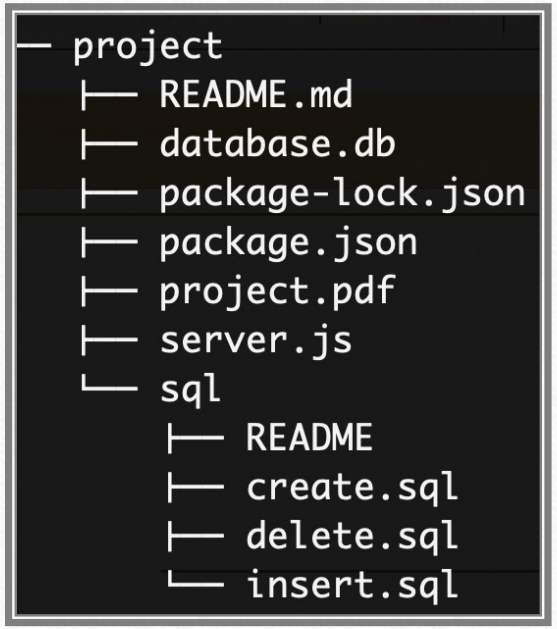
NodeJS Backend Project

Project structure

- README.md: Contains information about the project and instructions.
- database.db: The SQLite database file.
- package-lock.json & package.json: Manage project dependencies.
- project.pdf: The project presentation.
- server.js: The main server file.
- sql/: Contains SQL scripts for creating, deleting, and inserting data into the database.



Main functionalities

- Create, read, update, and delete data in a SQLite database via a Node.js server.
- The server processes HTTP GET requests to retrieve data, POST requests to add data, UPDATE requests to modify data, and DELETE requests to remove data.
- It also handles errors and sends responses in JSON format.

Technologies Used

- Node.js
- SQLite
- Express.js

Challenges

1. Setting up and managing the SQLite database.
2. Implementing the HTTP methods with proper error handling.
3. Ensuring the server responses are in the correct JSON format.

Solutions

1. Express.js middleware for error handling
   Use 'app.use()' to define a middleware function that checks for errors and responds with the appropriate HTTP status code and message.

2. Express.js ‘res.json()’ method
   It automatically sends responses as JSON.

Timeline

1. Create necessary scripts to setup SQLite database
2. Connect to the SQLite database from the Node.js application
3. Implement GET HTTP request to retrieve data from the database
4. Implement POST HTTP request to add data to the database
5. Implement PUT HTTP request to update data in the database
6. Implement DELETE HTTP request to remove data from the database
7. Implement error handling for all HTTP methods
8. Test all endpoints and ensure they work as expected
9. Write documentation for the project, including setup and usage instructions

Code

Create a basic Express server connected to a SQLite database

```
1  const express = require("express"); // Import Express
2  const app = express(); // Initialize Express app
3  app.use(express.json()); // Enable to parse JSON body in POST requests
4
5  const sqlite3 = require("sqlite3").verbose(); // Import SQLite
6  let db = new sqlite3.Database("./database.db"); // Connect to SQLite database
7  const table = "Clothes"; // Define table name
8
```

```
139  app.listen(8080, () => {
140    // Start server
141    console.log(`Server is running on http://localhost:8080 ...`);
142  });
```

Define variables in the beginning

```
 9  // Define HTTP status codes
10  const HTTP_STATUS_OK = 200;
11  const HTTP_STATUS_CREATED = 201;
12  const HTTP_STATUS_NO_CONTENT = 204;
13  const HTTP_STATUS_INTERNAL_SERVER_ERROR = 500;
14
15  // Define SQL queries
16  const SELECT_ALL = `SELECT * FROM ${table}`;
17  const SELECT_ID = `SELECT * FROM ${table} WHERE id = ?`;
18  const INSERT_INTO = `INSERT INTO ${table} (name, type, size, color, price) VALUES (?, ?, ?, ?, ?)`;
19  const UPDATE = `UPDATE ${table} SET name = ?, type = ?, size = ?, color = ?, price = ? WHERE id = ?`;
20  const DELETE = `DELETE FROM ${table} WHERE id = ?`;
21
```

error response

```
22  // Function to create error response
23  function createErrorResponse(err) {
24    return {
25      error: err.message, // Error message
26      code: err.code, // Error code
27      details: {
28        /* any relevant details */
29      },
30      stack: process.env.NODE_ENV === "development" ? err.stack : "hidden", // Stack trace (only in development)
31    };
32  }
33
```

Retrieve existing records (HTTP GET method)

```
34  app.get("/", (req, res) => {
35    // Root endpoint
36    res.redirect("/clothes"); // Redirect to '/clothes'
37  });
38
39  app.get(`/clothes`, (req, res) => {
40    // GET endpoint for all records
41    db.all(SELECT_ALL, [], (err, rows) => {
42      // Execute SQL query
43      if (err) {
44        // If error occurs
45        res
46          .status(HTTP_STATUS_INTERNAL_SERVER_ERROR)
47          .json(createErrorResponse(err)); // Send error response
48        return;
49      }
50      res.json(rows); // Send response with all rows
51    });
52  });
53
```

Retrieve a specific record (HTTP GET method)

```
54  app.get(`/clothes/:id`, (req, res) => {
55    // GET endpoint for a specific record
56    const values = [req.params.id]; // ID parameter from URL
57
58    db.get(SELECT_ID, values, (err, row) => {
59      // Execute SQL query
60      if (err) {
61        // If error occurs
62        res
63          .status(HTTP_STATUS_INTERNAL_SERVER_ERROR)
64          .json(createErrorResponse(err)); // Send error response
65        return;
66      }
67      res.json(row); // Send response with the row
68    });
69  });
70
```

Create a new record (HTTP POST method)

```
71  app.post(`/clothes`, (req, res) => {
72    // POST endpoint
73    const values = [
74      req.body.name, // Values from request body
75      req.body.type,
76      req.body.size,
77      req.body.color,
78      req.body.price,
79    ];
80
81    db.run(INSERT_INTO, values, function (err) {
82      // Execute SQL query
83      if (err) {
84        // If error occurs
85        res
86          .status(HTTP_STATUS_INTERNAL_SERVER_ERROR)
87          .json(createErrorResponse(err)); // Send error response
88        return;
89      }
90      res.status(HTTP_STATUS_CREATED).json({ id: this.lastID }); // Send response with created ID
91    });
92  });
93
```

Update an existing record (HTTP PUT method)

```
94  app.put(`/clothes/:id`, (req, res) => {
95    // PUT endpoint
96    const values = [
97      req.body.name, // Values from request body and ID from URL
98      req.body.type,
99      req.body.size,
100     req.body.color,
101     req.body.price,
102     req.params.id,
103   ];
104
105   db.run(UPDATE, values, function (err) {
106     // Execute SQL query
107     if (err) {
108       // If error occurs
109       res
110         .status(HTTP_STATUS_INTERNAL_SERVER_ERROR)
111         .json(createErrorResponse(err)); // Send error response
112       return;
113     }
114     res
115       .status(HTTP_STATUS_OK)
116       .json({ message: "Row updated", changes: this.changes }); // Send response with update message
117   });
118 });
119
```

Create a new record (HTTP POST method)

```
120  app.delete(`/clothes/:id`, (req, res) => {
121    // DELETE endpoint
122    const values = [req.params.id]; // ID parameter from URL
123
124    db.run(DELETE, values, function (err) {
125      // Execute SQL query
126      if (err) {
127        // If error occurs
128        res
129          .status(HTTP_STATUS_INTERNAL_SERVER_ERROR)
130          .json(createErrorResponse(err)); // Send error response
131        return;
132      }
133      res
134        .status(HTTP_STATUS_NO_CONTENT)
135        .json({ message: "Row deleted", changes: this.changes }); // Send response with delete message
136    });
137  });
138
```

Delete an existing record (HTTP DELETE method)

Retrieve existing records (HTTP GET method)

```
// Redirect from '/' to '/clothes'
app.get("/", (req, res) => {
  res.redirect("/clothes");
});

// HTTP GET endpoint
app.get("/clothes", (req, res) => {
  db.all("SELECT * FROM Clothes", [], (err, rows) => {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json(rows);
  });
});

// HTTP GET endpoint for a specific record
app.get("/clothes/:id", (req, res) => {
  const query = "SELECT * FROM Clothes WHERE id = ?";
  const values = [req.params.id];

  db.get(query, values, (err, row) => {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json(row);
  });
});
```

Create a new record (HTTP POST method)

```
// HTTP POST endpoint
app.post("/clothes", (req, res) => {
  const query =
    "INSERT INTO Clothes (name, type, size, color, price) VALUES (?, ?, ?, ?,
?)";
  const values = [
    req.body.name,
    req.body.type,
    req.body.size,
    req.body.color,
    req.body.price,
  ];

  db.run(query, values, function (err) {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json({ id: this.lastID });
  });
});
```

Update an existing record (HTTP PUT method)

```
// HTTP UPDATE endpoint
app.put("/clothes/:id", (req, res) => {
  const query =
    "UPDATE Clothes SET name = ?, type = ?, size = ?, color = ?, price = ? WHERE
id = ?";
  const values = [
    req.body.name,
    req.body.type,
    req.body.size,
    req.body.color,
    req.body.price,
    req.params.id,
  ];

  db.run(query, values, function (err) {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json({ message: "Row updated", changes: this.changes });
  });
});
```

Delete an existing record (HTTP DELETE method)

```
// HTTP DELETE endpoint
app.delete("/clothes/:id", (req, res) => {
  const query = "DELETE FROM Clothes WHERE id = ?";
  const values = [req.params.id];

  db.run(query, values, function (err) {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json({ message: "Row deleted", changes: this.changes });
  });
});
```

Test calls to backend

GET all clothing items

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080
Found. Redirecting to /clothes%

jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes
[{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","pric
e":59.99},{"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Blac
k","price":89.99},{"id":3,"name":"Floral Dress","type":"Dress","size":"S","colo
r":"Multicolor","price":45.99},{"id":4,"name":"Cotton T-Shirt","type":"Shirt","s
ize":"L","color":"White","price":15.99}]%
```

GET a specific item

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes/1
{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","price":
59.99}%
```

POST a new item

```
jingjingyang@jingjings-MacBook-Pro ~ % curl -X POST -H "Content-Type: applicatio
n/json" -d '{"name":"Wool Sweater","type":"Sweater","size":"L","color":"Red","pr
ice":60.99}' http://localhost:8080/clothes
{"id":5}%

jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes
[{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","pric
e":59.99},{"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Blac
k","price":89.99},{"id":3,"name":"Floral Dress","type":"Dress","size":"S","colo
r":"Multicolor","price":45.99},{"id":4,"name":"Cotton T-Shirt","type":"Shirt","s
ize":"L","color":"White","price":15.99},{"id":5,"name":"Wool Sweater","type":"Sw
eater","size":"L","color":"Red","price":60.99}]%
```

PUT to update(replace) an item

```
jingjingyang@jingjings-MacBook-Pro ~ % curl -X PUT -H "Content-Type: applicatio
n/json" -d '{"name":"Denim Jacket","type":"Jacket","size":"XL","color":"Brow
n","price":50.99}' http://localhost:8080/clothes/1
{"message":"Row updated","changes":1}%

jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes/1
{"id":1,"name":"Denim Jacket","type":"Jacket","size":"XL","color":"Brown","pric
e":50.99}%
```

DELETE an item

```
jingjingyang@jingjings-MacBook-Pro ~ % curl -X DELETE http://localhost:3000/clot
hes/1
{"message":"Row deleted","changes":1}%

jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes/1
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes
[{"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Black","pric
e":89.99},{"id":3,"name":"Floral Dress","type":"Dress","size":"S","color":"Multi
color","price":45.99},{"id":4,"name":"Cotton T-Shirt","type":"Shirt","siz
e":"L","color":"White","price":15.99},{"id":5,"name":"Wool Sweater","type":"Swea
ter","size":"L","color":"Red","price":60.99}]%
```

Include the HTTP response headers in curl

GET all clothing items

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://loc
alhost:8080
HTTP/1.1 302 Found
X-Powered-By: Express
Location: /clothes
Vary: Accept
Content-Type: text/plain; charset=utf-8
Content-Length: 30
Date: Tue, 12 Dec 2023 10:40:59 GMT
Connection: keep-alive
Keep-Alive: timeout=5

Found. Redirecting to /clothes%
```

GET all clothing items

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://loc
alhost:8080/clothes
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 357
ETag: W/"165-20EAdHwAIDZ0E8V9O2NHHPCAnwE"
Date: Tue, 12 Dec 2023 10:29:28 GMT
Connection: keep-alive
Keep-Alive: timeout=5

[{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","pric
e":59.99},{"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Blac
k","price":89.99},{"id":3,"name":"Floral Dress","type":"Dress","size":"S","colo
r":"Multicolor","price":45.99},{"id":4,"name":"Cotton T-Shirt","type":"Shirt","s
ize":"L","color":"White","price":15.99}]%
```

GET a specific item

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://loc
alhost:8080/clothes/1
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 86
ETag: W/"56-aGu82n/Q/4/aqfNMoVuUmqfb98w"
Date: Tue, 12 Dec 2023 10:30:44 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","price":
59.99}%
```

GET a non-existing resource

(Content-Length: 0)

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://
localhost:8080/clothes/88
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Date: Tue, 12 Dec 2023 10:54:35 GMT
Connection: keep-alive
Keep-Alive: timeout=5
Content-Length: 0
```

POST a new item

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X POST -H
"Content-Type: application/json" -d '{"name":"Wool Sweater","type":"Sweater","si
ze":"L","color":"Red","price":60.99}' http://localhost:8080/clothes
HTTP/1.1 201 Created
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 8
ETag: W/"8-4U72Xq+/t/P6Xscj7oQblSpGEbo"
Date: Tue, 12 Dec 2023 10:49:24 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"id":5}%
```

PUT to update(replace) an item

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X PUT -H
"Content-Type: application/json" -d '{"name":"Denim Jacket","type":"Jacket","siz
e":"XL","color":"Brown","price":50.99}' http://localhost:8080/clothes/1
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 37
ETag: W/"25-JB1Tin60AHjLd75ON4t0/Q1kVD8"
Date: Tue, 12 Dec 2023 10:31:07 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"message":"Row updated","changes":1}%
```

PUT with invalid data

("changes":0)

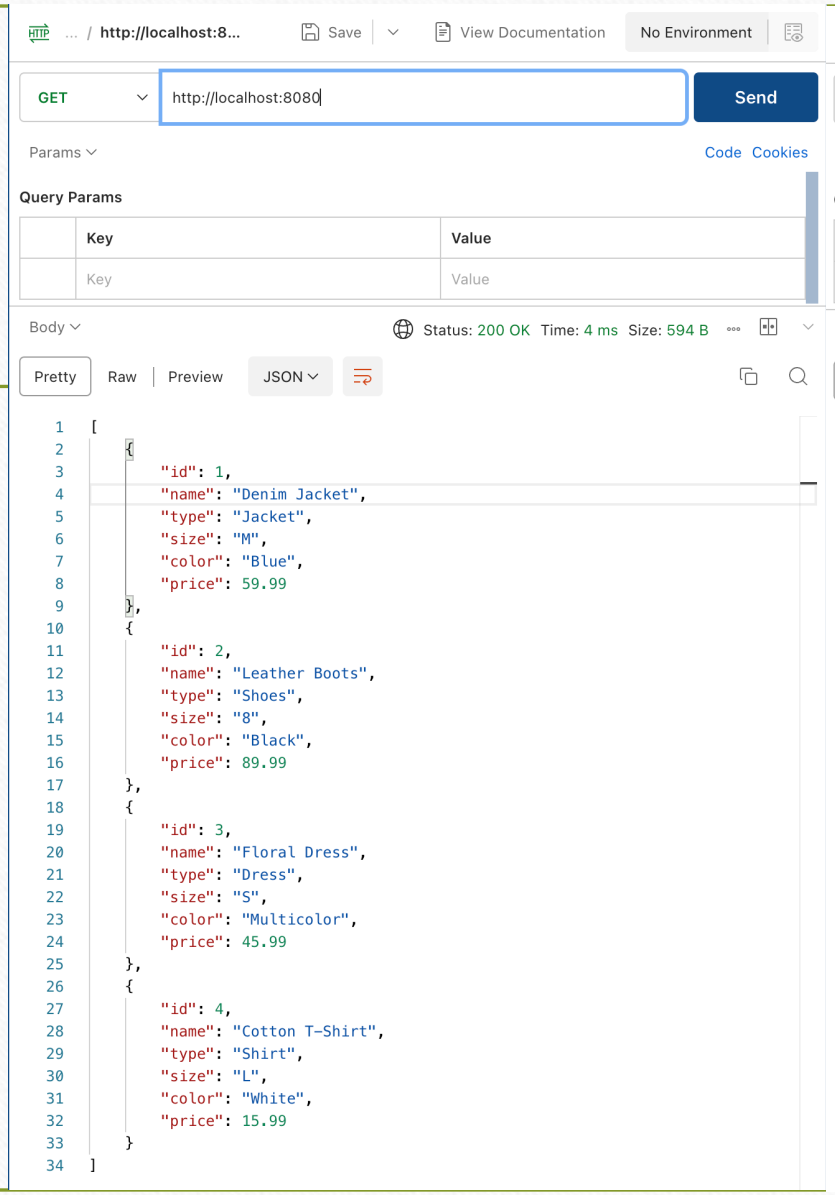
```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X PUT
-H "Content-Type: application/json" -d '{"name":"Denim Jacket","type":"Jacke
t","size":"XL","color":"Brown","price":50.99}' http://localhost:8080/clothes/
88
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 37
ETag: W/"25-H9XUMJUwB1GDqSwx5WsIscmVTlk"
Date: Tue, 12 Dec 2023 10:59:55 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"message":"Row updated","changes":0}%
```

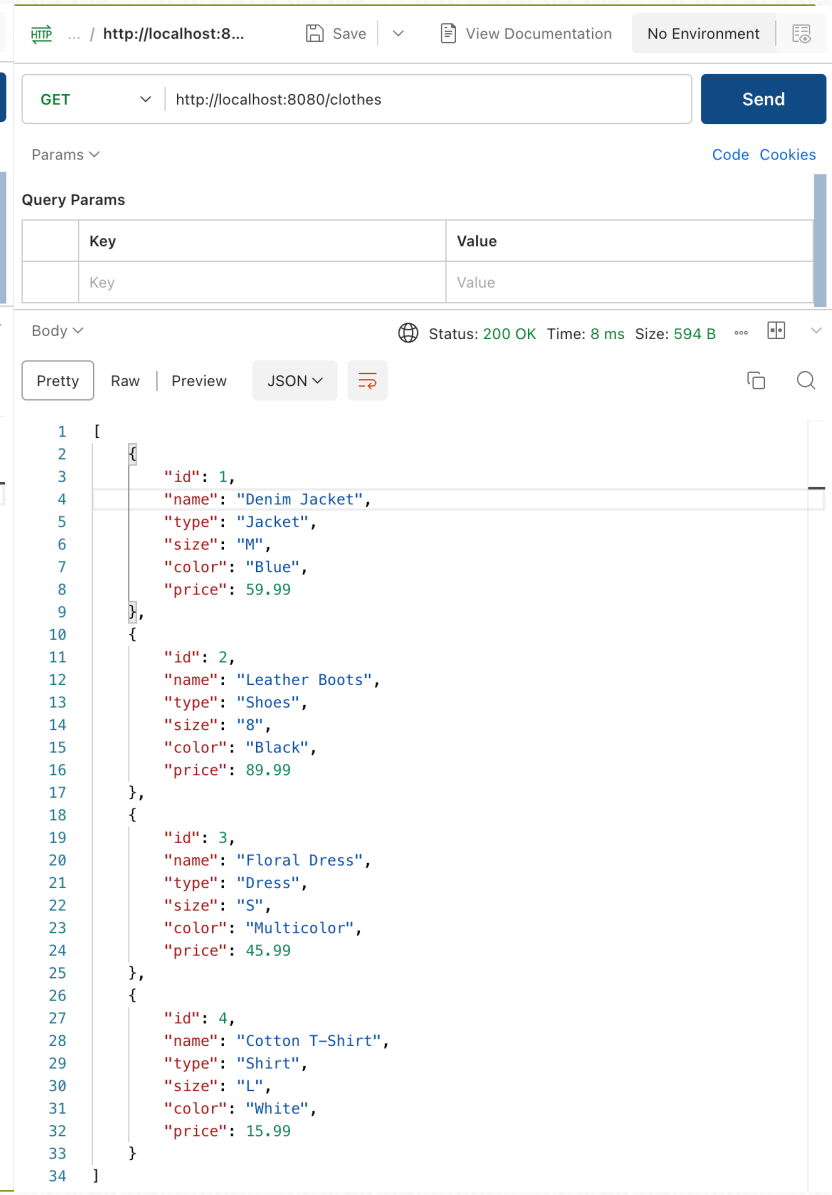
DELETE an item

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X DELETE
http://localhost:8080/clothes/1
HTTP/1.1 204 No Content
X-Powered-By: Express
ETag: W/"25-F8iueZV1O1Skkf6zApRwls6i7iU"
Date: Tue, 12 Dec 2023 10:32:35 GMT
Connection: keep-alive
Keep-Alive: timeout=5
```

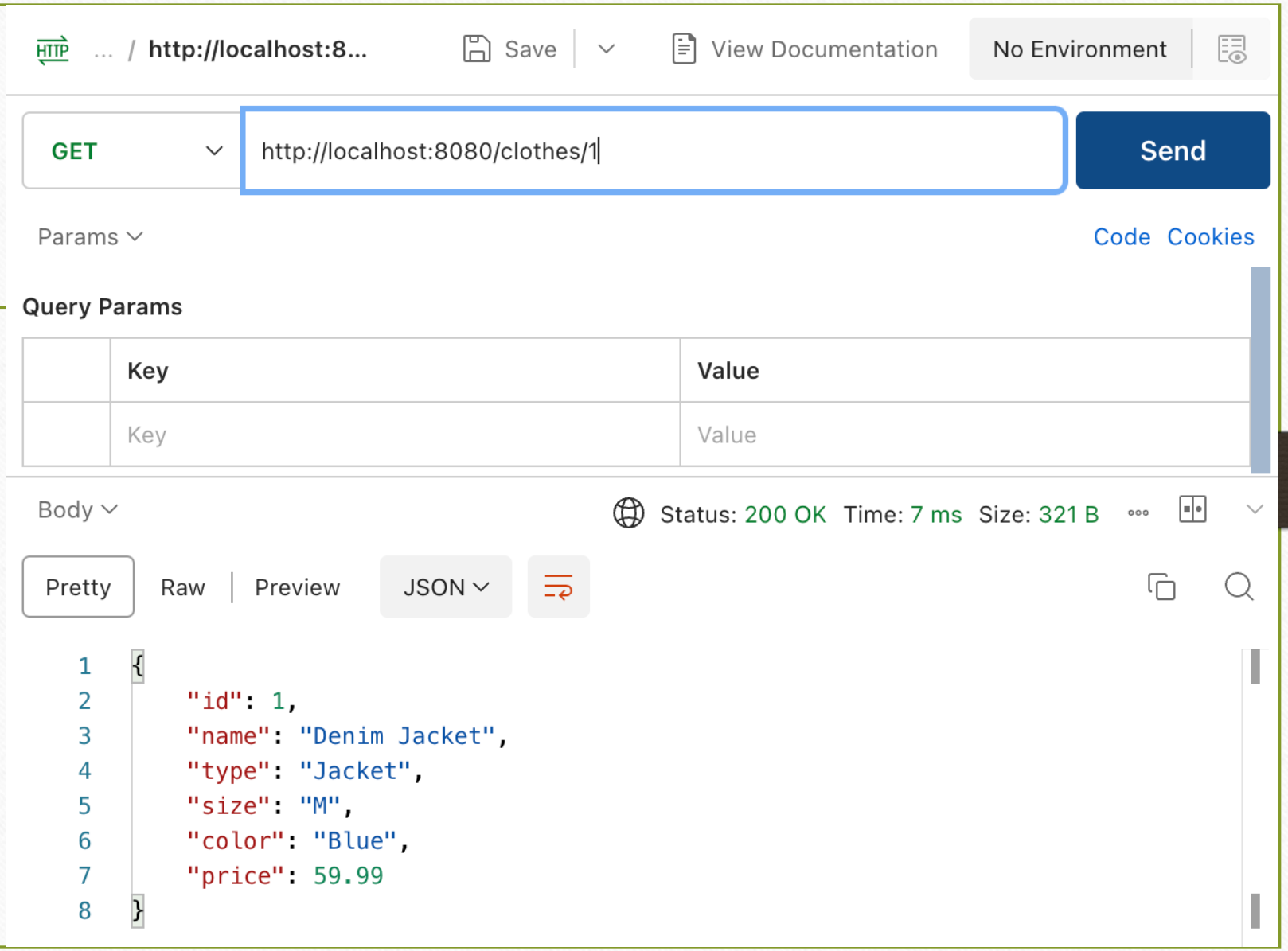
Test via Postman

GET all clothing items

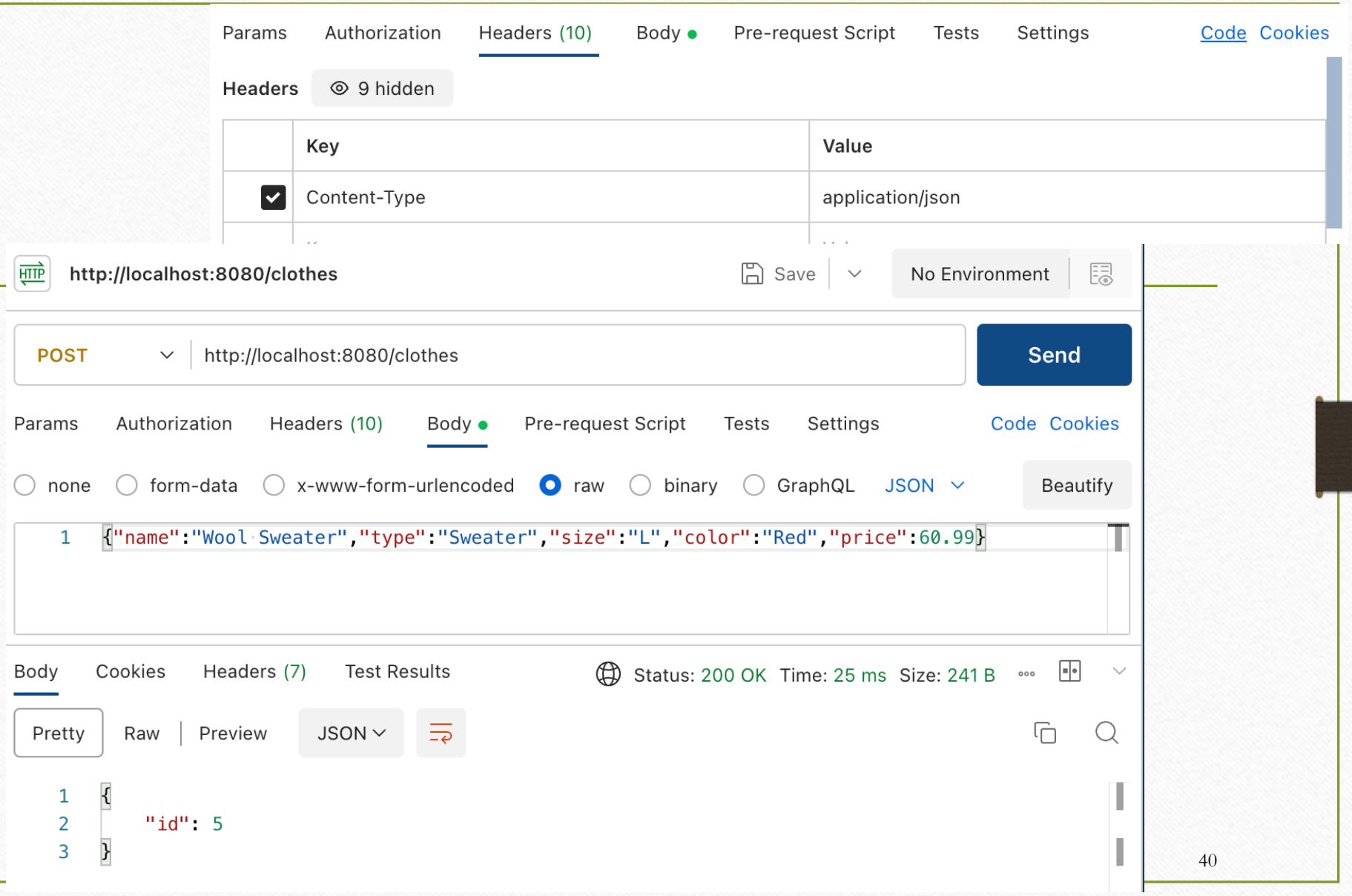




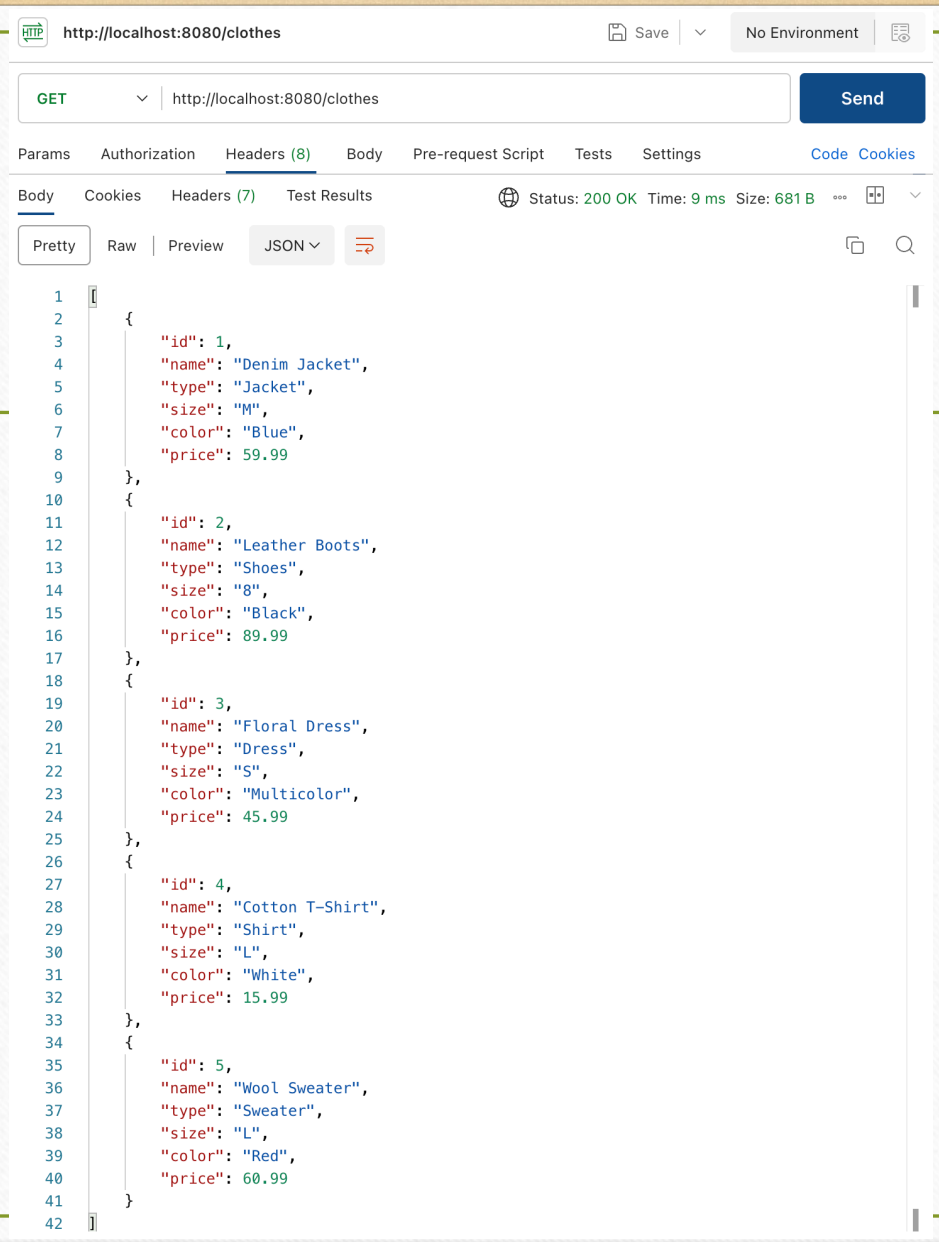
GET a specific item



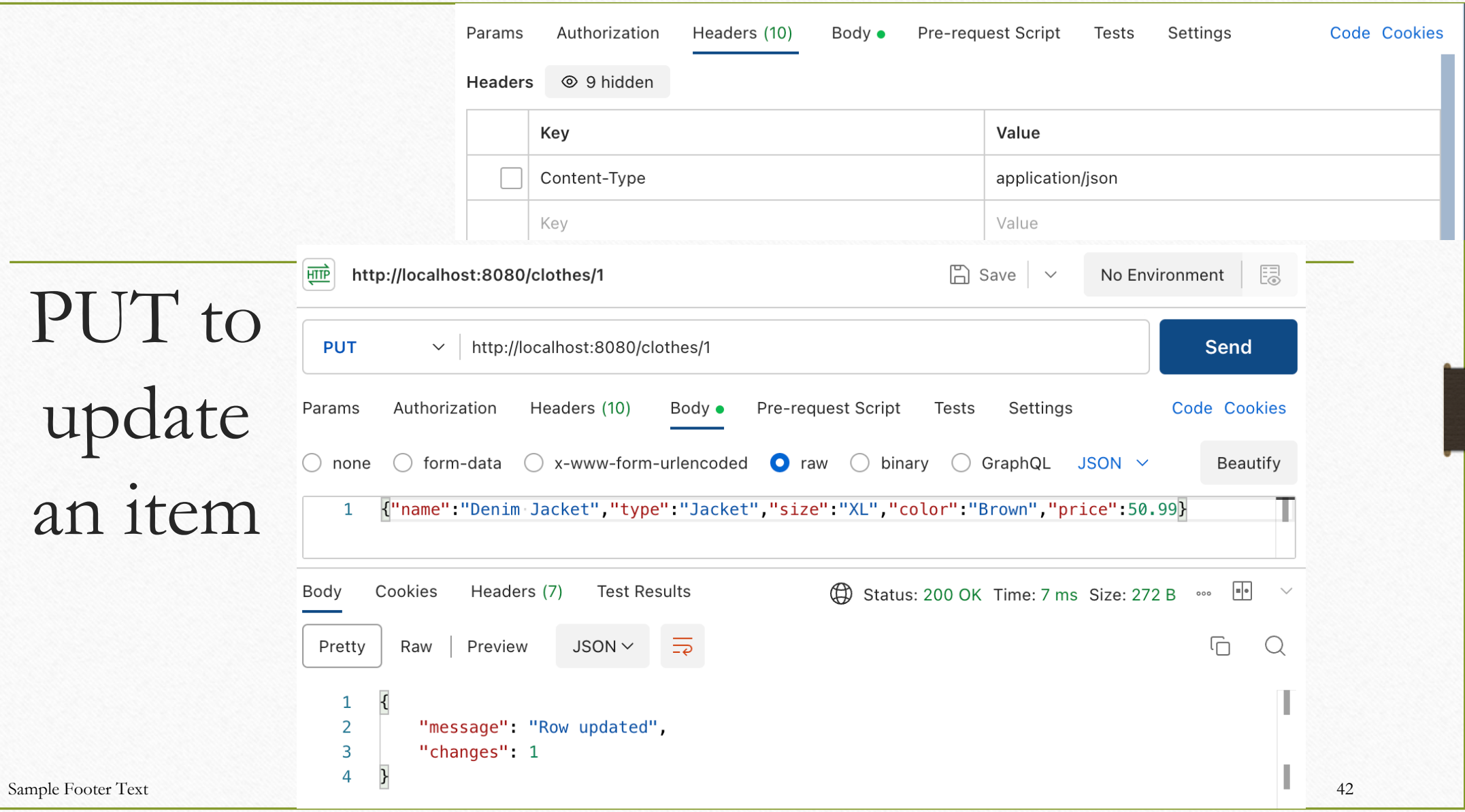
POST a new item



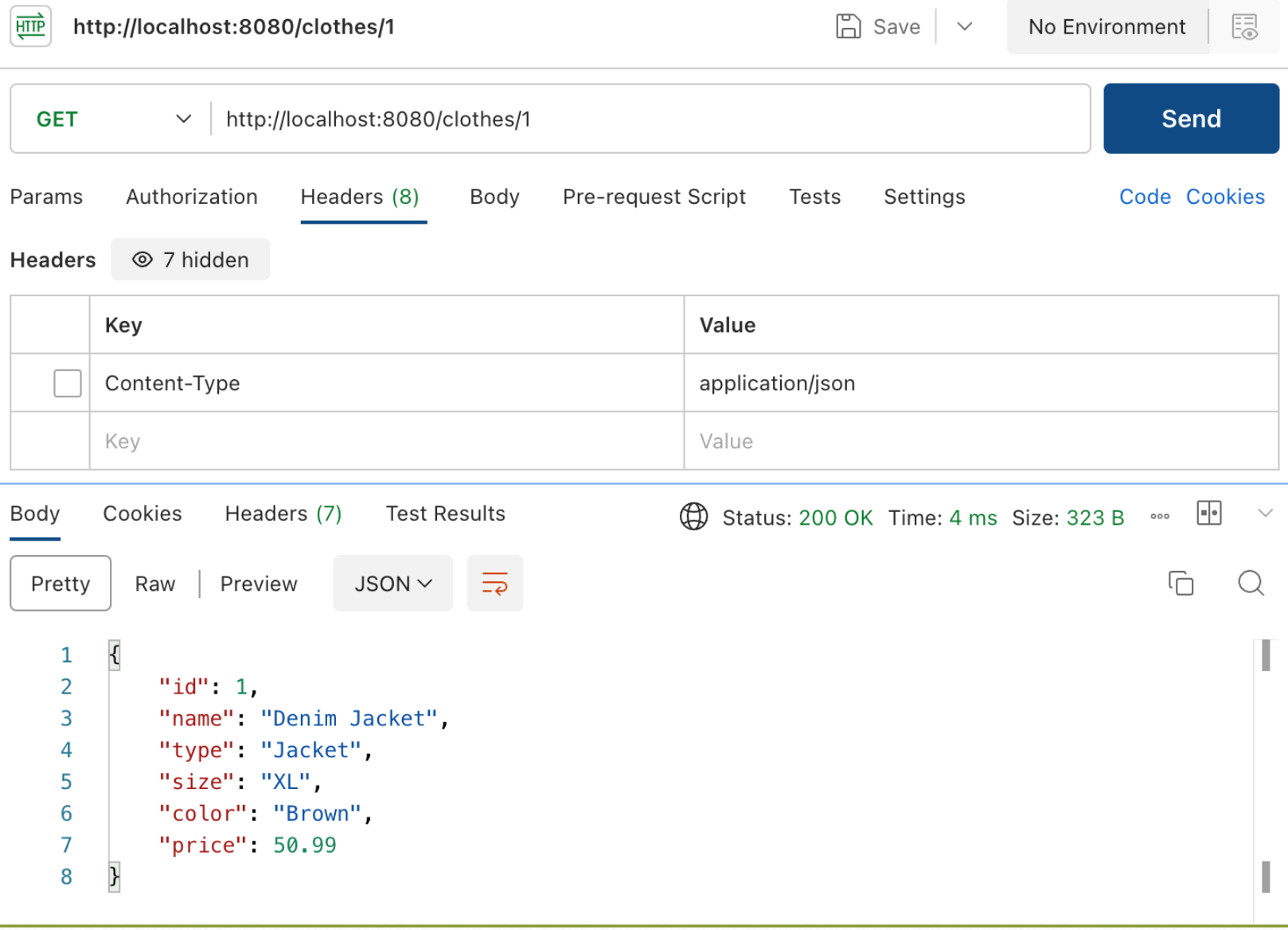
POST a new item



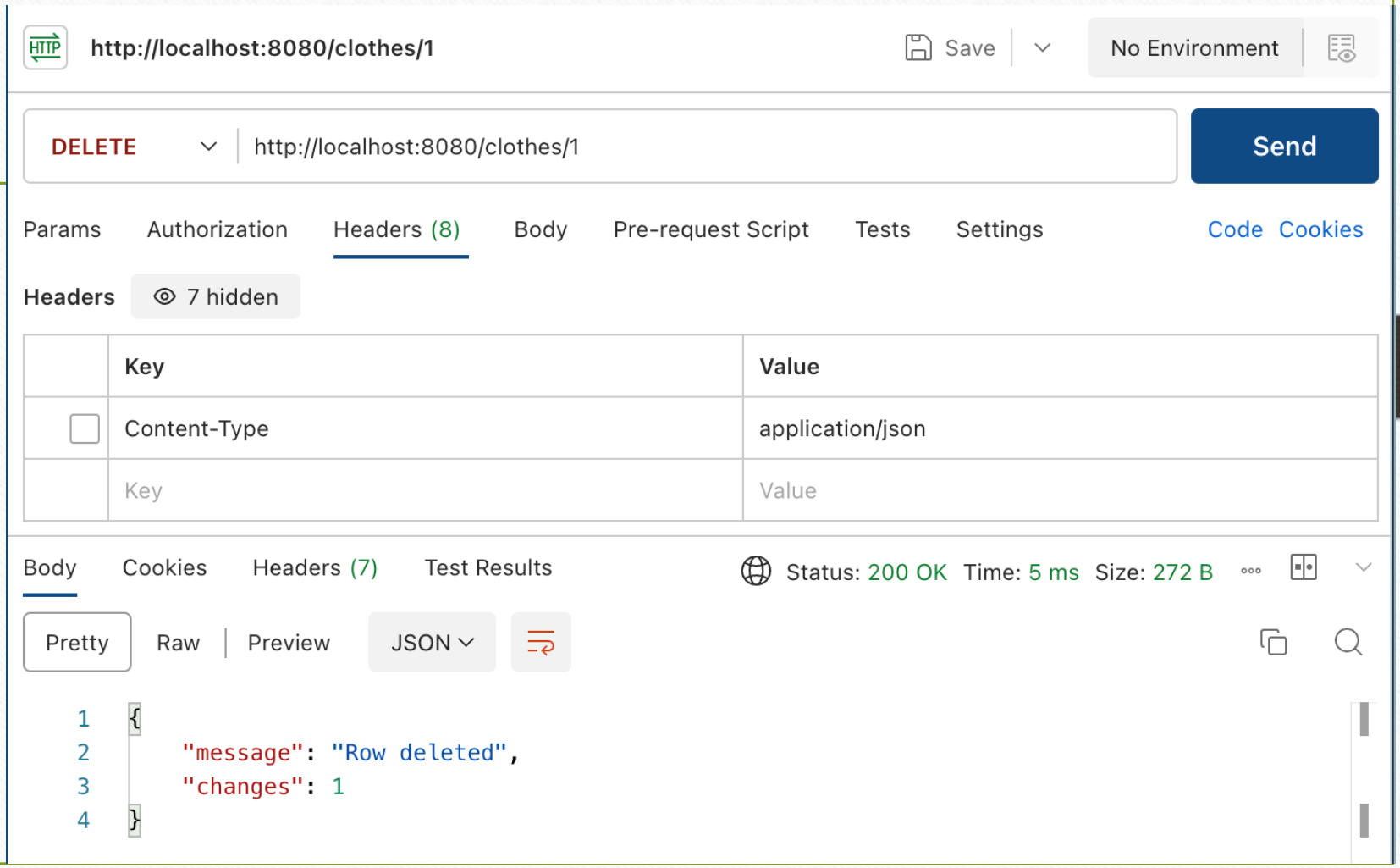
PUT to update an item



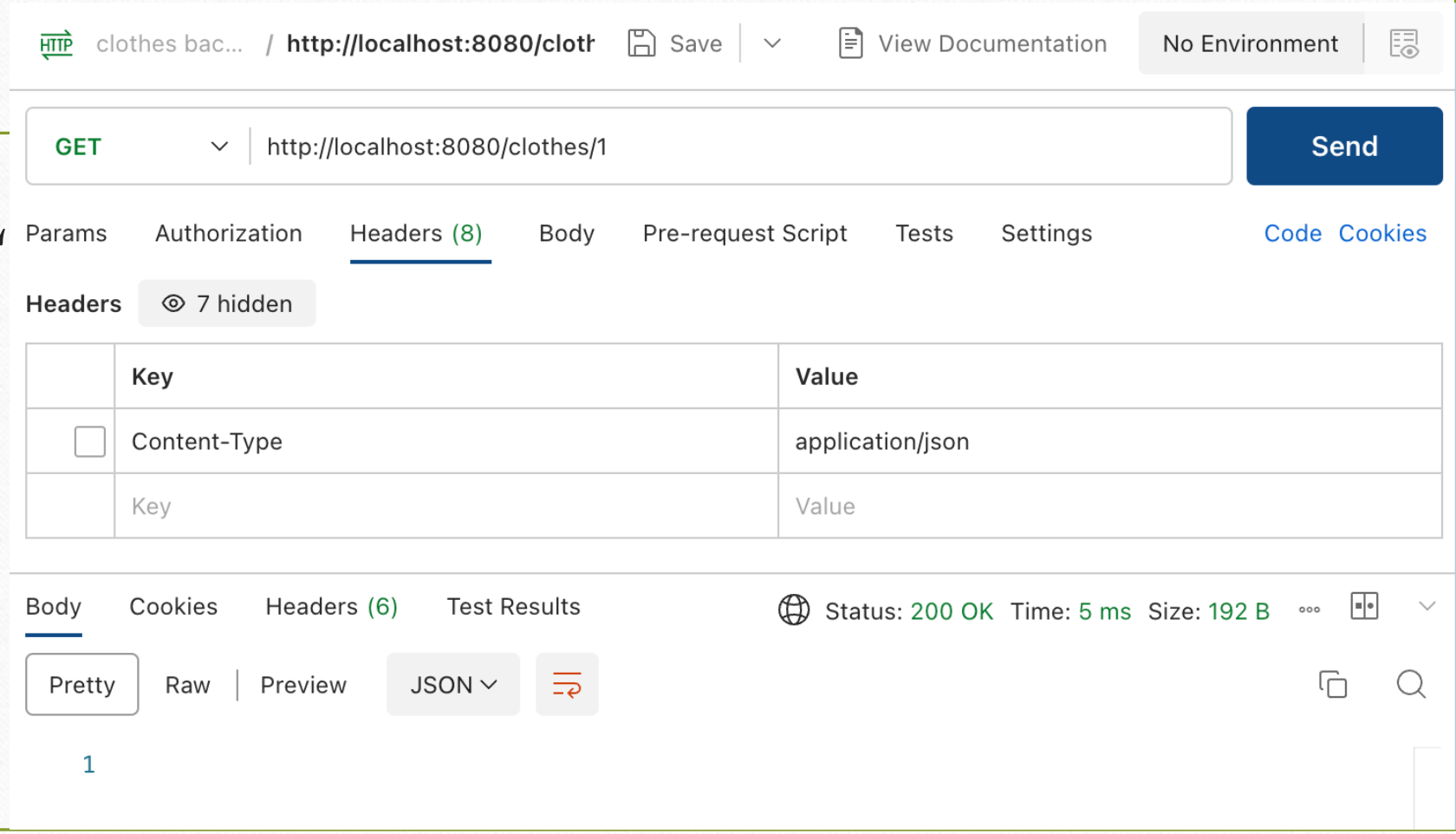
PUT to update an item



DELETE an item



DELETE an item



Test the various errors

POST with invalid data

(HTTP_STATUS_INTERNAL_SERVER_ERROR = 500)

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X POST
-H "Content-Type: application/json" -d '{"Name":"Wool Sweater","type":"Sweate
r","size":"L","color":"Red","price":60.99}' http://localhost:8080/clothes
HTTP/1.1 500 Internal Server Error
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 128
ETag: W/"80-B/PeHB4EmU5cnsDI1dkBPK43RQ0"
Date: Tue, 12 Dec 2023 11:01:55 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"error":"SQLITE_CONSTRAINT: NOT NULL constraint failed: Clothes.name","cod
e":"SQLITE_CONSTRAINT","details":{},"stack":"hidden"}%
```

DELETE a non-existing resource
(HTTP_STATUS_NO_CONTENT = 204)

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X DELE
TE http://localhost:8080/clothes/88
HTTP/1.1 204 No Content
X-Powered-By: Express
ETag: W/"25-EMgarNurQ4RT+HU/18cr5LeBED4"
Date: Tue, 12 Dec 2023 11:02:23 GMT
Connection: keep-alive
Keep-Alive: timeout=5
```

Summary

- In conclusion, I have successfully implemented a backend server using Node.js and SQLite in this project. I created a basic HTTP server, handled different types of HTTP requests, and connected to a SQLite database. I ensured to incorporate error handling and provide responses in JSON format, which are crucial for effective communication with clients. This project has been a foundational step in my journey towards mastering backend development.