**UML Documentation**

**Modeling and Simulation**

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**Class Relationships**

**Introduction**

The following design documentation presents the various relationships that exist between different classes and functions found within the Modeling and Simulation project. This document also serves to help better understand the overall structure of the UML diagram which shows a flow of processes found within this project.

**Project Synopsis**

The overall purpose of the project is to present and model the golf course pace of play issue that is frequently encountered due to the imperfection of human’s unorderly way of life. Specifically speaking, when a group of four golfers go on a morning, afternoon, or evening retreat to the course, the game serves much so as a source of enjoyment that supersedes the need to keep pace. Because of this, we run into the issues of slow play amongst golfers. This is a known issue that might be one of the leading causes of hemorrhaging money in golf courses across the world. This model and simulation implement a queue that queues carts together directly into individual groups and studies their pace through a round. If there is an instance that the groups go over the standard average time that it takes to complete a hole of either par 3,4, or 5, then this time gets tracked. Once that time exceeds 5 minutes, then a marshal is sent out to the group to reduce their time.

mod\_sim.py

This file contains the main, get\_par\_wait\_time(), def play\_hole(), def send\_cart\_to\_course(), def cart\_recieve(), def cart\_return(). Altogether, these functions’ purposes are to find the time that it takes in wait, use the environment to simulate a group playing a hole, send carts to the course, give the carts to golfers, and return the carts back to the cart barn.

course\_operator.py

This file contains the get\_par\_wait\_time(), detect\_slow(), and send\_marshal() functions. These functions serve to call upon and get the wait times per hole, detect when a group is playing slow, and send the marshal out to reduce time.

hole\_queue.py

This file contains the start\_hole() and show\_group() functions that add the carts to the course queue and allows the operator of the program to retrieve information on the groups on the course if necessary.

hole\_par.py

This file contains the par\_3(), par\_4(), and par\_5() functions that gives the random values that are used to represent the time it takes for the groups to individually finish each hole.

golf\_course.py

This file contains the progress\_group() function that allows the group to proceed to the next hole.

clubhouse.py

This file contains the add\_cart() and remove\_cart() functions that allows the ModSim functions that execute this process complete the task of sending and receiving carts.

**Course Relationship**

Course Queue – Cart Barn/Groups

This component is the component that manages the groups of golfers that are deployed out to the golf course at their own designated tee time.

The cart barn queue interacts with the rest of the holes of the course that are sequentially traversed by the groups that are deployed. This operates on a scheduled time to simulate the pace of play on the course using premeditated random values that are assigned to each group for the sake of the out of real world model and to display the disorderly nature of humans.

Course Queue – Clubhouse/Marshall

This component is the component that manages the marshal that is deployed out to the golf course when groups are playing slow and are holding others back from playing up to pace.

The clubhouse queue interacts with the slow groups and speeds them up upon need for them at an exceeded time limit of 5 minutes.

Once this takes place the program will reduce the time that the golfers have exceeded and the pace of play picks back up. This is done by using a subtraction function through the marshall class. Once the marshal detects that the function no longer has a time over the limit, then the golfers are free to keep playing from the marshal. The marshal then makes their way back to the clubhouse to monitor the play.

Holes 1 through 18

Each hole has a par number as a proper golf course does, a time to complete a round, and a counter that counts time exceeded over the course of a hole. These exceeded times are based off an average time that it should take each group to complete a hole based on its par number.

When each hole is completed, the groups travel to the next hole. Once they finish, they return to the cart barn to return the golf carts that they have used for the round. Each hole in the UML document will have a few other attributes like a function to monitor and keep track of certain groups.

The overall goals of this project are to display how the pace of play model works in the real world on a day when all carts are out on the course and every tee time is filled with groups of 4 in 2 carts. This serves as a good standardization for a particular course and shows that regardless of course layout, human error is a large contributing factor to the overall experience that the average golfer receives while playing.