In this tutorial, we will learn how to build REST APIs for a Library Management System Project using Spring Boot, Spring Data JPA (Hibernate), and MySQL database.
We'll create a simple version of the Library Management System with basic functionalities:

- Create a new User
- Fetch all the Users
- Add new book
- Fetch all the books
- Fetch specific book
- Delete a book
- Borrow a book
- Return a book

1. Set up a Spring Boot project

Let's launch Spring Initializr and fill up the following project details:

Project: Maven Project (or Gradle)

Language: Java

Packaging: Jar

Java version: 17

Dependencies: Spring Web, Spring Data JPA, MySQL Driver, and Lombok

Download, extract the project, and import to your favorite IDE.
2. Configure the MySQL database

Let's open the src/main/resources/application.properties file and add the MySQL configuration properties:

```
spring.datasource.url=jdbc:mysql://localhost:3306/banking_app
spring.datasource.username=root
spring.datasource.password=Mysql@123
spring.jpa.hibernate.ddl-auto=update
```

Make sure that you change the MySQL database username and password as per your MySQL installation on your machine.

The spring.jpa.hibernate.ddl-auto=update line ensures that tables and columns get automatically created or updated based on your JPA entities.
3. Create JPA Entities
User
Let's create a User JPA entity and add the following code to it:

```
import jakarta.persistence.*;
import lombok.Getter;
import lombok.Setter;

@Getter
@Setter
@Entity
public class User {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;
    private String name;
}
```

Book

Let's create a Book JPA entity and add the following code to it:

```
import jakarta.persistence.*;
import lombok.Getter;
import lombok.Setter;

@Getter
@Setter
@Entity
public class Book {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;
    private String title;
    private String author;
    private boolean borrowed;
    @ManyToOne
    @JoinColumn(name = "user_id")
    private User borrowedBy;
}
```

We added a relationship between the Book and User entities to track which user has borrowed a book.

4. Create Spring Data JPA Repositories

Next, let's create Spring Data JPA repositories to get CRUD methods to perform CRUD database operations on Book and User entities.

BookRepository

```
import net.javaguides.bankingapp.entity.Book;
```

```
import org.springframework.data.jpa.repository.JpaRepository;

public interface BookRepository extends JpaRepository<Book, Long> {
}
```

UserRepository

```
import net.javaguides.bankingapp.entity.User;
import org.springframework.data.jpa.repository.JpaRepository;

public interface UserRepository extends JpaRepository<User, Long> {
}
```

6. Create a Service Layer
BookService

```
import net.javaguides.bankingapp.entity.Book;
import net.javaguides.bankingapp.entity.User;
import net.javaguides.bankingapp.repository.BookRepository;
import net.javaguides.bankingapp.repository.UserRepository;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

import java.util.List;

@Service
public class BookService {

    @Autowired
    private BookRepository bookRepository;

    @Autowired
    private UserRepository userRepository;

    public List<Book> findAll() {
        return bookRepository.findAll();
    }

    public Book findById(Long id) {
        return bookRepository.findById(id).orElse(null);
    }

    public Book save(Book book) {
        return bookRepository.save(book);
    }
```

```
    public void deleteById(Long id) {
        bookRepository.deleteById(id);
    }

    public Book borrowBook(Long bookId, Long userId) {
        Book book = findById(bookId);
        User user = userRepository.findById(userId).orElse(null);

        if (book != null && !book.isBorrowed() && user != null) {
            book.setBorrowedBy(user);
            book.setBorrowed(true);
            return save(book);
        }
        // Handle errors (e.g., book not found, book already borrowed, user not found)
        return null;
    }

    public Book returnBook(Long bookId) {
        Book book = findById(bookId);
        if (book != null && book.isBorrowed()) {
            book.setBorrowedBy(null);
            book.setBorrowed(false);
            return save(book);
        }
        // Handle errors (e.g., book not found, book not borrowed)
        return null;
    }
}
```

UserService

```
import net.javaguides.bankingapp.entity.User;
import net.javaguides.bankingapp.repository.UserRepository;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

import java.util.List;
import java.util.Optional;

@Service
public class UserService {

    @Autowired
    private UserRepository userRepository;

    public List<User> findAll() {
```

```
        return userRepository.findAll();
    }

    public User save(User user) {
        return userRepository.save(user);
    }
}
```

7. Controller Layer

UserController

Let's create a UserController class and expose a couple of REST APIs to save and fetch all users.

```
import net.javaguides.bankingapp.entity.User;
import net.javaguides.bankingapp.service.UserService;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.*;

import java.util.List;

@RestController
@RequestMapping("/api/users")
public class UserController {
    @Autowired
    private UserService userService;

    @GetMapping
    public List<User> getAllUsers() {
        return userService.findAll();
    }

    @PostMapping
    public User addUser(@RequestBody User user) {
        return userService.save(user);
    }
}
```

BookController

Let's create BookController class and expose REST APIs to save, fetch, fetch all, delete, barrow, and return books.

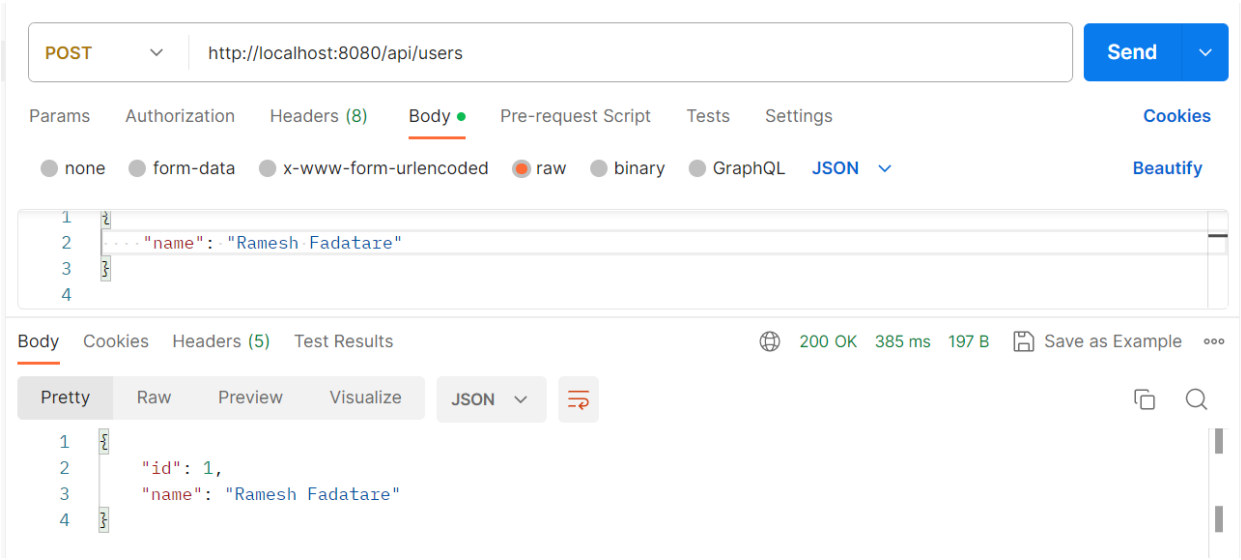
```
import net.javaguides.bankingapp.entity.Book;
import net.javaguides.bankingapp.service.BookService;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.http.ResponseEntity;
import org.springframework.web.bind.annotation.*;
```

```
import java.util.List;

@RestController
@RequestMapping("/api/books")
public class BookController {

    @Autowired
    private BookService bookService;

    @GetMapping
    public List<Book> getAllBooks() {
        return bookService.findAll();
    }

    @GetMapping("/{id}")
    public Book getBook(@PathVariable Long id) {
        return bookService.findById(id);
    }

    @PostMapping
    public Book addBook(@RequestBody Book book) {
        return bookService.save(book);
    }

    @PutMapping("/{id}")
    public Book updateBook(@PathVariable Long id, @RequestBody Book book) {
        // Additional logic to ensure you're updating the correct book
        return bookService.save(book);
    }

    @DeleteMapping("/{id}")
    public void deleteBook(@PathVariable Long id) {
        bookService.deleteById(id);
    }

    @PostMapping("/{bookId}/borrow/{userId}")
    public ResponseEntity<Book> borrowBook(@PathVariable Long bookId, @PathVariable
Long userId) {
        Book borrowedBook = bookService.borrowBook(bookId, userId);
        if (borrowedBook != null) {
            return ResponseEntity.ok(borrowedBook);
        } else {
            return ResponseEntity.badRequest().build(); // or a more descriptive error response
        }
    }
```

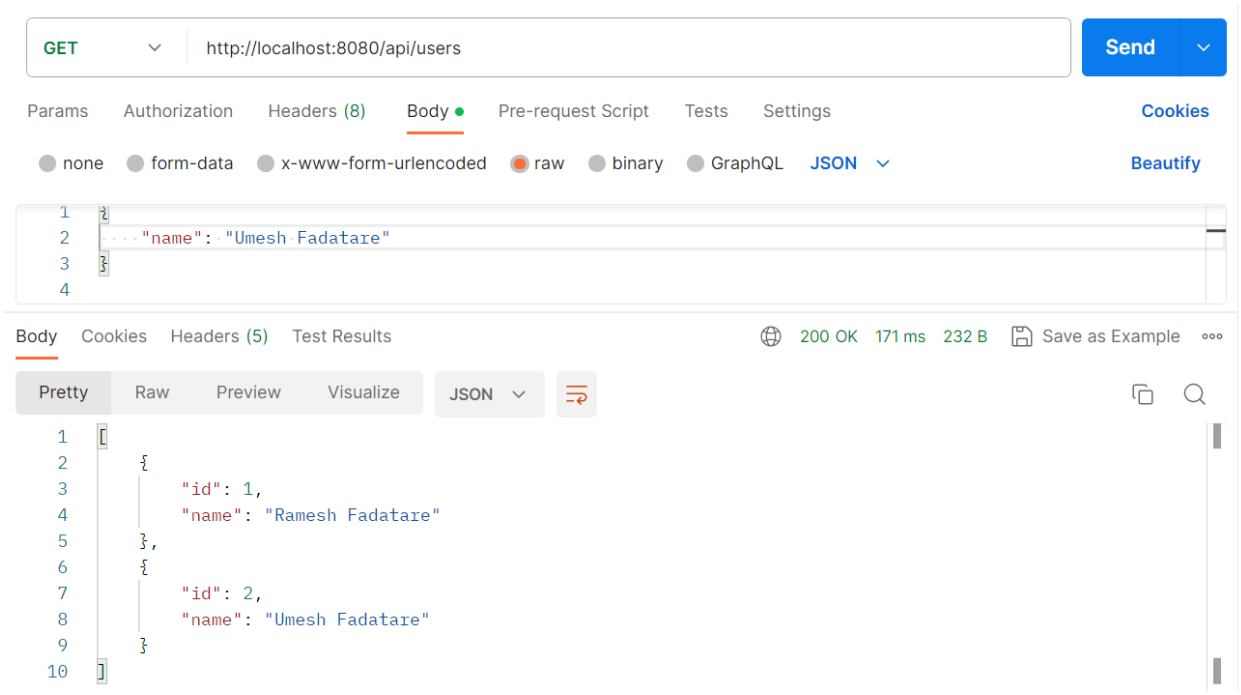
```
    @PostMapping("/{bookId}/return")
    public ResponseEntity<Book> returnBook(@PathVariable Long bookId) {
        Book returnedBook = bookService.returnBook(bookId);
        if (returnedBook != null) {
            return ResponseEntity.ok(returnedBook);
        } else {
            return ResponseEntity.badRequest().build(); // or a more descriptive error response
        }
    }
}
```

Run and Test the Spring Boot Application

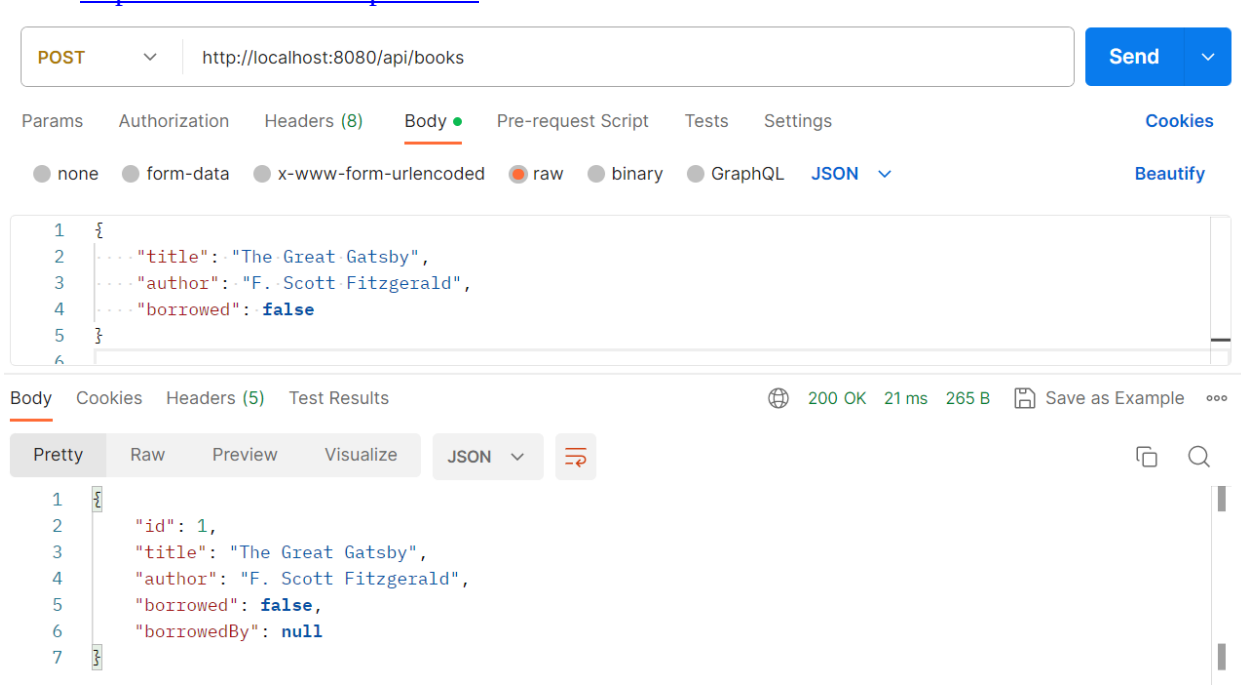
Navigate to the main application class (with @SpringBootApplication annotation) and run it as a Java application.
Add a new user:



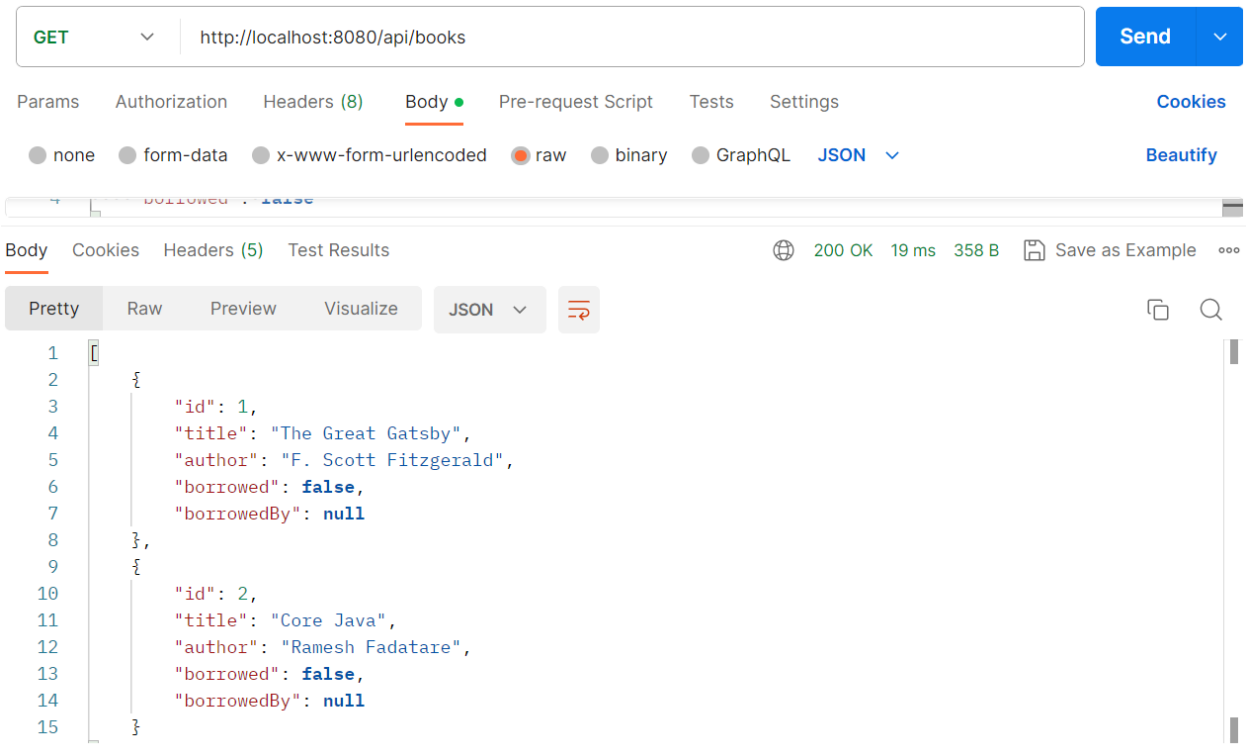
Fetch all users:
HTTP Method: GET



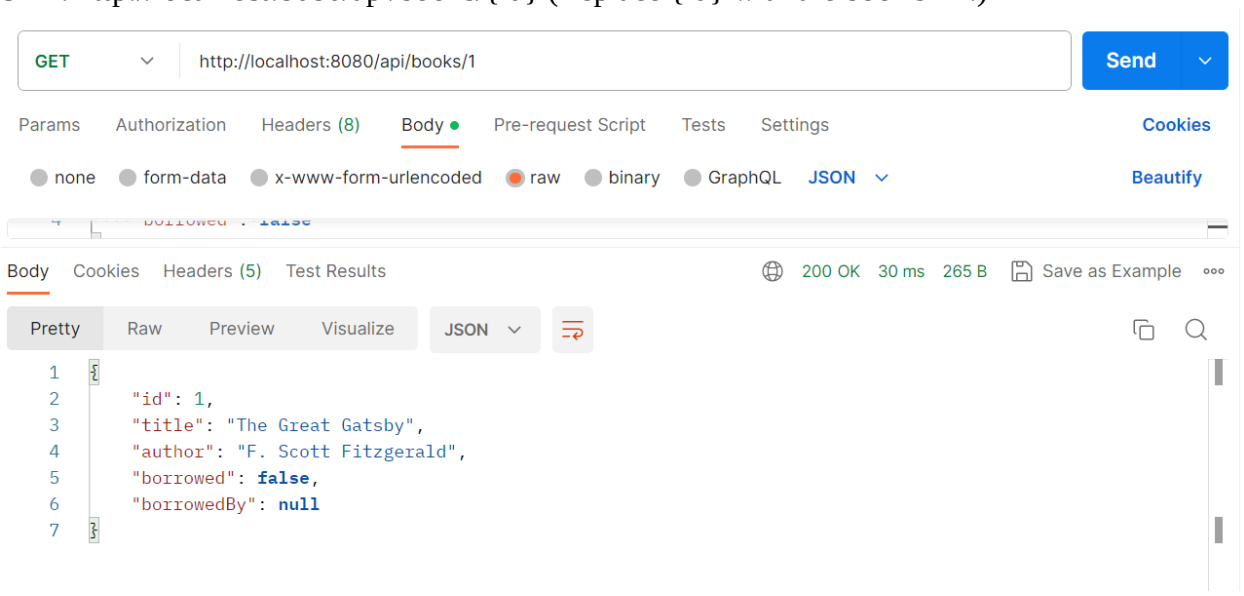
Add a new book:
HTTP Method: POST
URL: http://localhost:8080/api/books



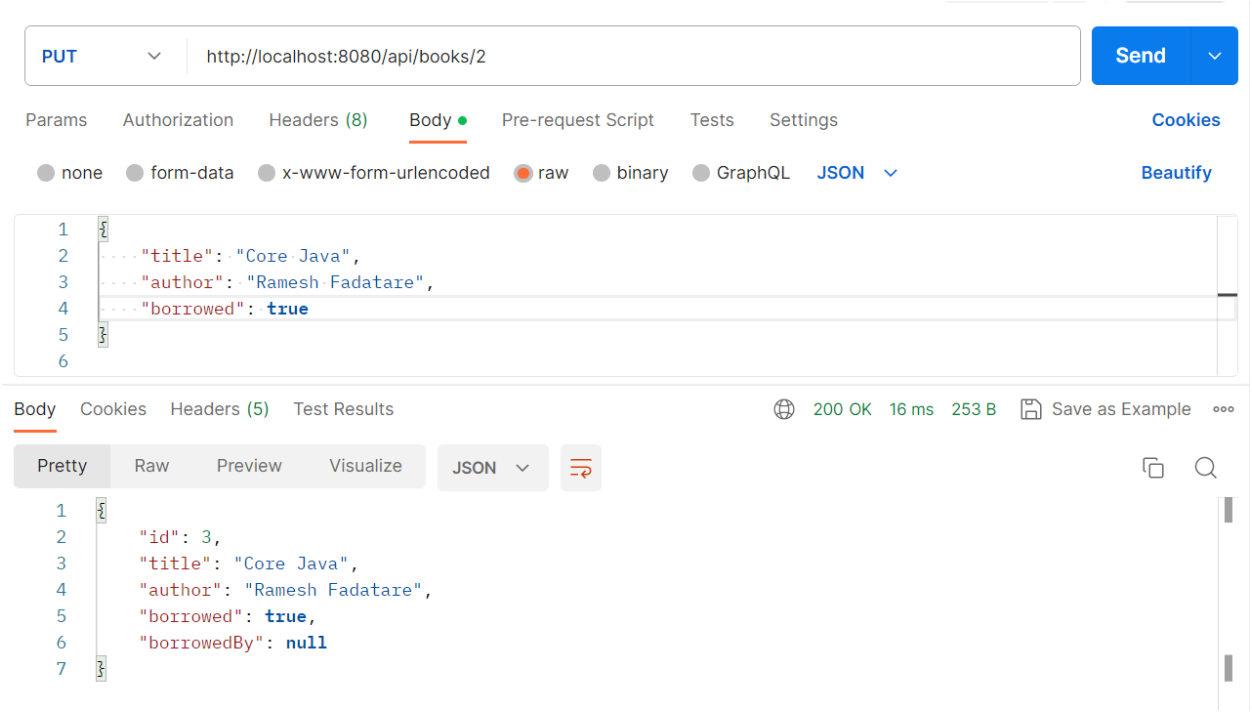
Fetch all books:
HTTP Method: GET
URL: http://localhost:8080/api/books



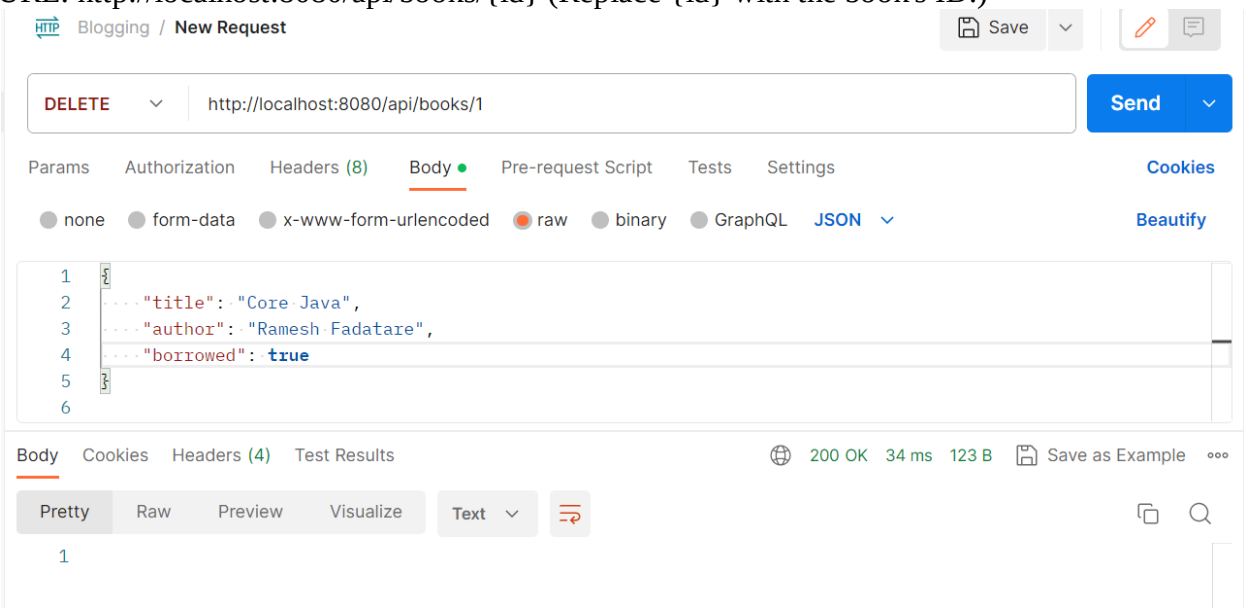
Fetch a specific book:
HTTP Method: GET
URL: http://localhost:8080/api/books/{id} (Replace {id} with the book's ID.)



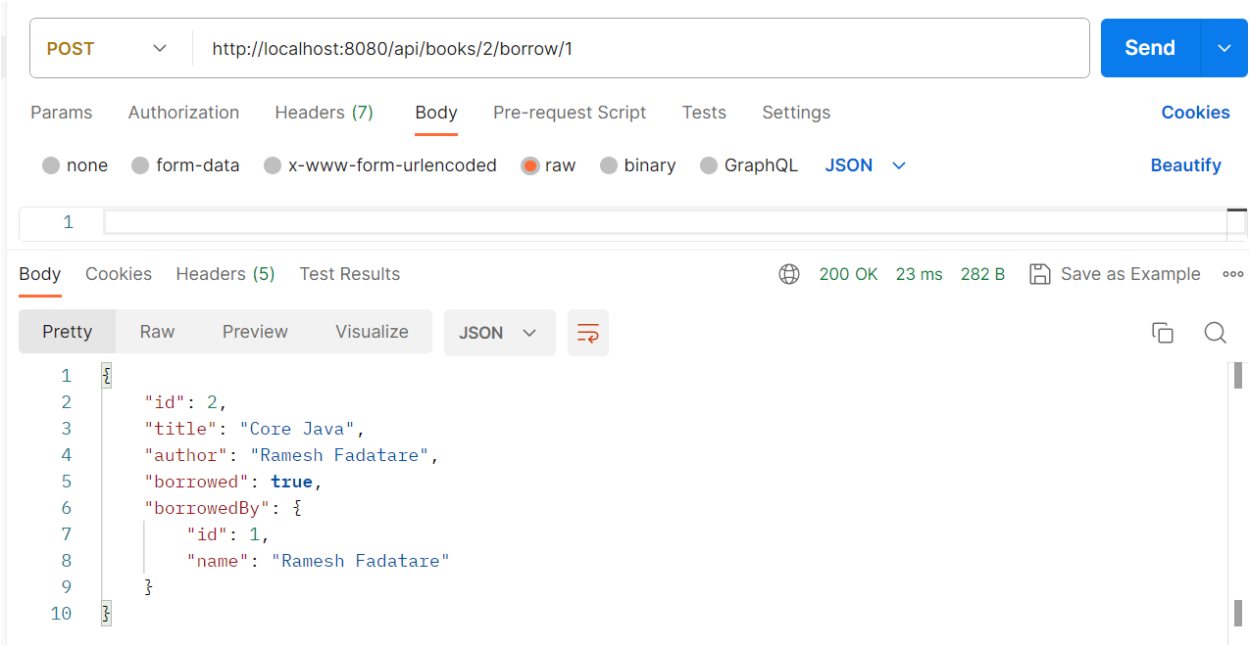
Update a book:
HTTP Method: PUT
URL: http://localhost:8080/api/books/{id} (Replace {id} with the book's ID.)



Delete a book:
HTTP Method: DELETE
URL: http://localhost:8080/api/books/{id} (Replace {id} with the book's ID.)



Borrow a book:
HTTP Method: POST
URL: http://localhost:8080/api/books/{bookId}/borrow/{userId}



Return a book:
HTTP Method: POST
URL: http://localhost:8080/api/books/{bookId}/return (Replace {bookId} with the book's ID.)