

## Full Stack Development with AI

### Lab 10.2 – Creating a Complete Web Application with Express.js

#### Lab Overview

In this lab, you will learn how to create a server-side rendering web application using Express.js. The web application will simulate the administrator panel of a typical business-to-consumer (B2C) ecommerce shopping website. The use cases will allow an administrator to perform basic data manipulation operations on the product catalogue, i.e., CRUD or create, retrieve, update and delete.

You will be using the Pug template engine and persist product data into an SQLite database.

The synthetic product data consists of 50 products over 10 categories.

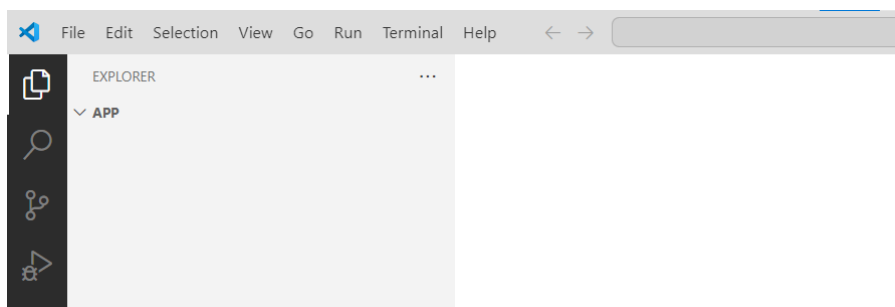
The resources that you need for this lab can be found in “resources.zip”.

#### Exercise 1 – Creating a new Express.js Application

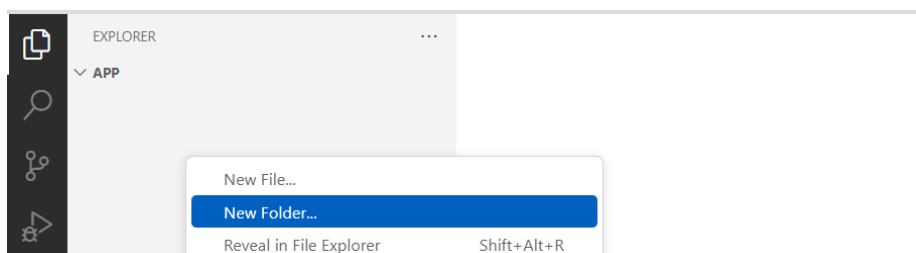
1. Use the file explorer or terminal on your computer to create a new folder **app**.

A typical location to create the new **app** folder is your home directory. On a Windows computer, this will be `C:\Users\<username>`. On a macOS computer, this will be `/Users/<username>`.

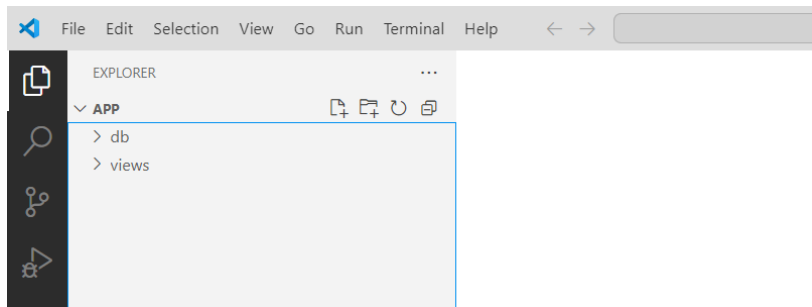
2. Start Visual Studio Code (VS Code) and open the newly created **app** folder. This folder will be empty as shown in the figure below:



3. Right click on the Explorer pane and select “New Folder” to create a new folder **db**. Repeat the same steps to create another new folder **views**.



4. Your Explorer should now resemble the figure below:



5. Start a terminal in VS Code.

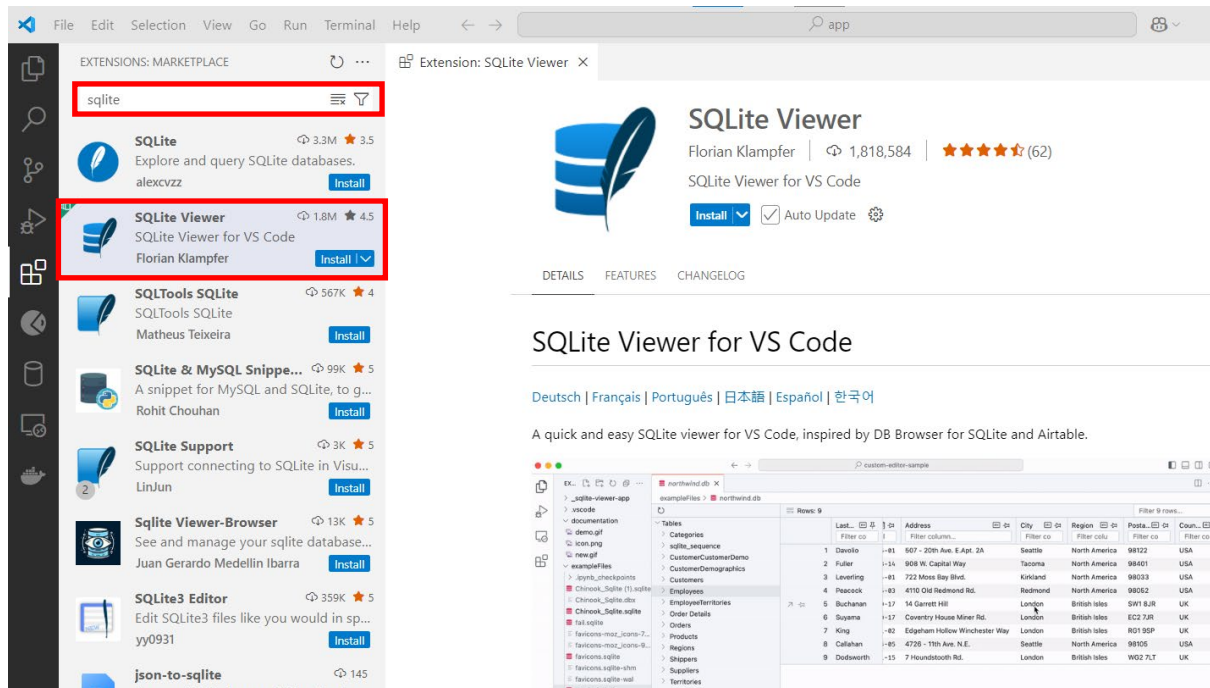
6. Run the following commands to install the required node packages using `npm`:

```
npm install express
npm install pug
npm install sqlite3
```

## Exercise 2 – Creating a New SQLite Database

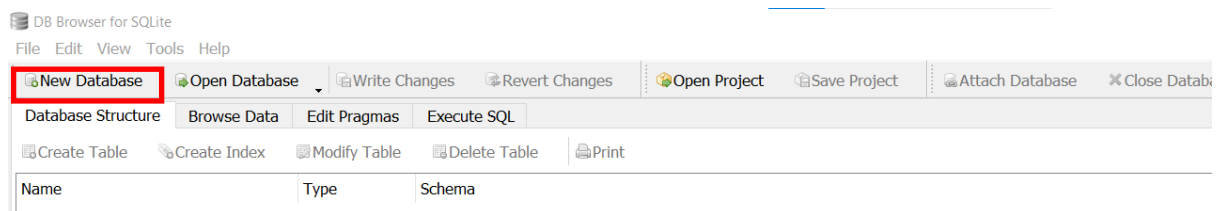
Follow the instructions below to install the SQLite Viewer extension in VS Code.

1. Go to the Extensions pane and search for “sqlite”. Then select “SQLite Viewer” and install it.



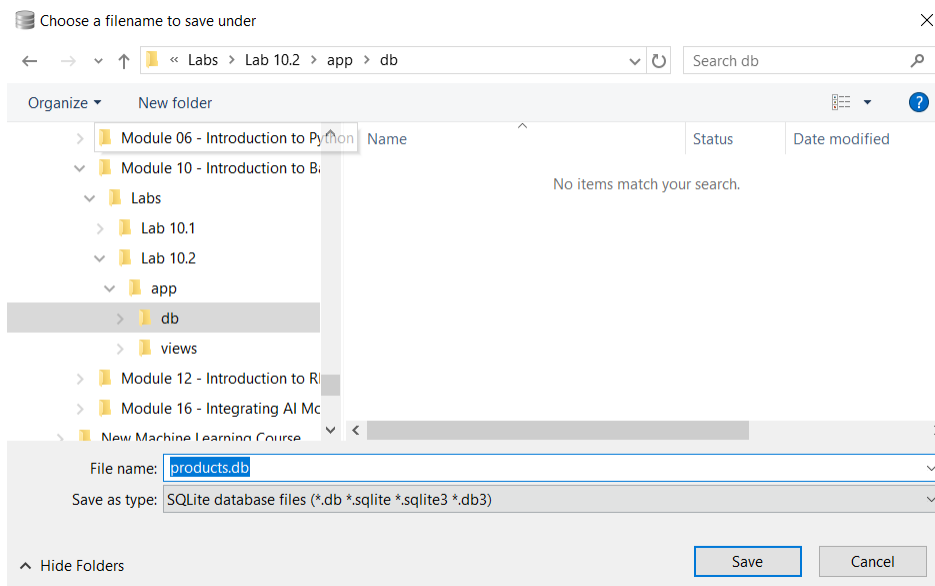
Next, follow the instructions below to create a new SQLite database:

1. Start DB Browser for SQLite.
2. Click on “New Database”



3. Navigate to the app\db folder that you have created earlier.

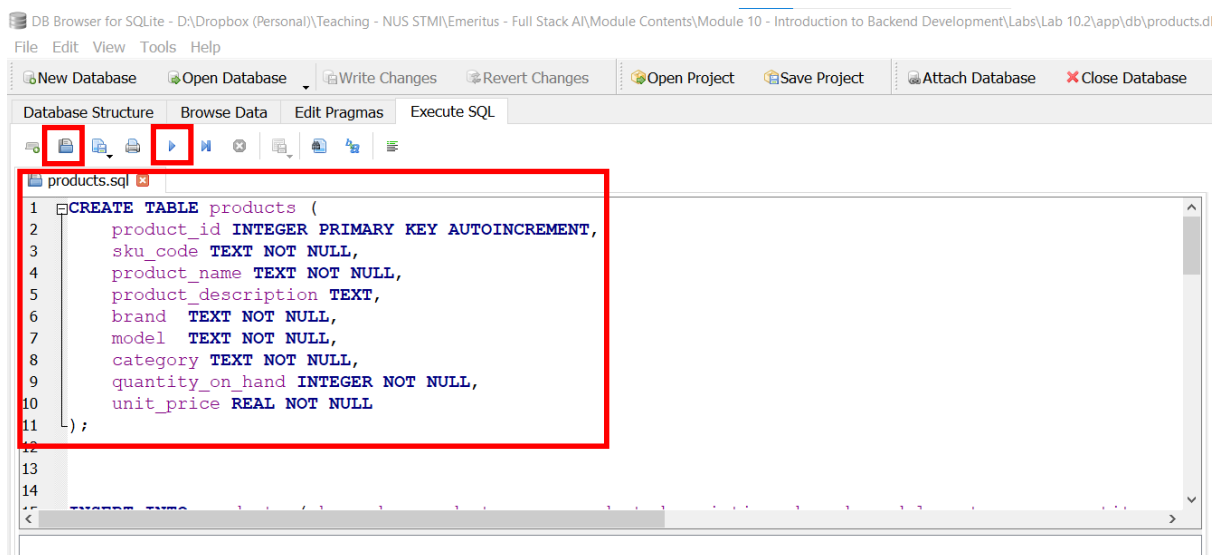
4. Name the new database as “products.db” and click “Save”.



5. Close the “Edit table definition” dialog box.

6. Switch to the “Execute SQL” tab.

7. Click on the “Open SQL File” button and navigate to the folder where you have extracted “resources.zip”. Then select “products.sql” and click on the “Run” button.



8. After the SQL statements have been executed, switch to the “Database Structure” and “Browse Data” tabs to inspect the “products” table and data.

Database Structure   Browse Data   Edit Pragmas   Execute SQL

Create Table   Create Index   Modify Table   Delete Table   Print

Name   Type   Schema

▼ Tables (2)

▼ products

```
CREATE TABLE products ( product_id INTEGER PRIMARY KEY AUTOINCREMENT, sku_code TEXT NOT NULL, product_name TEXT NOT NULL, product_description TEXT NOT NULL, brand TEXT NOT NULL, model TEXT NOT NULL, category TEXT NOT NULL, quantity_on_hand INTEGER NOT NULL, unit_price REAL NOT NULL )
```

product\_id   sku\_code   product\_name   product\_description   brand   model   category   quantity\_on\_hand

Filter   Filter   Filter   Filter   Filter   Filter   Filter   Filter

1	1	KEI00Q4K	Smartphones Item 1	The Apple iPhone 15 is a top-tier ...	Apple	iPhone 15	Smartphones
2	2	P0KJN21V	Smartphones Item 2	The Samsung Galaxy S23 is a top-tier...	Samsung	Galaxy S23	Smartphones
3	3	JOASAMXH	Smartphones Item 3	The Google Pixel 8 is a top-tier ...	Google	Pixel 8	Smartphones
4	4	DPVWH86R	Smartphones Item 4	The OnePlus 11 Pro is a top-tier ...	OnePlus	11 Pro	Smartphones
5	5	0731JTPV	Smartphones Item 5	The Xiaomi Mi 13 is a top-tier ...	Xiaomi	Mi 13	Smartphones
6	6	7P5DGTTH	Laptops Item 6	The Dell XPS 13 is a top-tier laptops ...	Dell	XPS 13	Laptops
7	7	IVFP3L1J	Laptops Item 7	The Apple MacBook Air M2 is a top-ti...	Apple	MacBook Air M2	Laptops
8	8	E577XUKY	Laptops Item 8	The HP Spectre x360 is a top-tier ...	HP	Spectre x360	Laptops
9	9	V1DDP6MR	Laptops Item 9	The Lenovo ThinkPad X1 is a top-tier ...	Lenovo	ThinkPad X1	Laptops
10	10	R5HEZKKW	Laptops Item 10	The Asus ZenBook 14 is a top-tier ...	Asus	ZenBook 14	Laptops
11	11	VP1RB850	Headphones Item 11	The Sony WH-1000XM5 is a top-tier ...	Sony	WH-1000XM5	Headphones
12	12	SAQ8ZOXG	Headphones Item 12	The Bose QC 45 is a top-tier ...	Bose	QC 45	Headphones
13	13	D254ZEGZ	Headphones Item 13	The Sennheiser Momentum 4 is a top...	Sennheiser	Momentum 4	Headphones
14	14	DGVD8ZEF	Headphones Item 14	The Apple AirPods Max is a top-tier ...	Apple	AirPods Max	Headphones
15	15	BETF7ZY4	Headphones Item 15	The Jabra Elite 85h is a top-tier ...	Jabra	Elite 85h	Headphones
16	16	ROURD40Z	Smartwatches Item 16	The Apple Watch Series 9 is a top-tie...	Apple	Watch Series 9	Smartwatches
17	17	AY72M2O4	Smartwatches Item 17	The Samsung Galaxy Watch 6 is a to...	Samsung	Galaxy Watch 6	Smartwatches
18	18	L8XX97EE	Smartwatches Item 18	The Garmin Fenix 7 is a top-tier ...	Garmin	Fenix 7	Smartwatches
19	19	4ZDA4QTQ	Smartwatches Item 19	The Fitbit Versa 4 is a top-tier ...	Fitbit	Versa 4	Smartwatches
20	20	T08DA62J	Smartwatches Item 20	The Huawei Watch GT 4 is a top-tier ...	Huawei	Watch GT 4	Smartwatches
21	21	FT71V8XK	Televisions Item 21	The LG OLED C3 is a top-tier ...	LG	OLED C3	Televisions
22	22	D5QDZCQH	Televisions Item 22	The Samsung QLED Q90T is a top-tie...	Samsung	QLED Q90T	Televisions
23	23	317K4BP1	Televisions Item 23	The Sony Bravia XR is a top-tier ...	Sony	Bravia XR	Televisions

9. Click on the “Write Changes” button and then “Close Database”. This will save the changes to “products.db”.

DB Browser for SQLite - D:\Dropbox (Personal)\Teaching - NUS STMI\Emeritus - Full Stack AI\Module Contents\Module 10 - Introduction to Backend Development\Labs\Lab 10.2\app\db\products.db

File   Edit   View   Tools   Help

New Database   Open Database   **Write Changes**   Revert Changes   Open Project   Save Project   Attach Database   **Close Database**

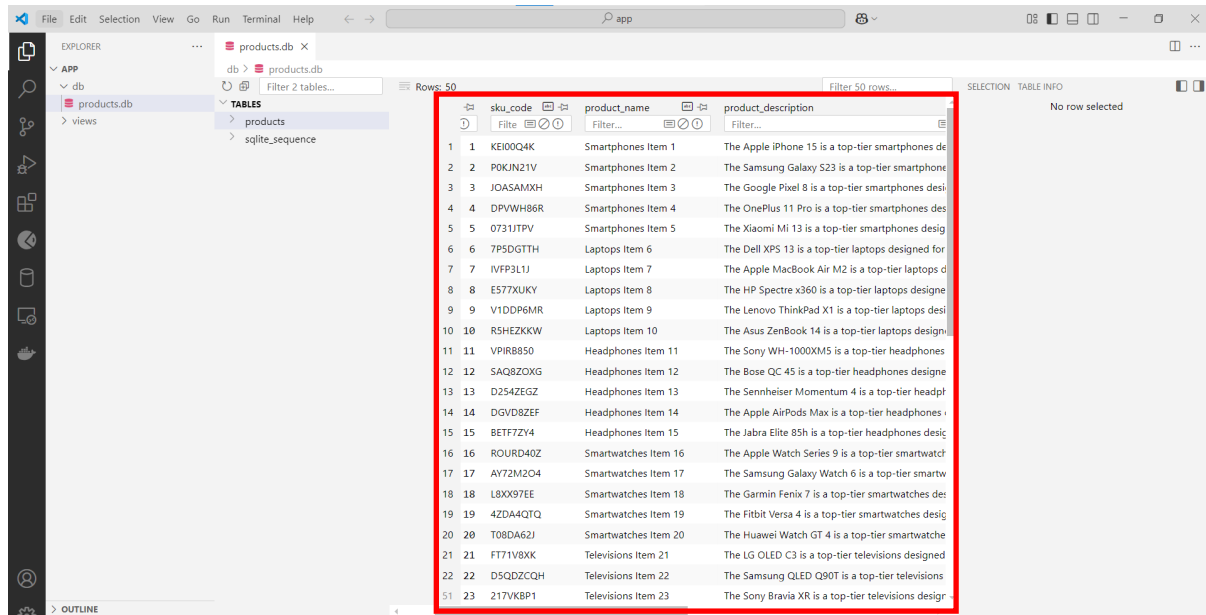
Database Structure   Browse Data   Edit Pragmas   Execute SQL

Table: products

Filter in any column

product_id	sku_code	product_name	product_description	brand	model	category	quantity_on
Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	1	KEI00Q4K	Smartphones Item 1	The Apple iPhone 15 is a top-tier ...	Apple	iPhone 15	Smartphones

10. Return back to VS Code and look under the “app\db” folder. Ensure that you can see “products.db”.
11. Select “products.db” and you should be able to view the “products” table and its data within VS Studio using the SQLite Viewer extension.



12. Take note that the SQLite Viewer extension does not support query running. If you wish to run any SQL statements, you will need to use DB Browser.

### **Exercise 3 – Creating New Endpoints**

In this exercise, you will be creating a series of endpoints using the GET and POST HTTP methods to implement the create, retrieve, update and delete use cases for product records.

1. Right click on the Explorer in the area outside of any subfolder and select “New File”. This will create the new file in the root of the web application or the **app** folder itself. Name the file as “app.js”
2. Paste the following code fragment representing the basic structure of an Express.js application into “app.js”

```
const express = require('express');
const app = express();
const port = 3000;

app.set('view engine', 'pug');

app.use(express.urlencoded({ extended: true }));

app.listen(port, function () {
  console.log(`Express app listening on port ${port}!`);
});
```

3. Your VS Code should resemble the following figure:

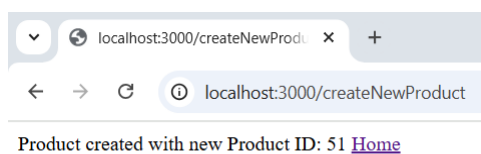


4. Between line 5 and 7, add a **GET** endpoint to the root path **/** that renders the pug template “index.pug” as response.
5. Add a **GET** endpoint to the path **/viewAllProducts** that performs the following two tasks:
  - a. Retrieves all the product records from the **products** table using a **SELECT** query.
  - b. Renders the pug template “viewAllProducts.pug” as response

6. Add a **GET** endpoint to the path `/createNewProduct` that renders the pug template “createNewProduct.pug” as response.

Note that this template will render a blank HTML form for user to input the data for a new product record.

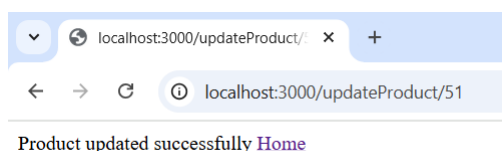
7. Add a **POST** endpoint to the path `/createNewProduct` that performs the following two tasks:
  - a. Retrieves the form data in the pug template “createNewProduct.pug”.
  - b. Insert the data for the new product record into the `products` table using an **INSERT** statement.
  - c. Return an information message together with a link back to the homepage.



8. Add a **GET** endpoint to the path `/updateProduct` that performs the following two tasks:
  - a. Accepts a path parameter for the product id of the product to be updated
  - b. Renders the pug template “updateProduct.pug” as response.

Note that this template will render a HTML form prepopulated with the existing data of the selected product for user to edit.

9. Add a **POST** endpoint to the path `/updateProduct` that performs the following four tasks:
  - a. Accepts a path parameter for the product id of the product to be updated
  - b. Retrieves the form data in the pug template “updateNewProduct.pug”.
  - c. Update the data for the existing product record into the `products` table using an **UPDATE** statement.
  - d. Return an information message together with a link back to the homepage.

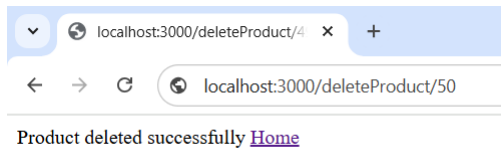


10. Add a **GET** endpoint to the path `/deleteProduct` that performs the following two tasks:
  - a. Accepts a path parameter for the product id of the product to be deleted
  - b. Renders the pug template “deleteProduct.pug” as response.

Note that this template will render a table showing the existing data of the selected product for user to confirm the deletion.



11. Add a **POST** endpoint to the path **/deleteProduct** that performs the following three tasks:
- Accepts a path parameter for the product id of the product to be deleted
  - Delete the existing product record from the **products** table using a **DELETE** statement.
  - Return an information message together with a link back to the homepage.

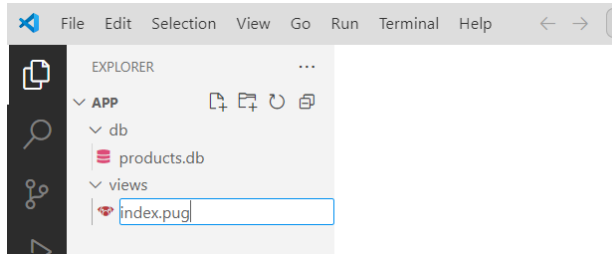


## **Exercise 4 – Creating the Views as pug Templates**

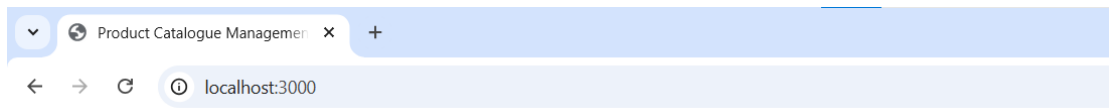
In this exercise, you will be creating a series of pug templates representing the views of the web application. Recall that the pug code will be converted to HTML on the server side before being returned to the web browser.

### **Index or Homepage of the Web Application**

1. Right click on the **views** folder and select “New File”. Name the file as “index.pug”



2. The new file will be opened for editing.
3. Input the pug code to create a web page resembling the figure below:



## **Welcome to Product Catalogue Management**

This web application allows you to manage the product records in your catalogue.

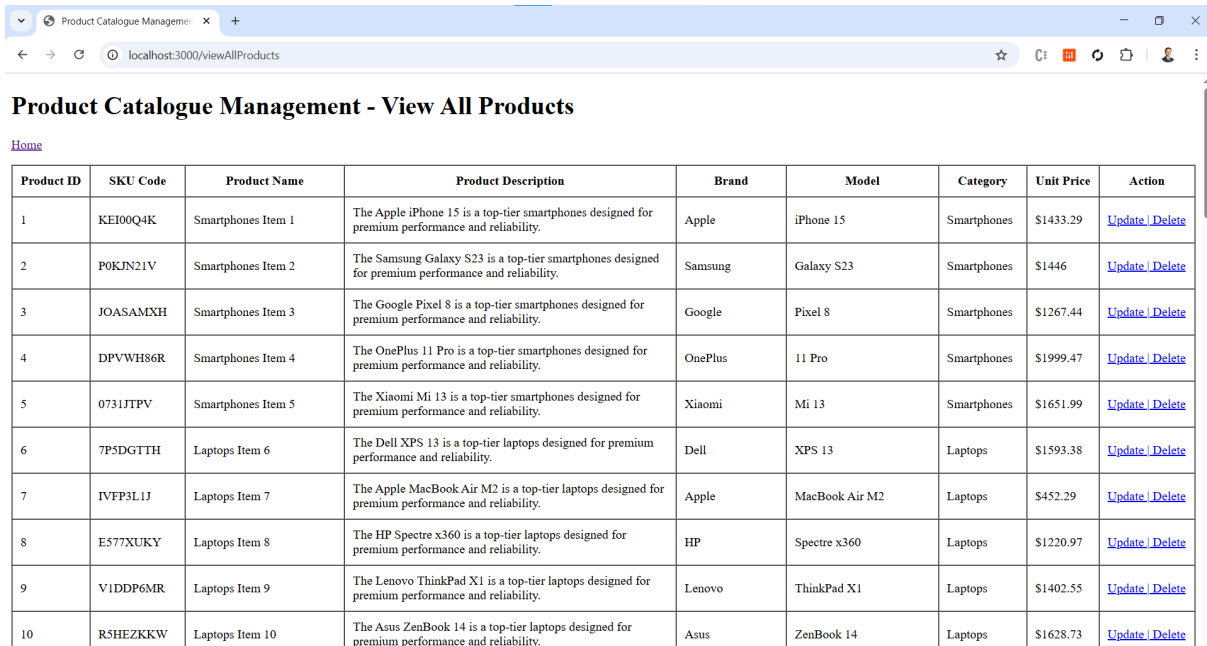
<a href="#">View All Products</a>	<a href="#">Create New Product</a>
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The two links should link to the following paths:

- View All Products – /viewAllProducts
- Create New Product – /createNewProduct

## View All Products

1. Right click on the **views** folder and select “New File”. Name the file as “viewAllProducts.pug”
2. Input the pug code to create a web page resembling the figure below:



**Product Catalogue Management - View All Products**

[Home](#)

Product ID	SKU Code	Product Name	Product Description	Brand	Model	Category	Unit Price	Action
1	KEI00Q4K	Smartphones Item 1	The Apple iPhone 15 is a top-tier smartphones designed for premium performance and reliability.	Apple	iPhone 15	Smartphones	\$1433.29	<a href="#">Update</a>   <a href="#">Delete</a>
2	P0KJN21V	Smartphones Item 2	The Samsung Galaxy S23 is a top-tier smartphones designed for premium performance and reliability.	Samsung	Galaxy S23	Smartphones	\$1446	<a href="#">Update</a>   <a href="#">Delete</a>
3	JOASAMXH	Smartphones Item 3	The Google Pixel 8 is a top-tier smartphones designed for premium performance and reliability.	Google	Pixel 8	Smartphones	\$1267.44	<a href="#">Update</a>   <a href="#">Delete</a>
4	DPVWH86R	Smartphones Item 4	The OnePlus 11 Pro is a top-tier smartphones designed for premium performance and reliability.	OnePlus	11 Pro	Smartphones	\$1999.47	<a href="#">Update</a>   <a href="#">Delete</a>
5	0731JTPV	Smartphones Item 5	The Xiaomi Mi 13 is a top-tier smartphones designed for premium performance and reliability.	Xiaomi	Mi 13	Smartphones	\$1651.99	<a href="#">Update</a>   <a href="#">Delete</a>
6	7P5DGTTH	Laptops Item 6	The Dell XPS 13 is a top-tier laptops designed for premium performance and reliability.	Dell	XPS 13	Laptops	\$1593.38	<a href="#">Update</a>   <a href="#">Delete</a>
7	IVFP3L1J	Laptops Item 7	The Apple MacBook Air M2 is a top-tier laptops designed for premium performance and reliability.	Apple	MacBook Air M2	Laptops	\$452.29	<a href="#">Update</a>   <a href="#">Delete</a>
8	E577XUKY	Laptops Item 8	The HP Spectre x360 is a top-tier laptops designed for premium performance and reliability.	HP	Spectre x360	Laptops	\$1220.97	<a href="#">Update</a>   <a href="#">Delete</a>
9	V1DDP6MR	Laptops Item 9	The Lenovo ThinkPad X1 is a top-tier laptops designed for premium performance and reliability.	Lenovo	ThinkPad X1	Laptops	\$1402.55	<a href="#">Update</a>   <a href="#">Delete</a>
10	R5HEZKKW	Laptops Item 10	The Asus ZenBook 14 is a top-tier laptops designed for premium performance and reliability.	Asus	ZenBook 14	Laptops	\$1628.73	<a href="#">Update</a>   <a href="#">Delete</a>

The two links should link to the following paths:

- Update – /updateProduct/:product\_id
- Delete – /deleteProduct/:product\_id

## Create New Product

1. Create a new pug template file “createNewProduct.pug”
2. Input the pug code to create a web page resembling the figure below:

Product Catalogue Management - Create New Product

[Home](#)

SKU Code:	<input type="text"/>
Product Name:	<input type="text"/>
Product Description:	<input type="text"/>
Brand:	<input type="text"/>
Model:	<input type="text"/>
Category:	<input type="text" value="Smartphones"/>
Quantity on Hand	<input type="text"/>
Unit Price:	<input type="text"/>

Create New Product

## Update Product

1. Create a new pug template file “updateProduct.pug”
2. Input the pug code to create a web page resembling the figure below:

Product Catalogue Management - Update Product

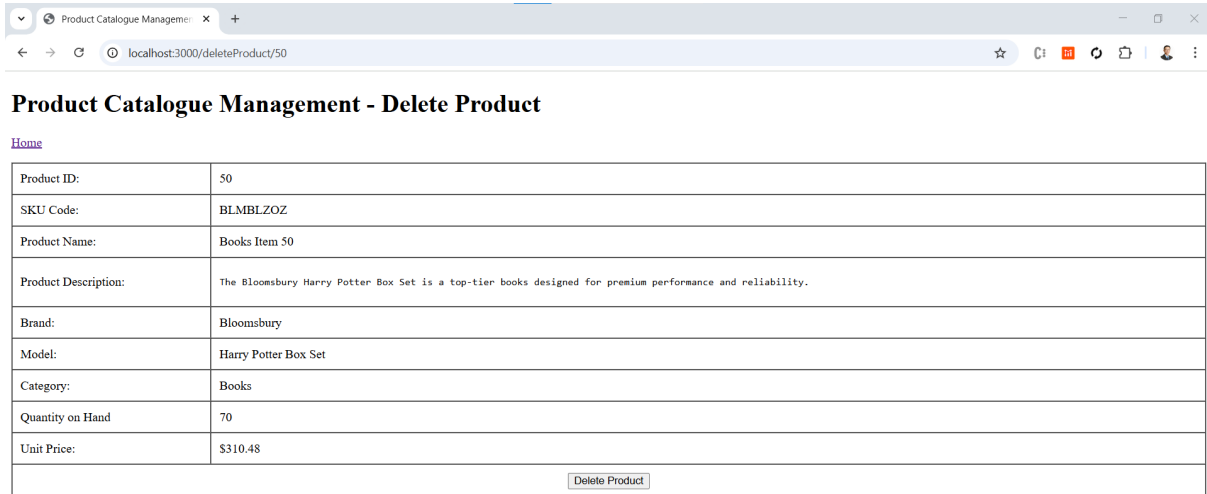
[Home](#)

Product ID:	51
SKU Code:	<input type="text" value="TEST1"/>
Product Name:	<input type="text" value="Test Product 1"/>
Product Description:	<input type="text" value="TEST1 This is good"/>
Brand:	<input type="text" value="Test Brand 1"/>
Model:	<input type="text" value="Test Model 1"/>
Category:	<input type="text" value="Books"/>
Quantity on Hand	<input type="text" value="100"/>
Unit Price:	<input type="text" value="10"/>

Update Product

## Delete Product

1. Create a new pug template file “deleteProduct.pug”
2. Input the pug code to create a web page resembling the figure below:



The screenshot shows a web browser window with the title 'Product Catalogue Management - Delete Product'. The address bar shows 'localhost:3000/deleteProduct/50'. The page content includes a 'Home' link and a form with the following fields:

Product ID:	50
SKU Code:	BLMBLZOZ
Product Name:	Books Item 50
Product Description:	The Bloomsbury Harry Potter Box Set is a top-tier books designed for premium performance and reliability.
Brand:	Bloomsbury
Model:	Harry Potter Box Set
Category:	Books
Quantity on Hand	70
Unit Price:	\$310.48

At the bottom right of the form is a button labeled 'Delete Product'.

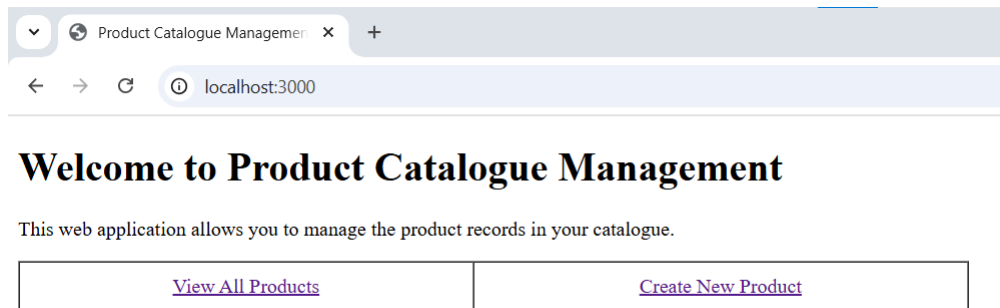
### **Exercise 5 – Running and Testing the Web Application**

Follow the instructions below to run the web application:

1. Start a new terminal in VS Code.
2. Run the following command to run the web application:

`node app.js`

3. Open your web browser and navigate to the address <http://localhost:3000/>. Ensure that you are able to view the index or homepage.



4. Click on the “View All Products” link to view the product records and perform some update and delete operations.
5. Click on the “Create New Product” link to add a new product record. Then return to the view all products webpage and ensure that you can view the new product record.

***-- End of Lab --***