Milestone 4: Documentation
CSSE 375

Team Clingon
Vibha Alangar, Haley Heshelman, Daniel Verlaque

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Introduction

Centipede is a fixed shooter arcade game that was originally produced by Atari in 1980. This game is a student recreation of the classic arcade game with some modifications in game play from the original including new monsters and weapons.

This document contains the all documentation related to the recreation including a user guide, installation guide, configuration guide, etc. and will allow users to install, play, and maintain the game. In addition to user specific documents, this document also features developer documents such as software requirements specifications, a software architecture design specification, and information about the software test suite included in the downloaded .jar file.

User Guide (How to Play)

When the application is launched, the user will be brought to a start screen. After clicking start, the hero of the game (the ship) will be in the middle of the bottom row of the game window. The goal of this game is to survive all five levels, and get the highest score. There are a variety of obstacles and bonuses to pick up that can make it harder or easier to survive.

Moving

To move the ship, use the the four arrow keys. Press and hold the arrow keys to move in the given direction. Pressing two arrow arrow keys will cause the ship to move in a diagonal direction. The ship will move as far as the playable area will allow it. It can't get past the playable area. That is, if the user continues to hold the up arrow, the ship will move forward as far as the playable area, and then stop, as opposed to moving all the way up the screen.

Lives

The ship starts off with 3 lives, and each time the ship comes in contact with a monster, the ship will lose a life. If all the lives are lost, the game will end. The current number of lives is displayed at the bottom left of the game screen. If the ship dies, the level will restart, but the score will stay the same. See Bonuses and Power-ups for ways to gain lives.

Weapons

The ship comes equipped with five different types of weapons to defend against the monsters and destroy mushrooms. The specific weapon type that the ship is set to is displayed at the bottom right of the game window, and pressing "**s**" will shoot off a weapon. The different types of weapons are:

1. **Cannon** - a regular bullet, travels from the ship in a straight line until it collides with another object.
2. **Guided Missile** - similar to a bullet, except will move with the ship. That is, it will move vertically up the screen, and horizontally to stay in line with the ship
3. **Shotgun** - similar to a regular bullet, except instead of a single bullet, 3 are sent out that fan out from the original location of the ship. Each of these three projectiles deals less damage than a standard bullet.
4. **Mines** - the user is allotted a maximum of 5 mines for the whole game, but can get more through power-ups. A mine is dropped by the ship, and anything that comes in contact with it (with the exception of the ship) will die.
5. **Exploding Bullets** - similar to a regular bullet. When the exploding bullet hits an object, it does no damage, but it explodes into 8 different smaller bullets that spread out in 8 different directions. Due to the explosiveness of this weapon, the 8 bullets do less damage, only weakening the monsters. (It wouldn't be as much fun if we gave you the ultimate weapon).

In order to switch to a different weapon type, simply press the number of the weapon you would like to select.

Monsters

Like any classic game, this arcade game has monsters which you have to defeat in order to stay alive. The monsters range in speed and difficulty to kill. Some of the more difficult monsters will only appear in later levels. To kill a monster, shoot a weapon at it. Some monsters may need more than 1 hit to be killed. The different types of monsters are as follows:

1. **Centipede** - a monster made up of multiple segments (starting with 5, and increasing with each level). These segments start off moving in a line, but will separate and move independently if they are forced to do so. They switch directions when they hit a mushroom and die when hit by a single bullet. Whenever a centipede hits a poisoned mushroom (see Scorpion, below), it will move downwards very rapidly, ignoring any mushrooms in its path. Killing every centipede segment will advance the player to the next level.
2. **Flea** - appear when there are less than 5 mushrooms in the playable area. Fleas will start anywhere in the top row of the board, and slowly descend down the board. They descend at a constant velocity until they are hit the first time, at which point they increase drastically in velocity and need to be shot a second time to be killed. If they get all the way to the bottom of the screen (without touching the ship) they just disappear off the screen. Fleas will drop up to two mushrooms as they descend.
3. **Scorpion** - move horizontally across the board and poison all the mushrooms they encounter. They appear once in each level, and spawn at random time intervals.
4. **Spider** - move in a zigzag pattern in the playable area. Spiders eat mushrooms, and will kill the ship if they come in contact with it. Spiders typically spawn a few seconds after the previous spider dies.

5. **Zombie** - moves slowly from side to side across the screen. Zombies walk through every other kind of monster/mushroom, and obstacles do not affect the it. The zombie will kill the ship if it gets all the way down the board to it.

Mushrooms

Mushrooms are placed strategically in each level throughout the game. They can be thought of as “roadblocks” for both the ship and monsters. The ship can’t pass through mushrooms, it can only go around them. The centipede will change direction if it comes across the mushroom. Mushrooms lose health each time they are hit with a projectile. Once the mushroom has lost all of its health, it will be removed from the game.

Bonuses and Power-Ups

The game comes with a set of Bonuses and Power Ups to help the player throughout gameplay. They appear randomly throughout the game for a few seconds at a time, and are displayed as different colored circles. The different types of bonuses and powerups are as follows:

1. **Grey** - resets the number of mines back to 5
2. **Yellow** - increments the score by 1000
3. **Orange** - adds an extra life to the ship

Winning the Game

The player wins the game by surviving all 6 levels. The player’s score will accumulate as they navigate through the levels, with each bonus and monster adding more the player’s score. When the game ends (either by winning or by running out of lives) the score will be displayed, along with the high score board. If The player will make it onto the high score board, the game will ask for their name and add their name to the score board.

Help Screen

If at any point in the game the user needs help with how to play, they can press “h” and a help screen will appear, pausing the game. The help screen has a quick explanation of each key and and the action associated with it. Pressing “h” again will resume the game.

Notable Icons

Ship	Mushroom	Damaged Mushroom	Poisoned Mushroom	Centipede
				
Dying Centipede	Flea	Spider	Scorpion	Poisoned Centipede

Installation/Configuration Guide

All users

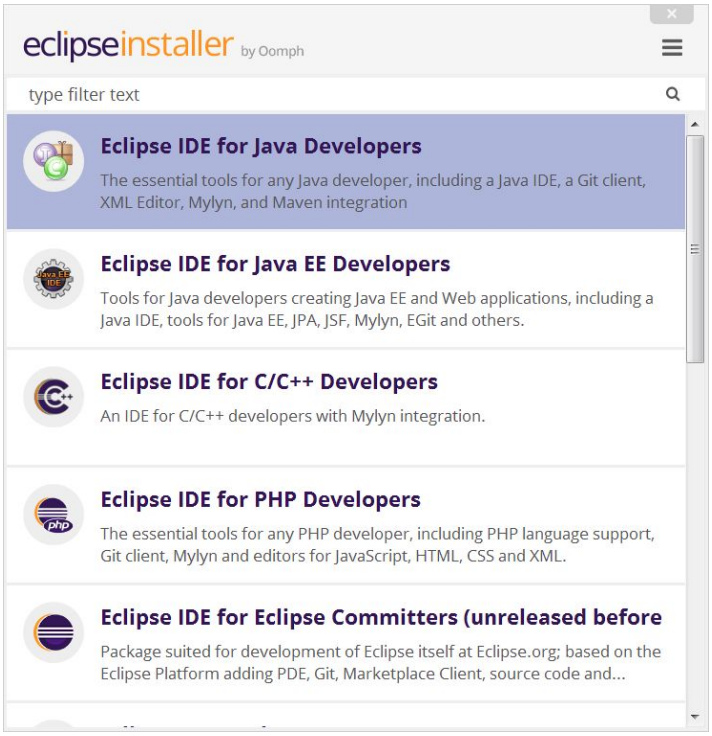
0. Precondition: JRE/JDK 1.7 or higher is installed on the system
    a. Download the appropriate JRE or JDK from Oracle's website
    b. Run the downloaded installer, following all prompts for a standard installation

End users

1. Download the executable JAR file
2. Run the JAR file to launch the game

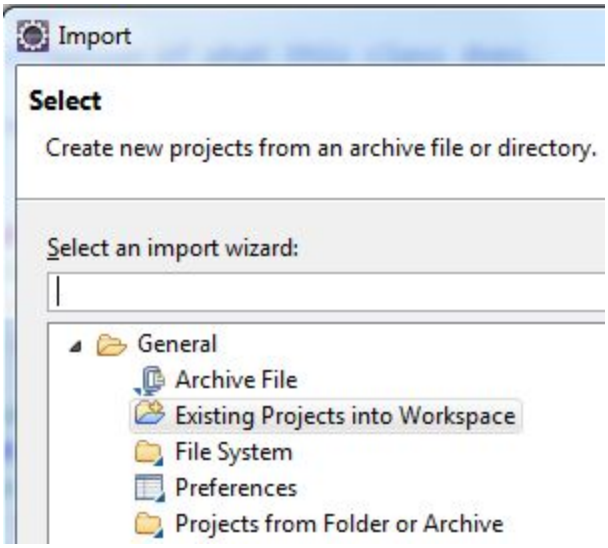
Developers and Maintainers

1. If Eclipse (Neon 1 or later) is not installed on the development system:
    a. Download Eclipse Neon from https://www.eclipse.org/downloads
    b. For full installation instructions, visit https://wiki.eclipse.org/Eclipse/Installation. Brief installation instructions are as follows:
        i. Open the downloaded installer
        ii. When you are asked to select the package to install, choose a Java development package:



iii. Continue through the installation

2. Download/git clone/etc. the project from the provided source and unzip if applicable
3. In Eclipse, choose File > Import, then select “Existing Projects Into Workspace” option:



4. Select the project folder and import it into Eclipse

Maintenance Guide

In the context of this project, there really is no maintenance to be done aside from refactoring to add new features, which can be done individually. The only changing data (so to speak) is the high scores file, which is “HighestScores.txt”, which the developer may modify as desired.

Software Requirements Specification

Current Specification List of Features

1. A “hero” ship who moves about the screen when the user presses the arrow keys.
2. The ship starts with 2 lives, and will lose a life it it collides with a monster.
3. A set of weapons that the hero can use to defeat monsters.
4. Mushrooms scattered throughout the board, which block movement and can be destroyed by weapons.
5. When a monster gets hit by a weapon, the monster becomes a mushroom.
6. The user can toggle between a set of different weapons, which behave in different ways and have different properties.
7. The different weapons include:
    a. Cannon - a regular bullet, travels from the ship in a straight line until it collides with another object
    b. Guided Missile - similar to a bullet, except will move with the ship. That is, it will move vertically up the screen, and horizontally to stay in line with the ship
    c. Shotgun - similar to a regular bullet, except instead of a single bullet, 3 are sent out that fan out from the original location of the ship
    d. Mines - the user is allotted a maximum of 5 mines for the whole game, but can get more through power-ups. A mine is dropped by the ship, and anything that comes in contact with it (with the exception of the ship) will die.
    e. Exploding Bullet - similar to a regular bullet. When the exploding bullet hits an object, it hits it with 0 damage, and explodes into 8 different smaller bullets in all 8 directions.
8. There are different Bonuses that the ship can get:
    a. Gray Bonuses - resets the number of mines back to 5
    b. Yellow Bonuses - increments the score by 1000
    c. Orange Bonuses - adds an extra life to the ship
9. The user presses keys to play the game:
    a. The arrow keys to move the ship
    b. S to fire weapons
    c. P to pause
    d. 1/2/3/4/5 to select the different weapons
10. There are 6 different levels that the ship has to navigate through to win the game
11. There are different monsters that are trying to defeat the ship
    a. Centipede - a group of 5 monsters that can operate independently, but start off as a group, all following each other. They switch directions when they hit a mushroom, and die when hit by a single bullet
    b. Flea - appears when there are less than 5 mushrooms in the playable area. Fleas will start anywhere in the top row of the board, and slowly descend down the

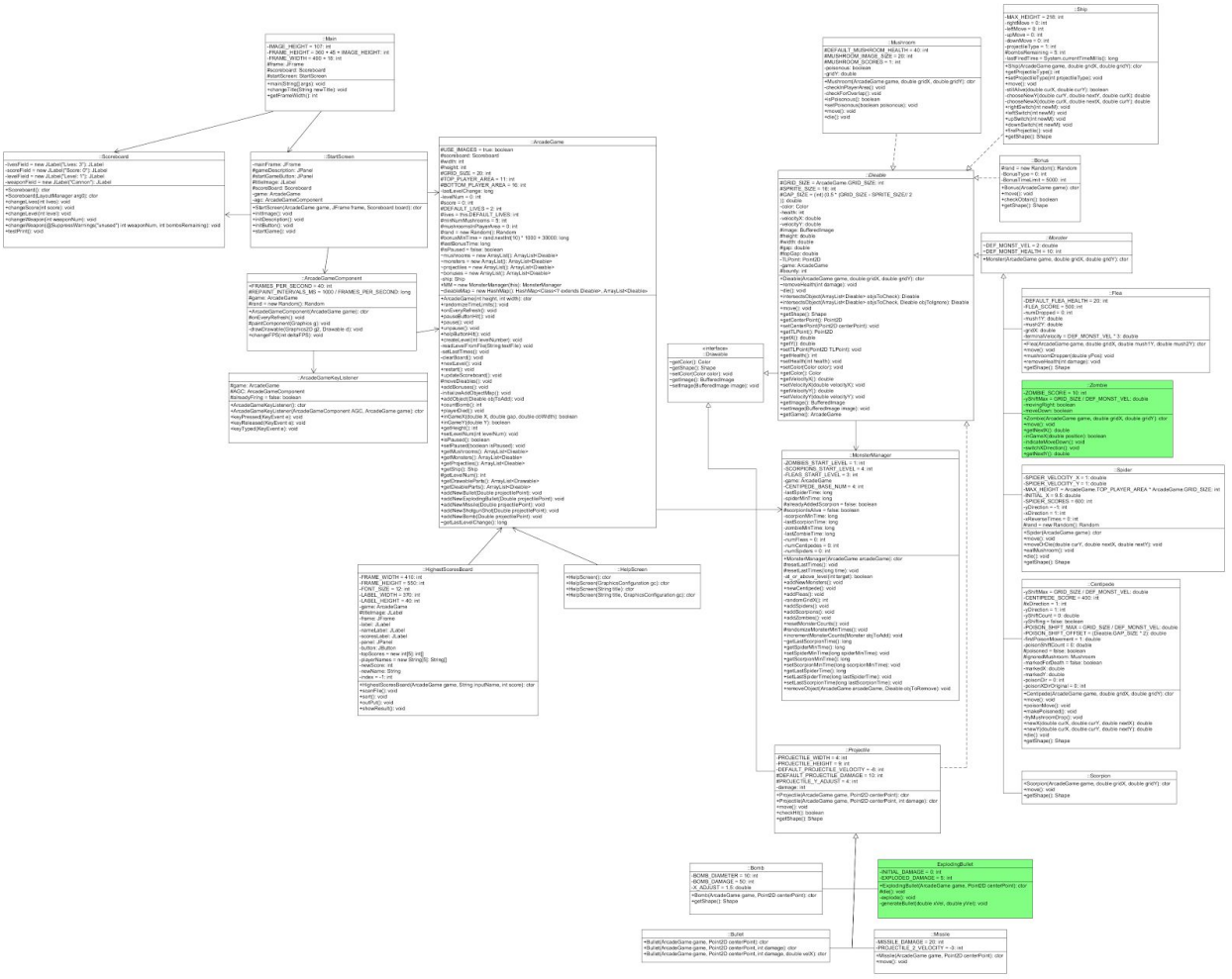
board. They descend at a constant velocity, until they are hit the first time, in which case they increase drastically in velocity and need to be shot a second time to be killed. If they get all the way to the bottom of the screen, they just disappear off the screen.

c. Scorpion - move horizontally across the board and poison all mushrooms they encounter. They appear once in each level, and spawn at random time intervals
d. Spider - move in a zigzag pattern in the playable area. Spiders eat mushrooms, and will kill the ship if they come in contact with it. Spiders spawn a few seconds after the previous spider dies.
e. Zombie - moves slowly from side to side across the screen. Zombies walk through every other kind of monster/mushroom, and those do not affect the Zombie. The zombie will kill the ship if it gets all the way down the board to it.

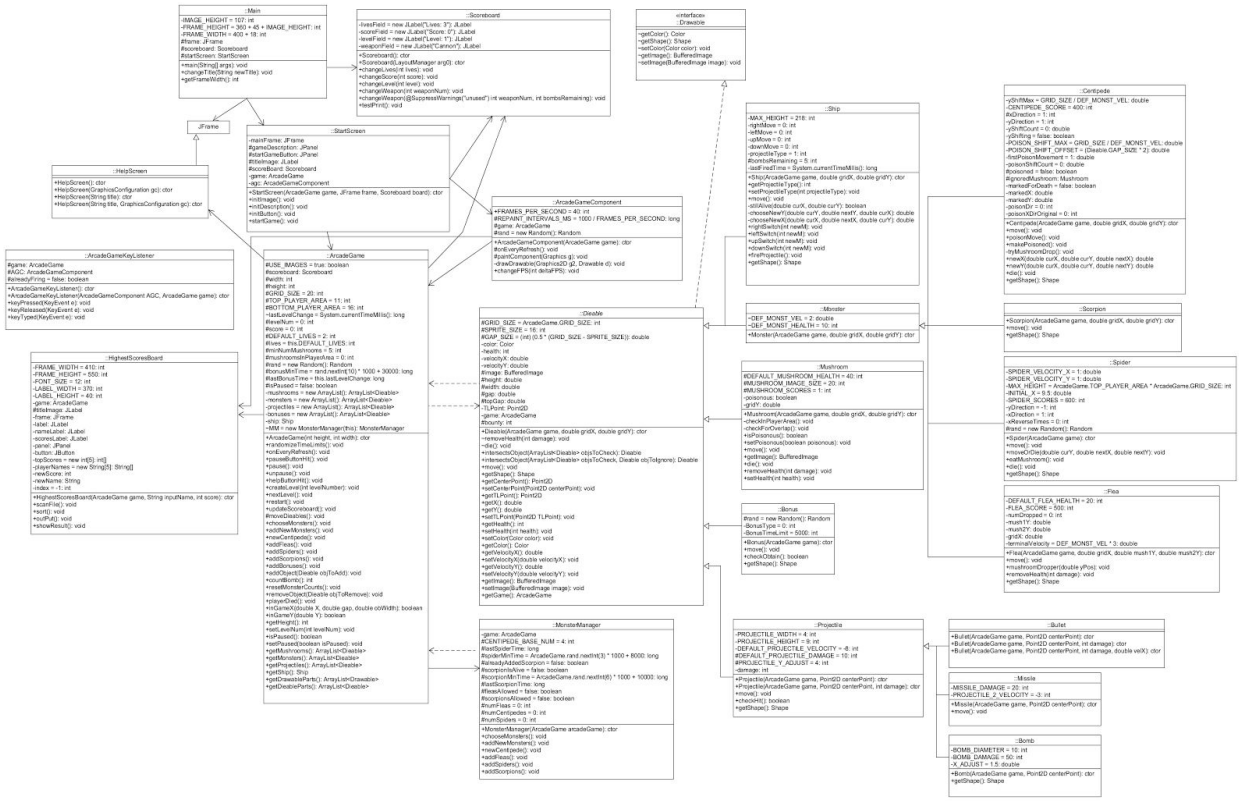
12. When the player dies, their score is saved. If they qualify for the high score board (i.e, the score is at least higher than the 5th score on the high score board) they can input their name and have their score saved in the game.
13. There are also a variety of debugging features:
    a. U/D to go up or down a level
    b. +/- to adjust the refresh rate
    c. G to enable or disable graphics

Software Architecture Design Specification

Final UML Diagram (new classes are highlighted in green)



Original UML



Test Suite

Approach

The approach that was taken for testing the arcade game was to first test the different objects. We first tested Dieables, such as the ship, specific monsters, bonuses, and bullet classes. Since we were using a system that not everyone was particularly familiar with, writing unit tests helped us to first understand the code, and then refactor it. While refactoring, we would first write unit tests, then refactor to add new features. While we were refactoring and adding new features, we would rerun the tests often, and then each new feature added would add another set of tests to the existing ones.

After writing and testing the individual classes, the team moved on to larger unit tests and integration tests. Here we refactored to add seems in order to write tests for classes and subparts that were difficult or impossible to test originally. For example, much of the functionality for objects like Bonuses and certain monsters relies on random number generation. This would be impossible to test because we needed to test the actions that occurred after the number was randomly generated, rather than before. For example, the Spider moves in a zigzag pattern, and switching directions is designated by a random number generator. In order to test that the spider moves properly, we refactored so that the number generation was in a seam that we could override in order to test the spider’s movement.

Finally, we were able to write larger, overall tests of the system, after all the different parts had been tested. These were continuous integration tests. For writing these tests, the team spent a good portion of time refactoring first in order to be able to write automated tests. Once the system was refactored to the team's liking, regression testing was easy.

Test Cases

- Classes tested via **Unit Tests**
    - Dieable
        - Ship attributes
        - Die
        - Decrementing Health
        - Get/Set velocity, color, health,
        - Get location/center point of monsters
    - Monster Manager
        - Adding new monsters
        - Setup of next level
    - Mushroom
        - Add to game
    - Zombie Movement
        - Movement
        - Switching directions appropriately
        - Moving downward
        - Die
    - Ship Projectile
        - Setting projectiles
        - Firing projectile (for all different types)
- Classes tested via **Integration Tests**
    - Ship Projectile
        - Rapidly firing missiles
    - Spider Movement
        - Movement
    - Bonus
        - Creating
        - Adding to a game
        - “Movement” i.e. ship colliding with a bonus
        - Obtaining a bonus
- **Continuous and Regression Tests**
    - AcradeGame
        - Start
        - Add objects
        - Objects in and out of game
        - Resetting