Maersk Task: Simulating a container terminal using SimPy

Installation and Running

I used Poetry to manage the dependencies and virtual environment, but there is a `requirements.txt` file for pip as well. Everything is handled with a Makefile. If Poetry is not installed, it uses Python `venv` to create a virtual environment.

1. Create a virtual environment

```
$ make install
```

2. run the simulation

```
$ make simulate
# or using proper python command
$ python -m maersk_task
```

3. Configuration

   You can find all configurations in config.py file. You can change the configuration as per your needs.

   You can configure:

   - Average vessel arrival time
   - Capacity of the vessel
   - Number of starting vessels (if set to 0, it will wait for the first vessel to arrive)
   - Number of berths
   - Number of cranes
   - Duration of crane to load/unload the container
   - Number of trucks
   - Duration of truck to load/unload the container
   - Log level (I used default logging levels)

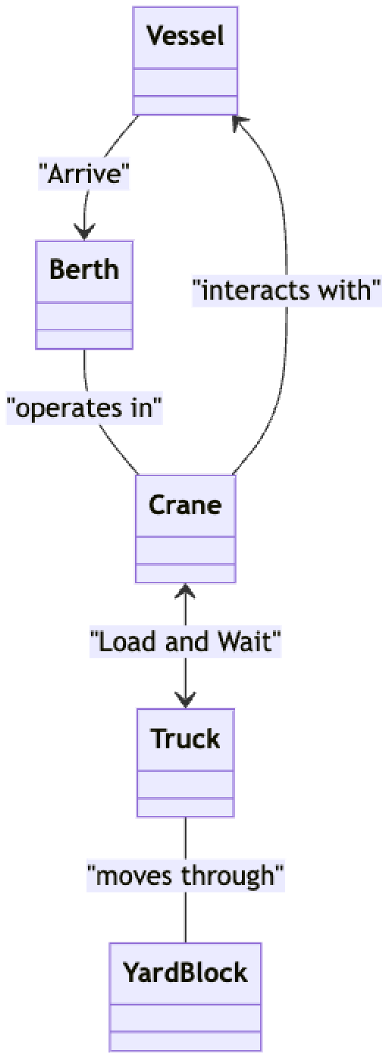
        - `DEBUG` : Truck action logs
        - `INFO` : Vessel and crane action logs (default)
        - `WARNING` : Only vessel arrival and departure logs
        - `ERROR` : Final summary logs
    - Simulation time in minutes
    - > Based on the task defention I made the assumption that number of cranes and berth should be equal.

```python
class Config:
  vessel_average_in_minutes: int = 5 * 60
  vessel_container_capacity: int = 150
  vessels_in_start: int = 1
  berth_count: int = 2
  # crane count should be equal to the berth count
  crane_count: int = 2
  crane_time_in_minutes: int = 3
  truck_count: int = 3
  truck_time_in_minutes: int = 6
  # Options: DEBUG, *INFO*, WARNING, CRITICAL
  log_level: int = logging.INFO
  simulation_time_in_minutes: int = SIMULATION_TIME_IN_MINUTES
```

Design

In the base.py file, you can find abstract classes. These abstract classes were used to define the structure of the simulation.

- The main resources in the simulation are Vessels, Cranes, and Trucks. These resources have actions that interact with each other.
- Class variables were utilized to keep track of the resources. For instance, in a crane, there is a `simpy.Resource` that allows us to acquire and release the crane, similar to the other resources.
- For the berth, I used a simple `simpy.Resource` to monitor the availability of the berth.
- The `Vessel` class has a `vessel_arrival` method that handles the arrival of the new vessel.


Vessel
"Arrive"
Berth
"interacts with"
"operates in"
Crane
"Load and Wait"
Truck
"moves through"
YardBlock