Beating up the Zombie

New class added: **Limb**

Roles and responsibilities:

- It's an abstract class that inherits WeaponItem class that will have attribute and method that are shared by Arm and Leg.
- Has an attribute of type weapon to store the weapon if this weapon is upgraded
- Has a final static field of type int called damage that stores the damage of this weapon which is equal to 20, and it's declared final static because it's a class variable and should be a constant for its child classes which is Arm and Leg
- Has an abstract method called craftWeapon() that return a new weapon (If it's an arm, player can craft it into a ZombieClub, if it's a leg, player can craft it into a ZombieMace)

New class added: **Arm**

Roles and responsibilities:

- A type of weapon that inherits Limb so it can be used by both zombie or the player
- Zombie should pick it up if zombie is stepping on it (has the same location as this Arm)
- Has an attribute of type Weapon called upgradedWeapon that stores the upgraded weapon Arm will become if it's crafted by the player, added notes, only player can craft this Arm into another weapon and zombie can only use this weapon as it is.
- It has a possibility to be dropped (or rather created since zombie doesn't store object of Arm type as an attribute) at the adjacent location around the zombie when the zombie is attacked by the player.
- Can be used by both zombie and the player as a weapon with damage of 20 as it inherits Limb class
- Represented by the symbol "A" when it's on the ground
- Has method craftWeapon() will return upgradedWeapon which is an object of type ZombieClub and it can only be called by the player when the player has an Arm in their inventory.

New class added: **Leg**

Roles and responsibilities:

- A type of weapon that inherits Limb so it can be used by both zombie or the player
- Zombie should pick it up if zombie is stepping on it (has the same location as this Leg)
- Has an attribute of type Weapon called upgradedWeapon that stores the upgraded weapon Leg will become if it's crafted by the player, similar to Arm, only the player can craft this Arm into another weapon and zombie can only use this weapon as it is.
- It has a possibility to be dropped (or rather created since zombie doesn't store object of Arm type as an attribute) at the adjacent location around the zombie when the zombie is attacked by the player.
- Can be used by both zombie and the player as a weapon with damage of 20 as it inherits Limb class
- Represented by the symbol "L" when it's on the ground
- Has method craftWeapon() will return upgradedWeapon which is an object of type ZombieMace and it can only be called by the player when the player has an Arm in their inventory.

Class modified: **AttackAction**

Roles and responsibility:

- This class is modified into an abstract class that provide a base code for all the attack actions in the game, which are AttackZombieAction class and AttackHumanAction class where they share some similar functionality such as the execution part when the target dies
- The execute method is modified into an abstract method since AttackZombieAction and AttackHumanAction has different execution.
- Has a new method called targetDied() that is responsible for the action when the target dies and this functionality is shared among AttackZombieAction and AttackHumanAction, therefore duplication of code can be reduced (DRY). It is currently part of the code of the execute function

New class added: **AttackZombieAction**

Roles and responsibilities:

- Inherits AttackAction and it represents an action that can be carried out by the Player to attack the zombie at adjacent location of the player.
- Has attribute of type ZombieCapability to store the attackable team UNDEAD so it only allows this action to be acted on the Zombie.
- Inherit AttackAction constructor which take in an Actor which is the target.
- In the execute method, when the player uses a weapon or intrinsic weapon which is punch, both attacks has a 70% successful hit rate. If the player successfully land a hit on the zombie, the zombie has a 30% probability of losing a limb, and a 10% probability of losing 2 limbs (A limb can be either an arm or a leg and it's randomly chosen, so the zombie could potentially lose both arms or both legs after being hit).
- When a limb is knocked off, it will deduct the number of limbs knocked off from the zombie attribute arm or leg
- Has a private method called dropAt() that will get Exits of the zombie, and return a Location that is available for the Limb to drop.
- Has a private method called dropWeapon(int lost_limb) that take in the number of limb lost after the attack. If lost_limb == 1, it has 50% chance to return True, if lost_limb == 2, it return True.

Class modified: **AttackBehaviour**

Roles and responsibility:

- In the getAction method, instead of returning a new AttackAction, it will first determine the attackableteam, if attackableteam == ALIVE, it will return a new AttackHumanAction. On the other hand, if attackableteaem == UNDEAD, it will return a new AttackZombieAction.

Class modified: **Zombie**

Roles and responsibilities:

- Has a field of type int called arm to store the number of arms that are still attached to the zombie.

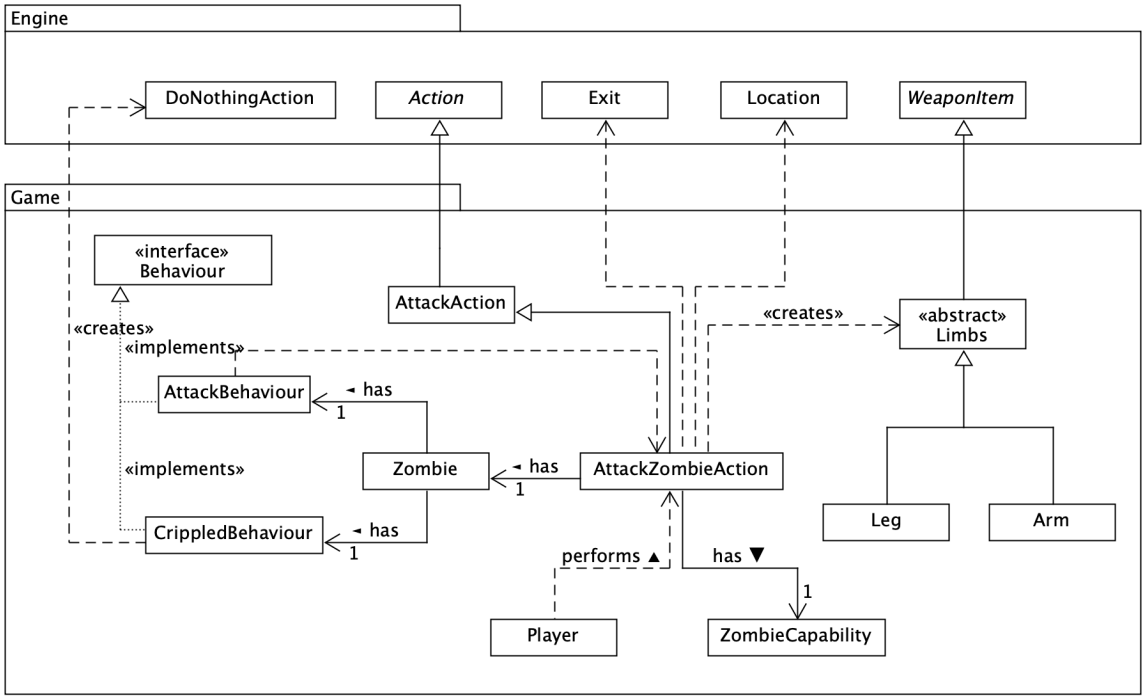
- Has a field of type int called leg to store the number of legs that are still attached to the zombie.
- Both field arm and leg are initialised to 2 to represent all zombie will have 2 arms and 2 legs upon creation.
- Has a field of type Boolean called isCrippled which is initialised to false.
- Has loseArm(int armLost) method that deduct armLost from its arm attribute if and only if arm – armLost >= 0.
- Has loseLeg(int legLost) method that deduct legLost from its leg attribute if and only if leg – legLost >= 0.
- Has getArm() method that returns the number of arms that are still attached to the zombie.
- Has getLeg() method that returns the number of legs that are still attached to the zombie.
- The getIntrinsicWeapon() method is modified so that it check the number of arm the zombie has before return Bite or Punch. If number of arm == 2, it has 50% of returning either IntrinsicWeapon, if number of arm == 1, it has 25% probability of returning Punch and 75% probability of returning Bite.
- Has dropWeapon() method that will drop the weapon it's currently holding, the weapon will be removed from the zombie's inventory and randomly dropped at the adjacent location around the zombie.
- Has negateIsCrippled method that negate the status of isCrippled when it's called.

Class added: **CrippledBehaviour**

Roles and responsibility:

- Inherit Behaviour class, and this behaviour will take into account the number of legs this zombie has, and the isCrippled attribute of zombie to determine if the zombie can move or not.
- Has a getAction method that it will get the number of leg. of the zombie, and return either Null or DoNothingAction based on the number of legs.

UML for Beating up the Zombies



How to achieve the required functionality:

- In order to provide more details on the action of player attacking the zombie, AttackZombieAction class is created and inherits from AttackAction class, at the same time, AttackAction class has to be made abstract to increase its reusability and its child class can share some of the same functionalities without duplication of code. AttackAction is split into AttackZombieAction and AttackHumanAction so that they only handle one responsibility, hence Single Responsibility Principle (SRP) is followed.
- Limb class is an abstract class so that Arm and Leg can inherit it, and increase the code reusability since both Arm and Leg are quite similar with a key difference of what their upgraded weapon will be.
- In the AttackZombieAction class, there's a series of if-else in the execute function. Each if-else will have a predetermined probability of occurrence, for example, if the player successfully landed an attack on the zombie (70%), the zombie will have 30% probability of dropping one limb and 10% of dropping two limbs, each limb that is dropped can be an Arm (50%) or a Leg (50%).
- The number of arms and legs are hard-coded to 2 upon creation of any zombie. Although hard-coding is not a preferable practice in object-oriented design, however,

this can be justified as the number of arms and legs are supposed to be a class variable and should be the same for all zombies when a new zombie object is created.

- The getIntrinsicWeapon in zombie class is modified so that it uses simple if-else based on the number of arms of the zombie before returning Punch or Bite, where both belong to type IntrinsicWeapon. If number of arm == 2, it's 50-50 for Punch and Bite, if number of arm == 1, its 25-75 for Punch and Bite.
- The dropWeapon method in AttackZombieAction class takes in the number of limb lost after the zombie being attack, and return a Boolean based on the number of limb lost. 50% returning true if limb lost == 1, 100% returning true if limb lost == 2. The execute function in AttackZombieAction will call this method and determine if the weapon will drop or not.
- At each turn, zombie will go through its behaviours and return the first allowable action it can take. CrippledBehaviour is created to determine if the zombie can move in that turn or not based on the number of legs the zombie has. It is placed right before the two movement behaviours which are HuntBehaviour and WanderBehaviour so that the zombie can return DoNothingAction if it's not supposed to be moving during that turn, or return null if it should be able to move.
- If the number of legs is equal to 2, return null. If the number of leg is equal to 0, return DoNothingAction. Lastly, if it's equal to 1, it will use getIsCrippled() method from zombie class to determine if this zombie can move or not. Since the isCrippled attribute of a zombie is initialised to false, and the zombie shouldn't be able to move in the first turn after the zombie loses one leg, it will negate the isCrippled attribute of the zombie and return DoNothingAction. The next turn, the isCrippled attribute of the zombie is now true, and this zombie should be able to move, so it will negate the isCrippled again and return null.
- Since CrippledBehaviour is placed after AttackBehaviour, The zombie will return an AttackAction if it's allow to do so and the number of legs will not affect it.
- In AttackZombieAction, the method dropAt() will get the Exits of the zombie and return a Location where the limb can be placed at. Hence, this implies that the limbs will drop at the adjacent location to the zombie.
- When the player landed a successful hit on the zombie, and the zombie has dropped x number of arms and y number of legs, a matching number of x and y of Arm and Leg

will be dropped on the ground. Since both Arm and Leg inherit from Limb, therefore they are a type of Weapon and has a damage of 20. It can be used by both player and zombie.

Crafting weapons

New class added: **CraftWeaponAction**

Roles and responsibilities:

- Inherits Action class so it can be used as an action by the player.
- Has a constructor CraftWeaponAction(Actor, Item).
- In the execute() method, it will first remove this current weapon from the actor's inventory, then it will call this weapon's craftWeapon method which will return a superior weapon. Finally, this superior weapon will be added into this actor's inventory.
- Has menuDescription() method that returns a string Original weapon + "is crafted into " + New weapon.

New class added: **ZombieClub**

Roles and responsibilities:

- Inherits WeaponItem class
- It is represented by the letter "C" when it's on the ground
- Has a damage of 35

New class added: **ZombieMace**

Roles and responsibilities:

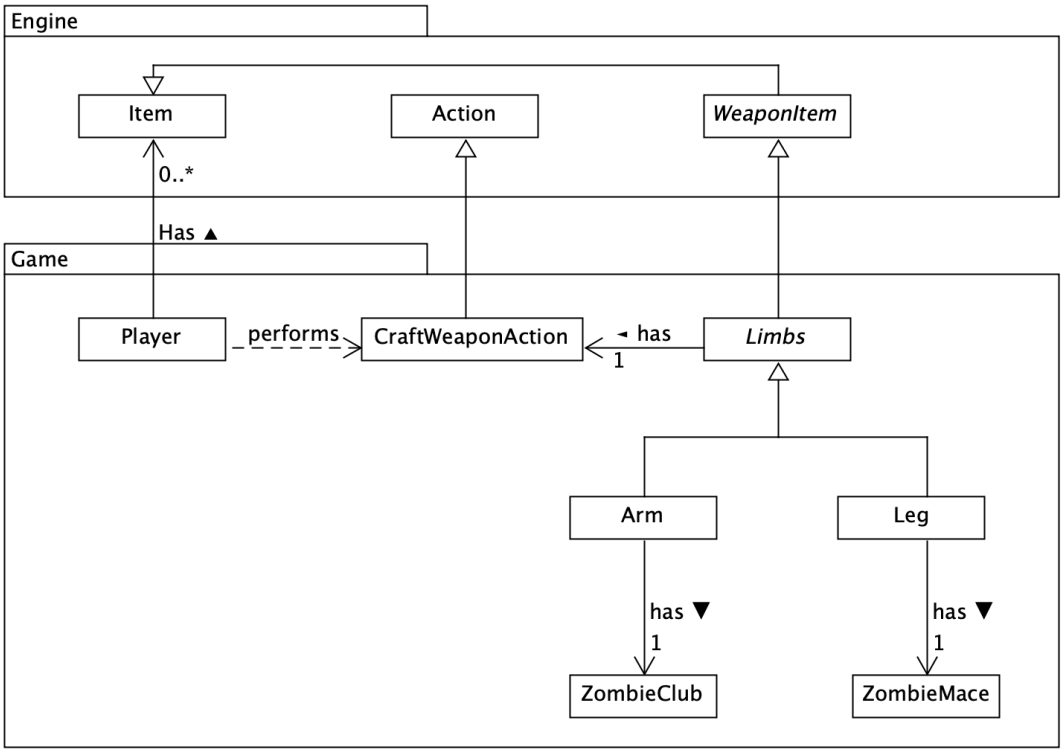
- Inherits WeaponItem class
- It is represented by the letter "M" when it's on the ground
- Has a damage of 50

Class modified: **Limbs**

Roles and Responsibility:

- In the constructor, add CraftWeaponAction into its allowableActions since both Arm and Leg can be crafted into better weapon, putting the code here will reduce duplicity of code.

UML for Crafting Weapons



How to achieve the required functionality:

- Arm class has a private attribute of type ZombieClub which stores a new ZombieClub object. This ZombieClub is the successor of Arm and has a damage of 35.
- Similarly, Leg class has a private attribute of type ZombieMace which stores a new ZombieMace object. This ZombieMace is the successor of Leg and has a damage of 50.
- When the player has either an Arm or a Leg in the inventory, since both Arm and Leg has CraftWeaponAction in their allowableActions, the player will have a choice to craft them into better weapon respectively.

- If CraftWeaponAction if executed, it will remove the weapon from the player's inventory, then it will call the craftWeapon method in Arm or Leg which will return a new weapon, either a ZombieArm or a ZombieMace depending on the weapon wished to be upgraded. Lastly, it will add this new weapon into the player's inventory.