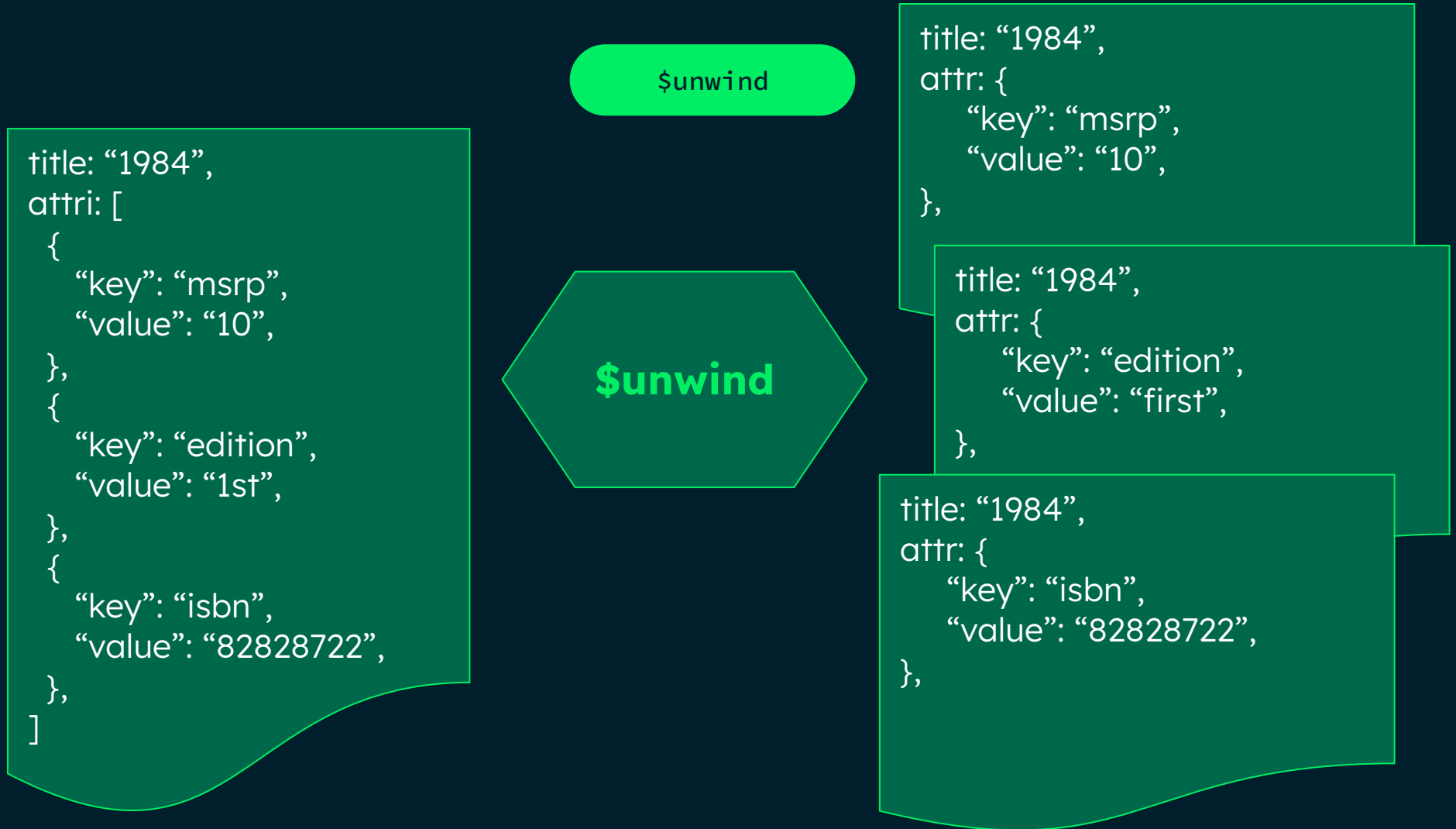
```
title: "4h workweek",
attr: [
  {
    key: "msrp",
    value: "10"
  },
  ...
]
```

```
db.books.aggregate([
    $match: {
        "attributes.key": "edition",
        "attributes.value": "1st",
    }
]);
```

Aggregation Stages

This is OK, but we get all attributes!


```
{
  "_id": "0002005018",
  "title": "Clara Callan: A novel",
  "attributes": [
    {
      "key": "edition",
      "value": "1st"
    },
    {
      "key": "dimensions",
      "value": "Height: 11.11 Inches, Length: 6.11 Inches,
Weight: 1 Pounds, Width: 1.11 Inches"
    },
    {
      "key": "isbn13",
      "value": "9780002005012"
    },
    {
      "key": "msrp",
      "value": "0.00"
    },
    {
      "key": "isbn",
      "value": "0002005018"
    },
    {
      "key": "isbn10",
      "value": "0002005018"
    }
  ]
}
```


$unwind
title: “1984”,
attri: [
{
“key”: “msrp”,
“value”: “10”,
},
{
“key”: “edition”,
“value”: “1st”,
},
{
“key”: “isbn”,
“value”: “82828722”,
},
]
$unwind
title: “1984”,
attr: {
“key”: “msrp”,
“value”: “10”,
},
title: “1984”,
attr: {
“key”: “edition”,
“value”: “first”,
},
title: “1984”,
attr: {
“key”: “isbn”,
“value”: “82828722”,
},

Aggregation Stages

We'll get only the attribute we're looking for!

```
db.books.aggregate([
  { $unwind : "$attr" },
  { $match:
    {"attr.key": "edition",
     "attr.value": "1st"}
  }
]);
```

Counting and Sorting

$count

```
db.books.aggregate([
  {
    $count: "numberOfBooks"
  }
]);
```

```
{
  "numberOfBooks": 6777
}
```

$sorting

```
db.books.aggregate([
  {
    $sort: {
      pages: -1
    }
  }
]);
```

```
_id: "0393970876"
title : "The Norton Shakespeare: Based on the Oxford Edition"
pages : 3420
```

```
_id: "0060655267"
title : "HarperCollins Study Bible: New Revised Standard Version (with the Apoc…"
pages : 2368
```

```
_id: "0443045607"
title : "Gray's Anatomy: The Anatomical Basis of Medicine and Surgery"
pages : 2092
```

```
_id: "0192835254"
title : "The Bible: Authorized King James Version with Apocrypha"
pages : 1824
```

```
_id: "0198600461"
title : "The Oxford English Reference Dictionary"
pages : 1804
```

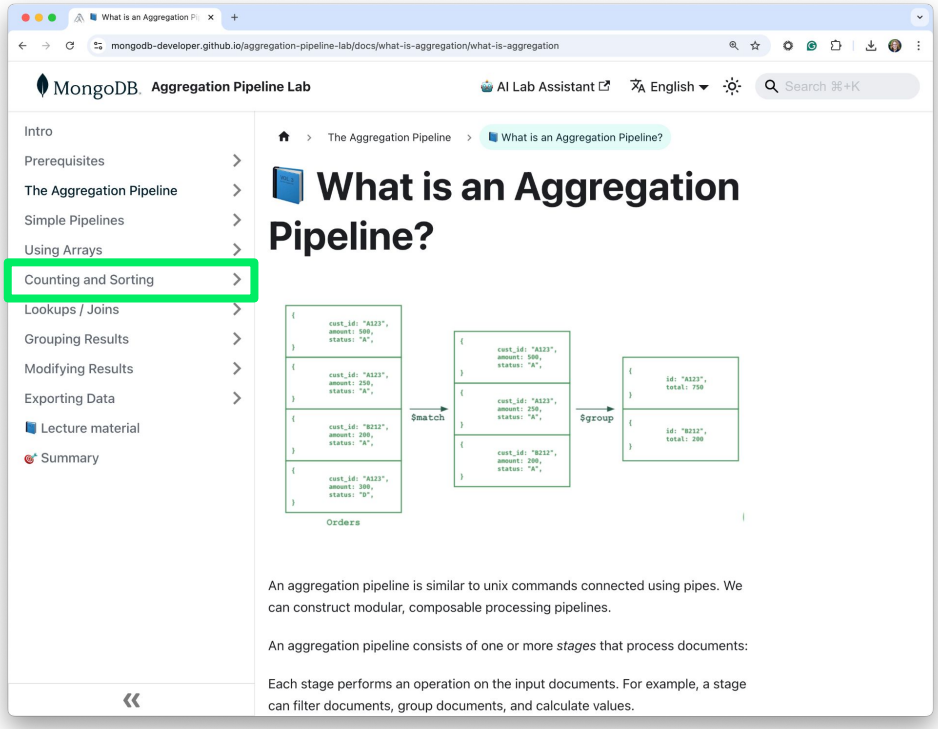
```
_id: "0312280874"
title : "Microsoft Encarta College Dictionary: The First Dictionary For The Int…"
pages : 1728
```

Exercise 2.
Counting and sorting

Environment:
mdb.link/instruqt-jedee

Lab:
mdb.link/agg-lab-grouping

Unsure? Need more information?
Ask the instructors!



Agenda

📘 A brief overview of last week's session

📘 MongoDB Query API

- CRUD
- Aggregation Framework

📘 **Common Aggregation Stages**

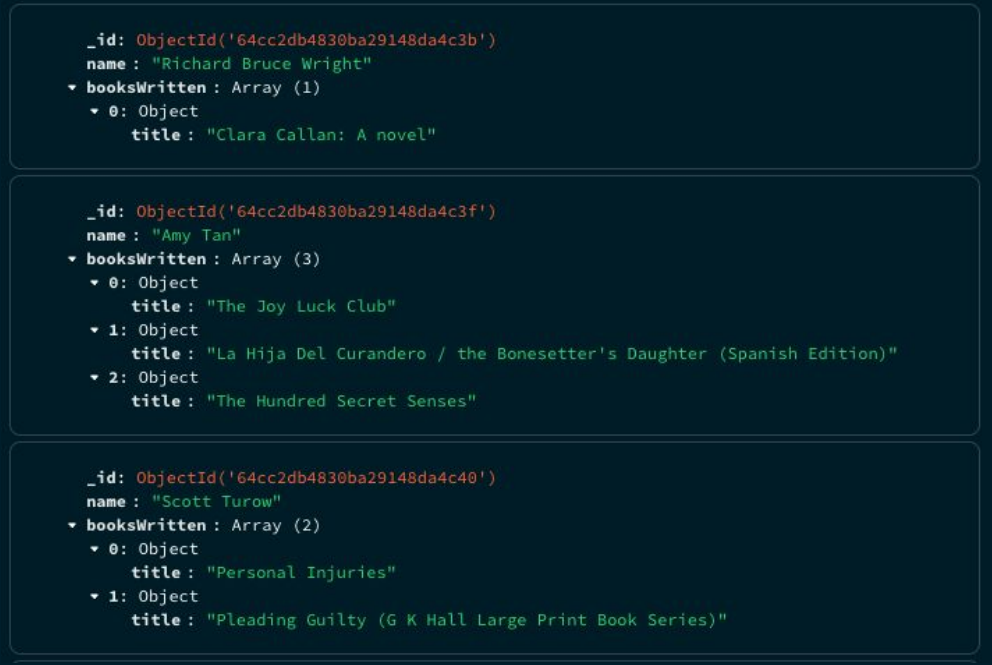
- 👐 Simple pipelines
- 👐 Arrays, counting, and sorting
- 👐 **Joins & working with results**

🎖️ Skill Badge Challenge

Joins

$lookup

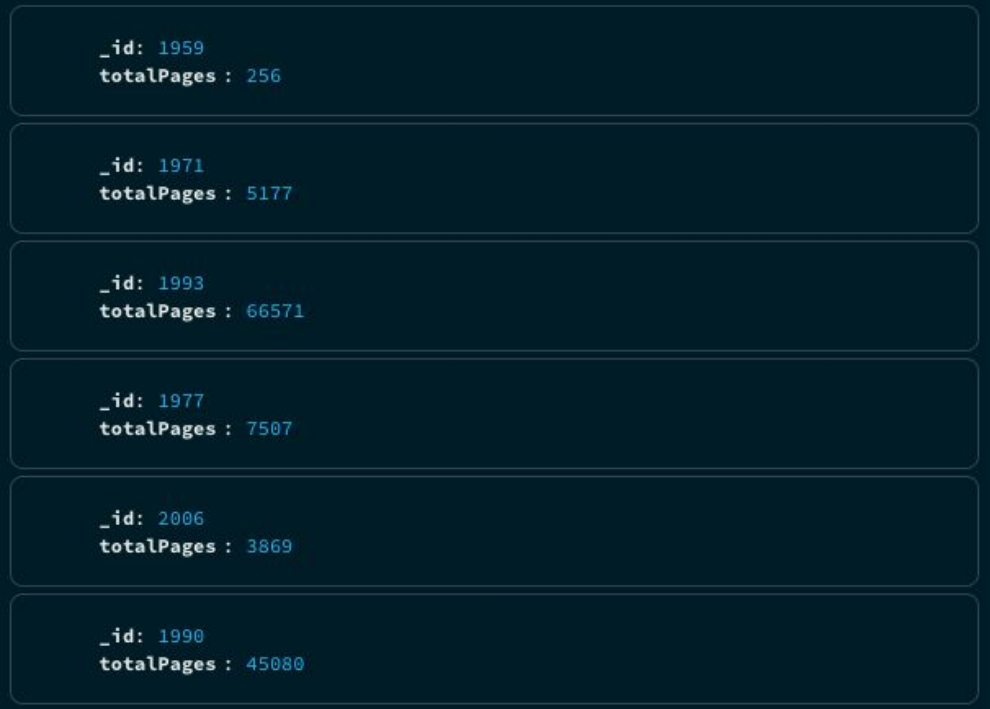
```
db.authors.aggregate([
  {
    $lookup: {
      from: "books",
      localField: "books",
      foreignField: "_id",
      as: "booksWritten"
    }
  }
])
```



Grouping Data

$group

```
db.books.aggregate([
  {
    $group: {
      _id: "$year",
      totalPages: {
        $sum: "$pages"
      }
    }
  }
])
```



Modifying Results

$set

```
db.books.aggregate([
  {
    $set: {
      readingTimeHours: {
        $divide: [
          { $multiply: ["$pages", 2] },
          60
        ]
      }
    }
  }
])
```

```
_id: "0002005018"
title : "Clara Callan: A novel"
pages : 414
readingTimeHours : 13.8
```

```
_id: "0002244705"
title : "Charity"
pages : 320
readingTimeHours : 10.666666666666666
```

```
_id: "0002251000"
title : "NBA: The Official Fan's Guide"
pages : 160
readingTimeHours : 5.333333333333333
```

```
_id: "0002253402"
title : "Anita and me"
pages : 328
readingTimeHours : 10.933333333333334
```

```
_id: "0002554062"
title : "Shadow maker: The life of Gwendolyn MacEwen"
pages : 416
readingTimeHours : 13.866666666666667
```

Exporting Data

$out

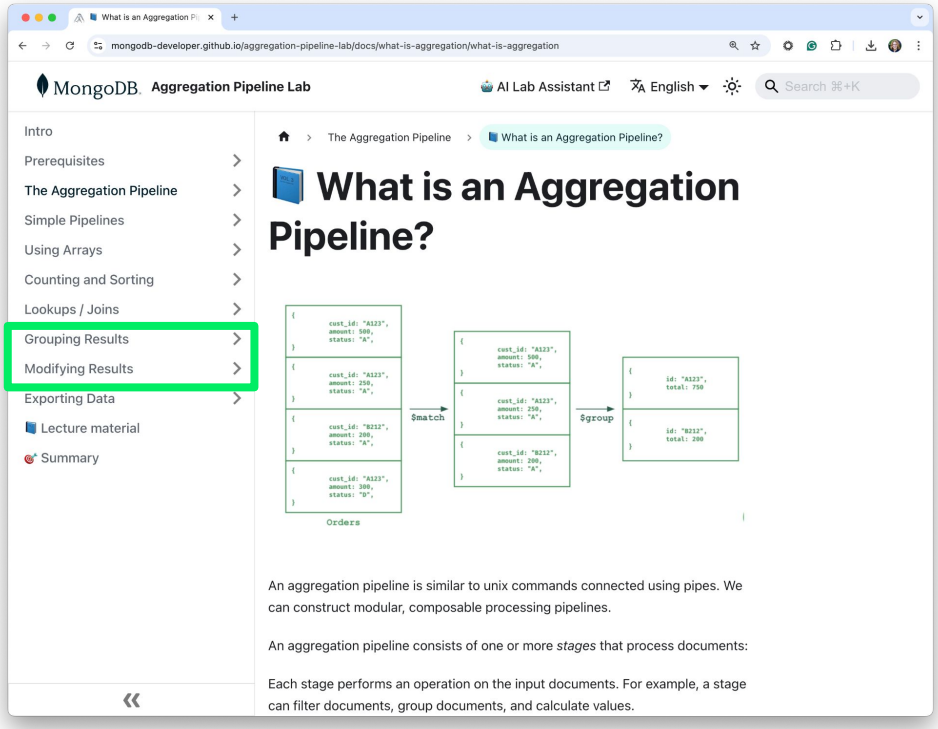
```
db.books.aggregate([
  {
    $match: {
      pages: 100
    }
  },
  {
    $out: {
      db: "reporting",
      coll: "authors"
    }
  }
])
```

Exercise 3.
Grouping results & modifying results

Environment:
mdb.link/instruqt-jedee

Lab:
mdb.link/agg-lab-grouping

Unsure? Need more information?
Ask the instructors!

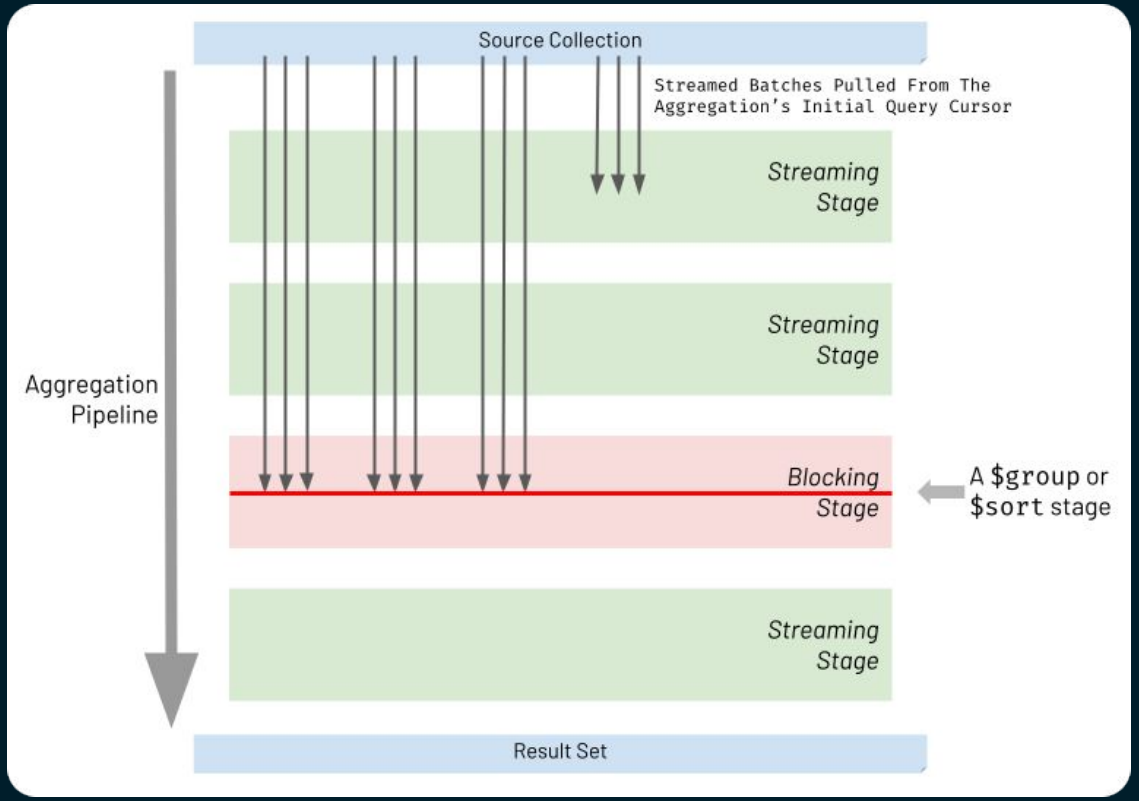


Bonus Question:

Using aggregation on *authors* collection:

For each author, find the book he/she has written with the most number of pages.

Streaming VS Blocking Stages



Best Practices

Avoid using aggregation only for transformation

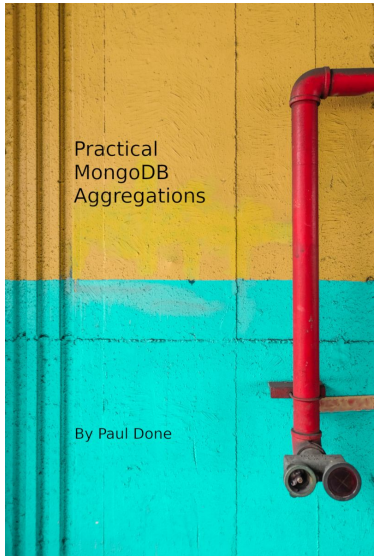
Avoid block stages

Use explain plan

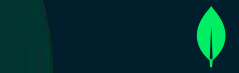
Embrace composability

E-BOOK

Practical MongoDB Aggregations



mdb.link/agg-ebook



Compass.
The GUI for MongoDB.

https://mdb.link/compass

Session survey

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🎖️ **Skill Badge Challenge**

SKILL BADGE knowledge check – 10 MINUTES

Fundamentals of Data Transformation

MongoDB Skill

Fundamentals of Data Transformation

mdb.link/apac-workshop/badge-3

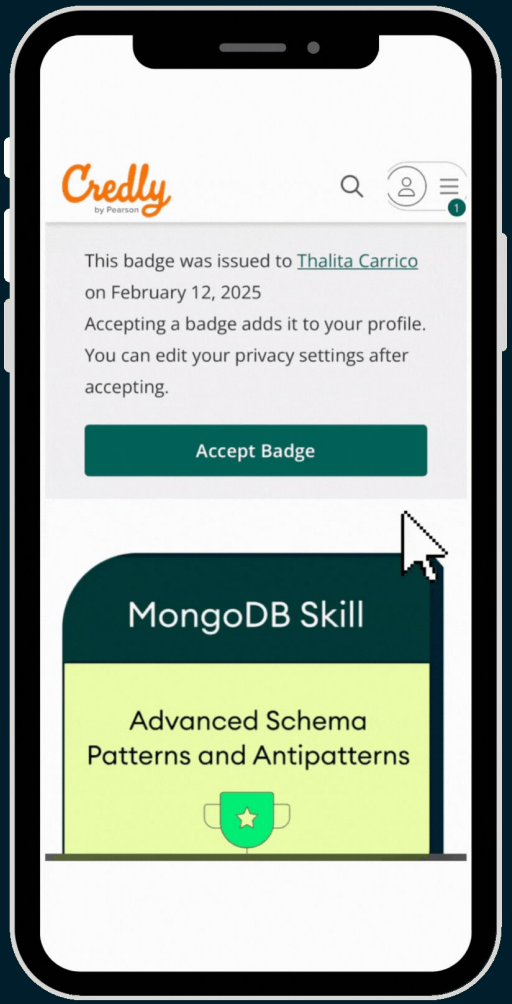
Questions?

Ask your neighbor

Raise your hand

Share Your Badge

Use **#MDBDayAPAC**



Thank you!

Teo Wen Jie
Senior Developer Advocate
/wjteo

Lets connect!