**Design Rational for Assignment 1**

1. **ZombieAttackActionclass**

This class is created that extends the class to accommodate the need for zombie to decrease their probability of punch when they lose one or both their limb. Modifying the code at AttackAction class has a high risk of breaking it, because some major changes are needed in the execute method, making a new class shorten the code. The reason we have not created an AttackBehaviour class for zombie is that, if human class were to be able to attack in the future, a simple if and else statement to return action from different attack action class( AttackAction and ZombieAttackAction) is all that we need, hence we think that making an new class for that is unnecessary and will create a lot of redundant code.

1. **WeaponLeg and WeaponHand**

This class is created to create a weapon obtained from fallen zombie’s limb. It inherits the WeaponItem class. We created this class, to make it easier to create an instance of this weapon every time a zombie’s limb fall off. This allow us to instantiate this item onto a location of the game map easily as well as allowing any actor to pick it up as a weapon. It will be used in the in the *hurt* method in the zombie class, where every time a zombie is hurt, it will call a method from limb class to have a probability of knocking off a hand

1. **BiteAction**

A new class for bite action is created and it will be implemented inside the GetIntrinsicWeapon method to add the probability of having a bite attack. The reason it is added here instead of adding it to the weapon because biting it’s an attack from a part of the zombie (i.e. not weapon), hence its more suitable to have it in the *GetIntrinsicWeapon* method. This class will increase modularity and extensivity of the code, where if any other actor requires the bite action, we can reuse this class.

1. **Zombie saying ‘Brainns’**

The probability of the zombies saying brains is implemented in the playTurn function where in every turn it takes it will have a probability of saying ‘Brainns’. This is implemented in playTurn instead of making it an action because, in every turn an actor can only take one action. We decided that we should not waste a turn for zombie just to say ‘Brainns’, so at the start of each turn the zombie will have a 10% chance of saying ‘Brainns’.

1. **Limb class**

A class limb that keeps track of the number of limbs a zombie has left is created instead of putting a counter in the zombie class. This follows the design principle that ‘classes should be responsible for their own properties’, where in this case, the purpose of this class is to keep track of a zombie’s limb. This makes future code refactoring easier.

This class is also responsible of knocking off a zombie arm, because the number of limbs of a zombie is kept here, hence modifying it will be easier. In addition to that, a method is created to have the probability of dropping weapon the zombie is holding whenever the function to knock of zombie arm is called. Again, this follows the principle where ‘class should be responsible for their own properties’ because everything related to zombie’s broken limb a placed inside this class.

1. **ZombieMoveBehaviour**This classes are implemented in the Zombie Behaviour array to replace the HuntBehaviour and WanderBehaviour. This class is created to allow easier control of movement control of the zombie when a zombie has a broken leg. Creating this class also allow easier testing because this class is not related to other method(e.g. if this class is not created and we use HuntBehaviour and WanderBehaviour in zombie class, its hard to test if the output is of that we require because it’s called in playTurn method, which does a series of complex computing before calling them and making debugging much more harder).

This class also has method canMove() is created to check if a zombie is allowed to perform any move action in this round if it has a broken leg.

1. **Corpse (Rising from the dead)**

A corpse object from the Corpse class is created when an AttackAction from the zombie class is acted upon Human classes from its playTurn action. A Corpse class is extended from PortableAction class because from the current game design and forum discussions, it has been clarified that a corpse object should be portable. After 10-20 rounds based on some probability calculations, it will create a Zombie object. The reason for having a Corpse class is to allow reusability of multiple Corpse object to have its own individual ticks.

1. **CraftAction, ZombieClub, ZombieMace (Crafting weapons)**

From the current source files, we found out that many of the class objects were created as a result of actions such as corpse object being created from AttackActions class. To justify our design reasonings, we have decided to create a new class CraftAction for extensibility purposes and allowing ZombieClub and ZombieMace objects to be created through this action.

When a ZombieLeg or ZombieHand object is instantiated, CraftAction is passed in as the fourth parameter in Item constructor as an allowableActions attribute. This allows the Player to craft weapons from ZombieLeg and ZombieHand into ZombieMace and ZombieClub respectively. ZombieClub and ZombieMace are extended from WeaponItem class. With this design implementation, Non-Player Characters will not be able to utilize CraftAction

1. **Farmer, FarmBehaviour(SowAction, FertilizeAction, HarvestAction), Crop, Food, HealBehaviour(HealAction) (Farmers and food)**

We have decided to create several new actions for the Farmer and Player class. SowAction, FertilizeAction and HarvestAction are extended from the Action class and is used to interact with Location of Ground object to produce Crop objects. We have allowed only the Farmer class to have FarmBehaviour which consists of SowAction, FertilizeAction and HarvestAction while Player will have HarvestAction as required which can be retrieved from Crop.allowableActions(). If there were to be multiple Farmer objects, they would reuse this behaviour and I will not have to repeat any codes.

A SowAction will have a 33% chance of creating a Crop object where the farmer will sow a seed onto nearby dirt that is unoccupied by Crop object. A SowAction will have an attribute of Location to determine whether a Crop should be sow. This allows me to utilize Fail Fast design if a Crop object should not be sown in the current location.

FertilizeAction class is created to allow Farmers to fertilize the crops and reducing the time left to ripe by 10 turns. FertlizeAction has Crop object attributes to determine if there are Crops objects.

HarvestAction class is used to act upon Crop objects that are ripe and will return a new Food object which can be used by heal method from Actor class to restore health points. This action also has Crop object as an attribute which checks if the crop is ripe before it is allowed to harvest.

The Crop class is extended from Ground class as it contains many of the required methods to determine whether the crops is ripe from the tick method. Other methods such as canActorEnter() and getDisplayChar() is useful for UI purposes.

Food class objects are created from HarvestAction by Farmer and Player class and is used for healing. They are extended from PortableItem class as the Player should be able to carry the Food object in its inventory.

HealAction is a new Action stored within a new Behaviour called HealBehaviour. From the original design documentation, we found out that Humans actions are based on its behaviour. Therefore, we have decided to introduce HealBehaviour to allow HealAction to be called when a damaged Human decides to recover some health points. This design implementation improves the Human AI instead of wandering around where HealBehaviour should be prioritize over wandering. With this design implementation, Player which is an extension of Human class should be able to heal.

We have decided to include many new classes to allow further extensibility to the game engine such as having the possibility of having multiple new Crop objects implementation which produces different kinds of Food object that heals for a different amount. Attributes are assigned to the newly introduced actions to allow Fail Fast design implementation.

These designs also reduce dependencies as much as possible, for example, method that are used by zombie only are implemented inside zombie class. We also try keep our code simple and clean to increase readability by splitting the longer method into smaller sub – method whenever possible.