# Design Rationale for Requirement 1: Let it Grow!

## Explanation of system

This system controls the trees and their actions. We have 3 types of trees: sprouts, saplings, and matures. Their core action is growing: the sprout is able to grow into a sapling after 10 turns, and the saplings are able to grow into matures after 10 turns. The matures also spread a new sprout every 5 turns, but also has a 20% chance to wither and die each turn, turning into dirt. Additionally, the sprouts are able to spawn goombas at a 10% chance each turn, the saplings can drop coins at 10% each turn, and the matures are able to spawn koopas at 15% chance each turn.

## Choice

Making Tree an abstract class

## Justification

This enables the efficient creation of multiple different sub-classes of tree, namely the sprout, sapling and mature trees. Their common/shared attributes and functionality can be inherited from the base Tree class, which supports the Don’t Repeat Yourself (DRY) principle and reduces redundancy.

## Choice

Addition of the Sprout, Sapling and Mature sub-classes of Tree

## Justification

These new sub-types of trees will have different functionality that distinguish them from each other. Their shared attributes and functionality will be inherited from the parent class Tree.

## Choice

Using an interface GrowCapable to provide the functionality for certain trees to grow.

## Justification

This implements the DRY principle, as by using an interface we are reducing redundancy of defining the similar method for each class. Instead, they can each have their own implementation of the single method under the same function name. It also supports the Open-Closed Principle from the SOLID principles of object-oriented design, as by using this interface to create the grow function, we are opening the system for the extension of adding new types of trees in the future that may use this method but closing the existing types of trees for modification.

## Choice

Actors will be stored in locations

## Justification

We decided that we will track the actors’ locations by moving the actor objects between different locations. This will include storing them in sub-types of locations, such as trees, dirt and floors. This will enable easy movement between locations, as well as helping provide the functionalities of stopping trees from spawning new actors when an actor is already standing on them.

# Design Rationale for Requirement 5: Trading

## Explanation of system

This system enables the trading functionality, by which the player can interact with Toad, and trade coins for useful items. The system involves Toad’s interactions, which can be to speak to the player, or trade with the player. It also shows that items can be held by Toad, and when traded for can be transferred to the player. (Note: items can also be found on the ground). It also shows that the player can collect coins while playing, and their value will be added to the player’s wallet.

## Choice

Adding Toad as a new actor

## Justification

Toad is a friendly NPC actor who can be interacted with by Mario. He can speak to Mario, or trade with him.

## Choice

Giving Toad the interactions of speaking and trading

## Justification

Toad is given 2 actions, speaking with Mario or trading with Mario. These actions are their own classes, but are extended by the ToadAction class, which will include the shared attributes and functionality that all of Toad’s actions need. This supports the Don’t Repeat Yourself (DRY) principle as we are using inheritance and abstract classes to reduce the redundancy of code, as well as the Open-Closed Principle from SOLID principles, as future actions can easily be implemented by extending from the parent class ToadAction.

## Choice

The Trade function

## Justification

The trade function allows the player to trade coins to Toad, in exchange for a useful item. This is done by checking and subtracting an amount of coins from Mario’s wallet, and moving the item from Toad’s inventory to Mario’s or instantly using it.

## Choice

Movement and storage of Items

## Justification

Items can be stored in Toad’s inventory, or Mario’s inventory when traded for, or can be randomly found on the ground. Items can be moved between these 3 storage locations, and can be used by the player when in Mario’s inventory.

## Choice

Collecting and tracking of Coins

## Justification

Coin objects can be picked up from the ground or from sapling trees that spawned them. When picked up by Mario, the coin object will be removed, and the value of the coin will be added to Mario’s wallet. The wallet will only be an attribute of Mario’s player character, and so the coins are no longer necessary. We decided to implement the collection of coins this way as it is the most efficient since we do not have to store extra objects, and does not lose any functionality as the coin objects are no longer needed after being collected.

# Design Rationale for Requirement 7: Reset Game

## Explanation of system

This system enables the game reset functionality, which the player can use once per playthrough, to clear an overwhelming map. Resetting the game will have the following effects:

* Trees have a 50% chance to be converted back to Dirt
* All enemies are killed.
* Reset player status (e.g., from Super Mushroom and Power Star)
* Heal player to maximum
* Remove all coins on the ground (Super Mushrooms and Power Stars may stay).

## Choice

ResetManager class

## Justification

This class is the core class that upon being called, resets the various parts of the game. This class will call methods that access data from all across the system to reset them as needed.

## Choice

Resettable interface

## Justification

This class is used in order to track whether the game has already been reset or not. If the game has been reset before, it cannot be reset again.

## Choice

Removing trees

## Justification

When the reset is called, all trees have a 50% chance to be converted back to dirt. This includes any sub-class of the Tree abstract class, namely sprouts, saplings, or mature trees.

## Choice

Removing coins and killing enemies

## Justification

These are done with quite standard implementation. Any coins on the map when reset is called are removed. The player’s coins however, are maintained. Any enemies on the map are instantly killed/removed.

## Choice

Changing player health and status

## Justification

When reset is called, the player’s current health should be reset to its maximum value. This may differ from the starting value, if the player has increased their maximum health through items such as the Super Mushroom. Any Status effects on the player at the time of reset, should also be cleared. This includes buffs from the Power Star, or Super Mushroom.