FastAPI Tutorial in Visual Studio Code

Python FastAPI tutorial showing IntelliSense and debugging support in Visual Studio Code, the best Python IDE.

20 min. read · View original

FastAPI is a modern high-performant web framework for building APIs with Python. It is designed to make it easy to build APIs quickly and efficiently while providing features like automatic validation, serialization, and documentation of your API, making it a popular choice for building web services and microservices.

In this FastAPI tutorial, we will create a grocery list app using FastAPI. By the end of the tutorial, you will understand how to work with FastAPI in the Visual Studio Code terminal, editor, and debugger. This tutorial is not a FastAPI deep dive. For that, you can refer to the official FastAPI documentation.

If this is your first time using Python, we recommend you to start with our Python tutorial to get familiar with the language and VS Code's Python support. This tutorial is more suited for those who are already familiar with Python and want to learn how to work with FastAPI in VS Code.

The completed code project from this FastAPI tutorial can be found on GitHub: python-sample-vscode-fastapi-tutorial.

If you have any problems, you can search for answers or ask a question on the Python extension Discussions Q&A.

Set up the project

There are different ways you can set up your project for this tutorial. We will cover how you can set it up in GitHub Codespaces and in VS Code on your local machine.

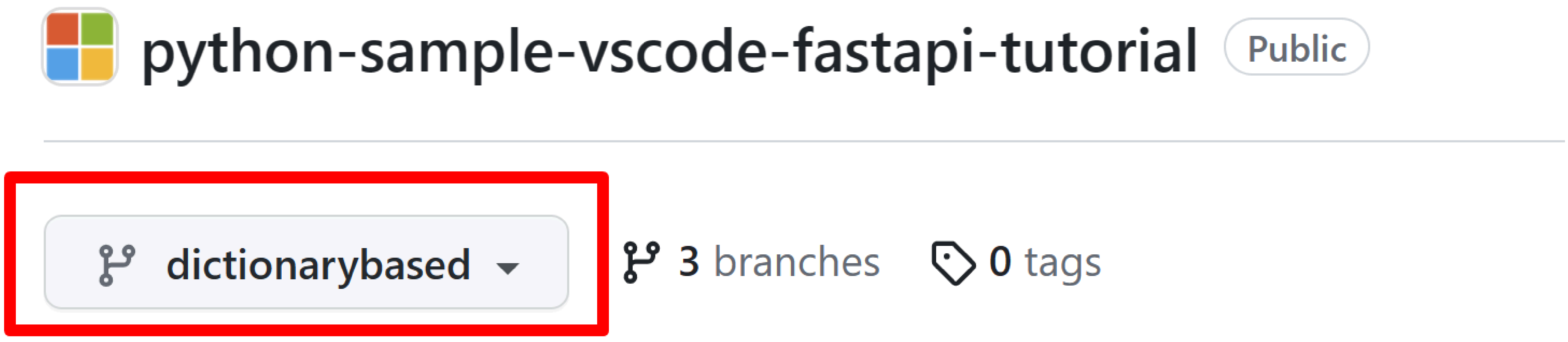
GitHub Codespaces

You can set up this project to develop in GitHub Codespaces, where you can code, debug, and run your app remotely in a codespace. A codespace provides a fully configured development environment hosted in the cloud, eliminating the need for local setup. This environment includes your project's dependencies, tools, and extensions, ensuring a consistent and reproducible development experience. It streamlines collaboration by providing real-time editing, integrated version control, and easy access to debugging and testing tools, all while maintaining the security and reliability of your project.

> **Note**: All GitHub.com accounts have a monthly quota of free use of GitHub Codespaces included in the Free or Pro plan. For more information, go to About billing for GitHub Codespaces.

To set up a codespace for this tutorial, navigate to this project's GitHub repository. This codespace contains all the necessary configurations and dependencies to quickly get started with FastAPI development.

For this tutorial, select the **dictionarybased** branch:



Then, select **Code** > **Codespaces** > **Create Codespace on <dictionarybased>** branch to create and open a codespace for your project.

Once you're done, you can continue with the Replace the database section below.

Locally in VS Code

To successfully complete this tutorial in VS Code, you first need to set up your Python development environment. Specifically, this tutorial requires:

In this section, we will create a folder to open as a workspace in VS Code, set up a Python virtual environment, and install the project's dependencies.

1. In your file system, create a project folder for this tutorial, such as `groceries-plugin`.

2. Open this new folder in VS Code (**File** > **Open Folder...**).

3. When the Workspace Trust prompt shows up, select **Yes, I trust the authors** to allow the workspace to access necessary resources and extensions. You can learn more about Workspace Trust in the documentation.

Now, let's create a `requirements.txt` file that lists the dependencies we wish to install for the application. The `requirements.txt` file is a common practice in Python development, used to specify the libraries that your project relies on and their versions. This file helps ensure that anyone working on the project can recreate a similar development environment, making it a convenient component for maintaining consistency.

We will install FastAPI for creating the app, uvicorn to work as the server, and Redis and `type-redis` for handling data storage and interacting with a Redis database.

4. Create a new file in VS Code (**File** > **New Text File** or Ctrl+N).

5. Add the following content to it:

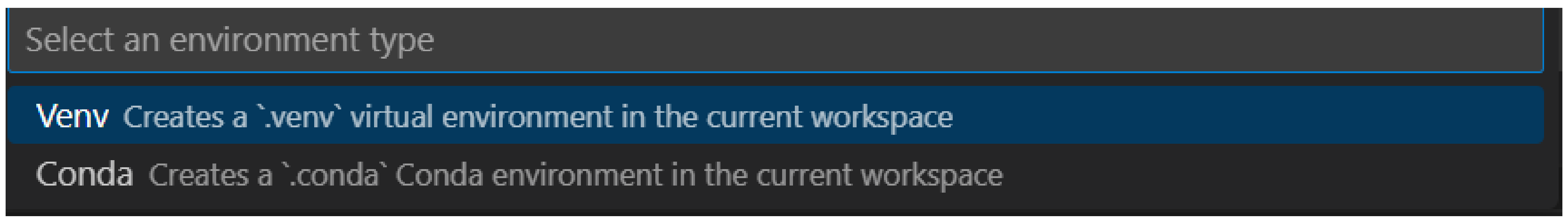
```
fastapi
redis
types-redis
uvicorn
```

6. Save the file (Ctrl+S) and name it `requirements.txt`.

7. Create a virtual environment by opening the Command Palette (Ctrl+Shift+P) and running the **Python: Create Environment** command.

> **Note**: This step may take a couple of minutes to complete.

8. When asked for the environment type, select **Venv**:

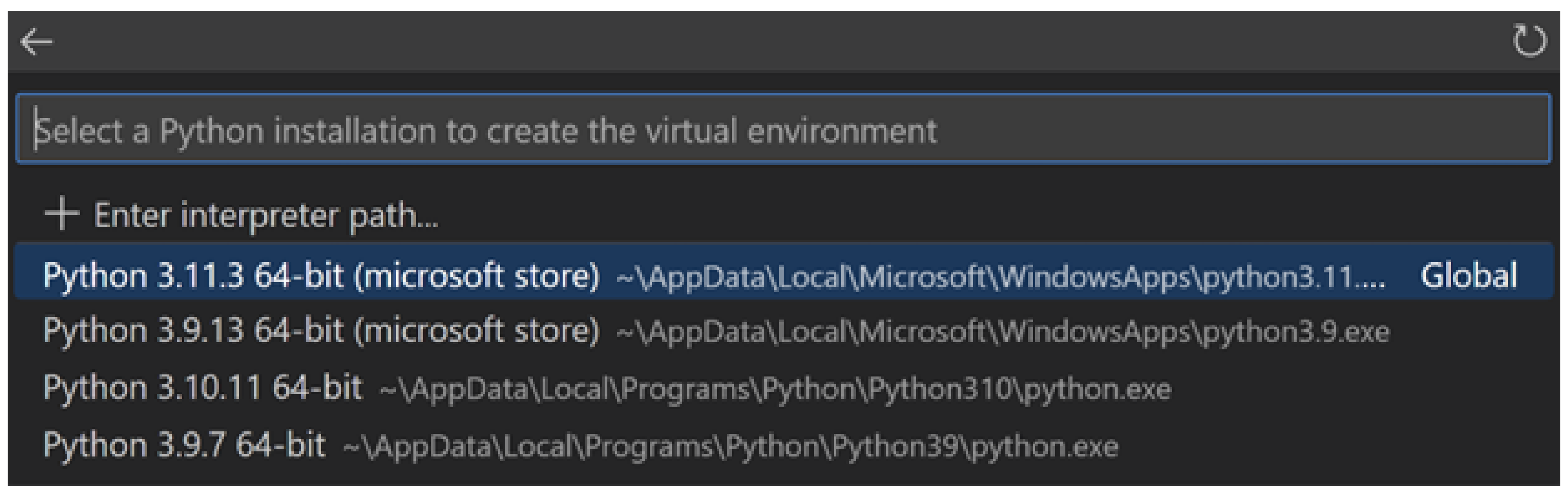


Select an environment type

Venv Creates a `.venv` virtual environment in the current workspace

Conda Creates a `.conda` Conda environment in the current workspace

9. Then select the latest version of Python available on your machine:



Select a Python installation to create the virtual environment

+ Enter interpreter path...

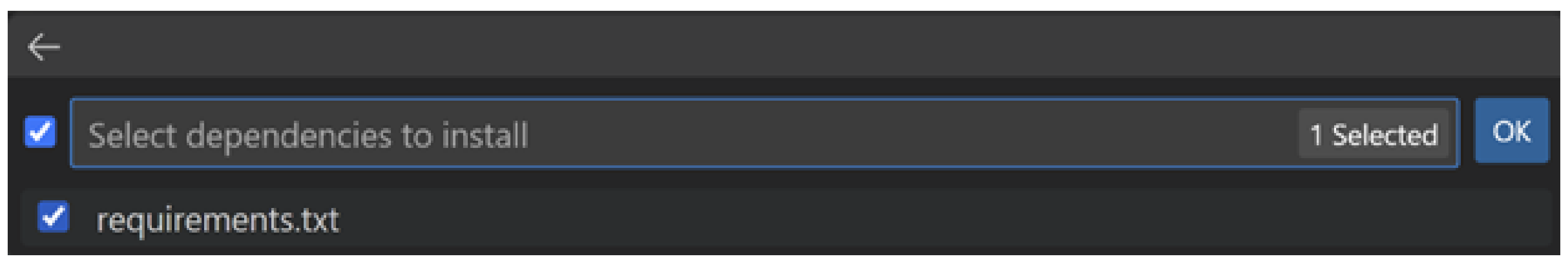
Python 3.11.3 64-bit (microsoft store) ~\AppData\Local\Microsoft\WindowsApps\python3.11.... Global

Python 3.9.13 64-bit (microsoft store) ~\AppData\Local\Microsoft\WindowsApps\python3.9.exe

Python 3.10.11 64-bit ~\AppData\Local\Programs\Python\Python310\python.exe

Python 3.9.7 64-bit ~\AppData\Local\Programs\Python\Python39\python.exe

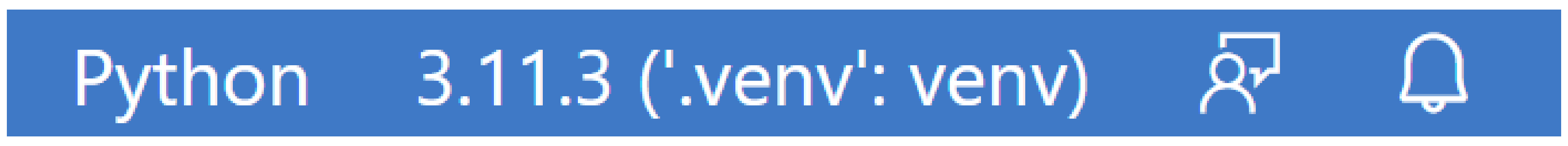
10. Select the `requirements.txt` file from the dropdown list, so the dependencies are automatically installed, and then select **OK**:



☑ Select dependencies to install 1 Selected OK

☑ requirements.txt

The virtual environment will be created, the dependencies automatically installed, and the environment selected for your workspace to be used by the Python extension. You can confirm it's been selected by checking the bottom right corner of VS Code:



Python 3.11.3 ('.venv': venv)

> **Note**: If you don't find the newly created environment information on the Status bar, you can click on the Python interpreter indicator (or run the **Python: Select Interpreter** command from the Command Palette) and manually select the virtual environment.

Start Coding

Let's create the application!

1. Create a new Python file by using **File** > **New File...** and then select **Python File**.

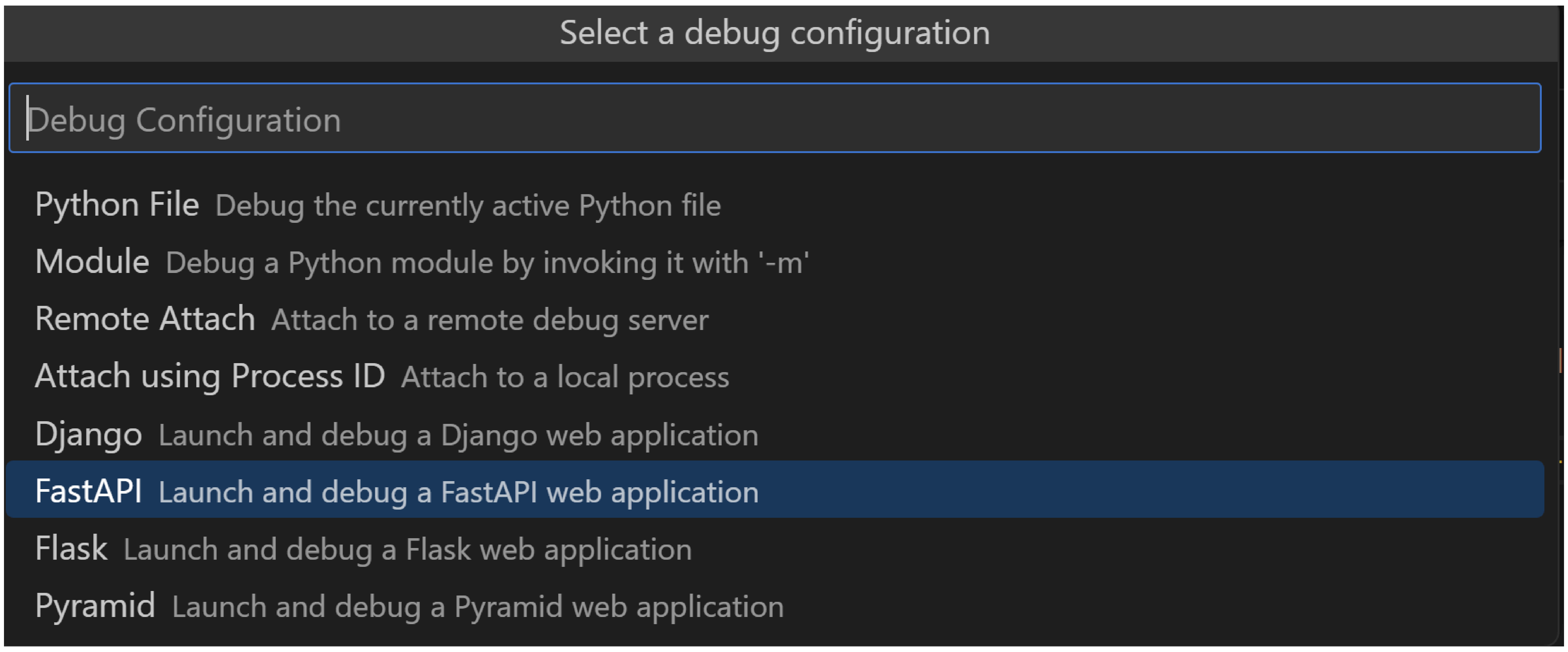
2. Save it as `main.py` (Ctrl+Shift+S) in the `groceries-plugin` folder.

3. Add the following code to `main.py` and save the file:

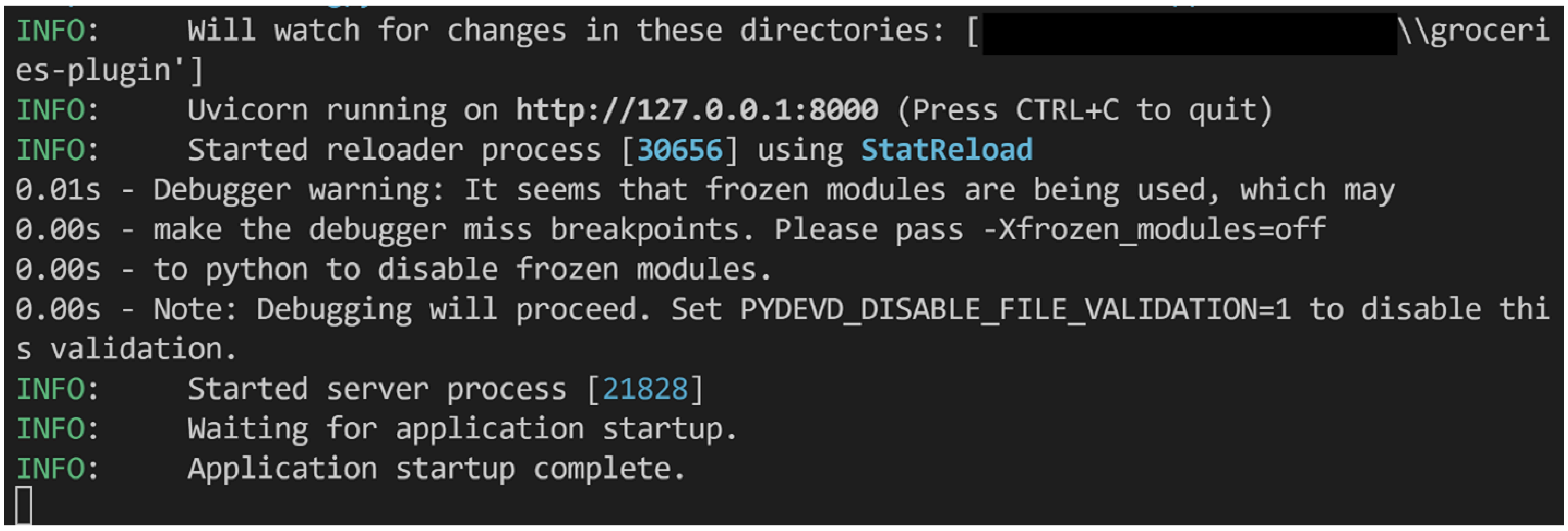
```
from fastapi import FastAPI

app = FastAPI()

@app.get("/")
def root():
    return {"message": "Hello World"}
```

4. Run the code by starting up the debugger (F5).

5. From the dropdown menu, select the **FastAPI** configuration option from the list:


Select a debug configuration
Debug Configuration
Python File Debug the currently active Python file
Module Debug a Python module by invoking it with '-m'
Remote Attach Attach to a remote debug server
Attach using Process ID Attach to a local process
Django Launch and debug a Django web application
FastAPI Launch and debug a FastAPI web application
Flask Launch and debug a Flask web application
Pyramid Launch and debug a Pyramid web application

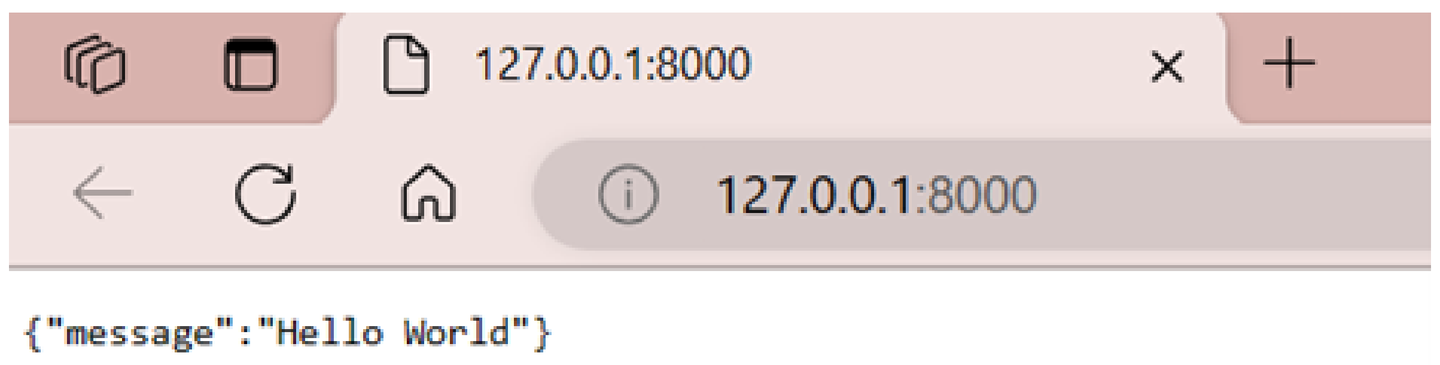
This automatically creates a debug configuration that invokes uvicorn to start the application server through the debugger and allows you to step through the source code to inspect its behavior. You should see something like the following in the terminal:



```
INFO:     Will watch for changes in these directories: [[redacted]\\groceri
es-plugin']
INFO:     Uvicorn running on http://127.0.0.1:8000 (Press CTRL+C to quit)
INFO:     Started reloader process [30656] using StatReload
0.01s - Debugger warning: It seems that frozen modules are being used, which may
0.00s - make the debugger miss breakpoints. Please pass -Xfrozen_modules=off
0.00s - to python to disable frozen modules.
0.00s - Note: Debugging will proceed. Set PYDEVD_DISABLE_FILE_VALIDATION=1 to disable thi
s validation.
INFO:     Started server process [21828]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
```

> **Tip**: In the case where your default port is already in use, stop the debugger and open the Command Palette (Ctrl+Shift+P), search for **Debug: Add Configuration**, select Python Debugger, and then FastAPI. This will create a custom config file in `.vscode/launch.json` that you can edit. Add the following to `"args":[]` to set a custom port: `"--port=5000"`. Save the file, and restart the debugger using (F5).

6. Ctrl+Click the `http://127.0.0.1:8000/` URL in the terminal to open your default browser to that address:



```
{"message":"Hello World"}
```

Congratulations! Your FastAPI app is up and running!

7. Stop the debugger by using the **Stop** button in the debug toolbar, or through Shift+F5.

Create a model for grocery list items

Now that we have the FastAPI app working, we can define our grocery list items by using Pydantic, a data validation and parsing library that integrates seamlessly with FastAPI. Pydantic lets you define data models using Python classes with type hints for automatic validation and parsing of incoming data (called "payloads") in API requests.

Let's create a model for our grocery list items. We will use the `ItemPayload` model to define the data structure of the items to add to the grocery list. This model will have three fields: `item_id`, `item_name`, and `quantity`.

1. Create a new Python file with **File** > **New File...** and then select **Python File**.

2. Add the following lines to the file, and then save it in the `groceries-plugin` folder as `models.py` (Ctrl+Shift+S):

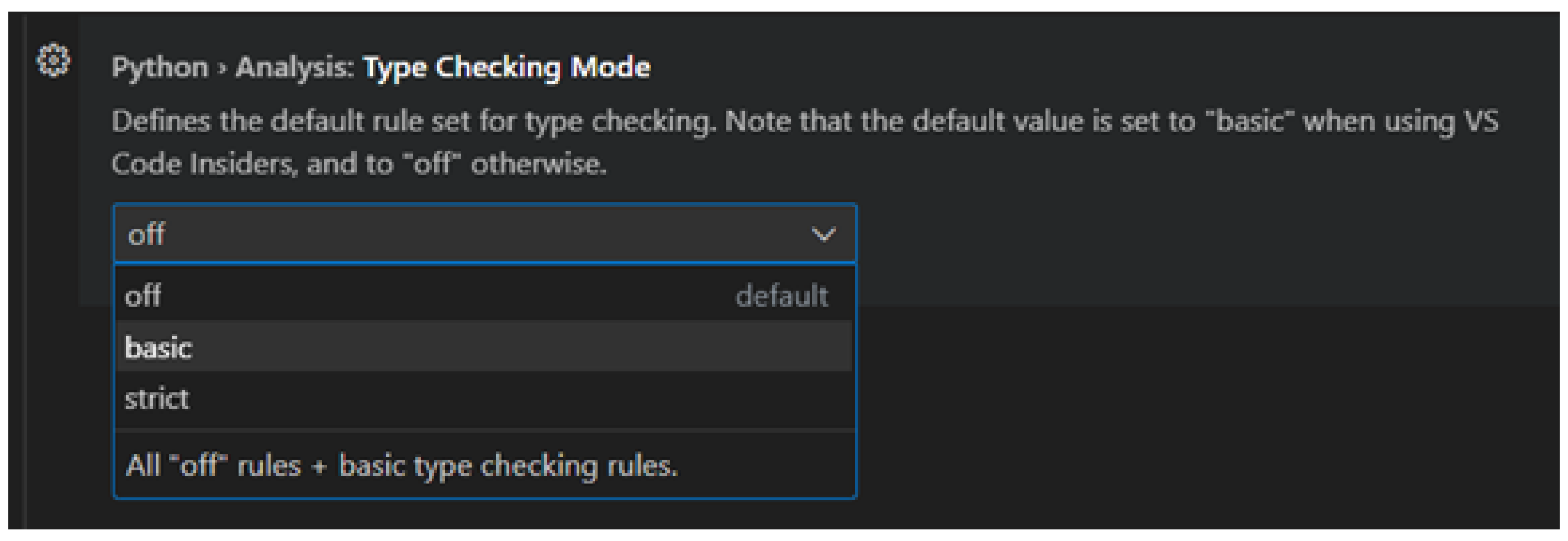
```
from typing import Optional
from pydantic import BaseModel

class ItemPayload(BaseModel):
    item_id: Optional[int]
    item_name: str
    quantity: int
```

Pylance, the default language server for Python in VS Code, supports type hinting features that can be helpful for working with Pydantic models and FastAPI. This is because Pylance is built on top of Pyright, a static type checker for Python that can detect type errors in your code to prevent bugs and improve code quality.

The three steps below are optional, but given that FastAPI uses type hints extensively to improve code readability and validation, we can take advantage of Pylance's type checking features to catch errors early on:

1. Open the Settings editor (Ctrl+,).

2. Search for "python type checking mode" and set it to `basic` for basic type checking. Pylance will now show diagnostics and warnings to catch simple type-related errors. Alternatively, you can set it to `strict` to enforce more advanced type checking rules.



Python › Analysis: **Type Checking Mode**

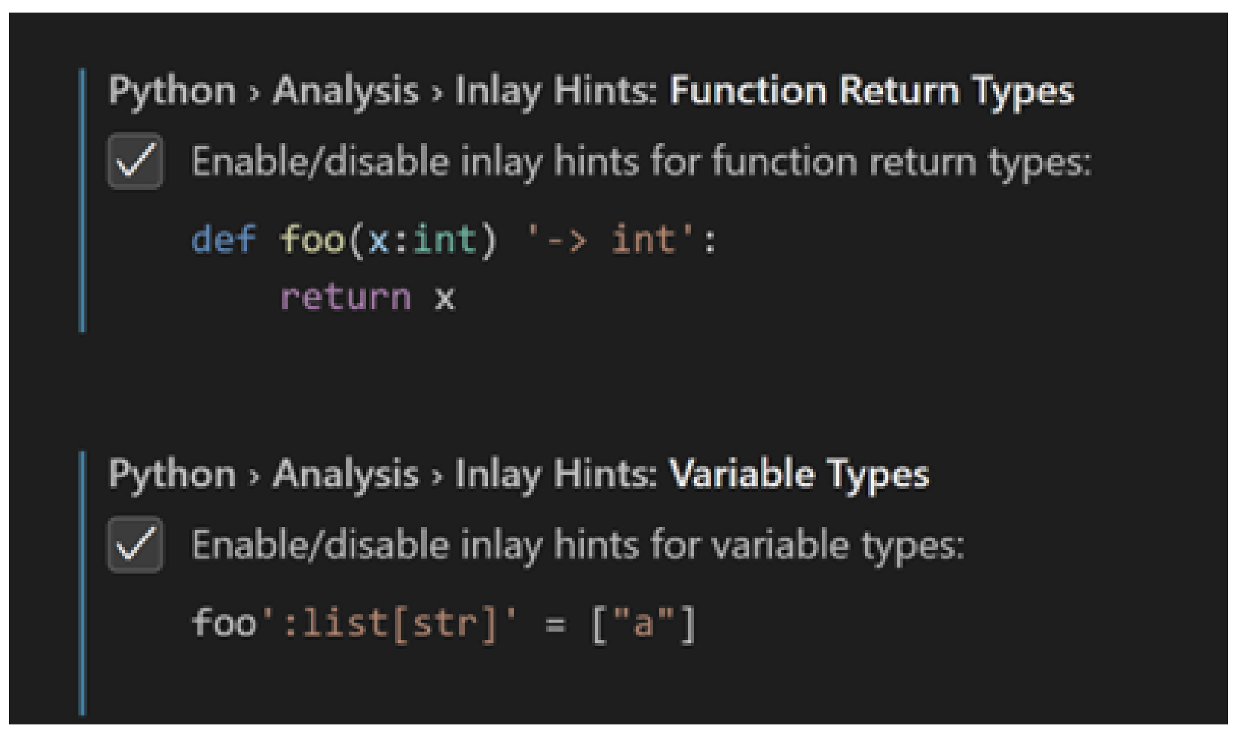
Defines the default rule set for type checking. Note that the default value is set to "basic" when using VS Code Insiders, and to "off" otherwise.

off

off default
basic
strict

All "off" rules + basic type checking rules.

3. Next, search for "Python inlay type hints", and enable inlay hints for **Variable Types** and **Function Return Types**:



Python › Analysis › Inlay Hints: **Function Return Types**

☑ Enable/disable inlay hints for function return types:

```
def foo(x:int) '-> int':
    return x
```

Python › Analysis › Inlay Hints: **Variable Types**

☑ Enable/disable inlay hints for variable types:

```
foo':list[str]' = ["a"]
```

Create routes

Now we need a place to store the grocery list items. For simplicity, let's start with an empty dictionary.

1. First, let's import all the packages we need for the sample. Open the `main.py` file and replace the first import line with the following ones:

```
from fastapi import FastAPI, HTTPException

from models import ItemPayload
```

2. Now add the following line right below `app = FastAPI()`:

```
grocery_list: dict[int, ItemPayload] = {}
```

This creates a new empty dictionary that receives keys of type `int` (as item IDs) and values of the `ItemPayload` type.

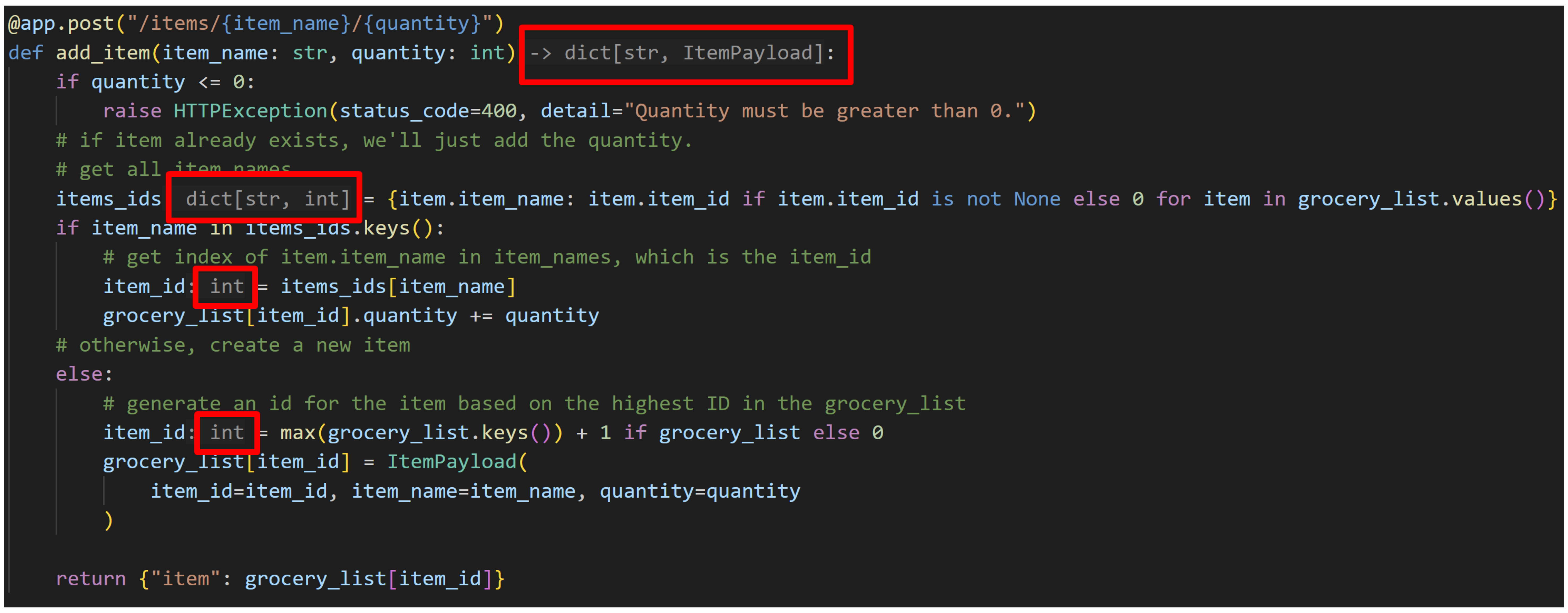
We'll now define routes in our FastAPI application. In the context of web applications, routes are like pathways that map specific URLs to the code that handles them. These routes serve as the entry points for the different functionality within our application. When a client, such as a web browser or another program, sends a request to our application with a particular URL, FastAPI routes that request to the appropriate function (also known as route handler or view function) based on the URL, and that function processes the request and generates a response.

Let's proceed with defining routes to add and retrieve individual items, as well as return all items in the grocery list.

3. Add the following route at the end of the `main.py` file:

```
# Route to add a item
@app.post("/items/{item_name}/{quantity}")
def add_item(item_name: str, quantity: int):
    if quantity <= 0:
        raise HTTPException(status_code=400, detail="Quantity must be greater than 0.")
    # if item already exists, we'll just add the quantity.
    # get all item names
    items_ids = {item.item_name: item.item_id if item.item_id is not None else 0 for item in grocery_list.values()}
    if item_name in items_ids.keys():
        # get index of item_name in item_ids, which is the item_id
        item_id = items_ids[item_name]
        grocery_list[item_id].quantity += quantity
# otherwise, create a new item
    else:
        # generate an ID for the item based on the highest ID in the grocery_list
        item_id = max(grocery_list.keys()) + 1 if grocery_list else 0
        grocery_list[item_id] = ItemPayload(
            item_id=item_id, item_name=item_name, quantity=quantity
        )

    return {"item": grocery_list[item_id]}
```

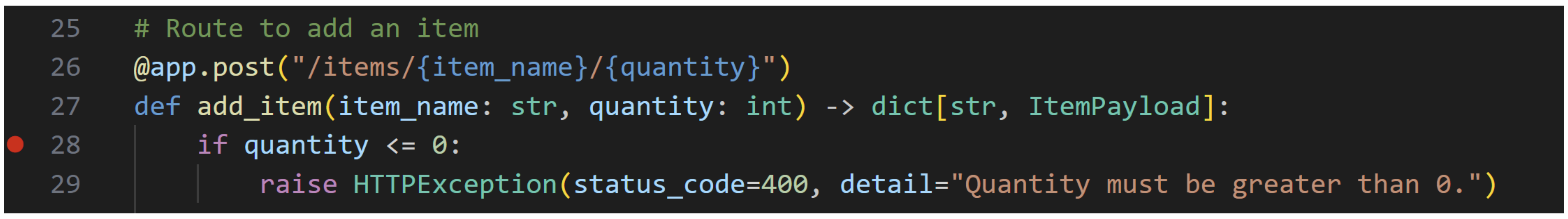
If you have enabled type hints in the previous section, you might notice Pylance adds inlay hints with the function return type, as well as the types for `item_ids` and `item_id`. You can optionally double-click on each suggestion to insert them into the code:



```
@app.post("/items/{item_name}/{quantity}")
def add_item(item_name: str, quantity: int) -> dict[str, ItemPayload]:
    if quantity <= 0:
        raise HTTPException(status_code=400, detail="Quantity must be greater than 0.")
    # if item already exists, we'll just add the quantity.
    # get all item names
    items_ids: dict[str, int] = {item.item_name: item.item_id if item.item_id is not None else 0 for item in grocery_list.values()}
    if item_name in items_ids.keys():
        # get index of item.item_name in item_names, which is the item_id
        item_id: int = items_ids[item_name]
        grocery_list[item_id].quantity += quantity
    # otherwise, create a new item
    else:
        # generate an id for the item based on the highest ID in the grocery_list
        item_id: int = max(grocery_list.keys()) + 1 if grocery_list else 0
        grocery_list[item_id] = ItemPayload(
            item_id=item_id, item_name=item_name, quantity=quantity
        )

    return {"item": grocery_list[item_id]}
```

Now let's check if this route is working as expected. The fastest way to do so is to use both VS Code's debugger as well as FastAPI's `/docs` endpoint, which provides information about all the available API routes and lets you interact with the API to explore their parameters and responses. This documentation is generated dynamically based on the metadata and type hints defined in the FastAPI application.

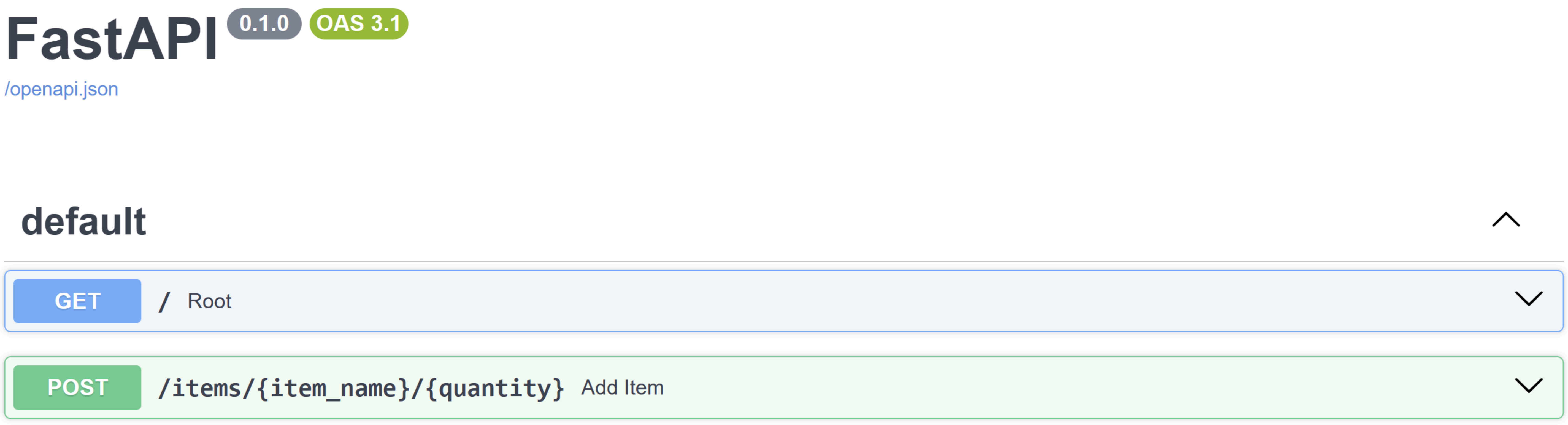
4. Add a breakpoint next to the `if quantity <= 0` statement, by clicking on the left margin of the line number (or F9). The debugger will stop prior to the execution of that line, so you can inspect the code line by line.



```
# Route to add an item
@app.post("/items/{item_name}/{quantity}")
def add_item(item_name: str, quantity: int) -> dict[str, ItemPayload]:
    if quantity <= 0:
        raise HTTPException(status_code=400, detail="Quantity must be greater than 0.")
```

5. Start the debugger (F5), and then navigate to `http://127.0.0.1:8000/docs` in the browser.

   There should be a Swagger interface with the two endpoints available in the app: `/items` and root (`/`).



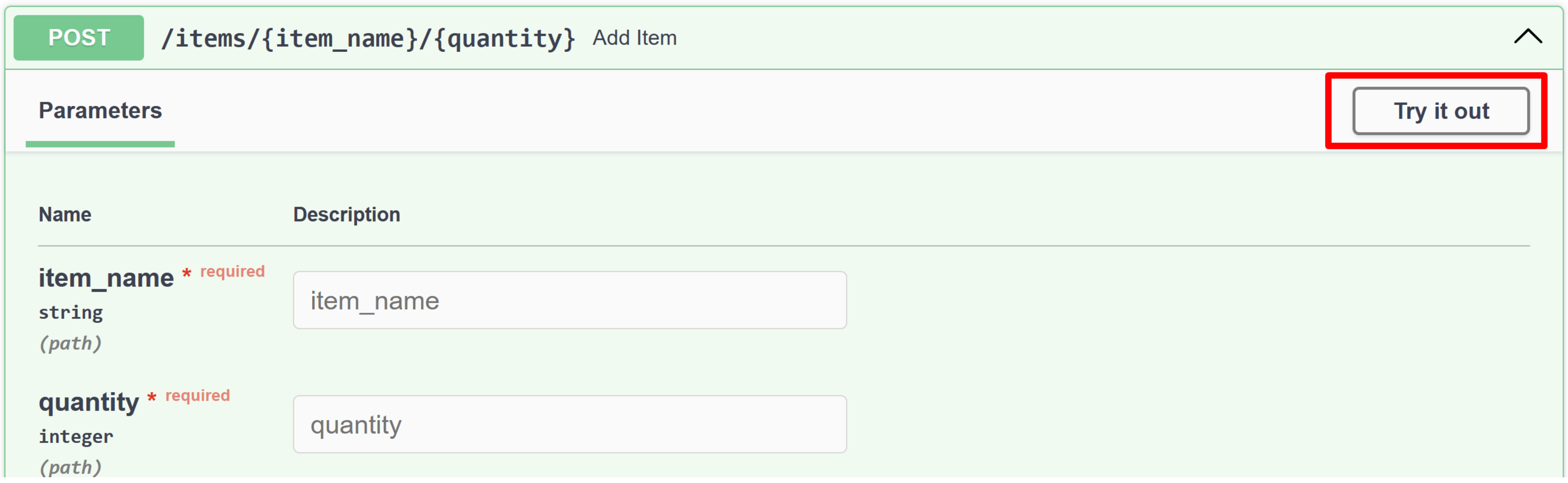
FastAPI 0.1.0 OAS 3.1
/openapi.json

default

GET / Root

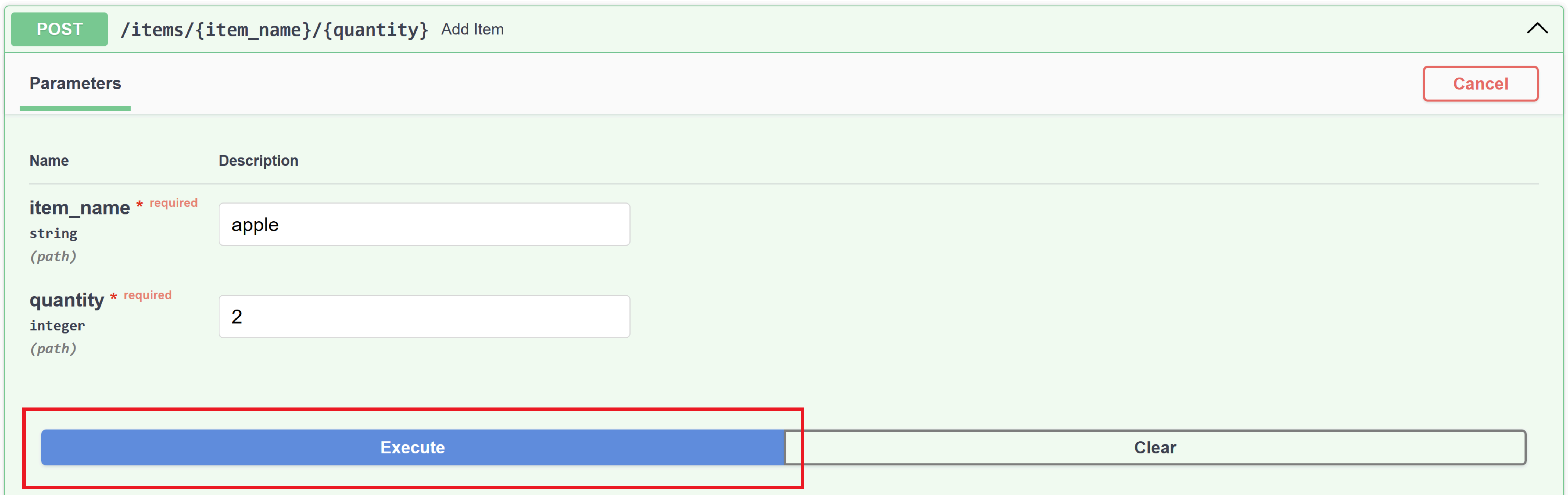
POST /items/{item_name}/{quantity} Add Item

6. Select the down arrow next to the `/items` route to expand it, and then the **Try it out** button that appears on the right side.



7. Add a grocery list item by passing a string to the `item_name` field and a number to `quantity`. For example, you could provide apple as the `item_name` and 2 as the `quantity`.

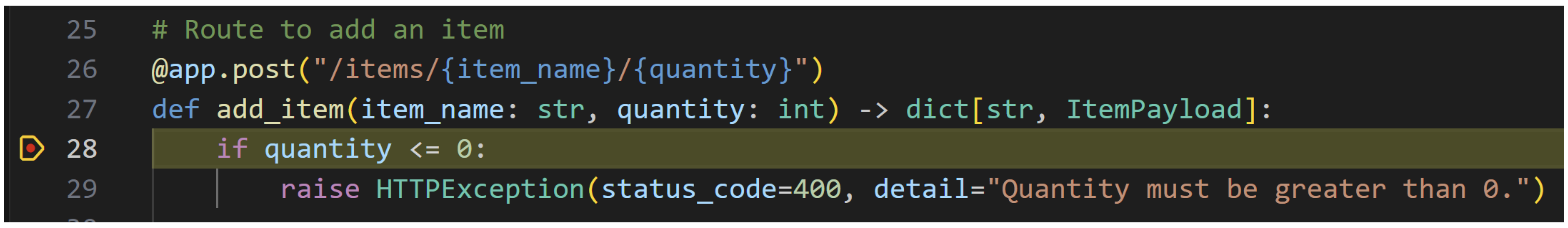
8. Select **Execute**.



item_name * required string (path): apple

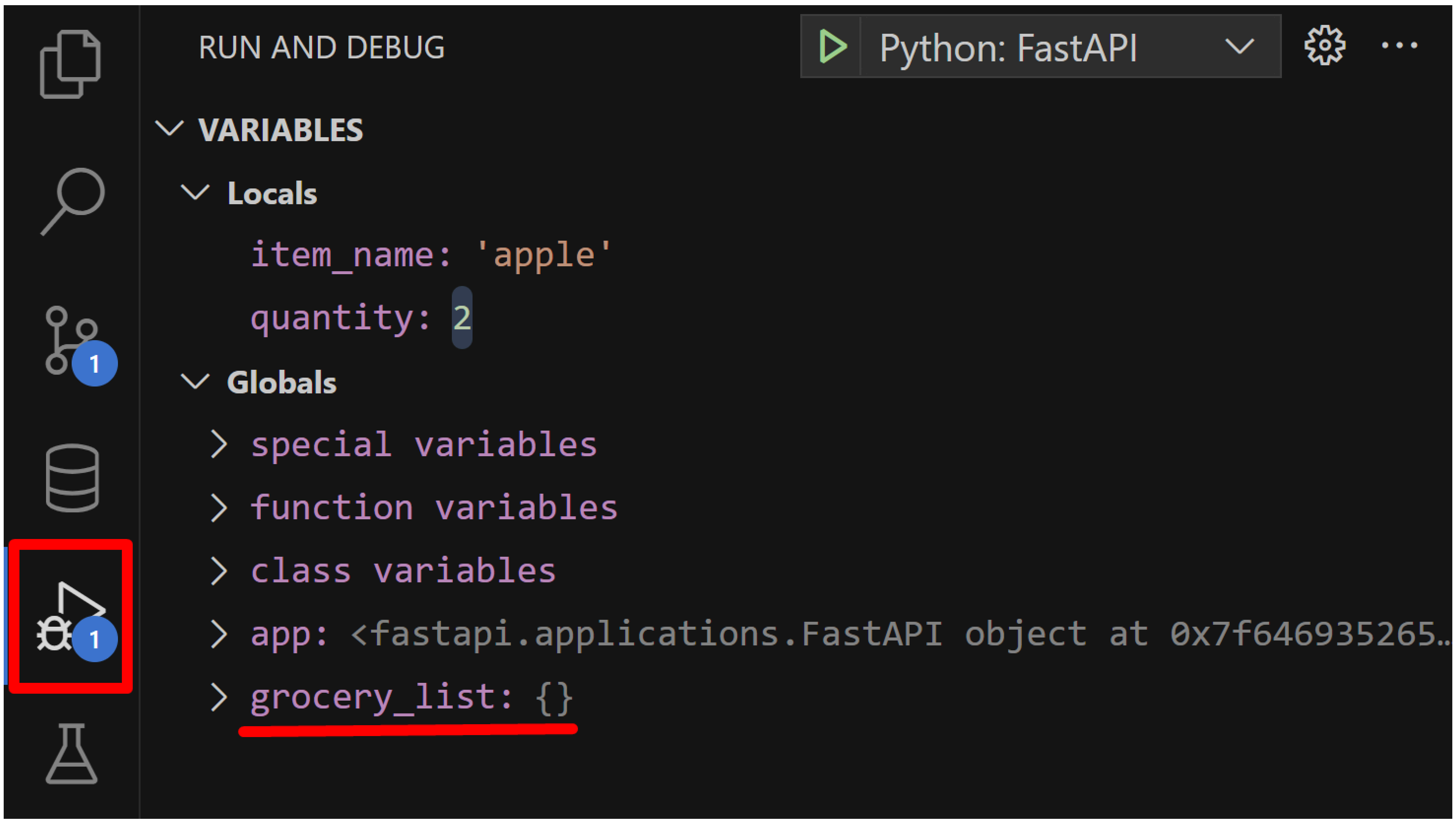
quantity * required integer (path): 2

9. Open VS Code again and notice the debugger has stopped at the breakpoint you set earlier.



```
# Route to add an item
@app.post("/items/{item_name}/{quantity}")
def add_item(item_name: str, quantity: int) -> dict[str, ItemPayload]:
    if quantity <= 0:
        raise HTTPException(status_code=400, detail="Quantity must be greater than 0.")
```

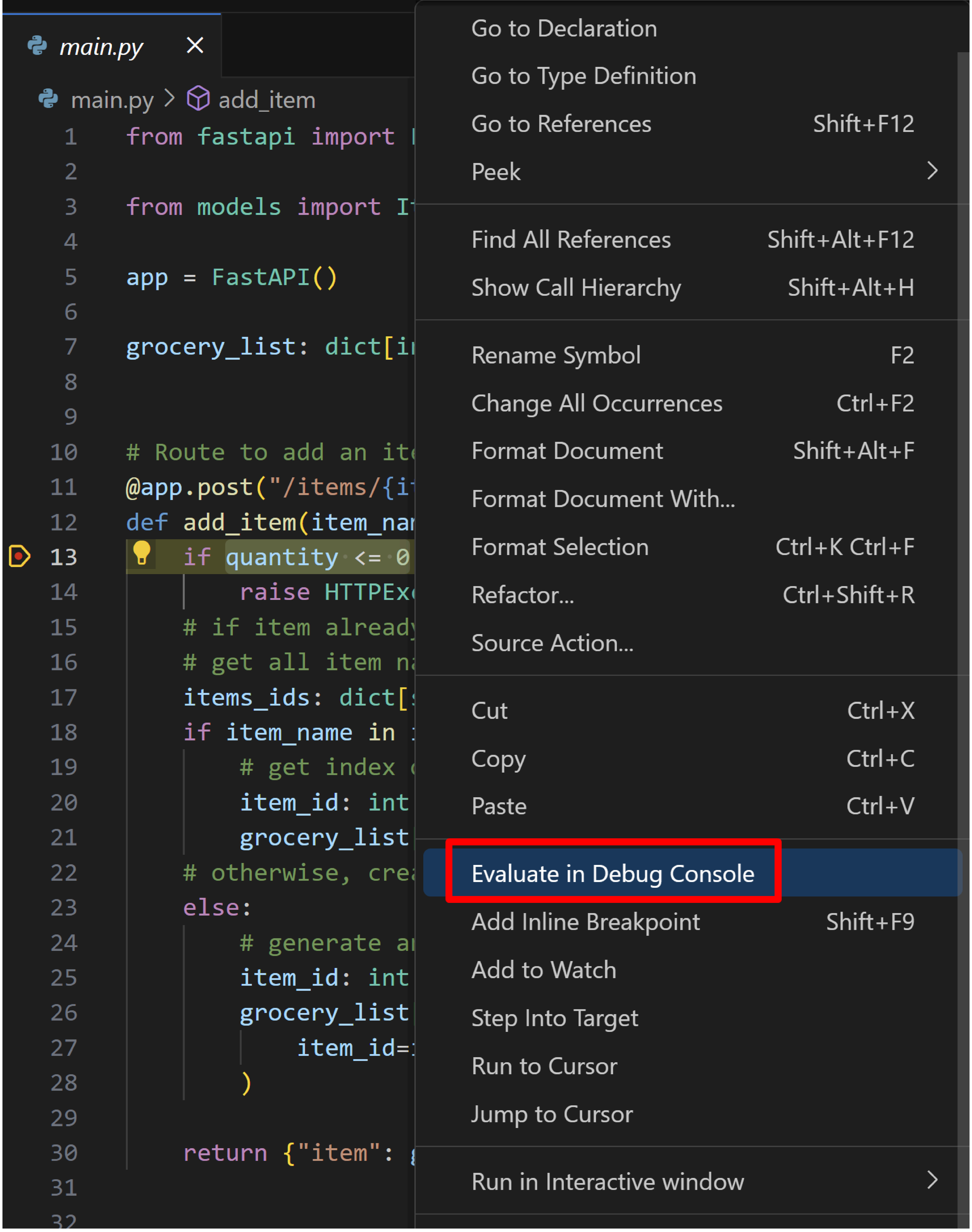
On the left side, all local and global variables defined at this point are displayed in the Variables window, under the **Run and Debug** view. In our example, `item_name` is set to 'apple' and `quantity` is set to 2 under the locals variable view, as well as an empty `grocery_list` dictionary under the globals variable view.



```
VARIABLES
  Locals
    item_name: 'apple'
    quantity: 2
  Globals
    > special variables
    > function variables
    > class variables
    > app: <fastapi.applications.FastAPI object at 0x7f646935265…
    > grocery_list: {}
```

Now let's use VS Code's Debug Console to do some exploration.

10. Select the `quantity <= 0` statement, right-click on the editor and select **Evaluate in Debug Console**:


main.py
main.py > add_item
Go to Declaration
Go to Type Definition
Go to References Shift+F12
Peek
Find All References Shift+Alt+F12
Show Call Hierarchy Shift+Alt+H
Rename Symbol F2
Change All Occurrences Ctrl+F2
Format Document Shift+Alt+F
Format Document With...
Format Selection Ctrl+K Ctrl+F
Refactor... Ctrl+Shift+R
Source Action...
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Evaluate in Debug Console
Add Inline Breakpoint Shift+F9
Add to Watch
Step Into Target
Run to Cursor
Jump to Cursor
Run in Interactive window

```
from fastapi import I

from models import It

app = FastAPI()

grocery_list: dict[in


# Route to add an ite
@app.post("/items/{it
def add_item(item_nam
    if quantity <= 0
        raise HTTPExc
    # if item already
    # get all item na
    items_ids: dict[s
    if item_name in i
        # get index o
        item_id: int
        grocery_list
    # otherwise, crea
    else:
        # generate an
        item_id: int
        grocery_list
            item_id=i
        )

    return {"item": g
```

This opens the Debug Console and runs the selected expression. As expected in our example, the expression evaluates to `False`.

The Debug Console can be a powerful tool to quickly test expressions and better understand the state of your code at the time of a breakpoint. You can also use it to run arbitrary code, such as calling functions or printing variables. You can learn more about Python debugging in VS Code in the Python tutorial.

You can now continue the execution of the code by selecting **Continue** in the Debug view tool bar, or by pressing F5.

Finally, let's add the remaining routes for the application so we can list all items or specific items, as well as remove them from our grocery list. You can leave the debugger running as it will automatically reload the application when you save the changes you make in the next step.

11. Replace the content in `main.py` with the code below:

```
from fastapi import FastAPI, HTTPException

from models import ItemPayload

app = FastAPI()
```

```
grocery_list: dict[int, ItemPayload] = {}

# Route to add an item
@app.post("/items/{item_name}/{quantity}")
def add_item(item_name: str, quantity: int) -> dict[str, ItemPayload]:
    if quantity <= 0:
        raise HTTPException(status_code=400, detail="Quantity must be greater than 0.")
    # if item already exists, we'll just add the quantity.
    # get all item names
    items_ids: dict[str, int] = {
        item.item_name: item.item_id if item.item_id is not None else 0
        for item in grocery_list.values()
    }
    if item_name in items_ids.keys():
        # get index of item_name in item_ids, which is the item_id
        item_id: int = items_ids[item_name]
        grocery_list[item_id].quantity += quantity
    # otherwise, create a new item
    else:
        # generate an ID for the item based on the highest ID in the grocery_list
        item_id: int = max(grocery_list.keys()) + 1 if grocery_list else 0
        grocery_list[item_id] = ItemPayload(
            item_id=item_id, item_name=item_name, quantity=quantity
        )

    return {"item": grocery_list[item_id]}


# Route to list a specific item by ID
@app.get("/items/{item_id}")
def list_item(item_id: int) -> dict[str, ItemPayload]:
    if item_id not in grocery_list:
        raise HTTPException(status_code=404, detail="Item not found.")
    return {"item": grocery_list[item_id]}


# Route to list all items
@app.get("/items")
def list_items() -> dict[str, dict[int, ItemPayload]]:
    return {"items": grocery_list}


# Route to delete a specific item by ID
@app.delete("/items/{item_id}")
def delete_item(item_id: int) -> dict[str, str]:
    if item_id not in grocery_list:
        raise HTTPException(status_code=404, detail="Item not found.")
    del grocery_list[item_id]
    return {"result": "Item deleted."}


# Route to remove some quantity of a specific item by ID
@app.delete("/items/{item_id}/{quantity}")
def remove_quantity(item_id: int, quantity: int) -> dict[str, str]:
    if item_id not in grocery_list:
        raise HTTPException(status_code=404, detail="Item not found.")
    # if quantity to be removed is higher or equal to item's quantity, delete the item
    if grocery_list[item_id].quantity <= quantity:
        del grocery_list[item_id]
        return {"result": "Item deleted."}
    else:
        grocery_list[item_id].quantity -= quantity
    return {"result": f"{quantity} items removed."}
```

12. Save the file (Ctrl+S). The application should automatically reload.

You can now open the `/docs` page again and test the new routes, using the debugger and the Debug Console to better understand the code execution. Once you're done, you can stop the debugger (Shift+F5). You can also remove the breakpoint we added in step 4 by clicking on it.

Congratulations! You now have a working FastAPI application with routes to add, list, and delete items from a grocery list.

Set up the data storage

At this point, you already have a working version of the application with the base functionality. This section guides you through setting up data storage for persistence, but you can choose to skip it if you're happy with what you've learned already.

So far we are storing the data in a dictionary, which is not ideal because all of the data will be lost when the application is restarted.

To persist the data, we will use Redis, which is an open source in-memory data structure store. Due to its speed and versatility, Redis is commonly used as a data storage system in a wide range of applications, including web applications, real-time analytics systems, caching layers, this tutorial, and more.

If you are already working on **GitHub Codespaces** with our existing template, you can skip directly to the Replace the database section.

If you are on Windows, you can work with Redis by setting up either a Docker container or a GitHub Codespace. In this tutorial we will use a Docker container, but you can refer to the section above for instructions on how to set up a GitHub Codespace.

Otherwise, if you are on a Linux or a macOS machine, you can install Redis by following the instructions on their website, and then skip to the Replace the database section.

Setting up a Docker Container on Windows

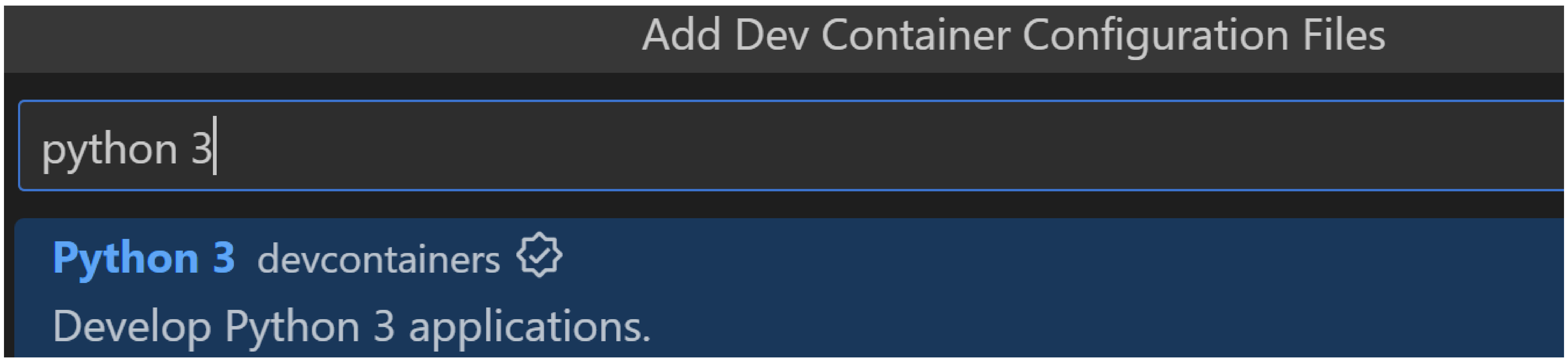
The VS Code Dev Containers extension offers a streamlined approach to consolidate your project, its dependencies, and all necessary tools into one tidy container, creating a full-featured development environment. The extension lets you open your project inside (or mounted into) the container in VS Code, where you'll have its full feature set.

For the steps below, make sure you have the following requirements installed on your machine:

Requirements

Create the Dev container configuration

1. Open the Command Palette and run the **Dev Containers: Add Dev Container Configuration Files...**.
2. Select **Python 3**:



Add Dev Container Configuration Files

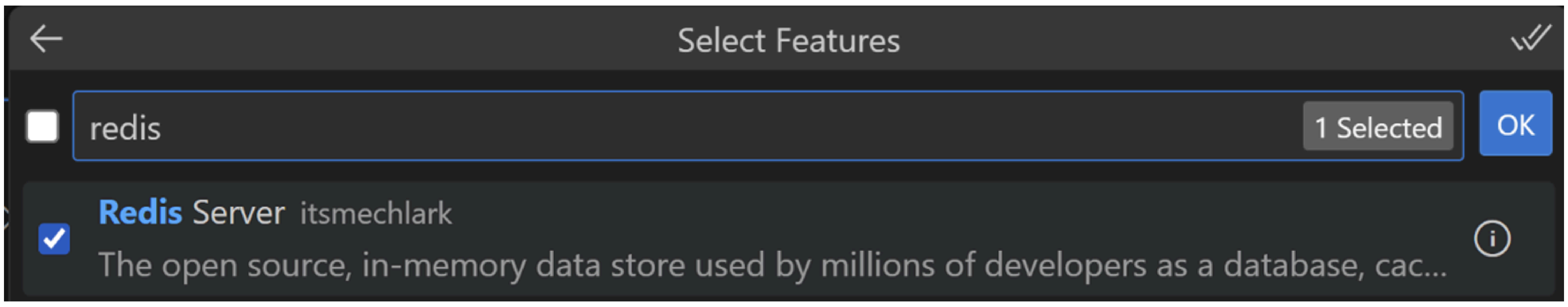
python 3

Python 3 devcontainers

Develop Python 3 applications.

3. Select the default version.
4. Select **Redis Server** as an additional feature to be installed, press **OK**, and then select **Keep Defaults**.

   We can optionally install Features to be included in the container. For this tutorial, we will install Redis Server, a community contributed Feature that installs and adds the proper dev container setup for Redis.



Select Features

redis

☑ Redis Server itsmechlark

The open source, in-memory data store used by millions of developers as a database, cac...

   This creates a `.devcontainer` folder in your workspace, with a `devcontainer.json` file. Let's make some edits to this file so the container setup includes steps such as installing the VS Code extensions we need as well as the project dependencies.

5. Open the `devcontainer.json` file.
6. Add a "," after the `"features" : { ... }` entry, so we can add more settings to the file.

   Next, we will add the necessary dependency installation commands to the `postCreateCommand` property in the `devcontainer.json` file, so our application is ready to run once the container is set up.

7. Locate the content below and remove the comment (`//`) from that line, so the dependencies can be installed once the container is created:

```
"postCreateCommand": "pip3 install --user -r requirements.txt",
```

   You can learn about `postCreateCommand` and more lifecycle scripts in the Development Containers Specification.

   Now we will use the `customizations` property to add the VS Code extensions we want installed in the container.

8. Add the following setting to `devcontainer.json`:

   ```
   // Use 'postCreateCommand' to run commands after the container is created.
   "postCreateCommand": "pip3 install --user -r requirements.txt",

   // Configure tool-specific properties.
   "customizations": {
       "vscode": {
           "extensions": [
               "ms-python.python", //Python extension ID
               "ms-python.vscode-pylance" //Pylance extension ID
           ]
       }
   }
   ```

9. Save the file.

10. Select **Reopen in Container** from the notification displayed in the bottom right corner, or run the **Dev Containers: Reopen in Container** command from the Command Palette.

    > **Note**: It may take several minutes to build the container, depending on internet speed and machine performance.

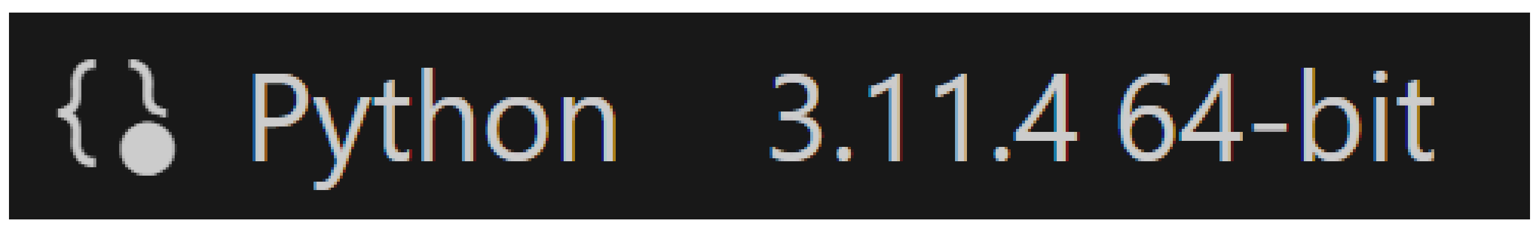
    You can learn more about dev container configuration in the Dev Containers documentation.

Once it's done, you will have a fully configured Linux-based workspace with Python 3 and Redis Server installed.

Once the container is set up, you will notice an indicator on the bottom left corner of VS Code:

> **Note**: Double check that the Python and Pylance extensions have been successfully installed in the container by opening the Extensions view (Ctrl+Shift+X) and searching for them. If not, you can install them by running **Install in Dev Container**.

The selected Python interpreter information is available on the Status bar at the bottom right corner, matching the version specified in the `devcontainer.json` file:



> **Note**: If you don't find the Python interpreter information on the Status bar, you can click on the Python interpreter indicator (or run the **Python: Select Interpreter** command from the Command Palette) and manually select the Python interpreter in the container.

We are now ready to move on to the next section, where we will replace the data storage.

Replace the database

We have a dictionary that stores the grocery list items, but we want to replace it with a Redis database. In this tutorial, we will use Redis hashes to store our data, which is a data structure that can store multiple key-value pairs.

Unlike a traditional database where you can retrieve an item without knowing its ID, you need to know the Redis hash key in order to retrieve a value from it. In this tutorial, we will create a hash called `item_name_to_id` to retrieve items by name, and map them to their IDs. In addition, we'll create other hashes to retrieve items by ID, mapping them to their names and quantities. Each item hash is named `item_id:{item_id}` and has two fields: `item_name` and `quantity`.

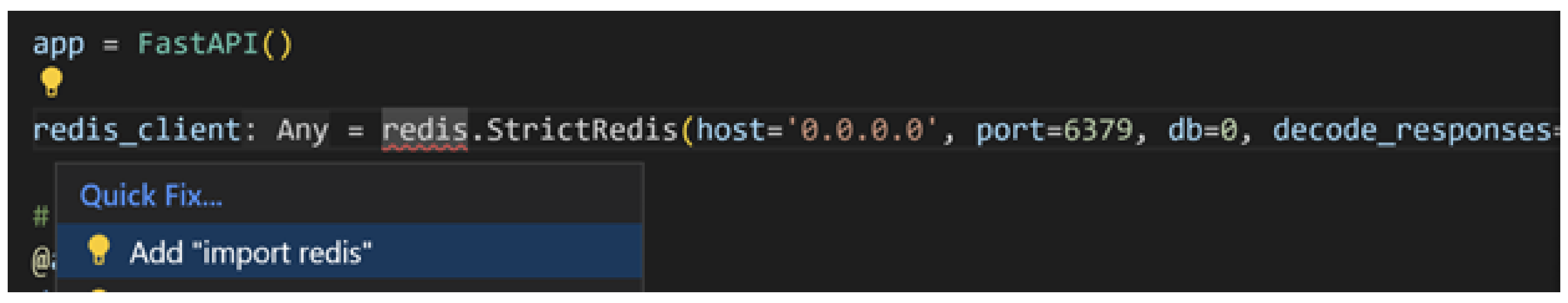
First, let's start by replacing the dictionary with a Redis client object that connects to a Redis server.

1. In the `main.py` file, replace the `grocery_list: dict[int, ItemPayload] = {}` in the beginning of the file with the lines below:

   ```
   redis_client = redis.StrictRedis(host='0.0.0.0', port=6379, db=0, decode_responses=True)
   ```

   Pylance will display an error message because Redis hasn't been imported yet.

2. Put the cursor on "redis" in the editor, and click on the displayed light bulb (or Ctrl+.). Then select **Add 'import redis'**.

   ```
   app = FastAPI()

   redis_client: Any = redis.StrictRedis(host='0.0.0.0', port=6379, db=0, decode_responses=
   ```

   > **Tip**: You can set up Pylance to automatically add imports by looking for the **Auto Import Completions** setting in the Settings editor (Ctrl+,) and enabling it.

We now have a Redis client object that connects to a Redis server running on the local host (`host="0.0.0.0"`) and listening on port 6379 (`port=6379`). The db parameter specifies the Redis database to use. Redis supports multiple databases, and in this code we're going to use database `0`, which is the default database. We're also passing `decode_responses=True` for the responses to be decoded as strings (instead of bytes).

Let's do some more replacements in the first route `add_item`. Instead of looking at all the keys from the dictionary to find the item name that has been provided, we can fetch that information directly from a Redis hash.

We'll assume that the `item_name_to_id` hash already exists, mapping item names to their IDs (don't worry, we'll add this code shortly!). We can then get the ID of the item name we're receiving in the request by invoking the `hget` method from Redis, which will return the item ID if the requested name already exists in the hash, or None if it doesn't.

3. Delete the line with the content below:

```
items_ids = {item.item_name: item.item_id if item.item_id is not None else 0 for item in grocery_list.values()}
```

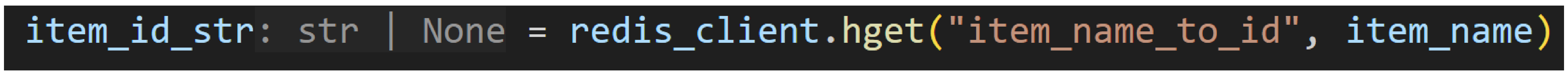
And replace it with:

```
  item_id = redis_client.hget("item_name_to_id", item_name)
```

Notice that Pylance raises a problem with this change. This is because the `hget` method returns either `str`, or None (if the item doesn't exist). However, the lines below the code that we haven't replaced yet expect `item_id` to be of type `int`. Let's address this warning by renaming the `item_id` symbol.

4. Rename `item_id` to `item_id_str`.

5. If you have inlay hints enabled, Pylance should show a variable type hint next to `item_id_str`. You can optionally double-click to accept it:



```
item_id_str: str | None = redis_client.hget("item_name_to_id", item_name)
```

6. If the item doesn't exist, then `item_id_str` is None. So now we can delete the line with the following content:

```
if item_name in items_ids.keys():
```

And replace it with:

```
if item_id_str is not None:
```

Now that we have the item ID as a string, we need to convert it to an `int` and update the quantity for the item. Currently, our Redis hash only maps item names to their IDs. To also map item IDs to their names and quantities, we will create a separate Redis hash for each item, using `"item_id:{item_id}"` as our hash name to make retrieval by ID easier. We'll also add `item_name` and `quantity` fields for each of these hashes.

7. Delete the code within the `if` block:

```
item_id: int = items_ids[item_name]
grocery_list[item_id].quantity += quantity
```

And add the following, to convert the `item_id` to an `int`, and then to increment the quantity of the item by calling the `hincrby` method from Redis. This method increments the value of the `"quantity"` field by the given amount in the request (`quantity`):

```
item_id = int(item_id_str)
redis_client.hincrby(f"item_id:{item_id}", "quantity", quantity)
```

We now only need to replace the code for when the item does not exist, when `item_id_str` is None. In this case, we generate a new `item_id`, create a new Redis hash for the item, and then add the provided item name and quantity.

To generate a new `item_id`, let's use the `incr` method from Redis, passing a new hash called `"item_ids"`. This hash is used to store the last generated ID, so we can increment it each time we create a new item, ensuring that they all have a unique ID.

8. Delete the line with the following content:

```
item_id: int = max(grocery_list.keys()) + 1 if grocery_list else 0
```

And add the following:

```
item_id: int = redis_client.incr("item_ids")
```

When this `incr` call is run for the first time with the `item_ids` key, Redis creates the key and maps it to the value 1. Then, each subsequent time it's run, it increments the stored value by 1.

Now we will add the item to the Redis hash, using the `hset` method and by providing a mapping for the fields (`item_id`, `item_name`, and `quantity`), and the values (the item's newly created ID, and its provided name and quantity).

9. Delete the line with the following content:

```
grocery_list[item_id] = ItemPayload(
        item_id=item_id, item_name=item_name, quantity=quantity
    )
```

And replace it with the following:

```
redis_client.hset(
            f"item_id:{item_id}",
            mapping={
                "item_id": item_id,
                "item_name": item_name,
                "quantity": quantity,
            })
```

Now we only need to map the newly created ID to the item name by setting the hash we referenced in the beginning, `item_name_to_id`.

10. Add this line to the end of the route, inside the `else` block:

```
redis_client.hset("item_name_to_id", item_name, item_id)
```

11. Delete the line with the following content:

```
return {"item": grocery_list[item_id]}
```

And replace it with:

```
return {"item": ItemPayload(item_id=item_id, item_name=item_name, quantity=quantity)}
```

12. If you would like, you can try to do a similar replacement for the other routes. Otherwise, you can just replace the entire content of the file with the lines below:

```
import redis
from fastapi import FastAPI, HTTPException

from models import ItemPayload

app = FastAPI()

redis_client = redis.StrictRedis(host="0.0.0.0", port=6379, db=0, decode_responses=True)

# Route to add an item
@app.post("/items/{item_name}/{quantity}")
def add_item(item_name: str, quantity: int) -> dict[str, ItemPayload]:
    if quantity <= 0:
        raise HTTPException(status_code=400, detail="Quantity must be greater than 0.")

    # Check if item already exists
    item_id_str: str | None = redis_client.hget("item_name_to_id", item_name)

    if item_id_str is not None:
        item_id = int(item_id_str)
        redis_client.hincrby(f"item_id:{item_id}", "quantity", quantity)
    else:
        # Generate an ID for the item
        item_id: int = redis_client.incr("item_ids")
        redis_client.hset(
            f"item_id:{item_id}",
            mapping={
                "item_id": item_id,
                "item_name": item_name,
                "quantity": quantity,
            },
        )
        # Create a set so we can search by name too
        redis_client.hset("item_name_to_id", item_name, item_id)

    return {
        "item": ItemPayload(item_id=item_id, item_name=item_name, quantity=quantity)
    }


# Route to list a specific item by ID but using Redis
@app.get("/items/{item_id}")
def list_item(item_id: int) -> dict[str, dict[str, str]]:
    if not redis_client.hexists(f"item_id:{item_id}", "item_id"):
        raise HTTPException(status_code=404, detail="Item not found.")
    else:
        return {"item": redis_client.hgetall(f"item_id:{item_id}")}


@app.get("/items")
def list_items() -> dict[str, list[ItemPayload]]:
    items: list[ItemPayload] = []
    stored_items: dict[str, str] = redis_client.hgetall("item_name_to_id")

    for name, id_str in stored_items.items():
        item_id: int = int(id_str)

        item_name_str: str | None = redis_client.hget(f"item_id:{item_id}", "item_name")
        if item_name_str is not None:
            item_name: str = item_name_str
        else:
            continue  # skip this item if it has no name

        item_quantity_str: str | None = redis_client.hget(
            f"item_id:{item_id}", "quantity"
        )
        if item_quantity_str is not None:
            item_quantity: int = int(item_quantity_str)
        else:
            item_quantity = 0

        items.append(
            ItemPayload(item_id=item_id, item_name=item_name, quantity=item_quantity)
        )

    return {"items": items}


# Route to delete a specific item by ID but using Redis
@app.delete("/items/{item_id}")
def delete_item(item_id: int) -> dict[str, str]:
    if not redis_client.hexists(f"item_id:{item_id}", "item_id"):
        raise HTTPException(status_code=404, detail="Item not found.")
    else:
        item_name: str | None = redis_client.hget(f"item_id:{item_id}", "item_name")
        redis_client.hdel("item_name_to_id", f"{item_name}")
        redis_client.delete(f"item_id:{item_id}")
        return {"result": "Item deleted."}


# Route to remove some quantity of a specific item by ID but using Redis
@app.delete("/items/{item_id}/{quantity}")
def remove_quantity(item_id: int, quantity: int) -> dict[str, str]:
    if not redis_client.hexists(f"item_id:{item_id}", "item_id"):
        raise HTTPException(status_code=404, detail="Item not found.")

    item_quantity: str | None = redis_client.hget(f"item_id:{item_id}", "quantity")

    # if quantity to be removed is higher or equal to item's quantity, delete the item
    if item_quantity is None:
        existing_quantity: int = 0
    else:
        existing_quantity: int = int(item_quantity)
    if existing_quantity <= quantity:
        item_name: str | None = redis_client.hget(f"item_id:{item_id}", "item_name")
        redis_client.hdel("item_name_to_id", f"{item_name}")
        redis_client.delete(f"item_id:{item_id}")
        return {"result": "Item deleted."}
    else:
        redis_client.hincrby(f"item_id:{item_id}", "quantity", -quantity)
        return {"result": f"{quantity} items removed."}
```

13. Re-run the debugger to test this application by interacting with the `/docs` route. You can stop the debugger once you're done.

Congrats! You now have a working FastAPI application with routes to add, list, and delete items from a grocery list, and the data is persisted in a Redis database.

Optional: Set up database deletion

With the data now persisted by Redis, you might want to create a script to erase all testing data. To do so, create a new file called `flushdb.py` with the following content:

```
import redis

redis_client = redis.StrictRedis(host='0.0.0.0', port=6379, db=0, decode_responses=True)
redis_client.flushdb()
```

Then when you want to reset the database, you can open the `flushdb.py` file in VS Code and select the **Run** button on the top-right corner of the editor, or run the **Python: Run Python File in Terminal** command from the Command Palette.

Note that this should be done with caution because it will delete all the keys in the current database, which could lead to data loss if done in production.

Optional: Create a ChatGPT plugin

With GitHub Codespaces, you can host your application for testing purposes when using ChatGPT Plugins. ChatGPT Plugins are tools that enable ChatGPT to interact with existing APIs to enhance ChatGPT's abilities, allowing it to perform a wide range of actions. ChatGPT Plugins are not currently publicly available, but you can join their wait list to get access. Once you do, you can follow along the live stream recording below to create your own grocery list plugin for ChatGPT:

> **Note**: All personal GitHub.com accounts have a monthly quota of free use of GitHub Codespaces included in the Free or Pro plan. For more information, go to About billing for GitHub Codespaces.

Next Steps

Thank you for following along this tutorial! We hope you learned something new about FastAPI and how to use it with VS Code.

The completed code project from this tutorial can be found on GitHub: python-sample-vscode-fastapi-tutorial.

Learn more about FastAPI at the official documentation.

To try the app on a production website, check out the tutorial Deploy Python apps to Azure App Service using Docker Containers.

You can also review these other VS Code Python articles:

05/08/2025