Design Relation

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BOLD - newly added class

RED - Changes to design in Assignment 2

Crafting Weapons

When I'm implementing the crafting weapons, I created classes which are **ZombieClub, ZombieMace** and **CraftingWeaponAction**. I will also modify the Player class to check whether the player inventory contains zombie arm / leg for the player to craft into a weapon.

Player Class:

In player class playTurn() method, I will check whether the player inventory contains a SimpleClub Object which may be zombie arm or leg. If the player inventory contains it, then the player can add the craft weapon action into the actions arrayList by creating new CraftingWeaponAction. So the player can choose whether they want to craft weapons by entering the hotkeys.

Instead of checking the player inventory contains a SimpleClub object, now I will check whether the player inventory contains a zombie's arm or leg as an Item Object.

CraftingWeaponAction Class:

CraftingAction class extends Action. It contains a one parameter constructor which takes in a SimpleClub Object. Eg. CraftingAction(SimpleClub weapon). Methods in this class:

- execute() – in this method we will create a new WeaponItem based on the Item Object whether it is a zombie's arm or a zombie's leg. If it is a zombie's arm we will create a new **ZombieClub.**Whereas a zombie's leg, we will create a new **ZombieMace.** After creating the WeaponItem, I will remove the zombie's leg / arm based on the which one the player used to craft from the player inventory.
- menuDescription() – in this method we will display a string of description that shows the actor has crafted into which weapon.

- Initially the CraftingAction constructor takes in a SimpleClub Object, now it takes in Item Object. Eg. CraftingAction(Item limb).

ZombieClub and ZombieMace class:

ZombieClub and ZombieMace class, both classes extend WeaponItem. They both contain zero parameter constructor and called the super class constructor which takes in the name of the weapon, displayChar of the weapon, damage of the weapon and the verb of the weapon. There will be no methods at this point like the Plank class. The name, displayChar, damage, and item we will set it ourself.

That's how I implement Crafting Weapon.

Advantages:

- CraftingAction is created so in the future if we want to craft multiple stuff into a single new stuff we can do that in CraftingAction class.
- ZombieMace and ZombieClub class implementation is just like the Plank class.
- Can craft into a stronger weapon make this game more interesting by also having multiple different weapons instead of just having one weapon (Plank).

Disadvantages:

- We only have an increase in damage for crafting weapons. Including some interesting skills such as every attack will heal the player some health or gain some movement speed.

Farmer and Food

When I'm implementing the Farmer and Food, I will create 7 classes which are **Farmer**, **FarmingBehaviour**, **FertiliseBehaviour**, **HarvestBehaviour**, **ConsumeAction**, **Crop**, and **Food** and **enum class** called **CropCapability** to handle the task given.

Farmer class is added which extends Human to implement what the farmer can do. It has an attribute called behaviors which is an array of Behavior Objects. It contains **FarmingBehaviour**, **FertiliseBehaviour**, **HarvestBehaviour** and **WanderBehaviour** where these behaviours show what the Farmer is able to do. The class Farmer has the following methods:

- playTurn(Actions actions, Action lastAction, GameMap map, Display display), to perform the action when the player turns starts.

In this class, there's a one parameter constructor called Farmer(String name), which takes in the name of the farmer. Then it will call the super class constructor to set the name, displayChar and hitpoints of the Farmer instance.

In the playTurn method, it will have a for each loop to loop through each behaviour and get the action of each individual behaviour by behavior.getAction(actor, map).

Instance variable:

- behaviours: ArrayList of Behaviour that stores the Behaviour Object that the farmer can do.

FarmingBehaviour, FertiliseBehaviour and HarvestBehaviour classes are created which extends Action and implements Behaviour. These classes are implemented in such a way what the Behaviour can do. In these classes they all have override same methods but with different bodies. These are the following classes with its methods:

FarmingBehaviour:

- getAction(Actor actor, GameMap map) – this method checks whether there is any Dirt beside the actor or where the actor is standing on. If there is, it will return this Farming action which sows a crop.
- execute(Actor actor, GameMap map) – this method set the Ground beside the actor to a new Ground called **Crop**(which is a newly added class). It was implemented to sow a crop on the ground and return a string of what the actor has done.

- menuDescription(Actor actor) – this method returns a String that displays the action the actor did in the console.

Instance variable:

- destination: Location that stores the location of where to sow the Crop.

FertiliseBehaviour:

- getAction(Actor actor, GameMap map) – this method checks whether the actor is standing on a Crop and the age of the Crop is < 20. If it is true, it will return this action which fertilises the Crop.
- execute(Actor actor, GameMap map) – this method will fertilise the Crop and return a String of what the actor has done.
- menuDescription(Actor actor) – this method returns a String that displays the action the actor did in the console.

Instance variable:

- destination: Location that stores the location of where to fertilise the Crop.

HarvestBehaviour:

- getAction(Actor actor, GameMap map) – this method checks whether the actor is a ripe Crop. If it is true, it will return this action which harvest the ripen crop into Food.
- execute(Actor actor, GameMap map) – If the actor is Farmer, he/she will harvest the Crop by removing it from the ground and changing the Ground back to Dirt and finally drop the Food on the Ground. If the actor is Player, he/she will harvest the Crop by removing it from the Ground and changing the Ground back to Dirt and finally putting it into his inventory. Lastly, return a String of what the actor has done.
- menuDescription(Actor actor) – return a String that displays the action the actor did in the console.

Instance Variable:

- destination: Location, that stores the location of which Crop to harvest.

Food class is newly added and extends Items. It has an instance variable which is Health and it shows the amount of health the actor will gain when the actor eats it. This is the following method of the Food class:

- getHealth() – a getter that gets the amount of health will be regenerated when the damaged Human or player consumed it.

Instance variable:

- healthGained: int that stores the health that will be gained from the food.

ConsumeAction is a newly added class and extends Action.The class implementation is to show how consumed action is done. In this class, it has instance variables of Food that initialize the food that the actor eats. These are the following methods implemented in ConsumedAction class:

- execute(Actor actor, GameMap map) - an overridden method that implements how the damage human/player consumed the Food, it will heal the actor by the amount of health contains in the food and remove it from the Ground or player inventory depends on which actor is consuming it and returns a string of the player consumed the Food.
- menuDescription(Actor actor) - an overridden method which returns a String to display the actor consumed the food.

Instance variable:

- food: Food that stores the food to be consumed by the actor.

A **Crop** class is added and extends the Ground. It has a zero parameter constructor which then calls the super class constructor to initialise the value. The contains the following methods:

- tick(), which decrements the age of the crop by one every turn and checks whether the age of the Crop is 20. If it is 20, then it will change the CropCapability to RIPE.
- fertilise(), which decrease the time left (age) to be ripen by 10 turns
- getAge(), which returns the age of the crop.

Instance Variable:

- age: int, that store the age of the Crop.

We then create an enum class called CropCapability to determine whether the crop is RIPE or UNRIPE.

There are few classes I have changed which are **Human**, **Player** and **Application**.

Human Class:

In the method of playTurn(), I will check if the human is damaged or not. If the human is damaged and he/she is standing on a Food, then it will return an Action called ConsumeAction that the Human will eat the food on the ground to regain some health back by calling the heal() method.

Player Class:

In the Player class I will add a new instance variable in the class which is an array of Behaviours. I choose array because if in the future the player can have more behaviour we can just add it in. I will add a HarvestBehaviour into it to allow the Player to have the HarvestBehaviour so that the player can harvest the ripe crop and put it inside the player inventory. Then in playTurn() method, I will check whether the player inventory contains food. If player inventory contains food then the player has the option whether the player wants to consume the food to regain some health.

Application Class:

In the application class I will add Farmer objects into the main method so that the farmer can be inside the game.

Advantage:

- Can display what the farmer did in that turn in the console.
- Farmers can have more unique actions and behaviours to be implemented in the future.
- Farmers can farm crops and be eaten by players so they can gain some health back.

Disadvantages:

- The farmer can only do one task at one turn. Maybe if it can fertilise and wander at the same time will make the game more interesting.
- Did not display the farmer's health and the turns left for the crop to ripe in the console.

FIT2099 - Update Design Rationale for Assignment 2

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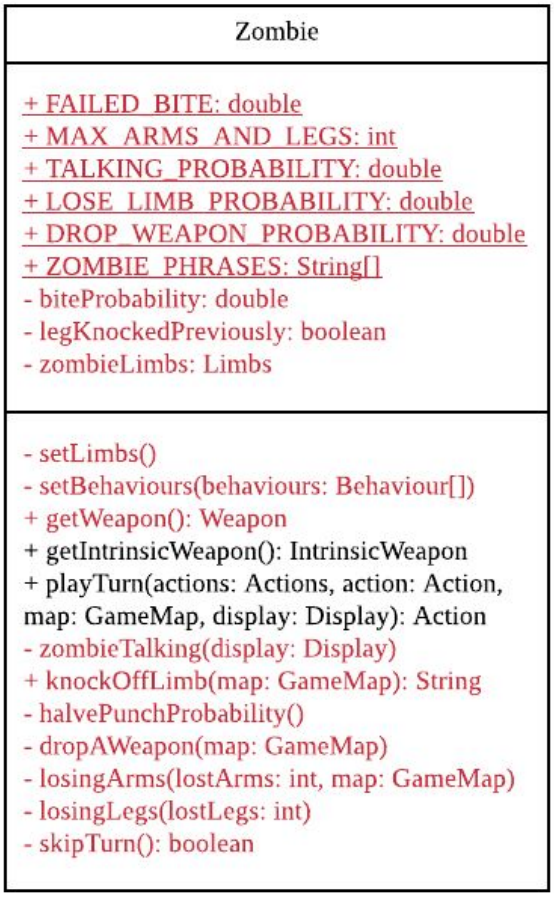
Old Classes Modified

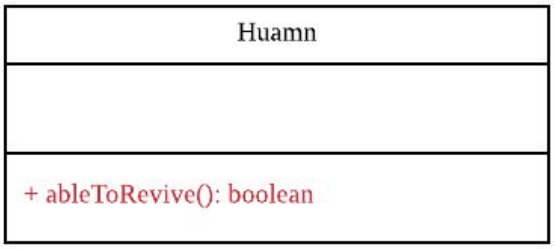
The words in **red** indicate a new variable/method being added into the class, whereas words in **black** indicate extending an already existing method.



- Declare **FAILED_BITE**, **MAX_ARMS_AND_LEGS**, **TALKING_PROBABILITY**, **LOSE_LIMB_PROBABILITY**, **DROP_WEAPON_PROBABILITY** & **ZOMBIE_PHRASES** as static final constant as all Zombie objects shares the same attributes and that it helps reduce embedded literals in source code.

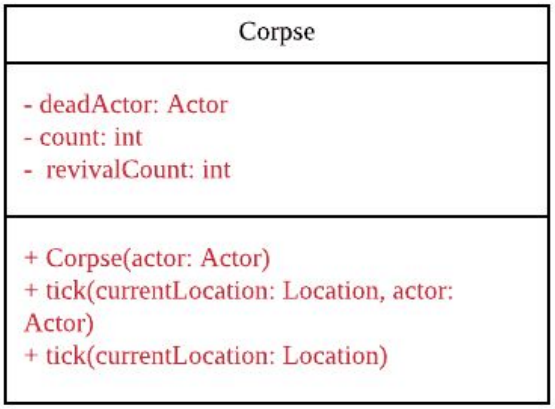
- A **typeOfZombieActor** attribute which indicates the type of ZombieActor this is (e.g. a player, zombie, etc)
- A **rand** attribute to generate random numbers used for determining the chances of a successful attack by the ZombieActor.

- A **getWeapon** override method which gets the player's preferred choices weapon and determines whether it misses while using that weapon to fight.



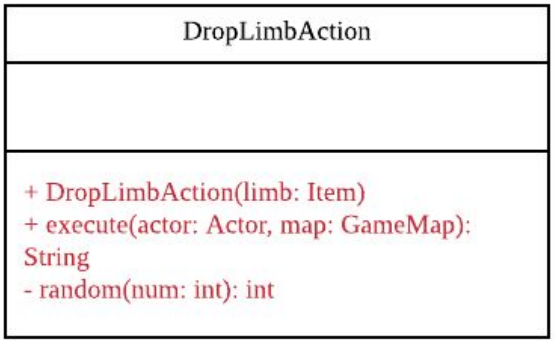
- An **ableToRevive** override method that indicates humans ability to rise from the dead because it can only be attacked/killed by zombies.

<u>New Classes Added/Extended</u>
The words in **red** indicate a new variable/method being added into the class, whereas words in **black** indicate extending an already existing variable/method.

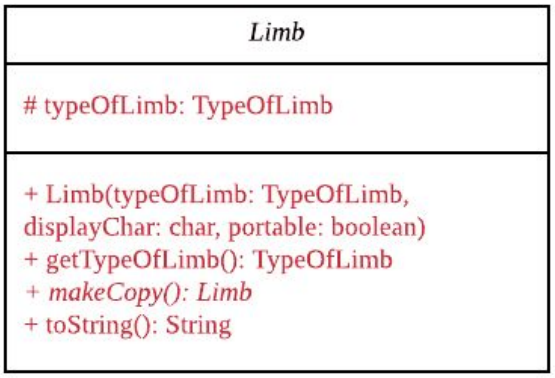


- A **Corpse** extends a **PortableItem**.
- A **count** attribute keeps track of the number of game time passed.
- A **revivalCount** attribute is assigned a value between 5-10 upon instantiation of a Corpse object.
- A **Corpse constructor** method that takes in the actor that has died.

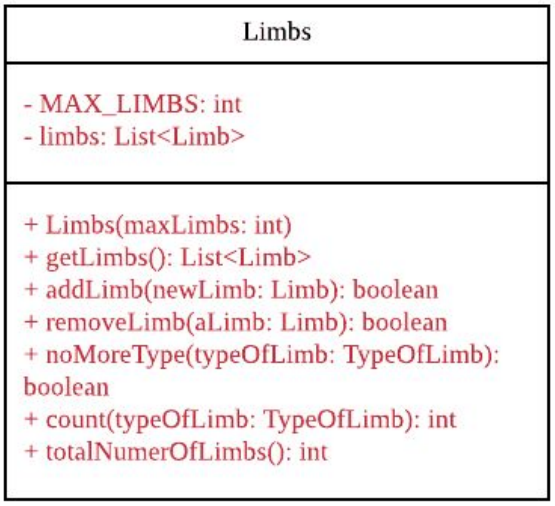
- A **tick** override method that has parameters currentLocation and actor which implements how a Corpse may be converted into a new Zombie.
- A **tick** override method that has parameter currentLocation which implements how a Corpse may be converted into a new Zombie.



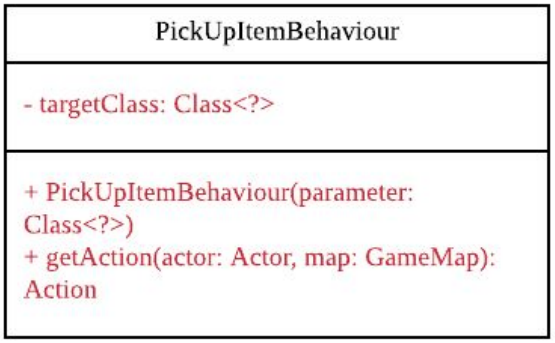
- A **DropLimbAction** extends a **DropItemAction**
- An **execute** override method that drops the item specified.
- A **DropLimbAction constructor** method that takes in the limb item to be dropped.
- A **random** method is created to help determine a random location (either adjacent to the actor's current position or on it) in the execute method.



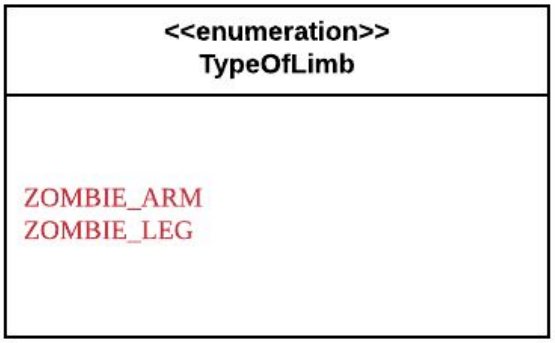
- A **typeOfLimb** attribute which stores the type of limb.
- A **getTypeOfLimb** method which returns the type of limb this object is.
- A **Limb constructor** method that takes in the type of limb it is.
- A **makeCopy** abstract method to get a copy of this Limb and referenced by this class.



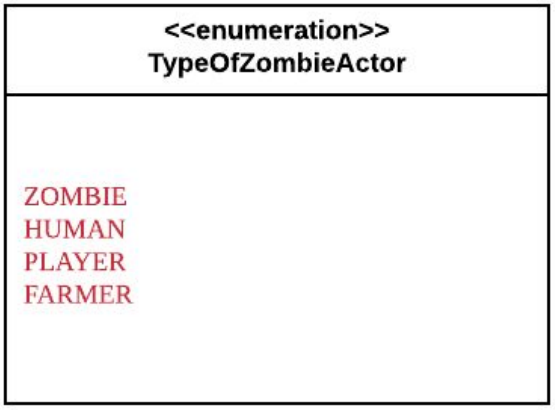
- A **MAX_LIMBS** final attribute to determine the maximum number of limbs allowed.
- A **limbs** attribute to keep a collection of the limb objects.
- A **Limbs constructor** method that takes in the maximum number of limbs.
- A **getLimbs** method to get an unmodifiable list of the collection of limb objects.
- An **addLimb** method to add a limb to the collection of limb objects.
- A **removeLimb** method to remove a specified limb from the collection of limb objects.
- A **noMoreType** method to determine whether this Limbs still has a certain type of Limb object.
- A **count** method to count the number of a certain type of limb.
- A **totalNumberOfLimbs** method to get the total number of limb objects in the collection.



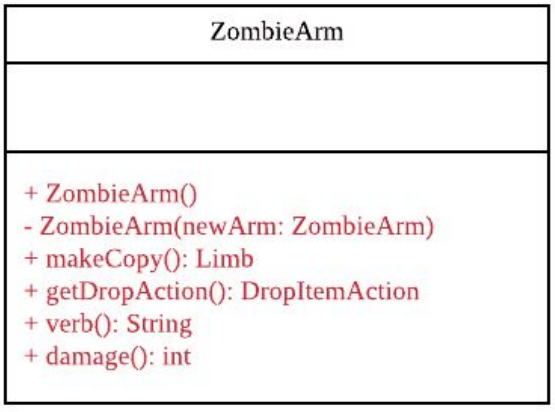
- A **PickUpItemBehaviour** implements a **Behaviour**.
- A generic **targetClass** attribute which determines the type of Item to pick up.
- A **PickUpItemBehaviour constructor** method that takes in the kind of item to be picked.
- A **getAction** override method which only picks up an Item specified by **targetClass**.



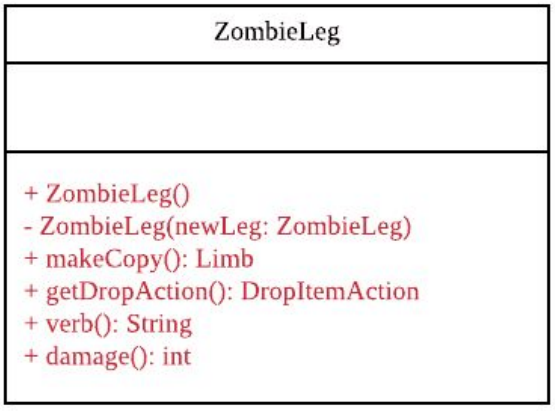
- A **TypeOfLimb** enum class that defines the type of **Limb** there is.
- Currently defines 2 constant values, **ZOMBIE_ARM** & **ZOMBIE_LEG** as types of limb.



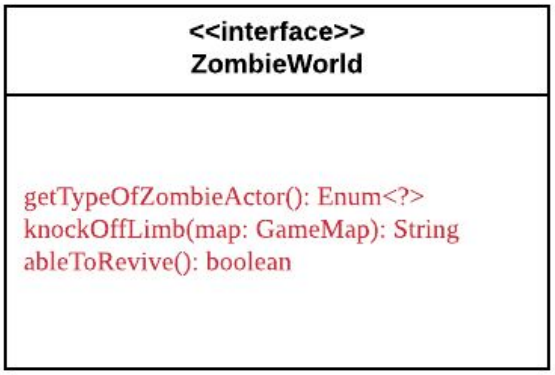
- A **TypeOfZombieActor** enum class that defines the different types of **ZombieActors** in the ZombieWorld.
- Currently defines **ZOMBIE**, **HUMAN**, **PLAYER** & **FARMER** as different types of ZombieActors in the ZombieWorld.



- A **ZombieArm** class that extends and implements a **Limb** & **Weapon** class respectively.
- A **ZombieArm constructor** method to create a ZombieArm object.
- A **ZombieArm copy constructor** method to make a copy of a ZombieArm object.
- A **getDropAction** override method to return a **DropLimbAction**.
- A **verb** method implemented to determine the verb used when this Limb is used as a weapon item.
- A **damage** method implemented to determine the amount of damage dealt by this Limb weapon item.



- A **ZombieLeg** class that extends and implements a **Limb** & **Weapon** class respectively.
- A **ZombieLeg constructor** method to create a ZombieLeg object.
- A **ZombieLeg copy constructor** method to make a copy of a ZombieLeg object.
- A **getDropAction** override method to return a **DropLimbAction**.
- A **verb** method implemented to determine the verb used when this Limb is used as a weapon item.
- A **damage** method implemented to determine the amount of damage dealt by this Limb weapon item.



- A **ZombieWorld** interface used to show what an Actor of the ZombieWorld game can do.

- A **getTypeOfZombieActor** method which returns the type of actor.
- A **knockOffLimb** default method which determines the behaviour of losing a limb if an actor has a limb.
- An **ableToRevive** default method which indicates this actor's ability to rise from the dead.

How are these classes used to implement the features described in the Assignment:

From the **Zombie Attacks** questions,

1) Zombies should be able to bite. Give the Zombie a bite attack as well, with a 50% probability of using this instead of their normal attack. The bite attack should have a lower chance of hitting than the punch attack, but do more damage – experiment with combinations of hit probability and damage that make the game fun and challenging. (You can experiment with the bite probability too, if you like.)
    a) Override the getWeapon method in both the Zombie & Player classes to also determine the chances of the actors missing its target while fighting besides getting its preferred choice of weapon.
    b) Extend the getIntrinsicWeapon method in the Zombie class to create a new bite IntrinsicWeapon and determine the chances of using it by comparing a randomly generated number with biteProbability.
    c) Override the getWeapon method in the Zombie class to include a check for a bite IntrinsicWeapon. If it's a bite, determine whether its bite attack is successful by comparing with FAILED_BITE.
    d) Override the getWeapon method in the Player class to determine its chances of missing its target.
    e) Designed it this way because:
        i) Zombie chances of using its bite intrinsic weapon and its chances of biting successfully is encapsulated inside the Zombie.
        ii) Player's chances of missing while fighting is encapsulated inside the Player's class.
        iii) Avoid dependencies and making use of polymorphic code by overriding already existing methods to implement behaviours specific only towards a Zombie.
        iv) Reusing the IntrinsicWeapon class to create a bite intrinsic weapon reduces duplicated codes.
2) A successful bite attack restores 5 health points to the Zombie
    a) While checking for a successful bite in the getWeapon method of the Zombie class, if the bite was successful, reuse the heal method to gain hitpoints.
    b) Designed it this way because:
        i) Only a Zombie will be able to heal after a bite attack, therefore encapsulating such behaviours specific only to a Zombie inside its own class.
        ii) Reusing existing methods, thus reducing duplicated codes.

3) If there is a weapon at the Zombie's location when its turn starts, the Zombie should pick it up. This means that the Zombie will use that weapon instead of its intrinsic punch attack (e.g. it might "slash" or "hit" depending on the weapon)
    a) Inside the Zombie class, add a new PickUpItemBehaviour object to the behaviours array. Ensure to pass the parameter Weapon.class during the instantiation process.
    b) For every play turn, if there's a weapon item, it will pick it up.
    c) Designed it this way because:
        i) Makes use of already existing methods to implement the behaviour of picking up weapons through the playTurn method.
        ii) May reuse the PickUpItemBehaviour class for other Actors to implement picking up item behaviours.
4) Every turn, each Zombie should have a 10% chance of saying "Braaaaains" (or something similarly Zombie-like)
    a) Inside the Zombie class, create a new method zombieTalking which determines the chances of saying something by comparing a randomly generated number with TALKING_PROBABILITY. If successful, it will randomly say a phrase specified in ZOMBIE_PHRASES.
    b) Designed it this way because:
        i) Only Zombies are able to say zombie-like phrases, hence encapsulating this property unique to a Zombie inside of the Zombie class.

From the **Beating Up Zombies** questions,

1) Any attack on a Zombie that causes damage has a chance to knock at least one of its limbs off (I suggest 25% but feel free to experiment with the probabilities to make it more fun)
    a) Create a new ZombieWorld interface with a default knockOffLimb method which returns null since not all ZombieActors have limbs and are able to have its limbs knocked off.
    b) Override the knockOffLimb in the Zombie class to determine the chances of knocking off a Zombie limb by comparing a randomly generated number with LOSE_LIMB_PROBABILITY.
    c) If successful, the Zombie gets a copy of all the limbs it has and randomly removes any limbs by generating a random number to specify the number of limbs to be knocked off.
    d) Designed it this way because:
        i) To avoid downcasting of data types by making a knockOffLimb interface and make use of polymorphism.
        ii) This behaviour is again unique only to Zombies, hence override the knockOffLimb method to implement its own behaviours of having its limbs knocked off. This helps reduce dependencies.
2) On creation, a Zombie has two arms and two legs. It cannot lose more than these.
    a) Add a new Limbs attribute, zombieLimbs, to the Zombie class that models a Zombie who has a collection of limbs.

b) In the Zombie class, create a new method setLimbs which adds ZombieArm & ZombieLeg objects, within the range of MAX_ARMS_AND_LEGS, which equals 2.
c) Every time the Zombie knockOffLimb method is called, it checks first whether the Zombie still has limbs.
d) Designed it this way because:
    i) Limbs class can be reused for other Actors (in case asked to implement) which can help reduce duplicate codes in the future.
    ii) Have the setLimbs method declared private to make sure this operation can only be performed by the Zombie (because Zombie's only have 2 arms and 2 legs)

3) If a Zombie loses one arm, its probability of punching (rather than biting) is halved and it has a 50% chance of dropping any weapon it is holding. If it loses both arms, it definitely drops any weapon it was holding.
    a) In the Zombie class, create a private method losingArms which helps implement the consequences of a Zombie losing 1 arm or both arms.
    b) Then, we also create a method dropAWeapon which helps drop the first occurence of a weapon item in the Zombie's inventory.
    c) Next, we create a method halvePunchProbability which reduces the probability of using the Zombie's punch intrinsic weapon by increasing the biteProbability variable.
    d) If lost 1 arm, calls halvePunchProbability while comparing a random generated number to DROP_WEAPON_PROBABILITY before calling dropAWeapon.
    e) If it loses both arms, it resets the behaviours attribute through the setBehaviours method to remove the PickUpItemBehaviour of a Zombie.
    f) In the Zombie class, after successfully knocking a Limb in knockOffLimb, it calls the losingArms method to implement the consequences.
    g) Designed it this way because:
        i) The consequences as a result of a Zombie losing an arm should be encapsulated within the Zombie class (i.e. this property/behaviour is unique to a Zombie only).
        ii) Created several methods to help modularise code so that methods don't become overly huge and easily maintainable.

4) If it loses one leg, its movement speed is halved – that is, it can only move every second turn, although it can still perform other actions such as biting and punching (assuming it's still got at least one arm)
    a) In the Zombie class, create a private method losingLegs which helps implement the consequences of a Zombie losing 1 leg or both legs.
    b) Then, we create a new attribute legKnockedPreviously to keep track of whether the Zombie had its leg knocked off by another Actor during an attack.
    c) Next, we create a method skipTurn that depending on the state of legKnockedPreviously, determines whether to skip a turn.
    d) If a Zombie loses a leg, it sets the legKnockedPreviously attribute to a value of true, which will be used in the skipTurn method to determine whether to skip a turn.

e) In the Zombie class, after successfully knocking a Limb in knockOffLimb, it calls the losingLegs method to implement the consequences.
f) In the playTurn method of the Zombie class, there is a call to the skipTurn method to determine whether to skip a turn by returning a DoNothingAction.
g) Designed it this way because:
    i) Again, the consequences as a result of a Zombie losing a leg should be encapsulated within the Zombie class (i.e. this property/behaviour is unique to a Zombie only).
    ii) Makes use of existing methods to skip a turn while creating new methods to help implement the behaviour.
    iii) Created several methods to help modularise code so that methods don't become overly huge and easily maintainable.

5) If it loses both legs, it cannot move at all, although it can still bite and punch
    a) Inside of the losingLegs method of the Zombie class, if it loses both legs, it resets the behaviours attribute (similar to how loseArms method did as well) through the setBehaviours method, which will remove the Zombie's ability to Wander and Hunt.
    b) Designed it this way because:
        i) To keep things simple
        ii) Make use of existing methods to implement this behaviour, reducing duplicated codes.
6) Lost limbs drop to the ground, either at the Zombie's location or at an adjacent location (whichever you feel is more fun and interesting)
    a) A ZombieArm & ZombieLeg both extends a Limb and implements a Weapon. Hence we override the getDropAction method of the Item abstract class for both classes to return a DropLimbAction (which will determine a random location adjacent to the Zombie or the current location) to drop the ZombieArm or ZombieLeg.
    b) Inside the knockOffLimb method of the Zombie class, while removing a limb from limbs, we will get a drop action by calling the getDropAction method and execute the action to drop the limb.
    c) Designed it this way because:
        i) Avoid downcasting by overriding existing methods to make use of polymorphic code, which can also help reduce unnecessary dependencies.
        ii) The DropLimbAction extends a DropItemAction, and this helps encapsulate its property of dropping a limb at a random location within it. This also prevents duplicated code by inheriting already existing ones.
7) Cast-off Zombie limbs can be wielded as simple clubs – you decide on the amount of damage they can do
    a) Since both ZombieArm & ZombieLeg objects are Items and Weapons, we are able to pick up these objects using the getPickUpAction of the Item class.
    b) Since both ZombieArm & ZombieLeg implement Weapon, they both have unique damages when using it.
    c) Designed it this way because:

i) Make use existing methods from the Item class, hence reducing duplicated codes.
ii) Only ZombieArm & ZombieLeg can be used as weapons, hence the reason both classes implement Weapon. This makes ZombieArm and ZombieLeg special limbs with its own attributes and capabilities.

From the **Rising from the Dead** questions,

1) As everybody knows, if you're killed by a Zombie, you become a Zombie yourself. After a Human is killed, and its corpse should rise from the dead as a Zombie 5-10 turns later.
    a) Create a new Corpse class that extends a PortableItem (since a corpse was previously a PortableItem).
    b) In the Corpse class, we override the tick method to implement the behaviour of having a killed Human Actor become a Zombie after 5-10 turns by creating a new Zombie.
    c) Upon instantiation of a new Corpse, a count and revivalCount variables are initialised to 0 and a random number between 5-10 respectively, to help keep track of the game time that has passed by.
    d) If a Corpse is in an Actor's inventory or when an Actor is standing on a location with a Corpse, it will create a new Zombie at a location adjacent to its current location.
    e) Determines whether an Actor can be revived if the ableToRevive method of the ZombieWorld interface and that this actor is of type human.
    f) Designed it this way because:
        i) We can then encapsulate the behaviours of a corpse within its own class. This will help maintainability of the class.
        ii) We override methods to make use of polymorphic code to prevent downcasting and reduce dependencies.