Class 13: Document Databases

- Review: Last Class
- MERN Stack
- Databases
- MongoDB

Review

Review: JavaScript Object Notation

JSON (pronounced “Jason”)is a text-based data interchange format for structuring and exchanging data as key-value objects and arrays between systems, like client and server. **Example:**

```
{
  "name": "Alice",
  "age": 30,
  "isStudent": false,
  "hobbies": ["reading", "hiking", "coding"],
  "address": {
    "street": "123 Main St",
    "city": "Anytown",
    "state": "CA"
  }
}
```

Review: Arrays of Objects

```
const cardData = [
  {
    id: 'galaxy',
    imgUri: "/images/galaxy.webp",
    altText: "galaxy",
    caption: "A galaxy is a collection of stars, gas, and dust held together by gravity.",
    citation: "Microsoft Copilot",
  },
  {
    id: 'asteroid',
    imgUri: '/images/asteroid.webp',
    altText: 'asteroid',
    caption: 'An asteroid is a small rocky body that orbits the sun.',
  },
  ...
]
```

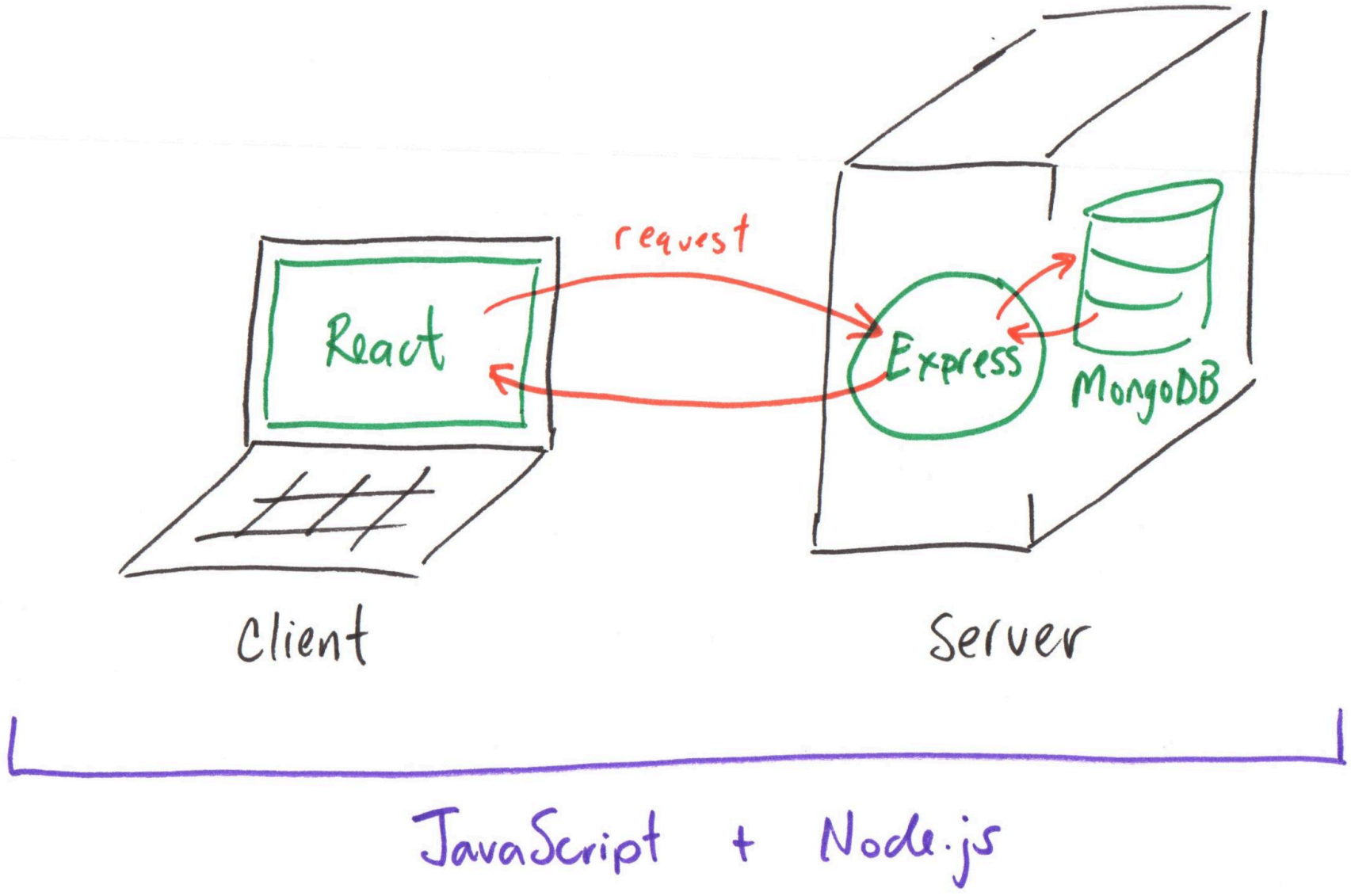
Review: Rendering Lists with `map`

```
{cardData.map((card, index) => (
  <Card
    key={card.id}

    imgUri={card.imgUri}
    altText={card.altText}
    caption={card.caption}
    citation={card.citation}
    bgColor={card.bgColor}

    isFlipped={flippedCard === card.id}
    onFlip={(showBack) => setFlippedCard(showBack ? card.id : null)}
  />
))}
```

MERN

MERN Stack

- **M**ongoDB
- **E**xpress
- **R**eact
- **N**ode.js


request
React
Express
MongoDB
Client
Server
JavaScript + Node.js

Databases

Database

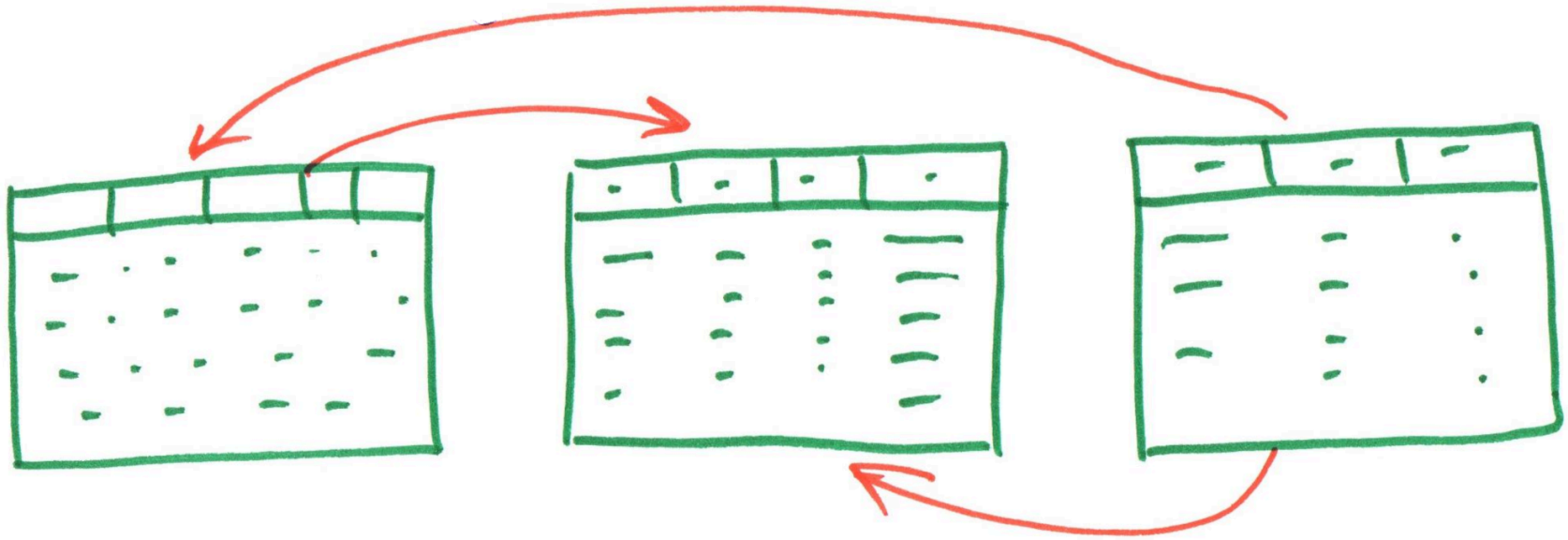
An organized collection of data.

Examples:

- Library catalog
- Phone contacts
- Music playlist
- Social media feed

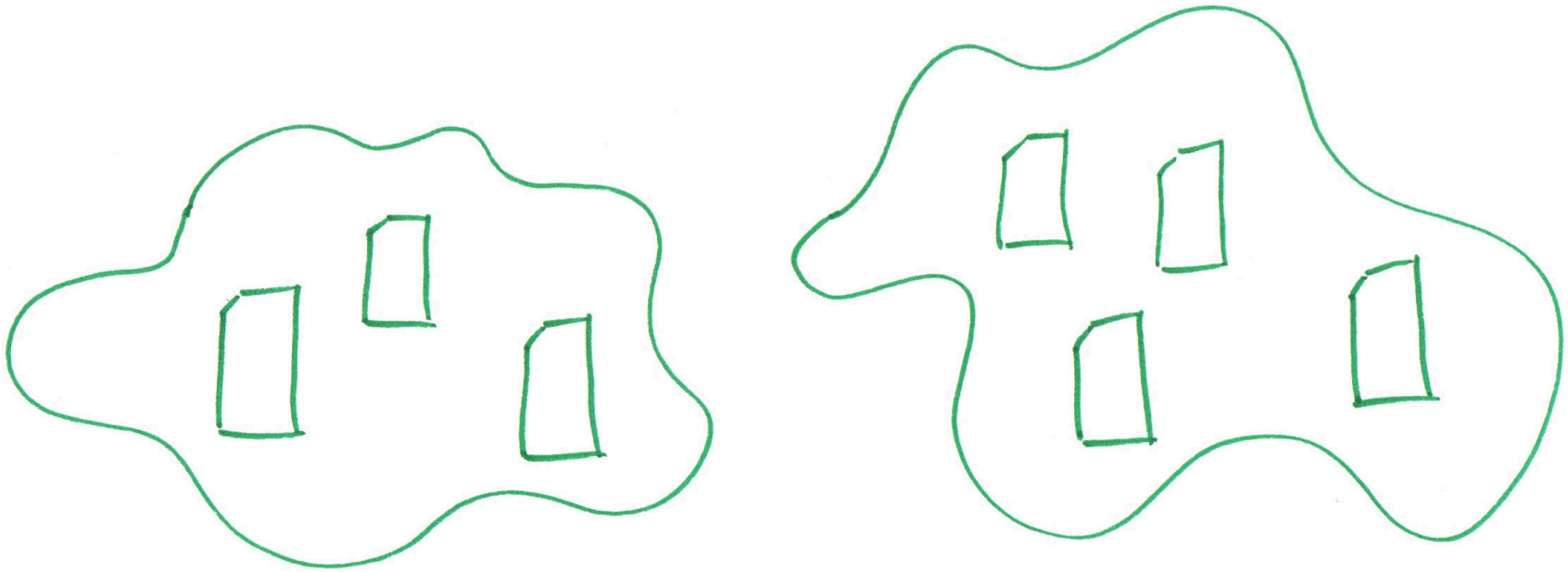
Relational Database

A database consisting of separate tables, having explicitly defined relationships, and who elements may be selectively combined as the results of queries.



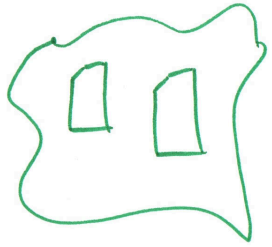
Document Database

A database that stores and manages large volumes of unstructured or semi-structured data as “documents”.

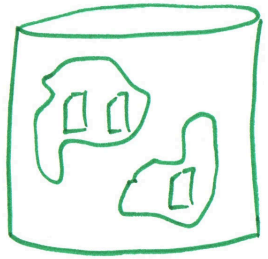


Document Database Terminology

Document: A self-contained unit of data that represents a single entity. (Typically JSON)



Collection: A group of documents.



Database: One or more collections of documents.

Activity: Make a Collection

With your peers (2-4), make a collection of documents on the board.

1. Identify something you are all interested in (e.g. video games, songs, foods, movies, etc.)
2. Next, plan a collection of documents where each document has a **string**, and **number**.

   Each person should draw a box representing a document, and write an example document with a **string** and **number** in that box.
3. Draw a big “circle” around all the documents to represent the collection.

Discussion: Making a Collection

Look around the room. Where are the documents, collections, and databases?

Database: The *entire classroom* is the “database” because it’s a grouping of collections.

Collection: The *circle* around the documents is the “collection” because it’s a grouping of documents.

Document: Each *box* is a “document” because it contains data about a single entity.

MongoDB

MongoDB

MongoDB is a popular document database.

All documents in MongoDB are JSON.

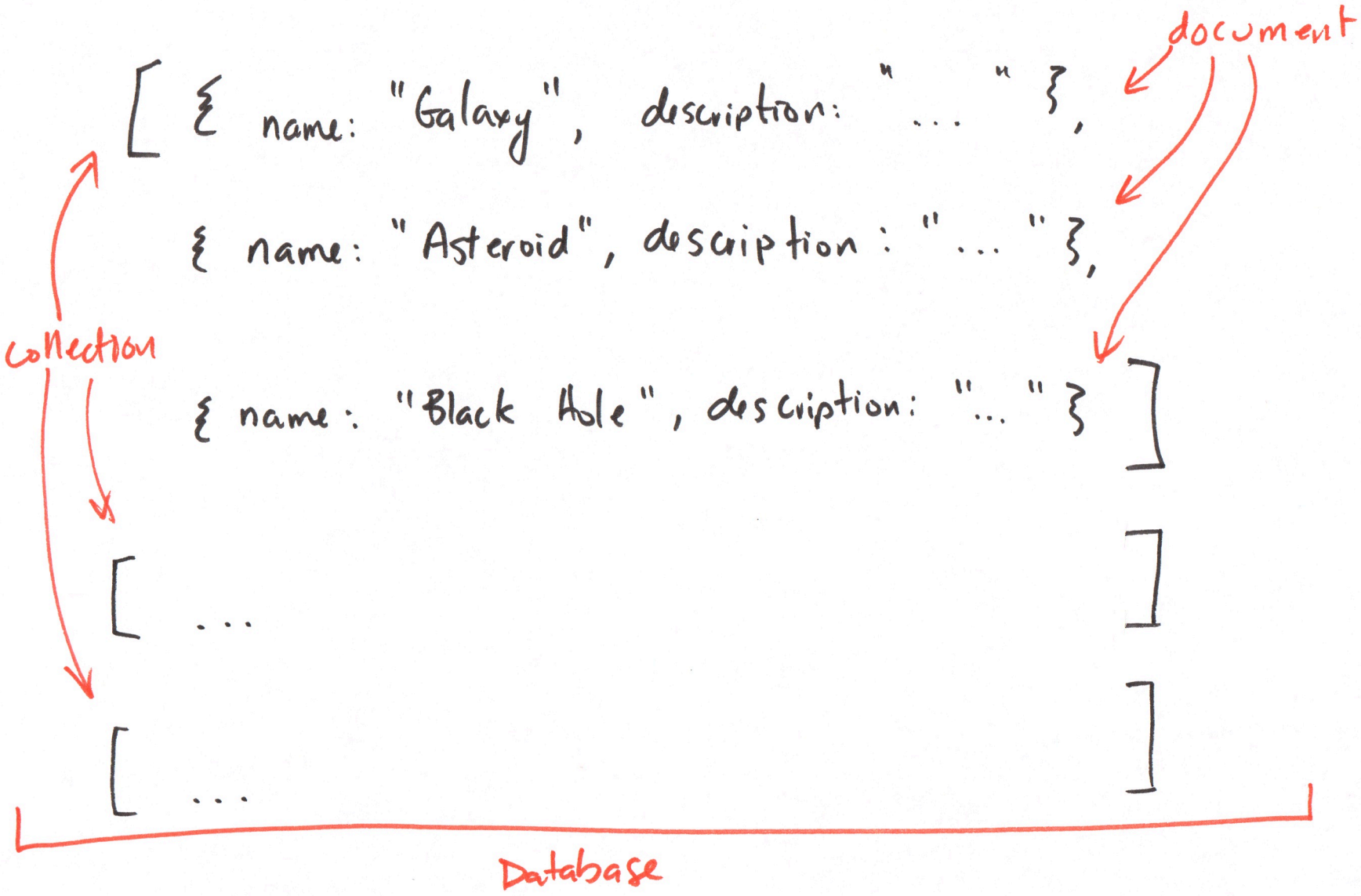
Example: MongoDB

Document (Object)

```
{
  name: "Asteroid",
  description: "An asteroid is a small
    rocky body that orbits the sun.",
}
```

Collection (Array of Objects)

```
[
  {
    name: "Asteroid",
    description: "An asteroid is a
      small rocky body that orbits
      the sun.",
  },
  {
    name: "Galaxy",
    description: "A galaxy is a
      collection of stars, gas, and
      dust held together by gravity.",
  }
]
```


document
[{ name: "Galaxy", description: "..." },
{ name: "Asteroid", description: "..." },
{ name: "Black Hole", description: "..." }]
collection
[...]
[...]
Database

Activity: Make a Collection

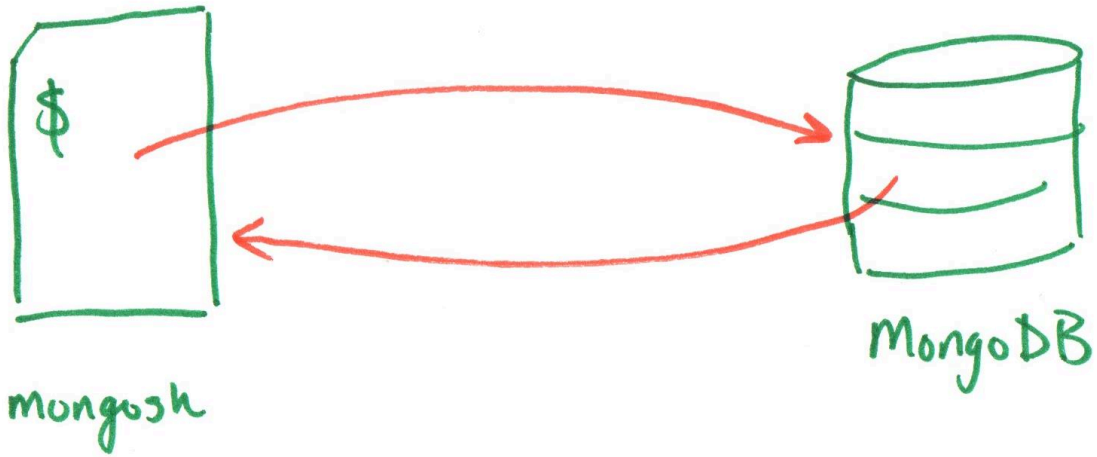
Working with your peers (2-4), complete **Part I** on the handout.

```
[
  {
    name: "Asteroid",
    description: "An asteroid is a small rocky body that orbits the sun.",
  },
  {
    name: "Galaxy",
    description: "A galaxy is a collection of stars, gas, and dust held together by gravity.",
  }
]
```

Coding the Database

`mongosh` is a *shell interface* for MongoDB.

Specifically, it is a JavaScript and Node.js environment for interacting with MongoDB databases.



MongoDB Shell

Create/use a database:

```
use("TODO_DATABASE_NAME")
```

Create a collection (and delete the old one):

```
db.TODO_COLLECTION_NAME.drop()
db.createCollection("TODO_COLLECTION_NAME")
```

Demo: Create a Database and Collection

```
use('app')

db.space.drop()
db.createCollection('space')

db.questions.drop()
db.createCollection('questions')
```

Activity: Initialize a MongoDB Database

Working with your peers (2-4), complete items **1** and **2** in **Part II** on the handout.

```
use('app')

db.space.drop()
db.createCollection('space')

db.questions.drop()
db.createCollection('questions')
```

MongoDB Shell: Insert Documents

Insert a single document:

```
db.TODO_COLLECTION_NAME.insertOne(TODO_DOCUMENT)
```

Insert multiple documents:

```
db.TODO_COLLECTION_NAME.insertMany([
  TODO_DOCUMENT_1,
  TODO_DOCUMENT_2,
  ...
])
```

Demo: Insert Documents into MongoDB

```
db.space.insertOne({
  name: "Galaxy",
  description: "A galaxy is a collection of stars, gas, and dust held together by gravity.",
  source: "Microsoft Copilot"
})

db.space.insertMany([
  {
    name: "Asteroid",
    description: "An asteroid is a small rocky body that orbits the sun.",
    source: "Microsoft Copilot"
  },
  {
    name: "Black Hole",
    description: "A black hole, a region of space where gravity is so strong that nothing can escape it.",
    source: "Microsoft Copilot",
  },
])
```

Activity: Insert Documents into MongoDB

Working with your peers (2-4), complete item **3** in **Part II** on the handout.

```
db.TODO_COLLECTION_NAME.insertMany([
  TODO_DOCUMENT_1,
  TODO_DOCUMENT_2,
  ...
])
```

Activity: MongoDB in Codespaces

Together, let's create a `playground.mongodb.js` file. Execute it to initialize the database, collection, and documents you planned in parts I & II.

Then, we'll explore the MongoDB shell in Codespaces to see the database, collection, and documents you created.

`_id` Field

When a document is inserted into a MongoDB collection, it is automatically assigned a unique identifier (the `_id` field).

```
{
  "_id": ObjectId("60c72b2f9b1e8a5f4d3e8b9c"),
  "name": "Asteroid",
  "description": "An asteroid is a small rocky body that orbits the sun.",
  "source": "Microsoft Copilot"
}
```

Summary

- Databases are organized collections of data.
- A relational database consists of separate tables with explicitly defined relationships.
- A document database stores and manages large volumes of unstructured or semi-structured data as “documents”.
- MongoDB is a popular document database that uses JSON to represent documents.
- The MongoDB shell (`mongosh`) is a JavaScript and Node.js environment for interacting with MongoDB databases.
- Documents inserted into MongoDB collections are automatically assigned a unique identifier in the `_id` field.

What's Next

Due Today: Project 1, Final Milestone

Wednesday: Database Operations

Wednesday: Project 2, Milestone 1 Released

Friday: Practice Problem Workshop (Document Databases)