

RunTime Terrors: War Simulator



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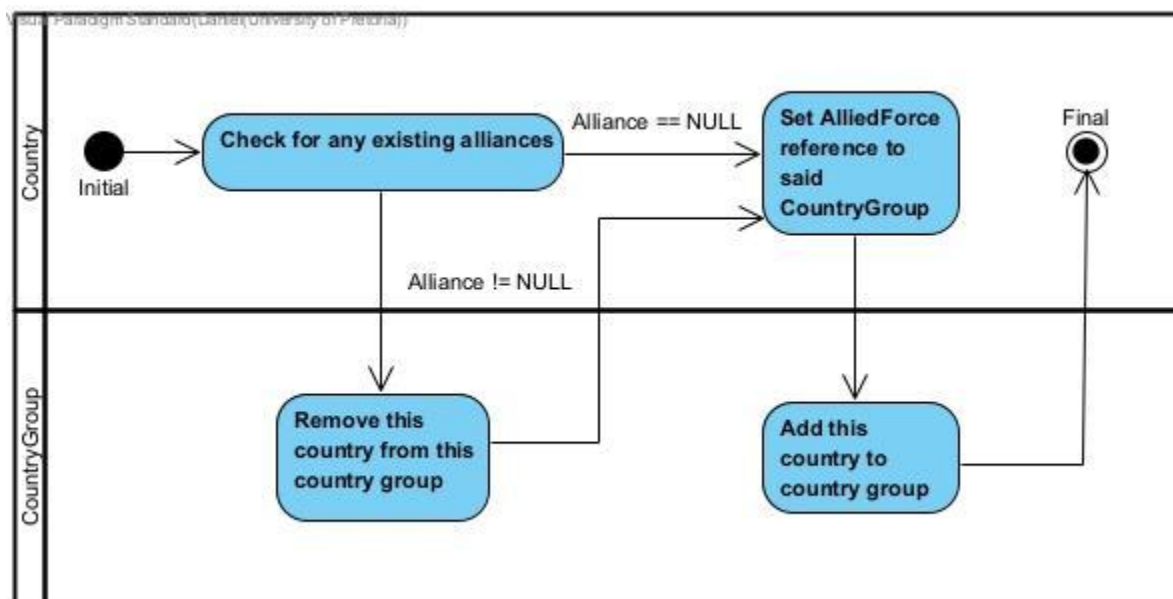
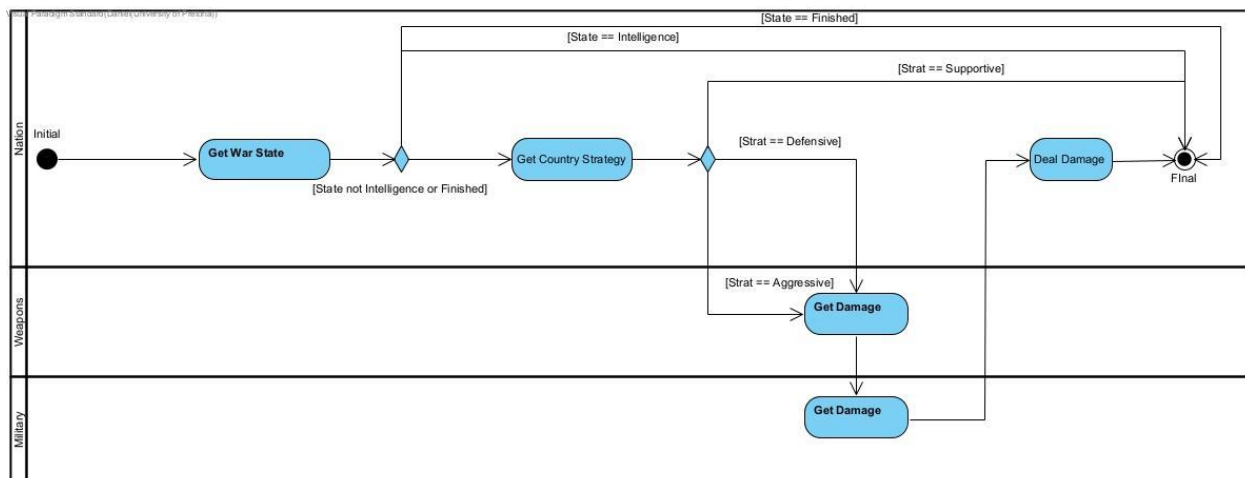
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Link To Google Document: [COS 214 Project](#)

TASK2: Initial Design

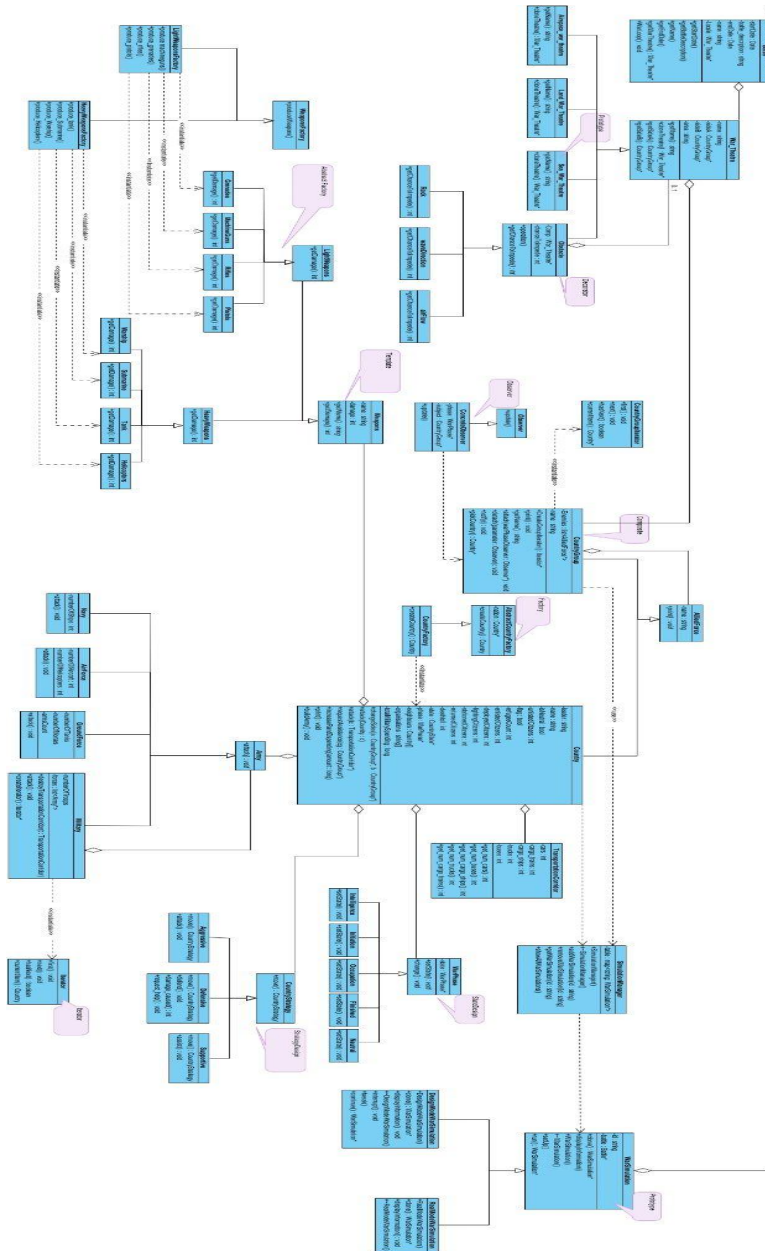
2.1) One of the functional requirements needed will be the ability for one country to attack one another. Another requirement would be the ability to set alliances between countries and country groups.

2.2)



2.3) We can use the state design pattern to check which phase the war is in. We can also make use of the strategy design pattern to employ different strategies for

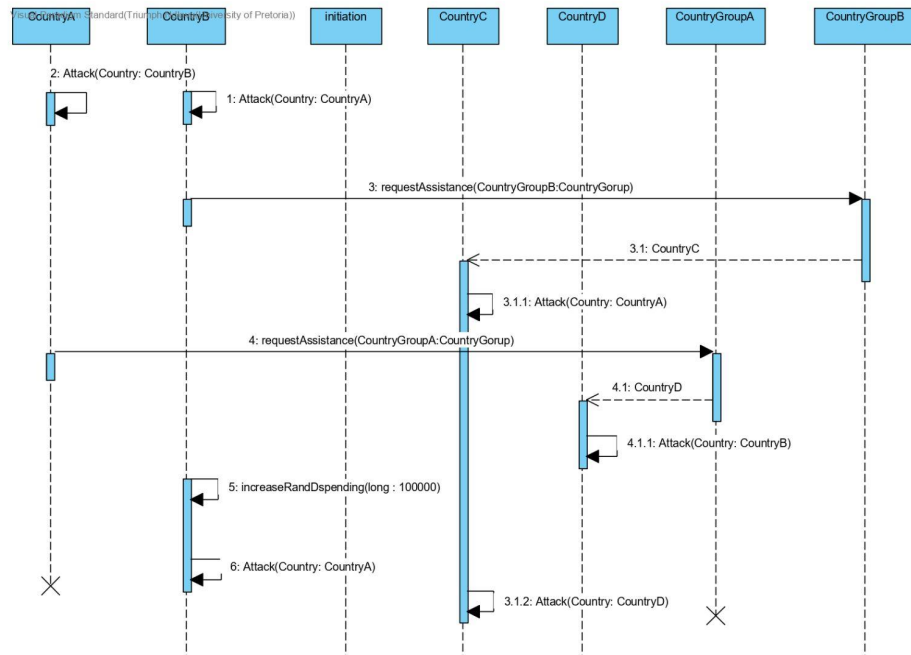
2.5)



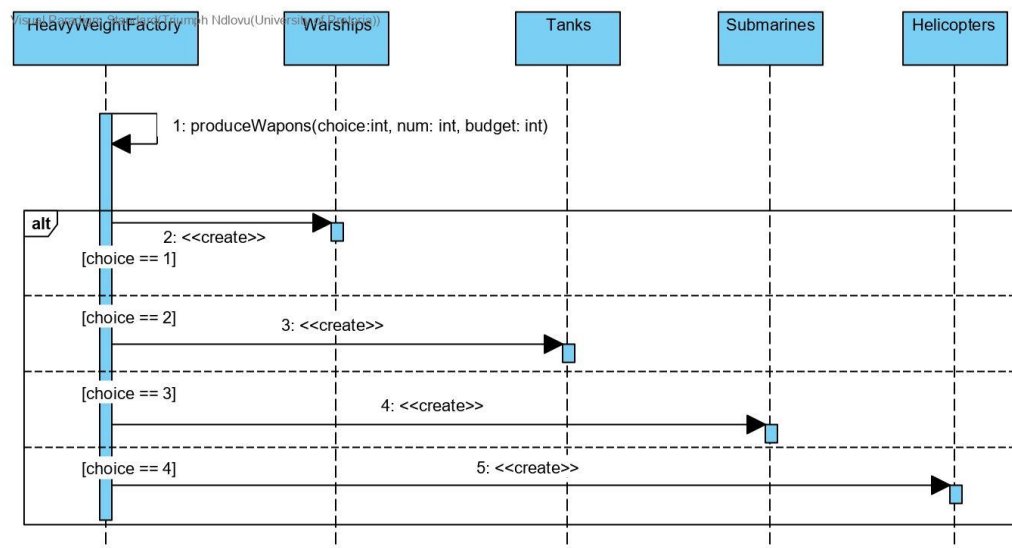
2.6)

UML Sequence Diagrams

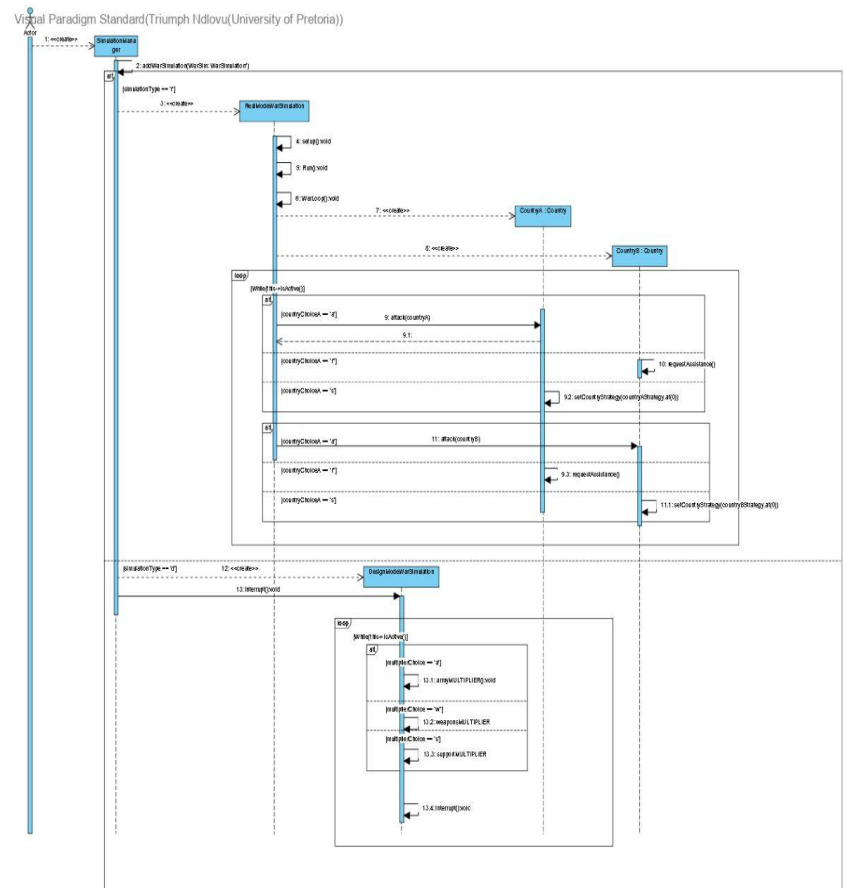
1-Country/CountryGroup Sequence Diagram



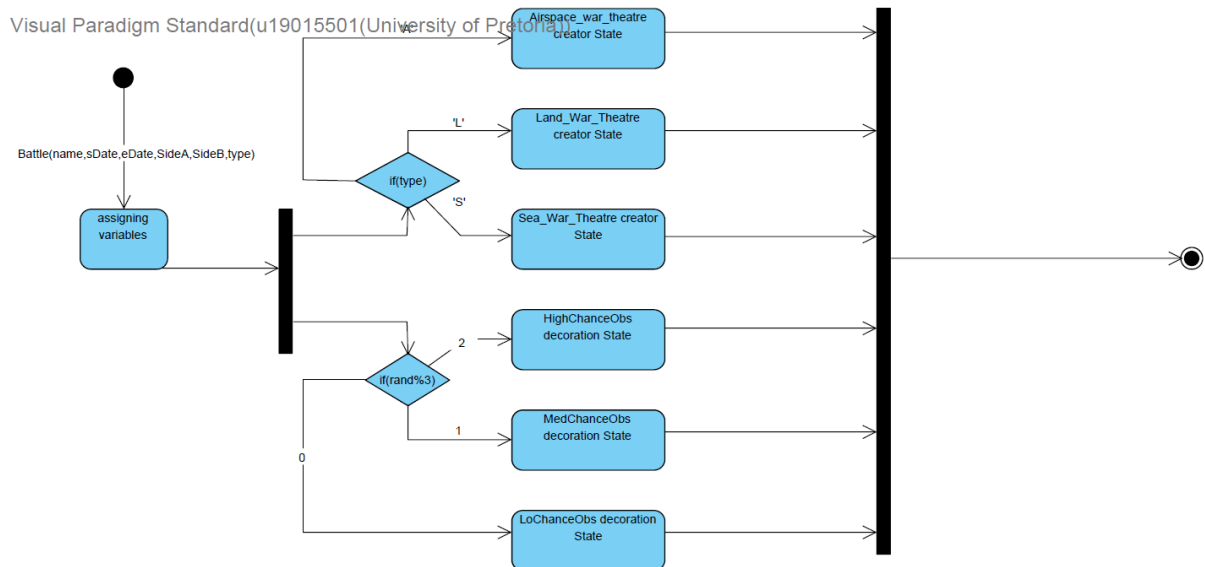
2- LightweightFactory/HeightWeightFactory(They are mirrors of each other)



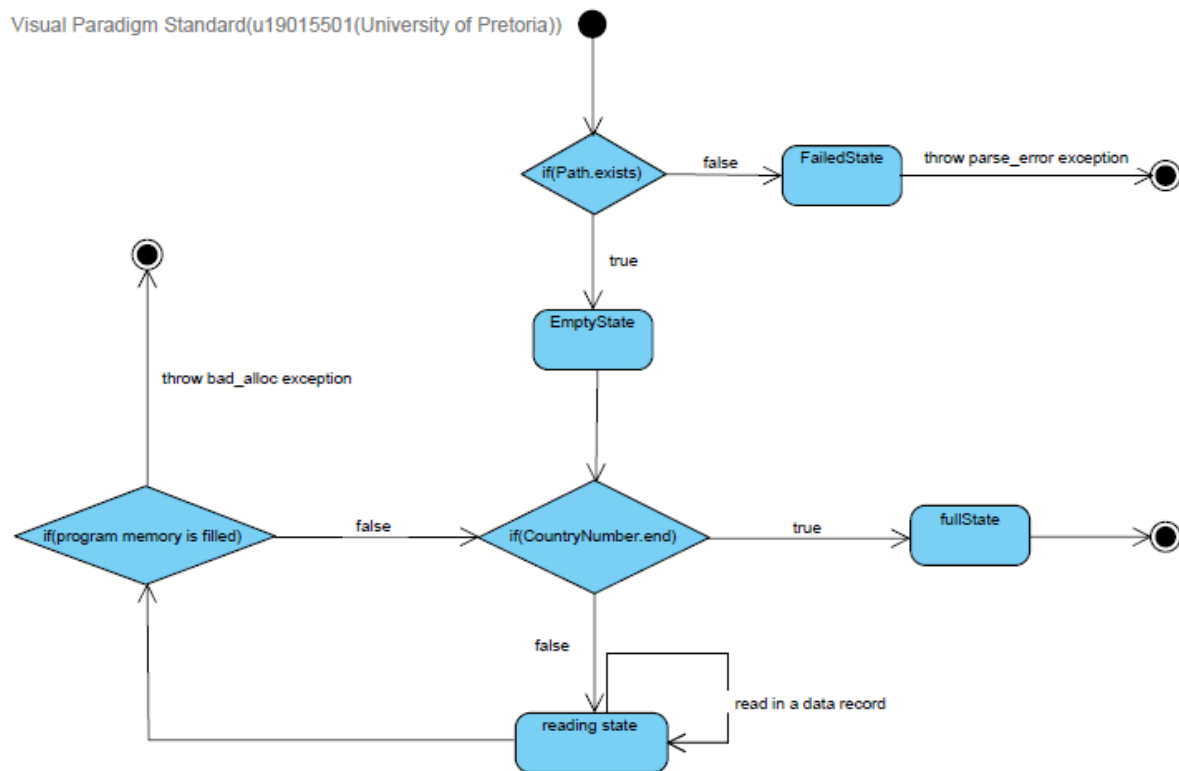
3-UML Sequence WarSimulator Diagram

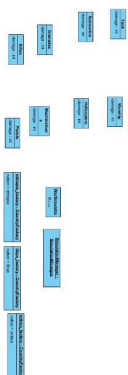
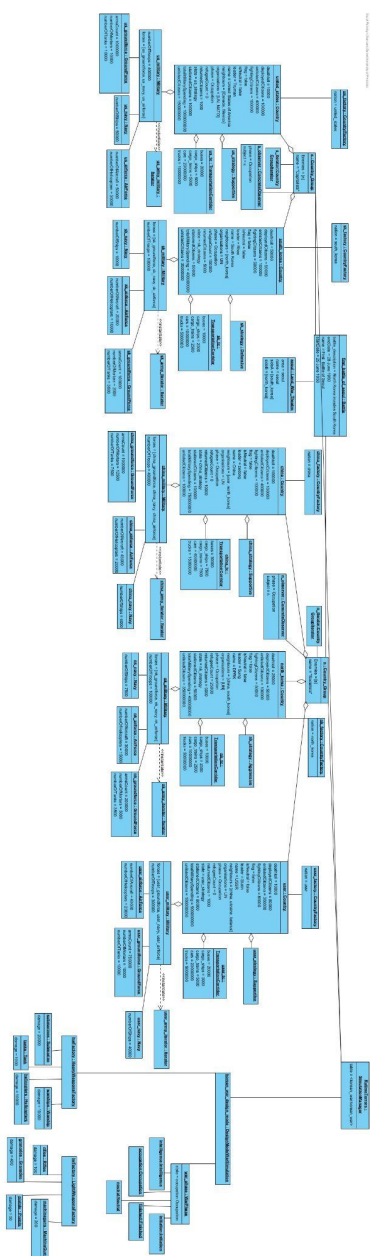


2.7) BattleObject state of decision to create warTheatre

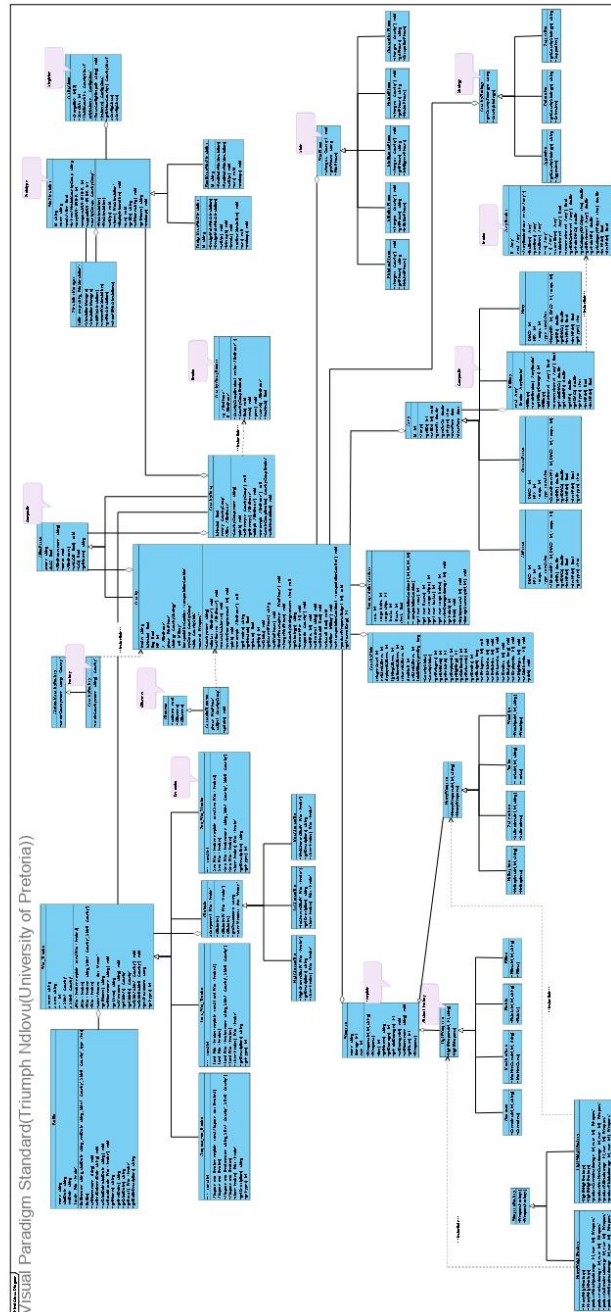


ConfigClass error handling States





FINAL UML DIAGRAM



TASK4: REPORT

4.1) War is defined in the Oxford dictionary as a state of armed conflict between different countries or different groups within countries. In larger wars, many countries may band together to form alliances such as the allies and the axes powers in WW2. (Encyclopedia Britannica. n.d.)

There are several phases of war. (Friedman 2022) The first phase is intelligence, in which the opposing forces gather intelligence about each other and prepare for war. Next, is initiation, when the forces first engage one another. Thirdly, comes occupation, in which the “winning” force pushes into the land of the other country to capture the land. Lastly, one of the forces falls, the war enters its final “finished” state.

Countries all have their own military, which is defined as the armed forces of the country. Different countries have different branches of the military based on their infrastructure as well as other elements such as the land they occupy. The general forces of a military can be split into 3 main groups, the ground forces which fight on land, the navy which fight at sea, and the air force which fight in the air. (Bledsoe 2022).

Another big factor in a Country’s military capabilities is their Weapons. Countries with more weapons, which can further be split into light weapons such as guns and explosives or heavy weapons such as tanks or attack helicopters, can do more damage. Countries with larger budgets due to better economic status, can in turn produce more weapons as they have more disposable income. (Juneja 2015)

Strategy in war is defined as the science or art of employing all the military, economic, political, and other resources of a country to achieve the objectives of war. A country can employ different strategies to achieve their goals. For example, a country may be on the aggressive, whereas the opposing force may be on the defensive. Countries can also help others in their alliance by supporting them.

Transport corridors are incredibly important in war. (Imperial War Museum 2018) The reason for this is the ability of a Country to resupply or gain assistance from

other allied forces is directly proportional to the efficiency of their support lines between the aforementioned forces.

Lastly, the terrain on which a battle takes place is immensely important to the battle. (Zabeki 2018) The fighting forces can use natural obstacles such as hills, rocks, as well as man made structures such as trenches to great effect in their attack strategy.

4.2) Many design patterns are extremely useful in modeling the various attributes of war.

To model the hierarchies of countries and country groups, as well as the army, we used the composite design pattern. The CountryGroup is the composite object, where Country is the leaf and AlliedForce is the component. Similarly, Army is the component, where Military is the composite object and Navy, Airforce, and GroundForce are the leaf objects.

To produce the multitude of weapons, we make use of the abstract factory to produce them. WeaponsFactory is the AbstractFactory, and LightWeaponsFactory as well as HeavyWeaponsFactory are our ConcreteFactories. LightWeapons and HeavyWeapons are examples of AbstractProduct, and ConcreteProduct is defined by Grenades, MachineGuns, Rifles, Pistols, Warship, Submarine, Tank and Helicopters.

Iterators are used to make the traversal of composite objects such as Military and CountryGroup. In this case, the pattern has been compressed for ease of use. Military defines both Aggregate and ConcreteAggregate, and CountryGroupIterator and ArmyIterator both define Iterator and ConcreteIterator in their respective cases.

To model the effect of terrain on a battle, we make use of a Decorator. This allows us to easily add an arbitrary number of obstacles to a battlefield, which will add stats to one of the countries in the battlefield. War_Theatre is the component in this case, where Airspace_war_theatre, Land_War_Theatre and Sea_War_Theatre are the ConcreteComponents. Obstacle is our Decorator, and Rock is our ConcreteDecorator.

We also make use of a Factory, as multiple countries can be part of a war and this simplifies the creation of the Country objects. In this case, the Country class is

both the Product and ConcreteProduct. The Factory class is the Creator, and CountryFactory is the ConcreteCreator.

The State design pattern was used to create the phases of war in our simulation. It uses the Country as context, to see what the state of the war is. It has the WarPhase object as the State, and Intelligence, Initiation, Occupation and Finished as the ConcreteStates.

To model the different strategies that a country may employ in war, we have used the Strategy design pattern. Once again, the Country class is the context. CountryStrategy is the Strategy, and Aggressive, Defensive and Supportive are all ConcreteStrategies. They all employ different behavior when the country calls attack. If a country is in the aggressive state, then they deal more damage. If they are defensive, then they receive less damage. If they are supportive, then they can help allied countries by calling the support function.

Since the specification requires that the engine should be able to run in design or real mode, and the WarSimulation class has many attributes, we have used the Prototype design pattern to make switching between the modes simpler by cloning the WarSimulation and simply changing the mode it is in. The WarSimulation class is the Prototype, and DesignModeWarSimulation and RealModeWarSimulation are the ConcretePrototypes. When in real mode, the program is more limited, only allowing the client to set up the war and then choose their next move in a turn-based system. Design mode allows for additional functionality which allows the user to change multiplier values in the .json file which has an effect on the game (damage multipliers, random chances, etc).

The Template design pattern is evident throughout our program, where certain functions are abstracted such as in AlliedForce and Weapons and implemented by their concrete versions.

Since the war loop provides a singular interface with the functional requirements for the client by accessing the numerous abstract interfaces in our program, it is an example of a Façade.

Lastly, since we only have one instance of ConfigClass that we use throughout our program, it is a Singleton object.

Reference list

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