

Texas Tech University
Department of Computer Science
Course: Object Oriented Programming
Professor: Dr. José Carranza-Rojas
Value: 25%
Individual project, or in pairs
Due date: Finals Week TBD, Fall, December 2024

Fall, 2024

Project 3 – Raiders versus Zombies



Zombies have come to our University! because, why not?

This project is about creating an automatic simulation of humans or raiders, trying to survive against a bunch of zombies as well as gathering resources for survival.

Simulating the Survival Game

In this OOP apocalyptic world, zombies and raiders are in a constant struggle to survive: humans need supplies, while zombies need to eat humans. The only safe place is the University, but humans also need to get out for supplies.

Humans

The idea of the simulation is to have multiple raiders (humans) from time to time at different parts of the map, who will try to run away from the zombies. In order to be safe, the humans can go to the University or sanctuary, a place where the zombies cannot get in, most likely because zombies are not interested in studying. The humans, however, will have the need to go out of the sanctuary/university when they need to eat or need some other resources. The time (human stamina) starts randomly different for each human and defines when they need to get out of the University to look for supplies. This means over the map, humans will try to reach food and other resources that appear randomly in the map, but also will run away from the zombies.

Zombies

The zombies on the other hand, will try to convert the humans into zombies all the time. When a human is converted into a zombie, they will start attacking other humans as well. Zombies also self-destruct after a certain time when their lifespan gets to 0, which varies from one zombie to another.

The University Sanctuary

The university also spans randomly in the map every now and then, which can be configurable as a range, with defaults. Then the humans can run towards any of the university sanctuaries that appear on the screen. University sanctuaries also have a timespan to make things more interesting. When they

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reach 0, they blow up leaving all its humans non protected, which means all of them will have to look for another sanctuary.

Decision Algorithms

The project must have 2 main algorithms to make decisions for humans and zombies. One must be completely random, but the other must make some fairly good decision based on something like distance to the goal, meaning, a zombie must look for the closest human, and human must look for the closest sanctuary or supply. Notice the concept is sort of the same, only the goal is different, which suggests that the underlying objects can benefit from common code.

Simulation Parameters

Here are some parameters that are needed to change the behavior of the simulation

- human velocity range: min and max numbers that define how fast humans can move, such as random velocity is added to their behavior inside such range.
- zombie velocity range: same, but for the zombies.
- initial number of zombies, initial number of humans.
- initial number of sanctuaries.
- Time range for cadence of humans, zombies and sanctuaries.
- Decision making algorithm for humans.
- Decision making algorithm for zombies.

User Interface

Here the UI is mandatory. If somebody does not finish the UI, it will most likely lead to a bad grade as it is important for the simulation viewing.

Thread utilization

Clearly, this project relies heavily on the usage of threads. Each object on screen will have its own thread, allowing it to behave separately from other objects or entities. Humans, zombies, and sanctuaries are all running on threads, and need to be aware of other objects to have a proper behavior. This also suggests that there may be an underlying common concept that runs a thread and has a certain lifespan.

Design

The simulation will follow some pattern design that allows to quickly update the UI based on the status of each object on screen in a separated fashion, such as MVC. The simulation has a certain number of raiders, zombies, sanctuaries and supply items at a given time, but that can constantly change. Also, the

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initial state of the simulation can be configured before running it, to start with different numbers of zombies, raiders, but also how often humans get hungry and need to get supplies.

It is also important to look for potential patterns that can be used for communication between objects, since each human instance needs to be aware of all closests zombies, supplies and sanctuaries to make decisions. Also the zombies need to be aware of humans to make decisions.

In terms of creation of new instances, the project requires the students to find a pattern that allows them to centralize the creation of different instances of the simulation, while referring to such instances using interfaces elsewhere.

It is expected to have pattern designs and heavy usage of interfaces, plus usage of SOLID principles. This is mandatory, NOT OPTIONAL.

Programming Language

The programming language is FREE to use as long as OOP is used. The UI is also free, students can choose any platform to create the system, as long as they have to deal with threads and instances. The language must also comply with interfaces, classes, and polymorphism.

Assessment

Task	Maximum Score
Modeling and Class Diagram (design patterns, interfaces, etc.)	20
Zombies (behavior, parameters, UI)	10
Humans (behavior, parameters, UI)	10
Sanctuaries (behavior, parameters, UI)	10
Supplies (behavior, parameters, UI)	10
Thread management	15
Random algorithm	10
Optimized algorithm	15