COS 214 PROJECT

REPORT

Shiluvelo Makhubele	u19086352
Christof Steyn	u17021074
Charl Volschenk	u17053928
Rebecca Oosthuizen	u20512008
Chris Mittendorf	u15092462
Akani Hlungwani	u19240202

2.1 Identify the functional requirements.

Main points

- Allow the user to decide how the program runs (Either as Design Mode or Real Mode)
- Allow the user to specify how many countries and alliances will be formed and the initial state of the countries.
- The program will need to run through the phases of the program by either accepting inputs from the user(design mode) or producing its own inputs to continue the program(real mode)
- Each country should be able to build their own army that will be used in a war. This includes flags, weapons, troops, soldiers and infantry.
- Countries should only be allowed to attack countries that are not in their alliance.
- Countries should have the choice to be able to form an alliance with other countries(phase 2).
- For any party to engage in warfare, their entities need to be entered into the war theatre.
- In the war Theatre, countries will compete against each other through their entities. Vehicles can only attack other vehicles and soldiers can only attack other soldiers. Attack damage is dealt and if a unit loses all their health they are eliminated.
- War Theatres will comprise of specific elements (land, sea or air, or a combination of elements). Only specific units can be deployed in the war theatre if their criteria are met. Eg Land for soldiers and tanks, sea for ships, air for planes.
- If units fall below a certain level they are considered damaged/wounded. They will then need to be repaired/healed by a mechanic/medic.
- After a certain amount of time, alliances will engage in peace talks (phase 4). If peace talks are successful then will continue to diplomacy (phase 5), if they are unsuccessful they will re engage in combat.
- If diplomacy(phase 5) is successful the program ends and a victor is declared, if it is unsuccessful then the program returns to forming of alliances (phase 2)

Introduction

We were tasked to implement a war simulator that will model the various elements of war. This program should be able to simulate a turn based style war that can take place between two countries. The war must take place within a specified location that can be defined as the war theatre. Each country will have its own assets, like the amount of soldiers, weapons, medics, infantry etc. Below is a detailed description of the requirements for the simulator:

In Depth Description

Countries can be alone or part of an alliance(data structure)
Countries have:

- Soldier/armies/troops
- Weapons
- Flags

There are multiple alliances

5.1 War engine

Countries take turns **ordering attacks** on countries from other alliances, until **one alliance**(super power country group) **remains**

5.2 Components (can add RnD to “upgrade” units)(Construction of new units)

5.2.1 War theatre

- List of defending countries(in same alliance)
- List of attacking countries(in same alliance)
- Location
- Area: Air space / land / sea

5.2.2 Transportation

- Transport **goods**(weapons), **people**(troops) and **services**(medics, engineers)
- Should be able to destroy transport

5.2.3 Entities

- Keep track of time elapsed
- Entities will all go through a timed process(eg: construction of a vehicle), after which the entity will be added to the corresponding country
- How aggressively countries respond to provocation and attack

5.2.4 Phases of war

- Phase 1 (Dispute) : A dispute takes place between countries. The user specifies how many countries are involved in the conflict and how many alliances can be formed. The starting states of each country is also decided here, for example the military size and resources available.
- Phase 2(Conflict) : The countries form alliances against one another. This can be done by the User or done randomly in the program.
- Phase 3(Fighting) : In this phase there is direct conflict between the alliances. In turns the alliances will attack one another and damage will be caused to the defender.

Resources will also be able to be managed before the end of a turn, this entails the maintenance of troops or vehicles, delivery for more units and ammunition and then the evacuation of refugees/POWs.

- Phase 4(Post-Conflict) : In this phase direct fighting stops but resource management still takes place. This stage is entered if an alliance's units and/or resources are depleted or if they surrender. Negotiations between alliances take place at this stage in order to end the conflict. If the negotiations are successful the war progresses to Phase 5. If negotiations are unsuccessful then the war goes back to stage 3.
- Phase 5(Diplomacy) : This is the final phase of the war where the dispute is settled. If diplomacy is successful then the war ends. If diplomacy is unsuccessful and a new dispute arises then the war goes back to Phase 2 where alliances are reformed and the war continues.

Influences on the above phases were drawn from the following article:
https://web.mit.edu/cascon/warend.html

5.2.5 Changes to war engine

As **time progresses** and according to **other factors** countries should **behave differently**:

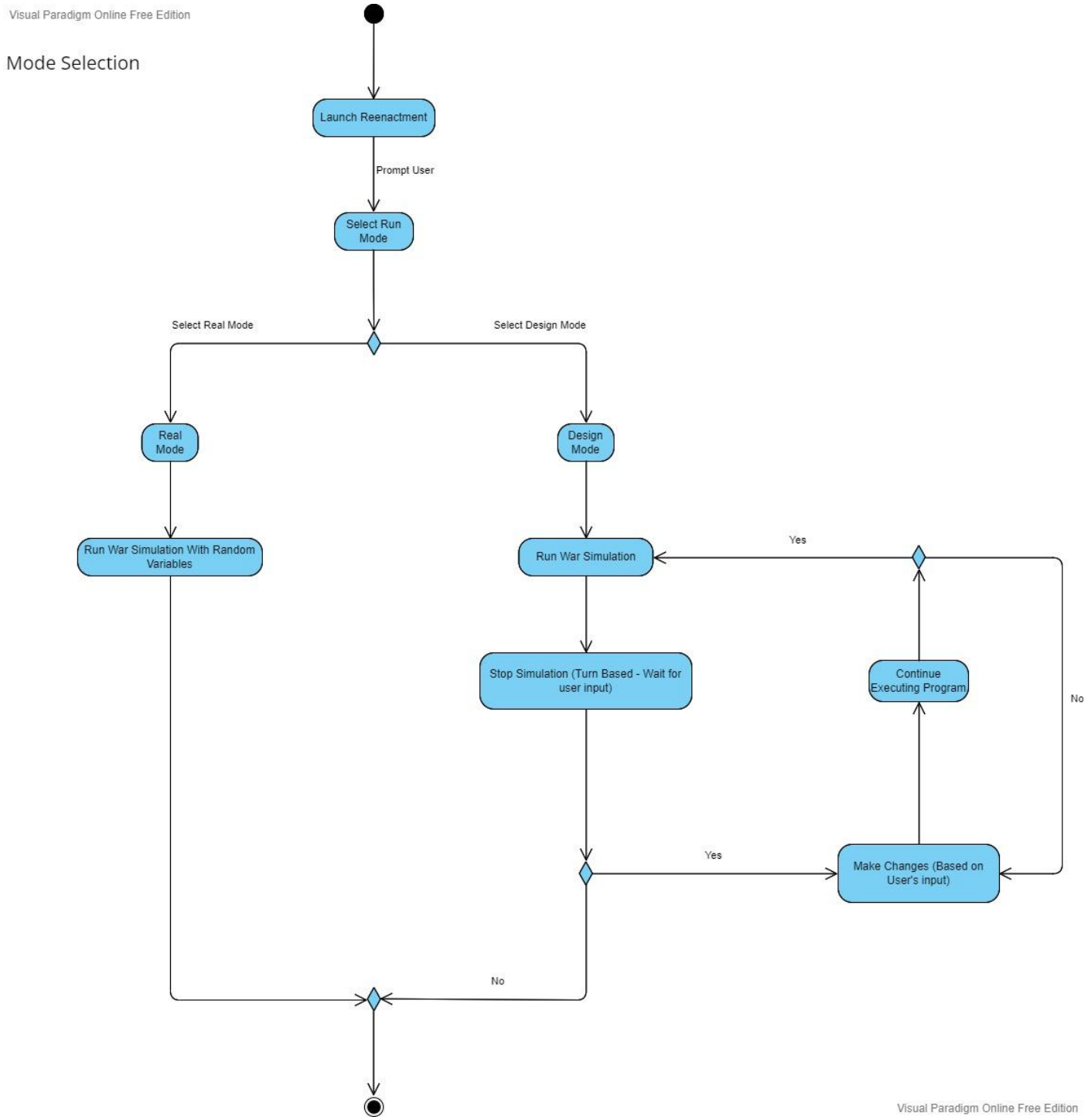
- On how they **spend money**(eg: they spend a lot of money in the middle of the war)
- Adopting **war treaties**(eg: they decide to adopt peace treaties towards the end of the war)
- On how aggressively the **respond to provocation or attack**(eg: if they know another country is weak, they might not respond on provocation)
- Countries can also **change or leave alliance**(eg: if they are losing, or if an has performed too many invasions)

5.3 War reenactment

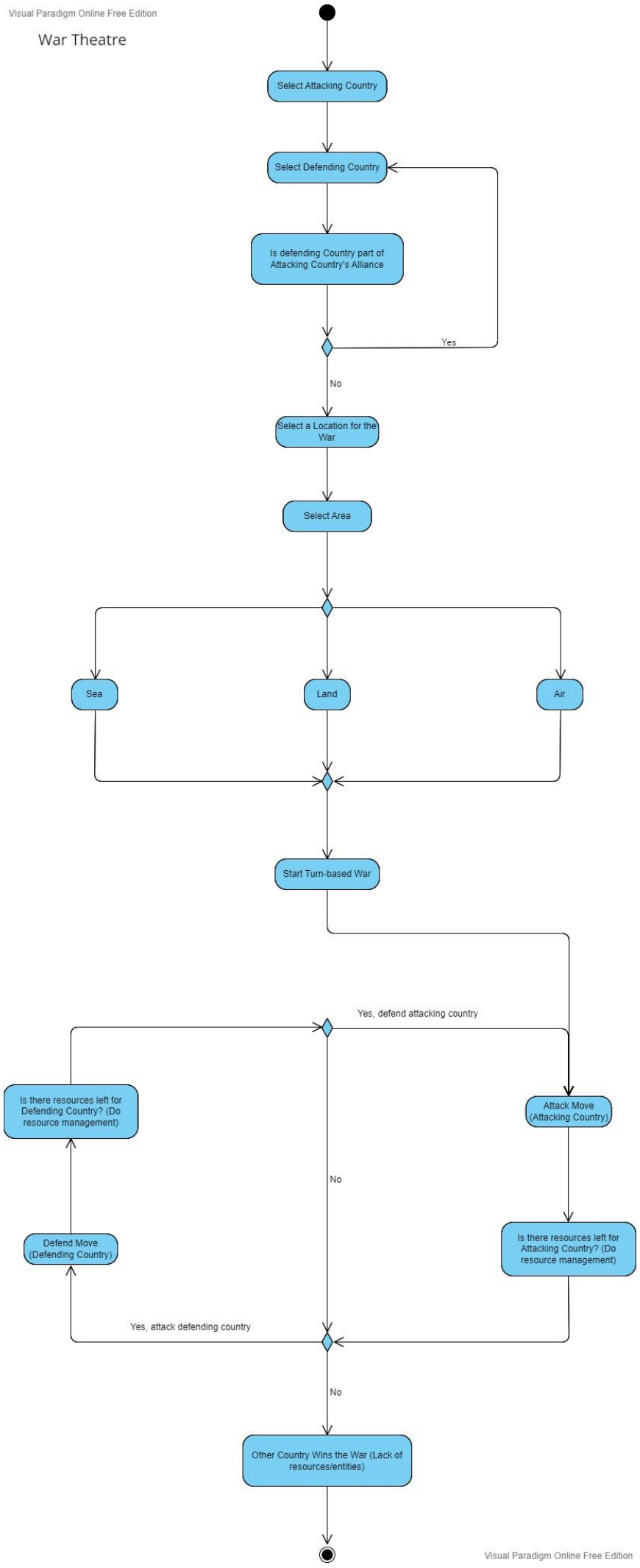
Interface where a user can run the war simulation
Should have 2 modes:

- **Design mode:** changes can be made on the fly
- **Real mode:** simulations are set up and run

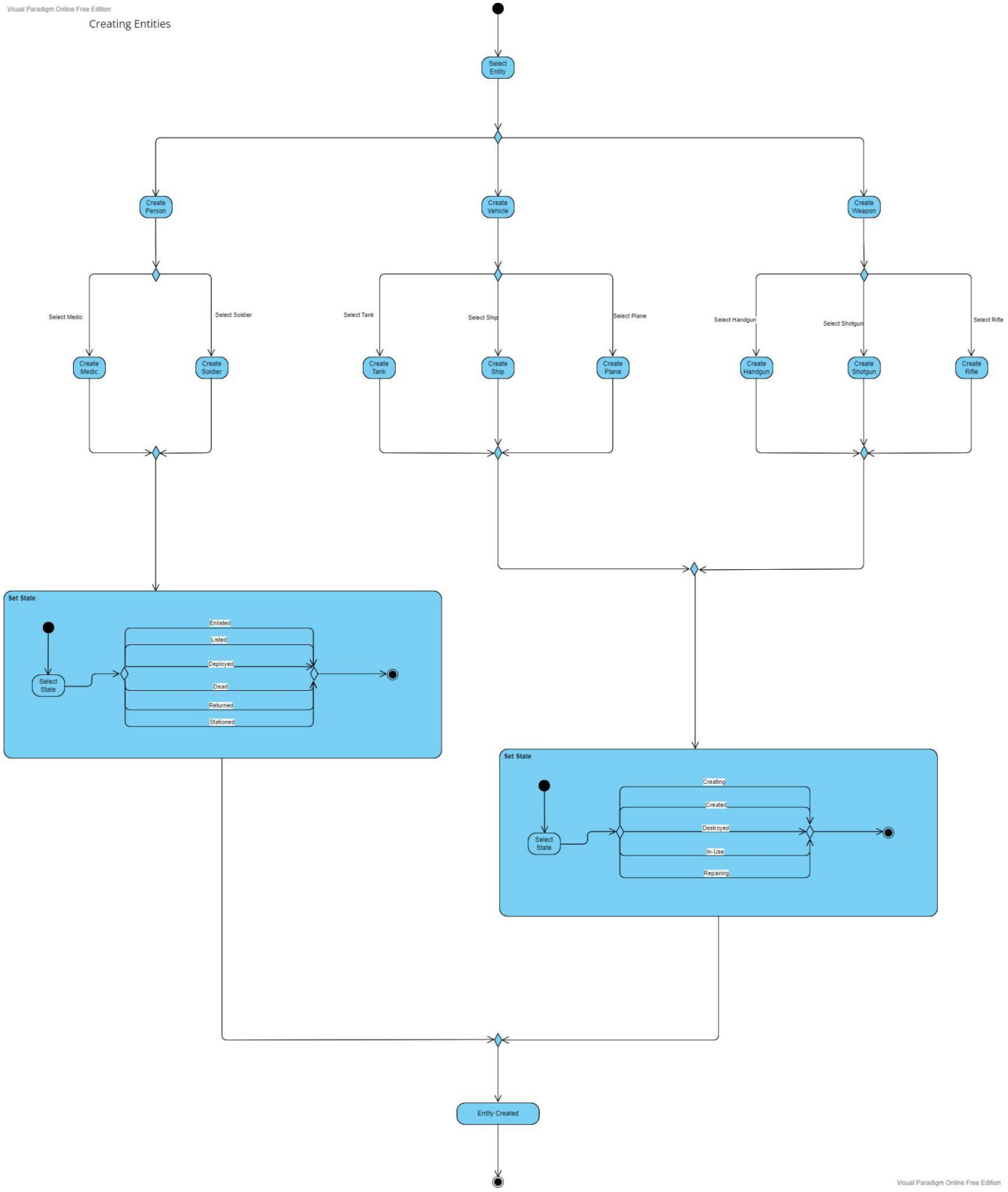
2.2 Design the processes using Activity diagrams.



War Theatre



Creating Entities



2.3 Decide on the patterns to address the functionality defined by the functional requirements and processes.

- Memento - used to restore the state of entities(units/vehicles) after they have been helped by a medic/mechanic. If a unit is damaged in battle and they are attended to by a medic or mechanic then the memento pattern is used to restore their orignal state. Also used to save the state of the entire system on the interrupts in the design mode in case the user wishes to pause the game or there is a system crash. This state can then be restored at a later stage if the user wishes to leave the program or if their is a prgram crash.
- Template - used to define the rough layout of an entity (units/vehicles). The general layout is used to define a person or vehicle unit and is used to create its shared methods and attributes that all types of units will have.
- AbstractFactory - used to produce the prototypes that are used in the creation of units. The abstractfactory will produce the specific types of units from the template. Ie, person is used to create soldiers, medics and mechanics. Vehicle is used to create tanks, ships and planes.
- Prototype - used by the AbstractFactory to create multiple instances of concrete products. Multiple instances of each unit will be created for the war simulation so that the number of units in an army are represented by actual objects and not just a number.
- Strategy - used to define the algorithms that units use depending on the overall state of the war engine program. Depending on the state of the program units may behave differently. The strategy pattern is used to select what methods are availible to units based on the current state of the program. People can engage in peace talks or fighting and vehicles can be used for transportation or fighting.
- State - used to control the phases of war that the war engine program is currently in. The states (as described above) will change how the program runs and how all the entities behave depending on the state currently being used.
- Decorator - used to add new methods/attributes to a unit as the war progresses. As turns take place in the war theatre in phase 3, countries wil make use of the decorator to “upgrade” their units. Eg health, armour, abilites etc. The decorator will simulate a reasearch and developement aspect of a country.
- Iterator - can be used to progress through a turn in Phase 3 (eg: attack->manage resources->evacuate personnel, etc.). The iterator will step through the methods in the war theatre to produce an outcome.
- Singleton - used to create a single intance of the war engine as there will only be one instace of this class used as it is the overall program.
- Command - might be able to use this in diplomacy/negotiations?

- Observer - the observer design pattern will act as the UN in the simulation. The observer will be notified when battles take place and then the outcomes of peace talks and negotiations.
- Composite - The lists of attacking/defending countries in a war theatre will be a composite, so that we can call each of their functions at the same time.

2.4 Design the classes for each of the identified patterns taking their interrelationships into account.

V1.0

1. WarEngine - Country(association), Snapshot(association), Alliance()
2. Alliance - Country(Template/Iterator-Generalization)
3. Country - EntityFactory(association), ProductEntity(association)
4. WarTheatre - Country(Not sure about the relationship?), Alliance(Not sure about the relationship?)?
5. EntityFactory - Country(association), PersonFactory(generalisation), VehicleFactory(generalisation), WeaponsFactory(generalisation)
6. PersonFactory - ProductPerson(dependency)
7. VehicleFactory - ProductVehicle(dependency)
8. WeaponsFactory - ProductWeapons(dependency)
9. ProductEntity - Country(association), ProductPerson(generalisation), ProductVehicle(generalisation), ProductWeapons(generalisation)
10. ProductPerson
11. ProductVehicle
12. ProductWeapons
13. State - ProductPerson(aggregation), ProductVehicles(aggregation), ProductWeapons(Aggregation)
14. Concrete States for ProductPerson - Listed, Enlisted, Deployed, Dead, Returned, Stationed, etc.
15. Concrete States for ProductVehicles - Creating, Created, Destroyed, In-Use, Repairing, etc.
16. Concrete States for ProductWeapons - Same as Vehicles?
17. Snapshot(Memento) <- SaveState(Association) - WarEngine

V2.0

Classes:

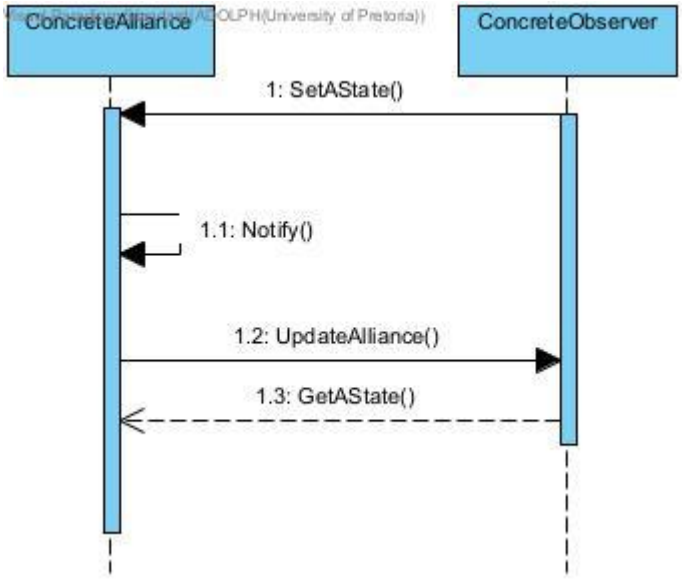
1. WarEngine
2. Alliance
3. Country
4. WarTheatre
5. EntityFactory
6. AbstractPerson
7. AbstractVehicle
8. Medic

9. Soldier
10. Tank
11. Plane
12. Ship
13. UnitCreator
14. AbstractUnitFactory
15. ConcreteVehicle
16. ConcretePerson
17. WarPhaseChanger
18. Phase
19. Phase1
20. Phase2
21. Phase3
22. Phase4
23. Phase5
24. Strategy
25. Fight
26. Negotiate
27. Diplomacy
28. CreateSave
29. SaveSpace
30. CurrentState
31. Singleton
32. Aggregate
33.

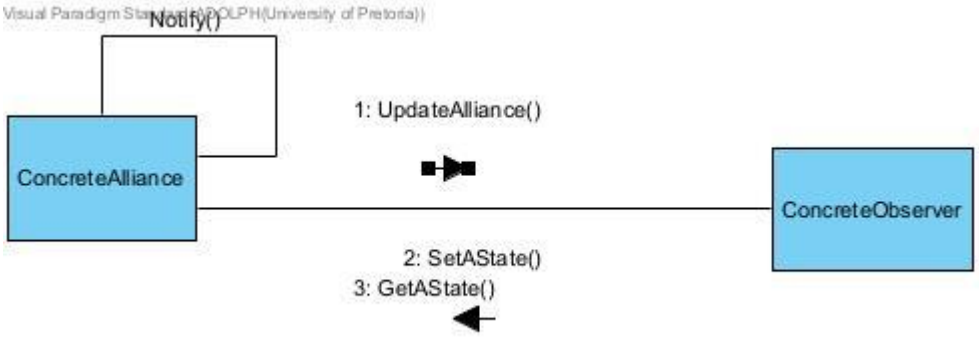
2.5 Draw a class diagram of your system.

2.6 Draw Sequence and communication diagrams showing the message passing between objects.

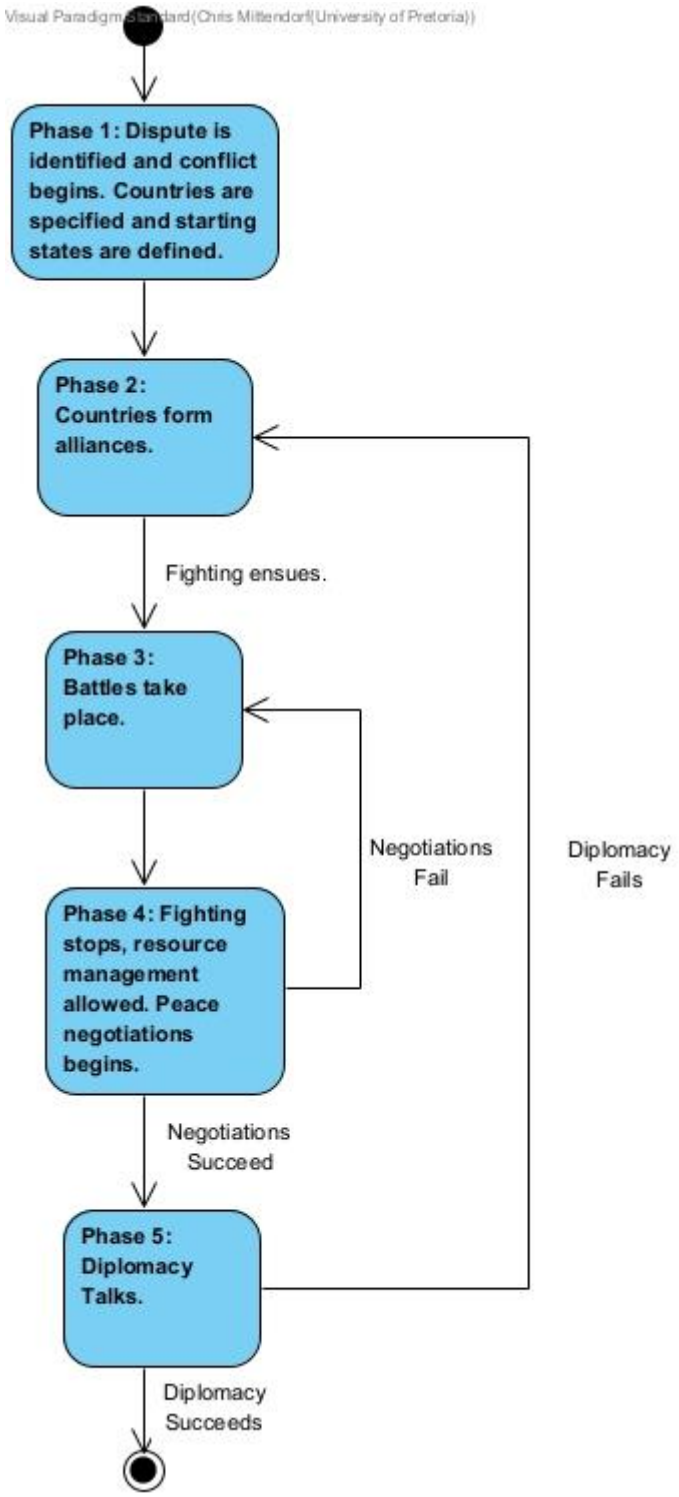
Sequence



Communication



2.7 Design state diagrams showing how an object (which could also be a composite) changes state.



2.8 Provide at least two object diagrams showing the state of the objects active in the war simulation at a specific point in time.