Experiment 4.3 Notes

Title

Concurrent Ticket Booking System with Seat Locking and Confirmation

Objective

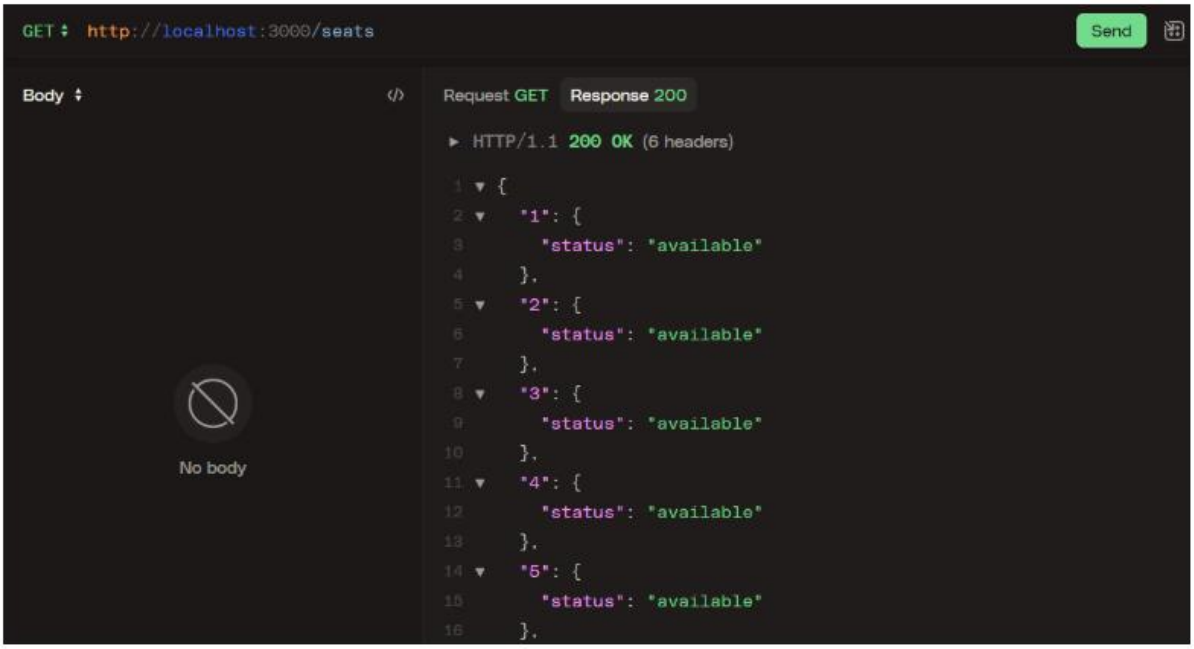
Learn how to implement a ticket booking system in Node.js that handles **concurrent seat reservation requests safely using a seat locking mechanism**. This task helps you understand how to **manage in-memory state**, **handle concurrent access**, and **design a system that prevents race conditions** during booking.

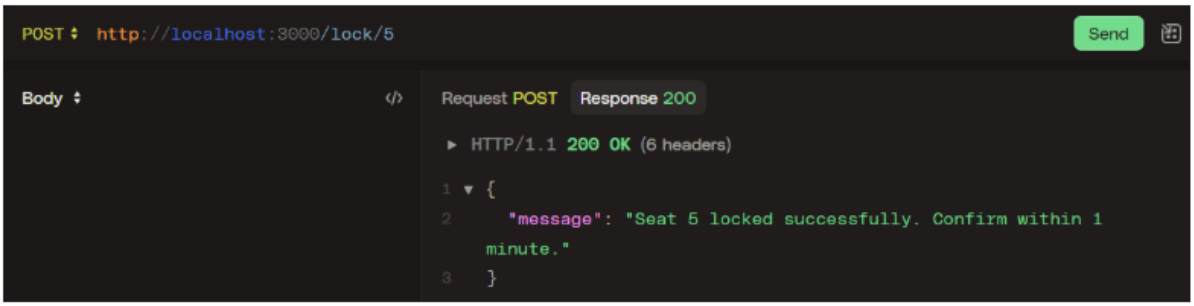
Task Description

Create a Node.js and Express.js application that **simulates a ticket booking system** for events or movie theaters. **Implement endpoints to view available seats**, **temporarily lock a seat for a user**, and **confirm the booking**. Design a seat locking mechanism so that **when a seat is locked, it cannot be locked or booked by other users until it is either confirmed or the lock expires automatically** (for example, after 1 minute).

Store seat states in an in-memory data structure for simplicity. Include clear success and error messages for different scenarios, such as trying to lock an already locked or booked seat, or confirming a seat without a lock. Test your API by simulating concurrent requests to demonstrate that the locking logic correctly prevents double booking and ensures reliable seat allocation.

Expected Output




POST http://localhost:3000/lock/5
Send
Body
Request POST
Response 200
HTTP/1.1 200 OK (6 headers)
{
"message": "Seat 5 locked successfully. Confirm within 1 minute."
}


POST http://localhost:3000/confirm/5
Send
Body
Request POST
Response 200
HTTP/1.1 200 OK (6 headers)
{
"message": "Seat 5 booked successfully!"
}


POST http://localhost:3000/confirm/2
Send
Body
Request POST
Response 400
HTTP/1.1 400 Bad Request (6 headers)
{
"message": "Seat is not locked and cannot be booked"
}


POST http://localhost:3000/lock/5
Send
Body
Request POST
Response 200
HTTP/1.1 200 OK (6 headers)
{
"message": "Seat 5 locked successfully. Confirm within 1 minute."
}


POST http://localhost:3000/confirm/5
Send
Body
Request POST
Response 200
HTTP/1.1 200 OK (6 headers)
{
"message": "Seat 5 booked successfully!"
}


POST http://localhost:3000/confirm/2
Send
Body
Request POST
Response 400
HTTP/1.1 400 Bad Request (6 headers)
{
"message": "Seat is not locked and cannot be booked"
}

Solution using Node.js and Express.js

Here we require a built-in module of ES6 called **Map()** to manage the key:value pairs. It also allows to create custom properties on demand.

Here we also require built-in operator of JavaScript called delete to **delete** the custom properties

Here also required a module **uuid** to generate Unique Key Code for the values

Here we are creating a custom property called **state** having states of the seat booking like **available**, **booked**, **locked** etc.

Time is taken in millisecond for 1 minute (60*1000) millisecond

```
//experiment4.3.js
import express from 'express';
import { v4 as uuidv4 } from 'uuid';

const app = express();
app.use(express.json());

const seats = new Map();

for (let i = 1; i <= 10; i++) {
  seats.set(String(i), { state: 'available' });
}

const LOCK_DURATION_MS = 60 * 1000;

function clearLock(seat) {
  if (seat.lockTimeoutId) {
    clearTimeout(seat.lockTimeoutId);
    seat.lockTimeoutId = undefined;
  }
  delete seat.lockId;
  delete seat.lockedAt;
  seat.state = 'available';
}

app.get('/seats', (req, res) => {
  const result = {};
  for (const [id, seat] of seats.entries()) {
    result[id] = {
      state: seat.state,
```

```
    };
  }
  res.json(result);
});

app.post('/lock/:id', (req, res) => {
  const id = String(req.params.id);
  const seat = seats.get(id);

  if (!seat) {
    return res.status(404).json({ message: `Seat ${id} does not exist.` });
  }

  if (seat.state === 'booked') {
    return res.status(400).json({ message: `Seat ${id} is already booked.` });
  }

  if (seat.state === 'locked') {
    return res.status(400).json({ message: `Seat ${id} is already locked.` });
  }

  seat.state = 'locked';
  seat.lockId = uuidv4();
  seat.lockedAt = Date.now();

  seat.lockTimeoutId = setTimeout(() => {
    // Only clear if still locked (it may have been booked)
    if (seat.state === 'locked') {
      clearLock(seat);
      console.log(`Auto-unlocked seat ${id} after timeout.`);
    }
  }, LOCK_DURATION_MS);

  return res.status(200).json({
    message: `Seat ${id} locked successfully. Confirm within 1 minute.`
  });
});

app.post('/confirm/:id', (req, res) => {
  const id = String(req.params.id);
  const seat = seats.get(id);

  if (!seat) {
    return res.status(404).json({ message: `Seat ${id} does not exist.` });
  }
```

```
  if (seat.state !== 'locked') {
    return res.status(400).json({ message: 'Seat is not locked and cannot be booked' });
  }

  if (seat.lockTimeoutId) {
    clearTimeout(seat.lockTimeoutId);
    seat.lockTimeoutId = undefined;
  }
  seat.state = 'booked';
  delete seat.lockId;
  delete seat.lockedAt;

  return res.status(200).json({ message: `Seat ${id} booked successfully!` });
});

const PORT = 3000;
app.listen(PORT, () => {
  console.log(`Seat-locking server listening on http://localhost:${PORT}`);
});
```

Test it using Postman