Anirudh Kaluri
Date: 20 July, 2023

BRIEF OVERVIEW:

The project is a Django REST application with one exposed API. It takes a POST request of a Chess Board configuration and a slug (one of the chess pieces sent in the URL as a parameter) as an input. The response provides all valid moves for the slug assuming the rest of the pieces on the board are opponents.

Summary of the features incorporated in the development process:

- Robust logic to get valid moves
- Logging
- Caching
- Unit tests
- Serialization
- Django Rest framework
- Docker

DIRECTORY STRUCTURE

assignment: It is the main project folder
chess: It is the Django App that encapsulates the functionality required for the problem.
chess/views.py: Implements PositionView which accepts the request and generates response of valid moves
chess/urls.py: Implements routing to PositionView when the API call is made.
chess/utils/validMoves.py: Hosts all the methods to compute a list of valid moves.

chess/serializers.py: Consists of PositionSerializer that validates and deserializes input request data.
chess/tests.py: Hosts unit tests to evaluate all the components.
project.log: Log file that logs INFO level and above messages.
Dockerfile: Consists of base image instructions to build the image.
docker-compose.yml: Configuration file specifying services, ports and commands to run after building the image.

MODELS/DATABASE SCHEMA:

The project was designed without the need for database persistence. There is only one API and each API call contains all necessary data to generate the response. However, a database can be easily integrated if required as another service.

LOGGING

Logging is configured in *settings.py* to provide with formatters, handlers and loggers. They system can effectively capture and record relevant events and messages, facilitating easier troubleshooting and debugging.

CACHING

Caching is implemented in this project to reduce the processing time for repetitive requests. These include requests to find valid moves for same board configuration and slug. An in-memory cache backend called LocMemCache is configured. It is simple and convenient choice for development and testing. However, it can be easily extended to more sophisticated Memcached and Redis.

SERIALIZATION/VALIDATION

The post method of the PositionView class uses PositionSerializer for validation and deserialization. The following are the validations:

1) No two pieces can have the same positions
2) There can only be one piece of each type
3) There can only be 4 types {Queen, Bishop, Rook, Knight}
4) The positions of the pieces must be valid:
    a) they must not fall outside the grid
    b) They must not be empty
5) The slug should a piece on the board as well as belong to the 4 types mentioned in (3)

In case of failure in validation, an exception will raised, handled and will be logged.

COMPUTATION FOR FINDING ALL VALID MOVES

The computations for finding all the valid moves for a given piece are in *chess/utils/validMoves.py* module.

Algorithm in brief:

1) For a given piece find a list of all possible_moves assuming other pieces don't attack.
2) Check all the positions in all possible_moves list that can be attacked by remaining pieces.
3) Remove those positions that can be attacked from the possible_moves list and return the answer.

The important methods used to implement this algorithm in the project are:

get_valid_moves: returns list of valid movies i.e. the answer

get_all_possible_moves: returns a list of all possible moves assuming pieces obstruct but don't attack.

check_attack_on_positions: takes all possible moves for a piece as an input and checks if these positions can be attacked by other pieces. It then removes the positions that can be attacked

Helper methods to implement the above methods are:

add_positions: helps *get_all_possible_moves* by adding possible positions to the list by travelling in a particular direction

direct_move_exists: checks if a "particular piece" can travel from one position to other in a "straight line in one move without obstruction". It can be interpreted as whether a particular piece can attack a position from its starting position

obstruction_exists: checks if there is any chess piece between two points on the board using the concept of slope to look for alignment of 3 points

check_limit: checks if a given coordinate falls out of the board (out of range for an 8X8 grid)

get_coordinate_position: translates a chess position terminology to a coordinate plane matrix terminology Example: G1 as [1,1] = [row,column]

Since there is only one API, all these functions have been clubbed in one module *chess/utils/validMoves.py.* However, the functions above are reusable and can be used to implement other necessary chess based operations.

INSTRUCTIONS TO RUN THE PROJECT:

1) Clone the repository at https://bitbucket.org/infilectassignment/chessapp/
2) Open the terminal and navigate into the *chessapp* directory cloned to your local machine
3) Execute the following command:
    $docker compose up -d --build

The command starts the app at 127.0.0.1:8000. Kill if any process is already running on that address.

API End Point: 127.0.0.1/chess/<string:slug>
Method: POST
Body: JSON data with chessboard positions

INSTRUCTIONS TO TEST THE PROJECT
After the App starts running, there are three ways to test:

1) UNIT TESTS
- Run the following command in the terminal
    $docker compose exec web python manage.py test

Test Class	What it tests
ValidMovesTest	Tests *get_valid_moves* method in *chess/utils/validMoves.py* module. There are 7 unique tests to test the core logic of the application.
PositionViewTest	Tests *PositionView* that uses Django REST framework to handle API calls. One positive test and two tests with invalid request format have been tested
PositionSerializerTest	Tests *PositionSerializer* that validates incoming data. One positive test and two tests with invalid request format have been tested

2) TESTING WITH CURL

- Open *CurlTests.txt* file present in the repository.
- Copy a curl command.
- Run it in the command line on the terminal.
- Verify the output with the expected output present in the same file.
- Repeat for all the Curl commands testing different scenarios

For example copy the below command present in the C*urlTests.txt file* and paste it in the command line

```
curl --location '127.0.0.1:8000/chess/queen/' \
--header 'Content-Type: application/json' \
--data '{
    "positions": {
        "Queen": "H1",
        "Bishop": "B7",
        "Rook":"H8",
        "Knight":"F2"
    }

}'
```

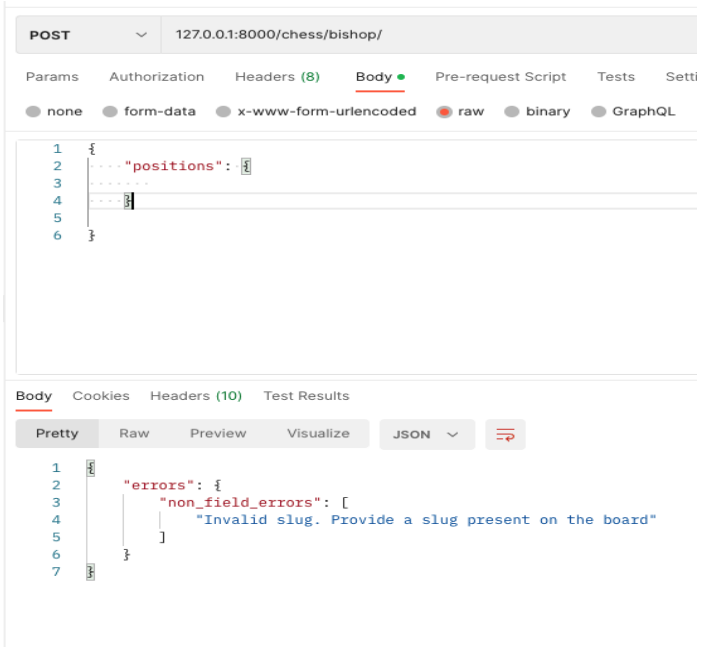
The output is as follows:

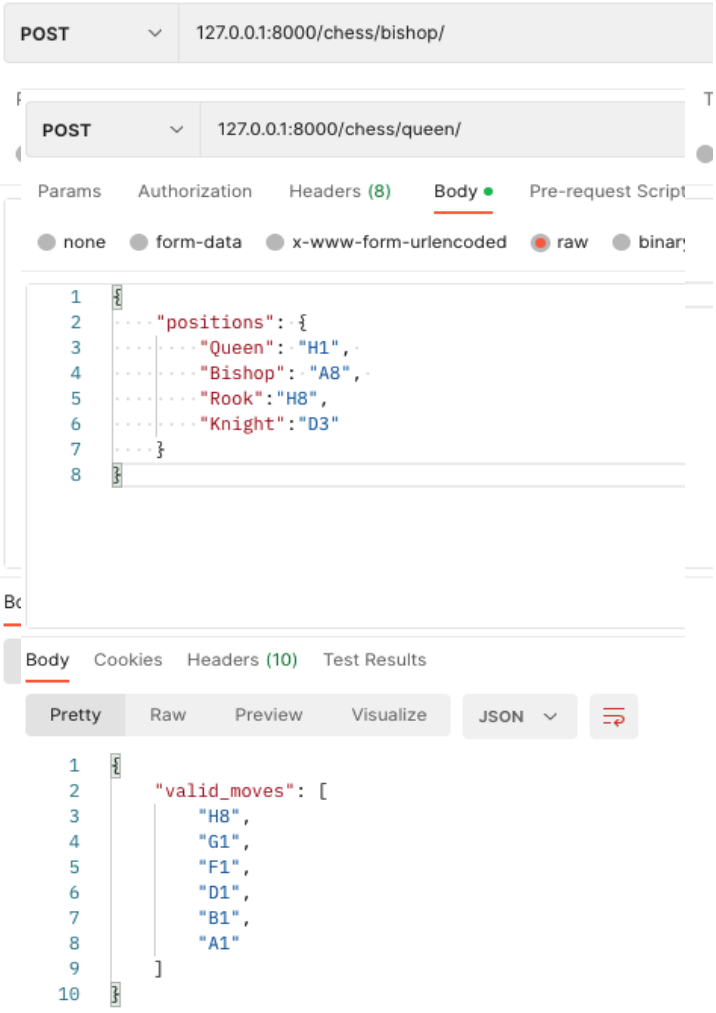
```
anirudhkaluri@Anirudh-Kaluris-Mac ~ % curl --location '127.0.0.1:8000/chess/knight/' \
--header 'Content-Type: application/json' \
--data '{
    "positions": {
        "Queen": "E7",
        "Bishop": "B7",
        "Rook":"G5",
        "Knight":"C3"
    }

}'

{"valid_moves": ["B1", "D1", "A4", "A2"]}%
```

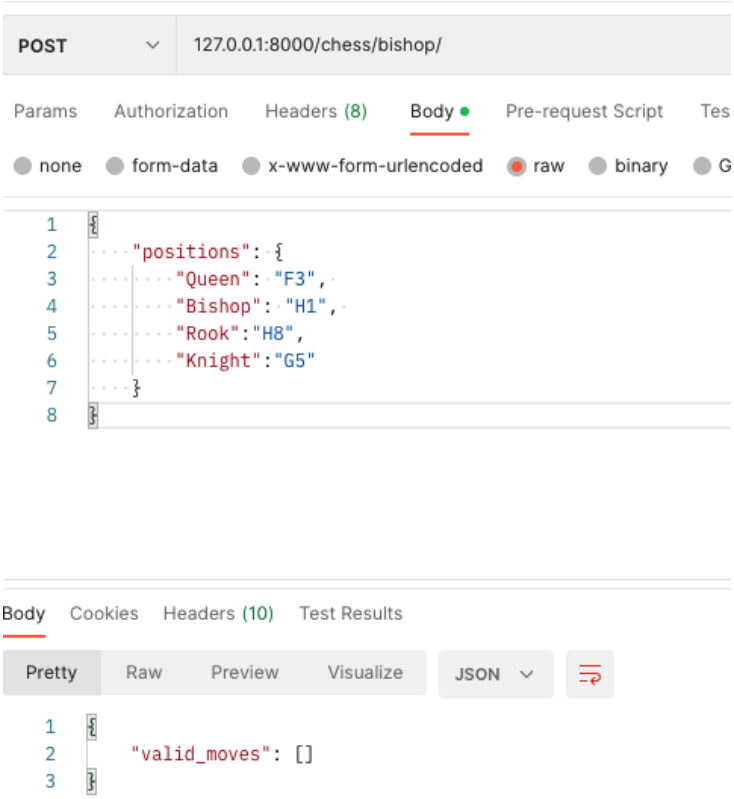
3) IMPORT TESTS INTO POSTMAN

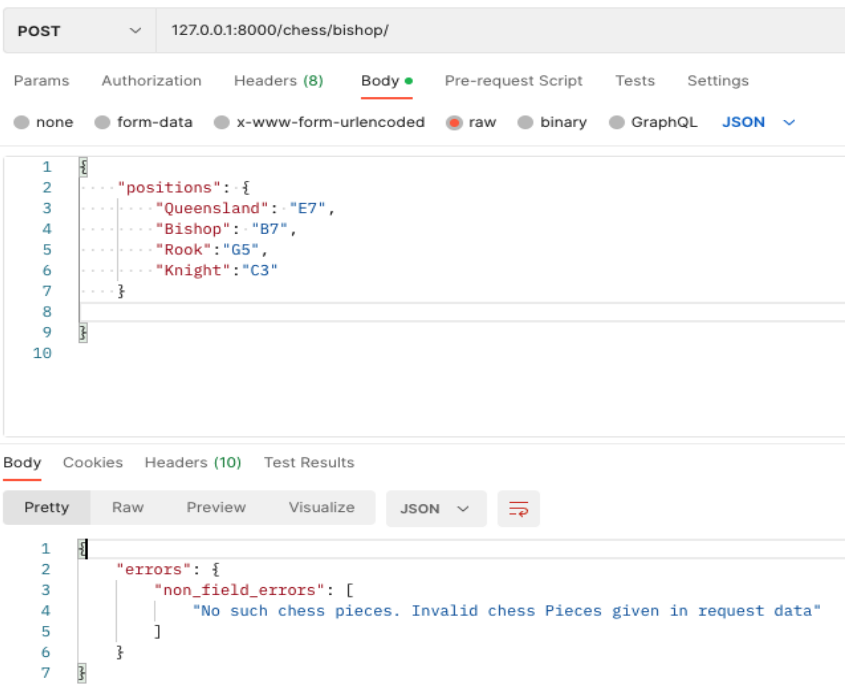
- Open Postman desktop application
- Click on File
- Select import
- Browse to the *Infilect.postman_collection.json* file present in the repository
- Add as a new collection
- Run each request in the collection

SOME SAMPLE POSTMAN SCREENSHOTS






POST
127.0.0.1:8000/chess/bishop/
Params
Authorization
Headers (8)
Body
Pre-request Script
Tes
none
form-data
x-www-form-urlencoded
raw
binary
G
{
"positions": {
"Queen": "F3",
"Bishop": "H1",
"Rook":"H8",
"Knight":"G5"
}
}
Body
Cookies
Headers (10)
Test Results
Pretty
Raw
Preview
Visualize
JSON
{
"valid_moves": []
}


POST
127.0.0.1:8000/chess/bishop/
Params
Authorization
Headers (8)
Body
Pre-request Script
Tests
Settings
none
form-data
x-www-form-urlencoded
raw
binary
GraphQL
JSON
{
"positions": {
"Queensland": "E7",
"Bishop": "B7",
"Rook":"G5",
"Knight":"C3"
}
}
Body
Cookies
Headers (10)
Test Results
Pretty
Raw
Preview
Visualize
JSON
{
"errors": {
"non_field_errors": [
"No such chess pieces. Invalid chess Pieces given in request data"
]
}
}