CSC 481/591 Fall 16 Homework 3

Due: 11/10/16 by the start of class

Overview

Your task for this assignment is to add more functionality to your Processing engine. Specifically, you will focus on the addition of an event system and replays, which will require you to include a notion of game time in your engine system. As with previous assignments, you will be using Processing along with your existing engine code. You will submit your code and a writeup of your results, including screenshots where appropriate. This is an ***individual assignment***, you are to work alone. As always, you are expected to abide by the University's Academic Integrity Policy (`http://policies.ncsu.edu/policy/pol-11-35-01`), which includes providing appropriate attribution for all external sources of information consulted while working on this assignment.

There are 125 points available on this assignment. Students enrolled in 481 are required to complete Parts 1–3 and the writeup, but may also choose to complete Part 4. Students earning scores above 100 will receive a 100 on the assignment. Students enrolled in 591 are required to complete all 125 points, and will receive a grade as the percentage of the 125 points they earn. All students are required to submit the writeup addressing the sections of the assignment they have completed.

Part 1: Time (10 Pts)

The first part of the assignment is to implement an explicit representation of time. You are to have a timeline class, that is flexible enough to represent both real time and local time, can represent time at different scales (*i.e.*, real time vs. game time vs. loop iterations vs. *etc.*). Your class should support an adjustable tic size and enable anchoring your timeline to another, arbitrary timeline (or to some measure of real time).

Part 2: Event Management System (25 Pts)

For this part of the assignment, you are tasked with adding an event management system to your game engine. You must queue events, and must allow different priorities for different events. In order to make your priority system work, you will also need to keep track of game time and time stamp all of your events accordingly. Note that in addition to your event management architecture, you will have to implement an event representation that will allow you to easily raise and handle events. Further, due to the networked architecture of your engine, take care to ensure that your events are `Serializable`, or can be shared across the network in some way.

You will need to write an event manager class to keep track of which engine systems or game objects are registered to receive events of arbitrary types (registration), manage events of arbitrary types (during raising), and dispatch those events appropriately (handling). You should make use of your `Timeline` class in event management (most likely during raising to timestamp and during handling).

To demonstrate your event management system, create at least four types of events: character collision, character death, character spawn, and user input. Reimplement each of those functions of your game from assignment 2 using events and handlers. How did you implement and represent events? What changes to your design did you need to make to accomplish this? Which do you think will ultimately be more flexible?

Part 3: Replays (35 Pts)

Your next task is to use your event system and timeline capabilities to implement a replay system. You should be able to press a button to begin recording a replay, another button to terminate recording, and then select from at least three replay speeds ($\frac{1}{2}$ time, normal time, and double time). Note, the starting and stopping of recordings should be handled as events. You should support changing replay speeds (among your three defined speeds) at any time during the replay. When the replay is done, the system state should return to where it was prior to the replay and the engine should continue. To simplify things, you do not need to display the replay on multiple machines; however, you do need to have the characters from multiple clients reflected in the replay.

If your event management system is implemented with the appropriate flexibility, you should be able to simply record events in a log file and replay the log by raising events according to the correct (local) timeline. Here are a few things to consider:

- It may be advantageous to support "wildcard" registration in your event manager, so, for example, your replay system can register to be notified of every event.

- You will need to take care to ensure that the initial state of your replay is dealt with appropriately, perhaps by teleporting characters and objects on the screen (which should also be events!). You will also want to save their location so you can teleport them back after the replay is complete.

- You will also need to make sure that you timestamp events appropriately, so that you can control the timing of their replay.

Pay close attention to how your represent time. If you are successful at these tasks, your event management system should "handle" the rest and replays should require little more effort than teleporting objects, reading the log of events, and raising them at the appropriate time.

Note: You will definitely need to be careful about event chains, where handling of an event triggers another. In those cases, the replay event and the event raised due to the chaining may conflict. That's a boundary case you need to design for explicitly. You may find an explicit "age" in your event representation useful for this application.

Were you successful at that? What changes to your design did you have to make to get it working?

Part 4 (591 required, 481 optional): Synchronization (25 Pts)

Your task for this part of the assignment is to distribute event management across multiple machines (server and client(s)) and ensure that events are handled in a synchronized way using the CMB algorithm presented in class. Any event raised should be replicated across other machines in the network and each should handle the event locally. You should demonstrate your system by showing that replays work correctly on multiple machines simultaneously. Pay careful attention to whether or not you have a need for `null` messages.

Writeup (30 Pts)

Now that you have designed and implemented a number of engine components, write a 2-3 page paper summarizing your design. That is a minimum of 2 *FULL* single-spaced pages. It is **strongly** suggested that you do not limit yourself to only answering the questions posed in this assignment. Think creatively about what you have done. Why did you make the design decisions you made? What did they enable for this assignment? What will they enable in the future? The most successful writeups will contain evidence that

you have thought deeply about these decisions and implementations and what they can produce and have gone beyond what is written in the assignment.

As an appendix to your paper, please include all relevant screenshots to support your discussion. The appendix does not count toward your 2-3 page requirement.

What to Submit

By the start of class on 11/10/16, please upload to moodle a .zip file containing your Java and/or Processing code, a compiled executable of your system, a README file with compilation and run instructions, and a .pdf of your writeup. If you elected to use the Processing IDE, you may export the