Library Management System Testing Report

Submission for the practical exam of Software Quality Assurance course (SEN 305) at Suez Canal University

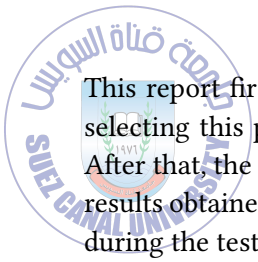
Ibrahim Habib Zeyad Mohamed Mohamed Essam

Youssef Ahmed Youssef Mahmoud

Table of contents

1 Project Overview

This document serves as the testing report performed by the authors as part of the Software Quality Assurance course (SEN 305) for the year 2025/2026 at Suez Canal University.



This report first presents the project chosen by us to be tested along with our justification for selecting this project. Then, it details the requirements and features expected from the project. After that, the report describes the testing stages we performed, the details of each stage, and the results obtained from them. It concludes with a summary of finding and a table of bugs discovered during the testing process.

The code for our final project can be found in this GitHub repository.

1.1 Project Selection

According to the practical exam guidelines, we were required to select a software system to test. To keep the task focused on testing rather than development, students are allowed to use an existing open-source project from GitHub.

The guidlines also specified that the project must offer:

- Login/Registration functionality.
- CRUD operations (Create, Read, Update, Delete).

Since the course discussed testing tools using Python, we decided to select a project where the backend is implemented using Python.

We also prefered to test a web-based application rather than a desktop or mobile application due to the popularity of testing tools and frameworks for web applications. Moreover, we had more experience working with web applications in our previous courses.

We also wanted a project to be built using modern tools and technologies. In particular, we wanted the project to be set up using docker to ensure consistent environment across all the team members.

After carefully researching open-source projects on GitHub that met the above criteria, we decided to initialize the project with the full-stack-fastapi-template repository by the FastAPI team. This is a popular and well-maintained repository with over 39k stars on GitHub, 75 contributors, and frequent updates (over 1,100 commits).

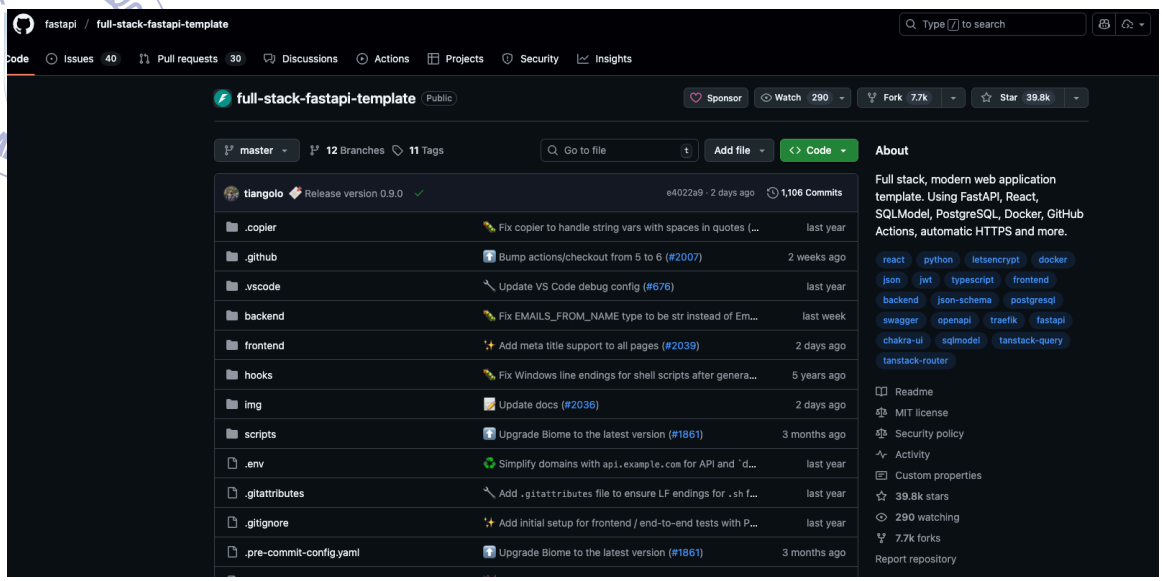


Figure 1: Screenshot of the GitHub repo

1.2 Project Description

Upon initializing the repo, this is a generic inventory management system. It provides

- User authentication (login, registration, password reset)
- User profile management
- CRUD operations for items
- Admin dashboard for managing users and items
- REST API for all functionalities

We decided to manipulate the project to turn it into a Library Management System. We added two entities: Books and Journals. Each entity has its own set of attributes and all CRUD operations are supported for both entities. The frontend was also updated to include pages for managing books and journals.

The final project used the following technologies:

- PostgreSQL as the database
- Python + FastAPI for the backend
- React + Vite for the frontend
- Docker for containerization
- Swagger for API documentation

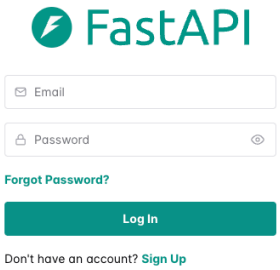


Figure 2: Screenshot of the system's login page

2 Requirements and Features

To facilitate the testing process, we created a table listing the main features expected from the system.

Table 1: System Features

Feature ID	Feature Description
F01	User Registration
F02	User Login
F03	User Profile Management
F04	Add New Book
F05	View Book Details
F06	Update Book Information
F07	Delete Book
F08	Add New Journal
F09	View Journal Details
F10	Update Journal Information
F11	Delete Journal
F12	Admin Dashboard Access
F13	Add New User by Admin
F14	View User List by Admin
F15	Update User Information by Admin
F16	Delete User by Admin

These features are written in a clear and concise manner to ensure that they can be easily understood and tested. At this stage, the description of each feature is kept high-level without going into details. However, during the testing process, the test cases will provide more specific details about the expected behavior of each feature.

3 Exploratory Testing Results

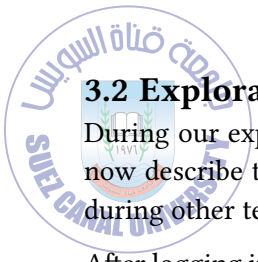
In exploratory testing, the goal is for testers to try and explore the system without predefined test cases. Here testers rely on their intuition and previous experience to find bugs in the system.

3.1 Our Strategy

In the exploratory testing phase, we tried to test all the main features in the system as listed in Table 1. In other words, we tried to cover every possible use case for the system.

We also tried to to use our intuition and previous experience with web application to find possible edge cases and scenarios that might lead to bugs.

After performing exploratory testing, we documented the issues we found along with steps to reproduce them and their severity levels.



3.2 Exploratory Testing Findings

During our exploratory testing, we identified a bug in related to the system's usability. We will now describe the bug in detail and Section 8 will mention it again along with other bugs found during other testing stages.

After logging in and moving to the dashboard, the system performs correctly and shows "Hi [user name]" message. If the user opened the inspector tool (F12) and opened the Application tab, he will see that the local storage contains a key named "access_token" with the value being the JWT token created by the backend during login to validate the user's session.

If the user alters the value of this key and refreshes the page, the system does not redirect the user to the login page. Instead, the dashboard loads with the message "Hi [empty space]". This indicates that the system loads the dashboard prior to validating the token stored in local storage. Only after the dashboard loads with some time, the system invalidates the token and redirects the user to the login page.

4 Manual Testing Stage

In the manual testing stage, we create a much more detailed description of the test cases to be performed on the system. Then, we manually execute each of these tests and record our findings.

4.1 Manual Testing Cases

The table below lists the test cases we created for the manual testing stage. To enhance the table's readability, we divided the table into two parts. The first part covers features related to login/ regestration, user portfolio management, and books management. The second part covers journals management and admin functionalities.

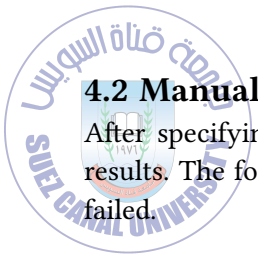
Table 2: Manual Test Cases Part 1

Test Case ID	Feature ID	Test Case Description	Expected Result
TC01	F01	Register a new user with valid details	User is registered successfully and redirected to login page
TC02	F01	Register a new user with an existing email	Error message “Email already exists” is displayed
TC03	F01	Register a user with invalid email format	Error message “Invalid email format” is displayed
TC04	F01	Register a user with 3 characters password	Error message “Password too short” is displayed
TC05	F02	Login with valid credentials	User is logged in and redirected to dashboard
TC06	F02	Login with correct email and wrong password	Error message is displayed
TC07	F02	Login with unregistered email	Error message is displayed
TC08	F03	Update user name and save changes	User profile is updated successfully
TC09	F03	Update user email to an existing email	Error message “Email already exists” is displayed
TC10	F03	Update user password with less than 6 characters	Error message “Password too short” is displayed
TC11	F04	Add a new book with valid details	Book is added successfully and appears in the book list
TC12	F04	Add a new book with missing required fields	Error message “Please fill all required fields” is displayed
TC13	F04	Add a new book with invalid ISBN format	Error message “Invalid ISBN format” is displayed
TC14	F05	View list of books	List of books is displayed correctly containing only books added by the user (except admin)
TC15	F06	Update book information with valid details	Book information is updated successfully
TC16	F06	Update book information with missing required fields	Error message “Please fill all required fields” is displayed
TC17	F06	Update book information with invalid ISBN format	Error message “Invalid ISBN format” is displayed
TC18	F07	Delete a book	Book is deleted successfully and removed from the book list

Table 3: Manual Test Cases Part 2

Test Case ID	Feature ID	Test Case Description	Expected Result
TC19	F08	Add a new journal with valid details	Journal is added successfully and appears in the journal list
TC20	F08	Add a new journal with missing required fields	Error message “Please fill all required fields” is displayed
TC21	F08	Add a new journal with invalid ISSN format	Error message “Invalid ISSN format” is displayed
TC22	F09	View list of journals	List of journals is displayed correctly containing only journals added by the user (except admin)
TC23	F10	Update journal information with valid details	Journal information is updated successfully
TC24	F10	Update journal information with missing required fields	Error message “Please fill all required fields” is displayed
TC25	F10	Update journal information with invalid ISSN format	Error message “Invalid ISSN format” is displayed
TC26	F11	Delete a journal	Journal is deleted successfully and removed from the journal list
TC27	F12	Access admin dashboard with admin account	Admin dashboard is displayed correctly with user management options
TC28	F12	Access dashboard with non-admin account	No user management options are displayed
TC29	F13	Add a new user by admin with valid details	User is added successfully and appears in the user list
TC30	F14	View user list by admin	List of users is displayed correctly
TC31	F15	Update user information by admin with valid details	User information is updated successfully
TC32	F16	Delete a user by admin	User is deleted successfully and removed from the user list

We created these test cases to cover all the main features of the system. Each test case includes a unique ID, the feature it tests, a description of the test case, and the expected result.



4.2 Manual Testing Results

After specifying the test cases, we manually executed each test case and recorded the actual results. The following table shows the actual result for each test case and whether it passed or failed.

Table 4: Manual Test Cases Results Part 1

Test Case ID	Actual Result	Status
TC01	User registered successfully and redirected to login page	Passed
TC02	Error message “The user with this email already exists in the system”	Passed
TC03	Error message “Invalid email address”	Passed
TC04	Error message “Password must be at least 8 characters”	Passed
TC05	User logged in and redirected to dashboard	Passed
TC06	Error message “Incorrect email or password”	Passed
TC07	Error message “Incorrect email or password”	Passed
TC08	User profile updated successfully	Passed
TC09	Error message “User with this email already exists”	Passed
TC10	Error message “Password must be at least 8 characters”	Passed
TC11	Book added successfully and appears in the book list	Passed
TC12	Save button is disabled until all required fields are filled	Passed
TC13	The system accepted the invalid ISBN format (bug found)	**Failed**
TC14	List of books displayed correctly	Passed
TC15	Book information updated successfully	Passed
TC16	Empty required fields are highlighted with error messages	Passed
TC17	The system accepted the invalid ISBN format (bug found)	**Failed**
TC18	Book deleted successfully and removed from the book list	Passed

Table 5: Manual Test Cases Results Part 2

Test Case ID	Actual Result	Status
TC19	Journal added successfully and appears in the journal list	Passed
TC20	Save button is disabled until all required fields are filled	Passed
TC21	The system accepted the invalid ISSN format (bug found)	**Failed**
TC22	List of journals displayed correctly	Passed
TC23	Journal information updated successfully	Passed
TC24	Empty required fields are highlighted with error messages	Passed
TC25	The system accepted the invalid ISSN format (bug found)	**Failed**
TC26	Journal deleted successfully and removed from the journal list	Passed
TC27	Admin dashboard displayed correctly with user management options	Passed
TC28	No user management options are displayed	Passed
TC29	User added successfully and appears in the user list	Passed
TC30	List of all users displayed correctly	Passed
TC31	User information updated successfully	Passed
TC32	User deleted successfully and removed from the user list	Passed

Out of the 32 test cases, 28 passed successfully while 4 failed due to bugs related to input validation for ISBN and ISSN formats.

5 White Box Testing

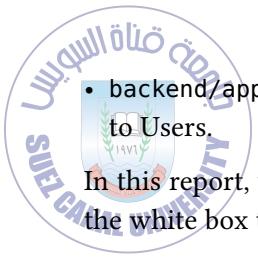
White box testing involves testing the internal logic and structure of the code. In this stage, we created automated test cases to test specific functions and methods in the codebase.

The backend of the system is built using FastAPI, which is a Python web framework. We used `pytest` as the testing framework to create and run our automated tests. Some of these tests used internal knowledge of the codebase (white box testing) while others focused on testing the API endpoints (black box testing).

The repo we used had some initial test cases. We expanded on these test cases to cover the new features we added to the system (Books and Journals management).

Three testing scripts were used for white box testing:

- `backend/app/tests/crud/test_book.py`: Contains unit tests for the CRUD operations related to Books.
- `backend/app/tests/crud/test_journal.py`: Contains unit tests for the CRUD operations related to Journals.



- `backend/app/tests/crud/test_user.py`: Contains unit tests for the CRUD operations related to Users.

In this report, we are going to focus on the 5 test cases defined in `test_book.py` as examples of the white box testing we performed.

Since `pytest` manages both the white box and black box testing stages, we are going to discuss the test results and code coverage in Section 6.

5.1 Books CRUD Operations Tests

The `test_book.py` script contains the following test cases for the Books CRUD operations:

- `test_create_book`
- `test_get_book_by_id`
- `test_get_books`
- `test_update_book`
- `test_delete_book`

We are going to show the code for these test cases and briefly explain each one.

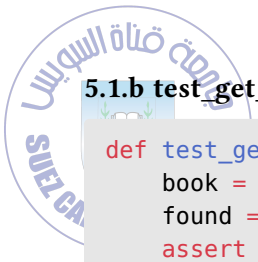
5.1.a test_create_book

```python
def test_create_book(db: Session) -> None:
    user = create_random_user(db)
    book_create = BookCreate(
        title="Test Book",
        author="Test Author",
        isbn="1234567890",
        description="Test Description",
    )
    book = crud.create_book(
        session=db, book_in=book_create, owner_id=user.id
    )
    assert book.title == book_create.title
    assert book.author == book_create.author
    assert book.isbn == book_create.isbn
    assert book.description == book_create.description
    assert book.owner_id == user.id
```

This test case verifies that a new book can be created successfully. It creates a random user, then creates a book with specific details, and finally asserts that the created book's attributes match the input values.

The `create_random_user` function is a helper function that creates a user with random details for testing purposes. It is defined in `backend/app/tests/utils/user.py`.

The `db` parameter is provided by a pytest fixture that sets up a test database session. It can be found in `backend/app/tests/conftest.py`.



5.1.b test_get_book_by_id

```
def test_get_book_by_id(db: Session) -> None:
    book = create_random_book(db)
    found = crud.get_book_by_id(session=db, id=book.id)
    assert found
    assert found.id == book.id
    assert found.title == book.title
```

This test case verifies that a book can be retrieved by its ID. It creates a random book, then retrieves it using its ID, and asserts that the retrieved book's attributes match the original book's attributes.

5.1.c test_get_books

```
def test_get_books(db: Session) -> None:
    book1 = create_random_book(db)
    book2 = create_random_book(db)
    books = crud.get_books(session=db, owner_id=None)
    ids = [b.id for b in books]
    assert book1.id in ids
    assert book2.id in ids
```

This test case verifies that multiple books can be retrieved. It creates two random books, then retrieves all books, and asserts that the created books are present in the retrieved list by checking their IDs.

5.1.d test_update_book

```
def test_update_book(db: Session) -> None:
    book = create_random_book(db)
    update_in = BookUpdate(title="Updated Title")
    updated = crud.update_book(session=db, db_book=book, book_in=update_in)
    assert updated.title == "Updated Title"
    assert updated.id == book.id
```

This test case verifies that a book's information can be updated. It creates a random book, then updates its title, and asserts that the updated book's title matches the new value while its ID remains unchanged.

5.1.e test_delete_book

```
def test_delete_book(db: Session) -> None:
    book = create_random_book(db)
    crud.delete_book(session=db, db_book=book)
    found = crud.get_book_by_id(session=db, id=book.id)
    assert found is None
```

This test case verifies that a book can be deleted. It creates a random book, deletes it, and then attempts to retrieve it by its ID, asserting that the book is no longer found.

6 Black Box Testing

In the black box testing stage, we focused on testing the API endpoints of the system without any knowledge of the internal code structure. We created automated test cases to test the various API endpoints for Books and Journals management. These API endpoints can be quickly explored from the Swagger documentation.

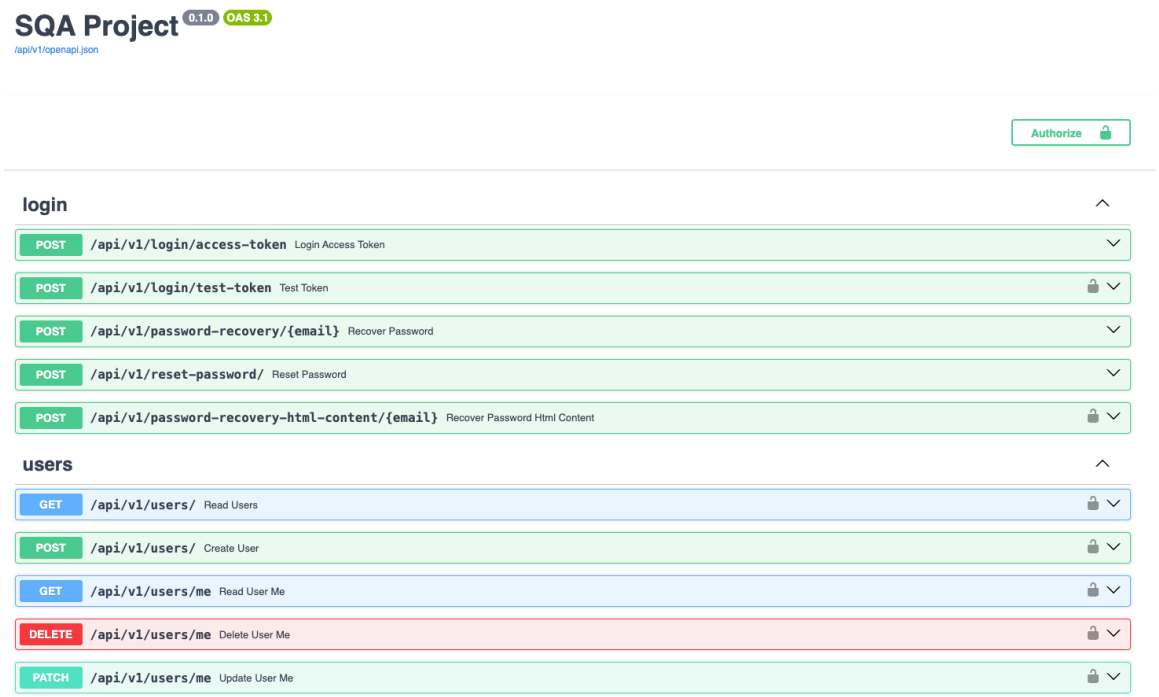


Figure 3: Part of the Swagger documentation showing the login and users endpoints

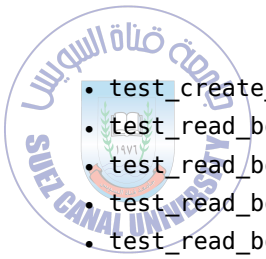
The black box tests were defined in the folder `backend/app/tests/api/routes`. The following testing scripts were used for black box testing:

- `test_books.py`: Contains API tests for Books management endpoints.
- `test_items.py`: Contains API tests for Items management endpoints.
- `test_journals.py`: Contains API tests for Journals management endpoints.
- `test_login.py`: Contains API tests for authentication endpoints.
- `test_private.py`: Contains API tests for user creation endpoints.
- `test_users.py`: Contains API tests for Users management endpoints.

In this report, we will cover the 11 test cases defined in `test_books.py` as examples of the black box testing we performed.

6.1 Books API Endpoints Tests

The `test_books.py` script contains the following test cases for the Books API endpoints:



- test_create_book
- test_read_book
- test_read_book_not_found
- test_read_book_not_enough_permissions
- test_read_books
- test_update_book
- test_update_book_not_found
- test_update_book_not_enough_permissions
- test_delete_book
- test_delete_book_not_found
- test_delete_book_not_enough_permissions

We are going to show the code for these test cases and briefly explain each one.

6.1.a test_create_book

```python
def test_create_book(
    client: TestClient, superuser_token_headers: dict[str, str]
) -> None:
    data = {
        "title": "FooBook",
        "author": "AuthorName",
        "isbn": "1234567890",
        "description": "A book description."
    }
    response = client.post(
        f"{settings.API_V1_STR}/books/",
        headers=superuser_token_headers,
        json=data,
    )
    assert response.status_code == 200
    content = response.json()
    assert content["title"] == data["title"]
    assert content["author"] == data["author"]
    assert content["isbn"] == data["isbn"]
    assert content["description"] == data["description"]
    assert "id" in content
    assert "owner_id" in content
```

This test case checks the API endpoint for creating a new book. It sends a POST request with book details and asserts that the response status code is 200 (OK) and that the returned book details match the input data.

The `client` parameter is a pytest fixture that provides a test client for making API requests. The `superuser_token_headers` parameter is another fixture that provides authentication headers for a superuser (admin). These fixtures can be found in `backend/app/tests/conftest.py`.

6.1.b test_read_book

```python
def test_read_book(
    client: TestClient, superuser_token_headers: dict[str, str], db: Session
) -> None:
    book = create_random_book(db)
    response = client.get(
        f"{settings.API_V1_STR}/books/{book.id}",
        headers=superuser_token_headers,
    )
    assert response.status_code == 200
    content = response.json()
    assert content["title"] == book.title
    assert content["author"] == book.author
    assert content["isbn"] == book.isbn
    assert content["description"] == book.description
    assert content["id"] == str(book.id)
    assert content["owner_id"] == str(book.owner_id)
```

This test case checks the API endpoint for retrieving a book by its ID. It creates a random book, saves it in the database, sends a GET request to retrieve it, and asserts that the response status code is 200 (OK) and that the returned book details match the original book's attributes.

6.1.c test_read_book_not_found

```python
def test_read_book_not_found(
    client: TestClient, superuser_token_headers: dict[str, str]
) -> None:
    response = client.get(
        f"{settings.API_V1_STR}/books/{uuid.uuid4()}",
        headers=superuser_token_headers,
    )
    assert response.status_code == 404
    content = response.json()
    assert content["detail"] == "Book not found"
```

This test case checks the API endpoint for retrieving a book that does not exist. It sends a GET request with a random UUID (to ensure it does not exist) and asserts that the response status code is 404 (Not Found) and that the error message indicates that the book was not found.

6.1.d test_read_book_not_enough_permissions

```python
def test_read_book_not_enough_permissions(
    client: TestClient, normal_user_token_headers: dict[str, str], db: Session
) -> None:
    book = create_random_book(db)
    response = client.get(
        f"{settings.API_V1_STR}/books/{book.id}",
```

```
        headers=normal_user_token_headers,
    )
    assert response.status_code == 400
    content = response.json()
    assert content["detail"] == "Not enough permissions"
```

This test case checks the API endpoint for retrieving a book when the user does not have enough permissions. It creates a random book, sends a GET request using a normal user's authentication headers, and asserts that the response status code is 400 (Bad Request). This is because only the owner or admin can view the book details.

6.1.e test_read_books

```
def test_read_books(
    client: TestClient, superuser_token_headers: dict[str, str], db: Session
) -> None:
    create_random_book(db)
    create_random_book(db)
    response = client.get(
        f"{settings.API_V1_STR}/books/",
        headers=superuser_token_headers,
    )
    assert response.status_code == 200
    content = response.json()
    assert len(content["data"]) >= 2
```

This test case checks the API endpoint for retrieving multiple books. It creates two random books, sends a GET request to retrieve all books, and asserts that the response status code is 200 (OK) and that at least two books are returned in the response data.

6.1.f test_update_book

```
def test_update_book(
    client: TestClient, superuser_token_headers: dict[str, str], db: Session
) -> None:
    book = create_random_book(db)
    data = {
        "title": "Updated Book Title",
        "author": book.author,
        "isbn": book.isbn,
        "description": book.description
    }
    response = client.put(
        f"{settings.API_V1_STR}/books/{book.id}",
        headers=superuser_token_headers,
        json=data,
    )
```

```
    assert response.status_code == 200
    content = response.json()
    assert content["title"] == data["title"]
    assert content["id"] == str(book.id)
    assert content["owner_id"] == str(book.owner_id)
```

This test case checks the API endpoint for updating a book's information. It creates a random book, sends a PUT request with updated title, and asserts that the response status code is 200 (OK) and that the returned book details reflect the updates.

6.1.g test_update_book_not_found

```
def test_update_book_not_found(
    client: TestClient, superuser_token_headers: dict[str, str]
) -> None:
    data = {
        "title": "Updated Book Title",
        "author": "AuthorName",
        "isbn": "1234567890",
        "description": "A book description."
    }
    response = client.put(
        f"{settings.API_V1_STR}/books/{uuid.uuid4()}",
        headers=superuser_token_headers,
        json=data,
    )
    assert response.status_code == 404
    content = response.json()
    assert content["detail"] == "Book not found"
```

This test case checks the API endpoint for updating a book that does not exist. It sends a PUT request with a random UUID (to ensure it does not exist) and asserts that the response status code is 404 (Not Found) and that the error message indicates that the book was not found.

6.1.h test_update_book_not_enough_permissions

```
def test_update_book_not_enough_permissions(
    client: TestClient, normal_user_token_headers: dict[str, str], db: Session
) -> None:
    book = create_random_book(db)
    data = {
        "title": "Updated Book Title",
        "author": book.author,
        "isbn": book.isbn,
        "description": book.description
    }
    response = client.put(
```

```
        f"{settings.API_V1_STR}/books/{book.id}",
        headers=normal_user_token_headers,
        json=data,
    )
    assert response.status_code == 400
    content = response.json()
    assert content["detail"] == "Not enough permissions"
```

This test case checks the API endpoint for updating a book's information when the user does not have enough permissions. It creates a random book, sends a PUT request with updated title using a normal user's authentication headers, and asserts that the response status code is 400 (Bad Request) and that the error message shows insufficient permissions.

6.1.i test_delete_book

```
def test_delete_book(
    client: TestClient, superuser_token_headers: dict[str, str], db: Session
) -> None:
    book = create_random_book(db)
    response = client.delete(
        f"{settings.API_V1_STR}/books/{book.id}",
        headers=superuser_token_headers,
    )
    assert response.status_code == 200
    content = response.json()
    assert content["message"] == "Book deleted successfully"
```

This test case checks the API endpoint for deleting a book. It creates a random book, sends a DELETE request, and asserts that the response status code is 200 (OK) and that the success message indicates the book was deleted successfully. Note that the user here is a superuser (admin).

6.1.j test_delete_book_not_found

```
def test_delete_book_not_found(
    client: TestClient, superuser_token_headers: dict[str, str]
) -> None:
    response = client.delete(
        f"{settings.API_V1_STR}/books/{uuid.uuid4()}",
        headers=superuser_token_headers,
    )
    assert response.status_code == 404
    content = response.json()
    assert content["detail"] == "Book not found"
```

This test case checks the API endpoint for deleting a book that does not exist. It sends a DELETE request with a random UUID (to ensure it does not exist) and asserts that the response status code is 404 (Not Found) and that the error message indicates that the book was not found.

6.1.k test_delete_book_not_enough_permissions

```
def test_delete_book_not_enough_permissions(
    client: TestClient, normal_user_token_headers: dict[str, str], db: Session
) -> None:
    book = create_random_book(db)
    response = client.delete(
        f"{settings.API_V1_STR}/books/{book.id}",
        headers=normal_user_token_headers,
    )
    assert response.status_code == 400
    content = response.json()
    assert content["detail"] == "Not enough permissions"
```

This test case checks the API endpoint for deleting a book when the user does not have enough permissions. It creates a random book, sends a DELETE request using a normal user's authentication headers, and asserts that the response status code is 400 (Bad Request) and that the error message shows insufficient permissions.

6.2 Automated Tests Results

After defining the automated test cases for both white box and black box testing stages, we executed all the tests using `pytest`. The following table image shows the test results.

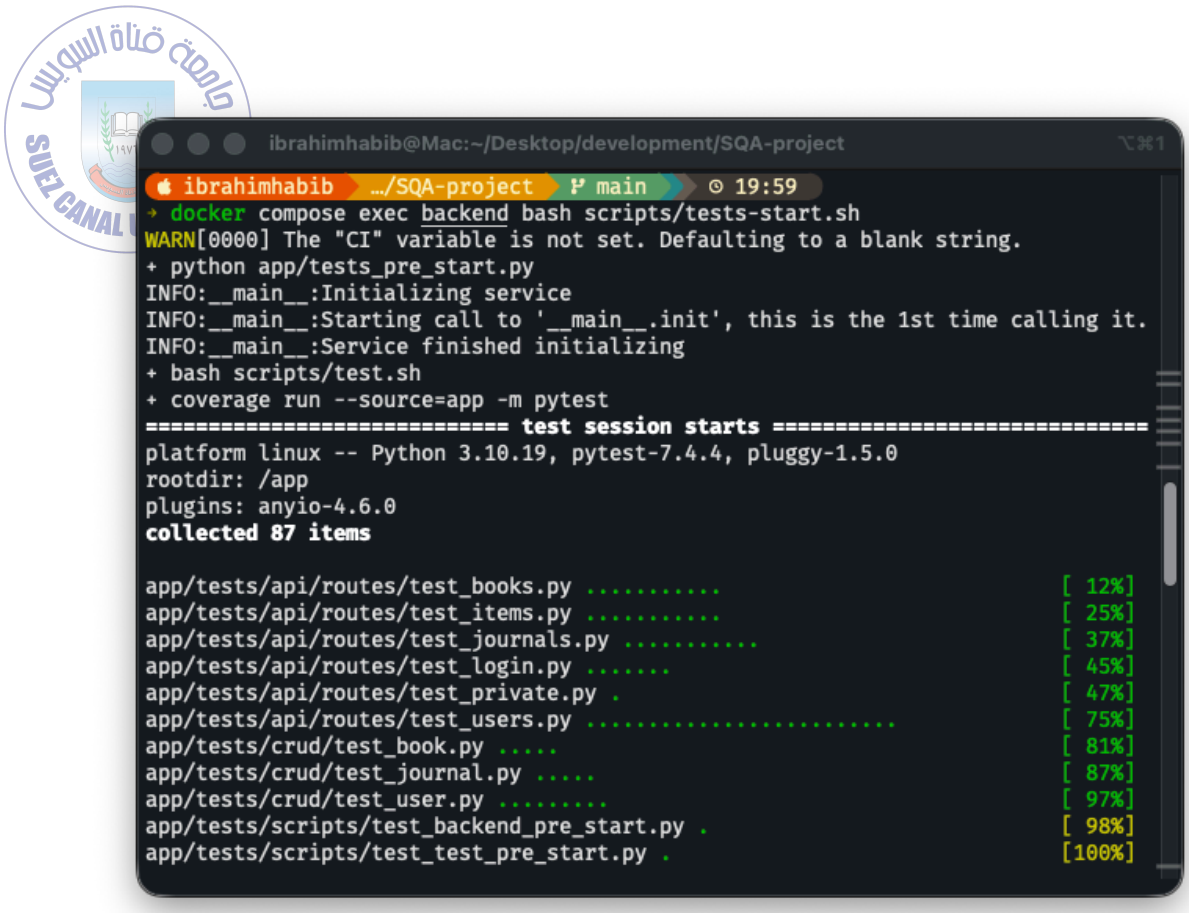


Figure 4: Automated test results showing all tests passed

In Figure 4, we can see that all the automated tests passed successfully. Each green dot represents a passed test case. Since all tests are green, there are no failed tests.

6.3 Code Coverage

One of the advantages of using `pytest` is its ability to automatically measure code coverage. Code coverage indicates the percentage of the codebase that is executed during testing. Higher code coverage generally implies better test coverage and a lower likelihood of undetected bugs.

`pytest` generates an HTML report for code coverage that can be viewed in a web browser. The following image shows a snippet of the code coverage report.

coverage: 96%

Files | Functions | Classes

coverage.py v7.6.1, created at 2025-12-10 18:00 +0000

File ▲	statements	missing	excluded	coverage
app/__init__.py	0	0	0	100%
app/api/__init__.py	0	0	0	100%
app/api/deps.py	35	4	0	89%
app/api/main.py	12	0	0	100%
app/api/routes/__init__.py	0	0	0	100%
app/api/routes/books.py	47	2	0	96%
app/api/routes/items.py	57	4	0	93%
app/api/routes/journals.py	47	2	0	96%
app/api/routes/login.py	57	9	0	84%
app/api/routes/private.py	18	0	0	100%
app/api/routes/users.py	100	0	0	100%
app/api/routes/utils.py	14	4	0	71%
app/backend_pre_start.py	23	7	0	70%
app/core/__init__.py	0	0	0	100%
app/core/config.py	70	7	0	90%
app/core/db.py	10	0	0	100%
app/core/security.py	16	0	0	100%
app/crud.py	86	2	0	98%

Figure 5: Code coverage report snippet showing overall coverage of 96%

The overall code coverage achieved during our testing process is 96%, as shown in Figure 5 in the top of the page. For each file, the report shows the number of statements covered by tests, the number uncovered ,and the percentage of coverage. Most files have 100% coverage, while a few files have slightly lower coverage. Some of these files are related to db setup and configuration, which are not directly tested.

7 End-to-End Automated Testing

In the end-to-end testing, we focus on the system as a whole. These tests view the system in the same manner the end user would: using the web interface to perform various actions.

7.1 Testing Framework

To perform end-to-end testing, we used Playwright, a popular framework for end-to-end testing web applications.

Playwright tests are defined using JavaScript or TypeScript. Throughout the whole app, we used TypeScript for the frontend codebase, so we used it for the tests also.

The directory `frontend/tests` contains the Playwright tests. Inside this directory, there are files ending with `.spec.ts`, each containing a set of related test cases.

7.2 Summary of Automated Playwright Test Scenarios

The Playwright suite covered:

7.2.a Login Tests

- Login with valid credentials
- Login with invalid or missing credentials

7.2.b Books Management Tests

- Add a book with valid information
- Attempt to add a book with **invalid ISBN format**

7.2.c UI Validation Tests

- Required field messages

Playwright also generated screenshots and logs for debugging.

```
test("Invalid ISBN triggers an error message", async ({ page }) => {
  await page.goto("/books")
  await page.getByRole("button", { name: "Add Book" }).click()

  await page.getByPlaceholder("Title").fill("Test Book")
  await page.getByPlaceholder("Author").fill("Tester")
  await page.getByPlaceholder("ISBN").fill("123") // invalid ISBN

  await page.getByRole("button", { name: "Save" }).click()

  await expect(page.getByText("Invalid ISBN")).toBeVisible()
})
  return go(f, seed, [])
}
```

Figure 6: Sample Playwright Test Definition using TS

7.3 Playwright Test Results

Table 6: Playwright Test Results Summary

Test Category	Passed	Failed	Notes
Login Scenarios	3	0	All login flows behaved as expected
Add Book (Valid Data)	1	0	Book successfully added and displayed
Add Book (Missing Fields)	1	0	UI correctly displayed validation messages
Add Book (Invalid ISBN)	0	1	**Frontend accepted invalid ISBN (matches manual testing bug)**
UI Rendering & List Updates	2	0	Lists updated correctly after valid submissions

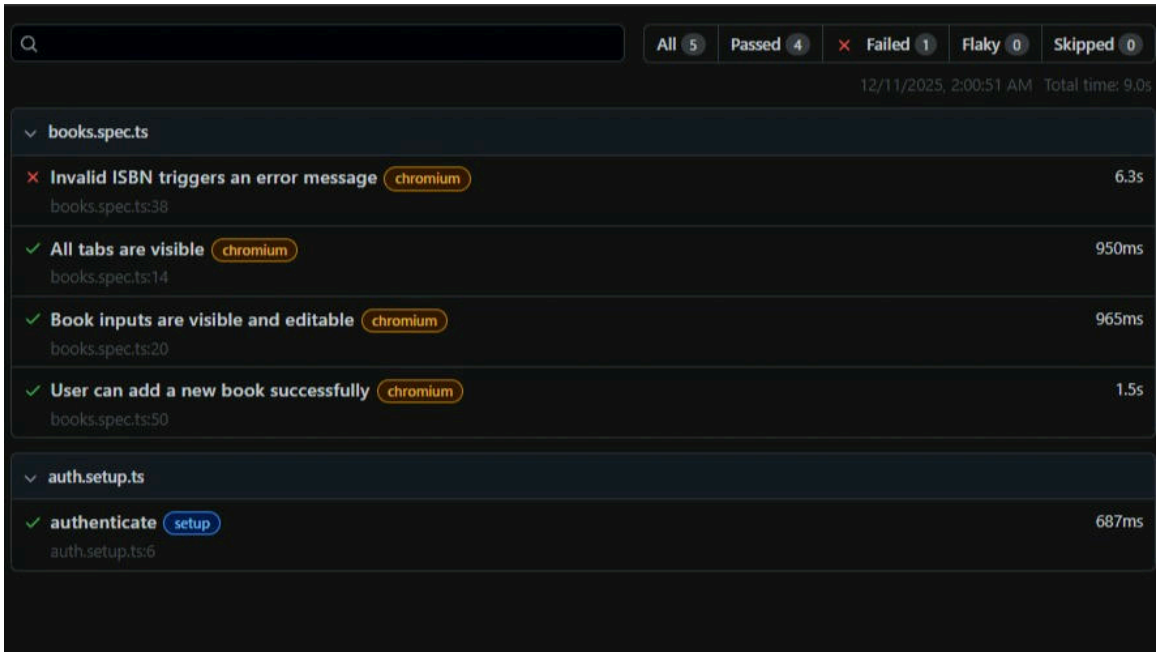


Figure 7: Playwright Test Report

The main failure occurred in the **Invalid ISBN validation test**, where the frontend allowed the creation of a book with an incorrect ISBN format. This matches the issue previously discovered in manual testing.

8 Bug Reports

Before we conclude this report, we will summarize the bugs we found during the different testing stages.

The table below lists the bugs we found along with their severity levels, reproduction steps, the expected behavior, and the actual behavior. To enhance the table's readability, we have broken

down the table into multiple parts with different columns shown in each part. The bug IDs are consistent across all parts.

Table 7: Bug Summary

Bug ID	Severity Level	Description
B01	Medium	Input validation bug for ISBN format when adding a new book. The system accepts invalid ISBN formats.
B02	Medium	Input validation bug for ISBN format when updating book information. The system accepts invalid ISBN formats.
B03	Medium	Input validation bug for ISSN format when adding a new journal. The system accepts invalid ISSN formats.
B04	Medium	Input validation bug for ISSN format when updating journal information. The system accepts invalid ISSN formats.
B05	Low	Usability bug related to token validation on dashboard load. The system loads the dashboard before validating the token, leading to a brief display of incorrect user information.

Table 8: Bug Reproduction Steps

Bug ID	Steps to Reproduce
B01	1. Navigate to the “Add New Book” page. 2. Fill in the book details with an invalid ISBN format. 3. Click the “Save” button.
B02	1. Navigate to the “Update Book” page for an existing book. 2. Modify the book details with an invalid ISBN format. 3. Click the “Save” button.
B03	1. Navigate to the “Add New Journal” page. 2. Fill in the journal details with an invalid ISSN format. 3. Click the “Save” button.
B04	1. Navigate to the “Update Journal” page for an existing journal. 2. Modify the journal details with an invalid ISSN format. 3. Click the “Save” button.
B05	1. Log in to the system. 2. Open the browser’s inspector tool (F12) and go to the Application tab. 3. Modify the “access_token” value in local storage to an invalid value.

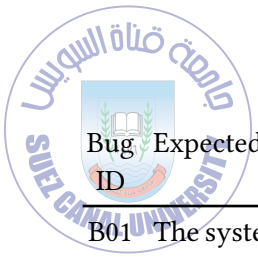


Table 9: Bug Behavior

Bug ID	Expected Behavior	Actual Behavior
B01	The system should display an error message indicating that the ISBN format is invalid and prevent the book from being added.	The system accepts the invalid ISBN format and adds the book successfully.
B02	The system should display an error message indicating that the ISBN format is invalid and prevent the book information from being updated.	The system accepts the invalid ISBN format and updates the book information successfully.
B03	The system should display an error message indicating that the ISSN format is invalid and prevent the journal from being added.	The system accepts the invalid ISSN format and adds the journal successfully.
B04	The system should display an error message indicating that the ISSN format is invalid and prevent the journal information from being updated.	The system accepts the invalid ISSN format and updates the journal information successfully.
B05	The system should validate the token before loading the dashboard and redirect the user to the login page if the token is invalid.	The system loads the dashboard before validating the token, leading to a brief display of incorrect user information before redirecting to the login page.

9 Conclusion

In this report, we described our process for testing the Library Management System.

The project was initialized from a GitHub repo that provided a basic implementation of user authentication and item management features. We expanded the system by adding Books and Journals management functionalities.

To test the system, we started by listing the major system features. Then, we created manual test cases to cover these features and executed them, recording the results.

We also developed automated test cases for both white box and black box testing stages using `pytest`. We executed all the automated tests and achieved a high code coverage of 96%.

9.1 Acknowledgments

- **Dr. Samah Zakaria**: For her Software Quality Assurance course and continuous support.
- **Dr. Mirhan Hisham**: For her valuable hands-on sessions.