Creating A Snake Game
In Java

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Object Oriented

programming

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Abstract

This project aims to recreate the classic Snake game using Object-Oriented Programming (OOP) principles in Java. The Snake game is a timeless classic that challenges players to control a snake as it navigates a grid, consuming food and growing longer with each bite, while avoiding collisions with itself and the walls. The *IDE* that this project is using is Intellij IDE.

Chapter 1 - Project Description

1.1 Introduction

In this project, I am recreating the classic Snake game using Java and Object-Oriented Programming (OOP). With Java, I organize the game into smaller parts that work together. This helps me to learn important concepts like creating different pieces of the game and how they interact. and I combine old-fashioned fun with modern ways of making computer games. This project especially helps me learn while having a great time.

1.2 Idea inspiration

The idea why i made this Snake game because i am new to the Java environment and i want to learn Java but the amount of material that i need to learn is wide ranging to easy to the hardest and it demotivate me, so i have a thought that i should made a project to challenge myself to create something while learning something and that is how i decide i want to make Snake game because i played it in the past it was an iconic game and it's not a boring project to make.

1.3 How it works

This Java Project creates a simple Snake game using Swing for the GUI and sound effects. The `App` class initializes a `JFrame` window and adds an instance of `SnakeGame`. The `SnakeGame` class extends `JPanel` and implements `ActionListener` and `KeyListener` to manage game updates and user input. The game initializes the snake and food positions, sets a timer for game updates, and handles key events to control the snake's direction. The game loop checks for collisions with food or the snake's body and updates the display accordingly. Eating food grows the snake and plays a sound effect, while background music loops during gameplay and stops upon game over, triggered by collisions or boundary breaches.
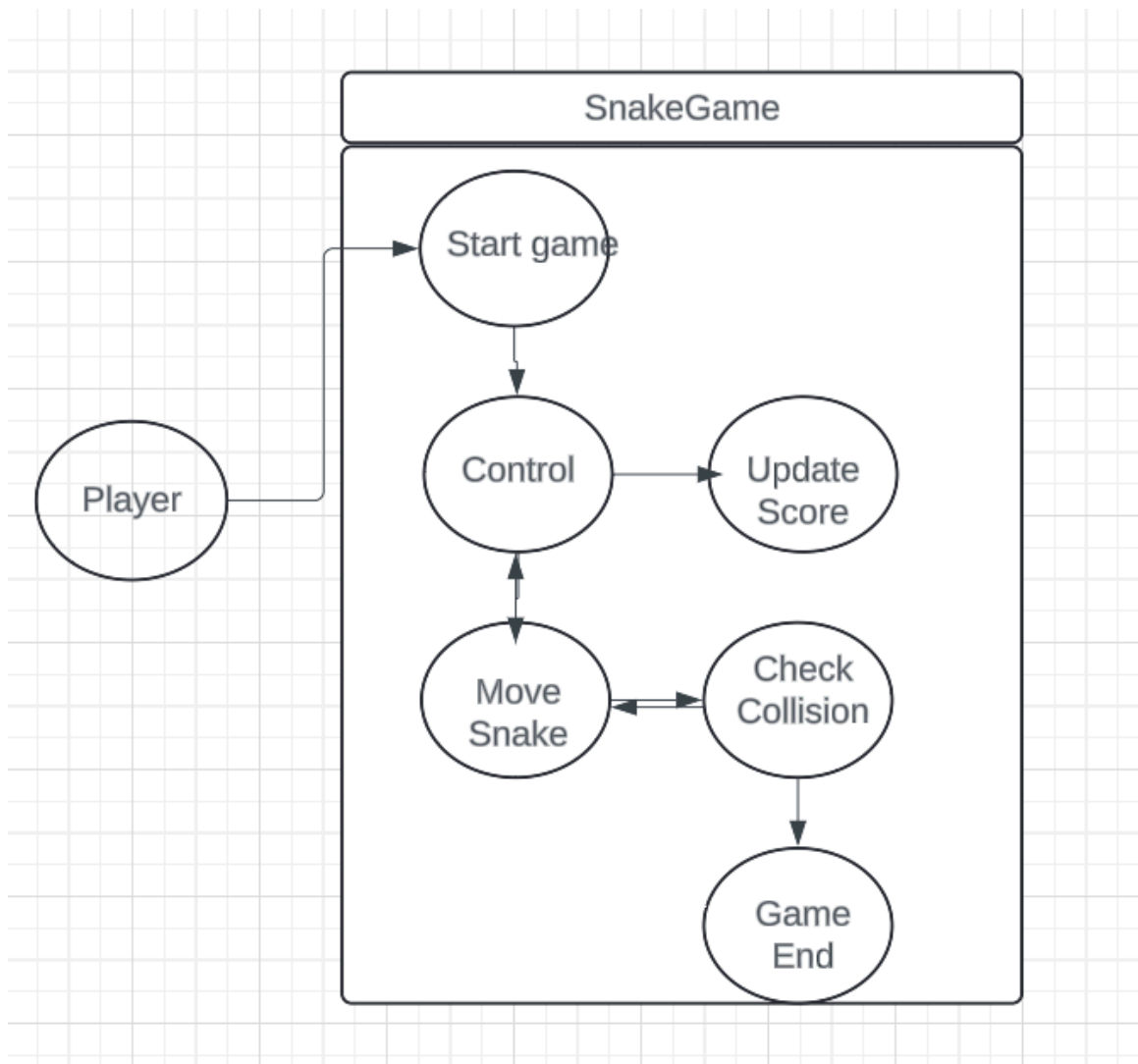
Chapter 2 - Use Case Diagram
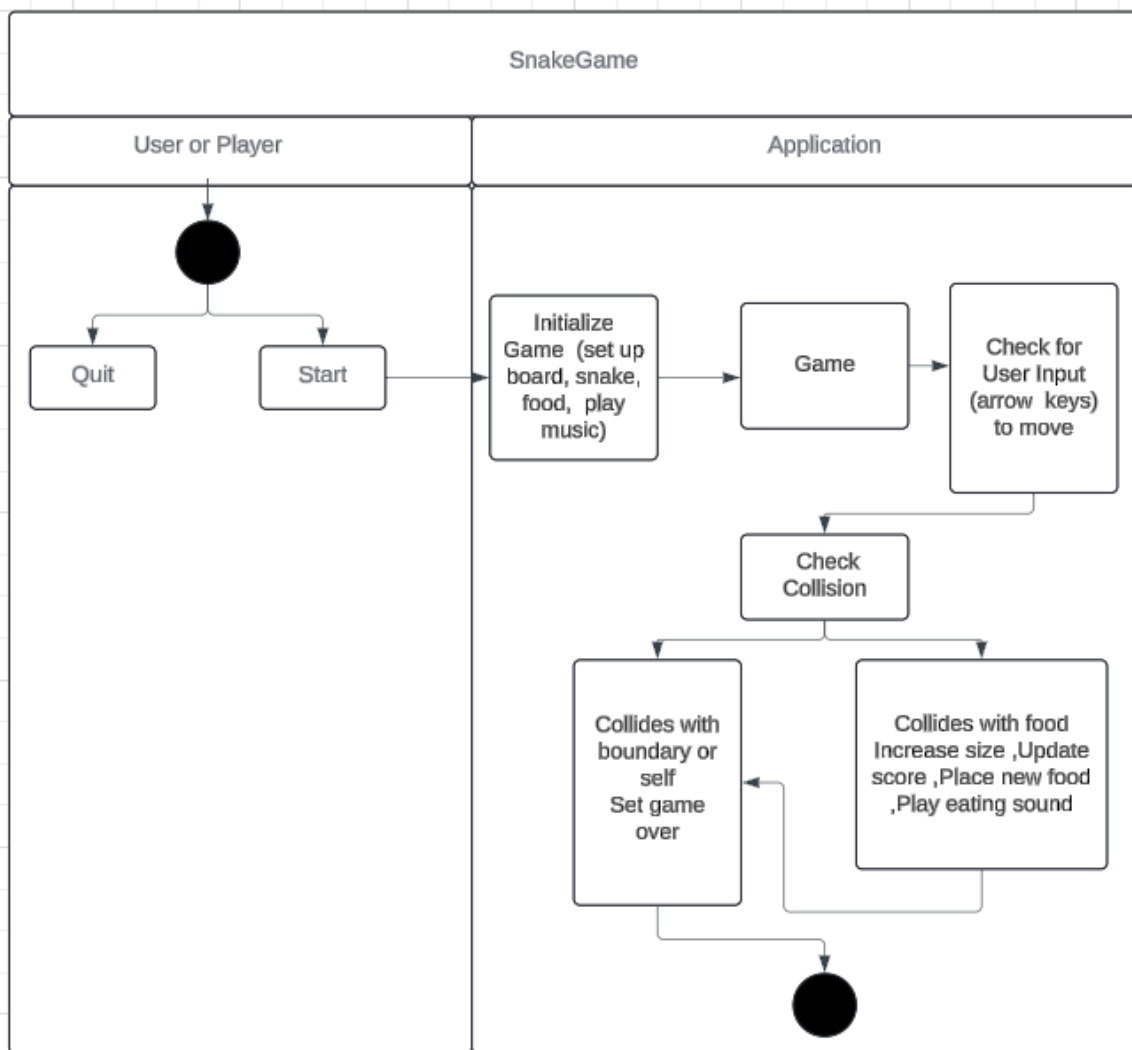

Figure 2.1

Chapter 3 - Activity Diagram

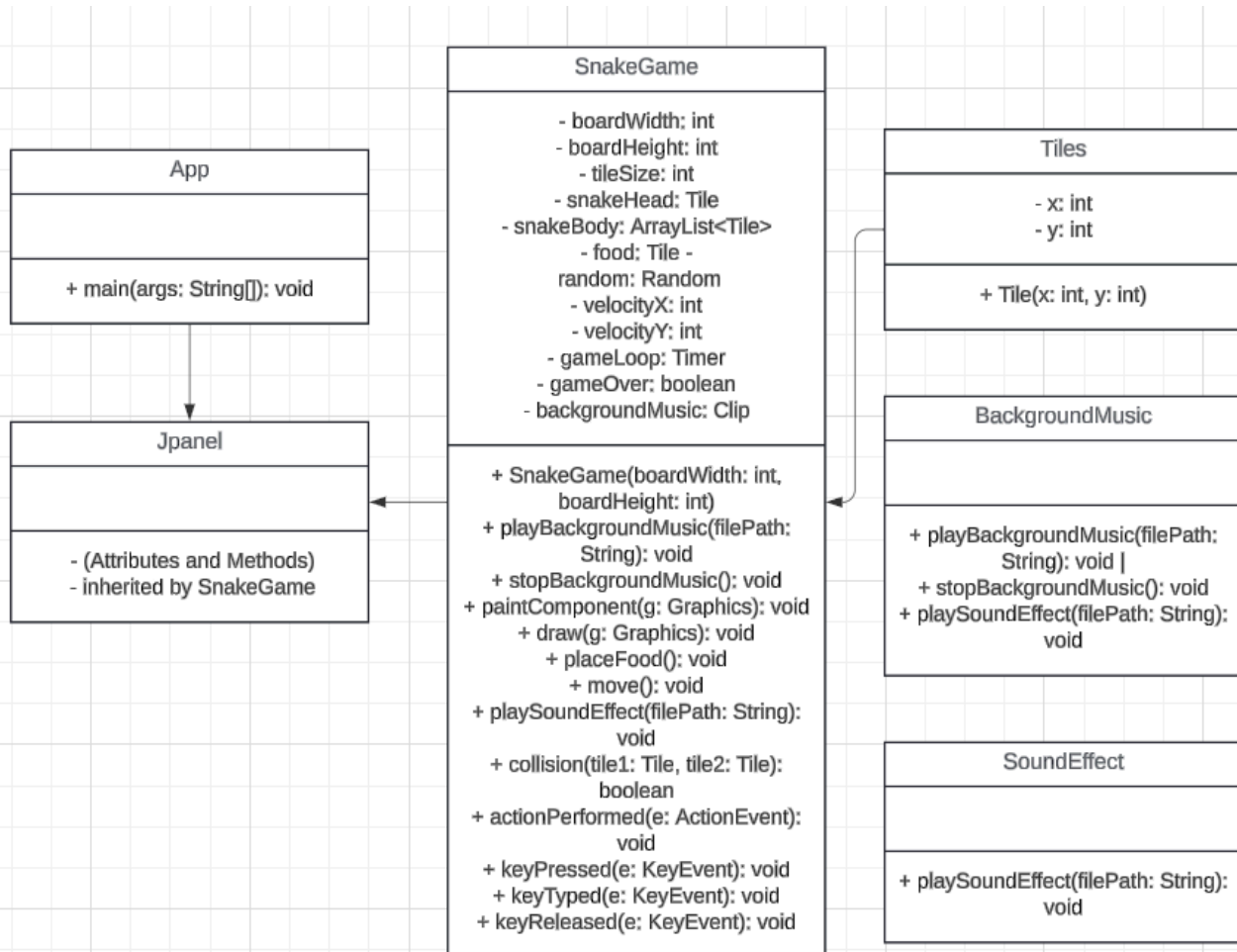Figure 3.1

Chapter 4 - Class Diagram

App

+ main(args: String[]): void

Jpanel

- (Attributes and Methods)
- inherited by SnakeGame

SnakeGame

- boardWidth: int
- boardHeight: int
- tileSize: int
- snakeHead: Tile
- snakeBody: ArrayList<Tile>
- food: Tile -
random: Random
- velocityX: int
- velocityY: int
- gameLoop: Timer
- gameOver: boolean
- backgroundMusic: Clip

+ SnakeGame(boardWidth: int,
boardHeight: int)
+ playBackgroundMusic(filePath:
String): void
+ stopBackgroundMusic(): void
+ paintComponent(g: Graphics): void
+ draw(g: Graphics): void
+ placeFood(): void
+ move(): void
+ playSoundEffect(filePath: String):
void
+ collision(tile1: Tile, tile2: Tile):
boolean
+ actionPerformed(e: ActionEvent):
void
+ keyPressed(e: KeyEvent): void
+ keyTyped(e: KeyEvent): void
+ keyReleased(e: KeyEvent): void

Tiles

- x: int
- y: int

+ Tile(x: int, y: int)

BackgroundMusic

+ playBackgroundMusic(filePath:
String): void |
+ stopBackgroundMusic(): void
+ playSoundEffect(filePath: String):
void

SoundEffect

+ playSoundEffect(filePath: String):
void

Figure 4.1

Chapter 5 - Modules Used

```
1    import javax.swing.*;
2    import java.awt.*;
3    import java.awt.event.*;
4    import java.util.ArrayList;
5    import java.util.Random;
6    import javax.sound.sampled.*;
7    import java.io.File;
8    import javax.imageio.ImageIO;
9    import java.awt.image.BufferedImage;
10   import java.io.IOException;
11   import java.awt.geom.AffineTransform;
12   import java.awt.image.AffineTransformOp;
```

Figure 5.1

SnakeGame.java

- javax.swing.: Provides classes for building a graphical user interface (GUI) using Swing.

- java.awt.: Contains classes for creating user interfaces and for painting graphics and images.

- java.awt.event.: Includes interfaces and classes for dealing with different types of events fired by AWT components.

- java.util.ArrayList: A resizable array implementation of the List interface.

- java.util.Random: A class for generating random numbers.

- javax.sound.sampled.: Provides classes and interfaces for capturing, processing, and playing sound samples.

- java.io.File: Represents a file or directory path.

- javax.imageio.ImageIO: Provides methods for reading and writing images.
  java.awt.image.

- BufferedImage: Describes an image with an accessible buffer of image data.

- java.io.IOException: Signals that an I/O exception has occurred. java.awt.geom.

- AffineTransform: Provides the transformation matrix for rotating, scaling, translating, or shearing the graphics.

- java.awt.image.AffineTransformOp: A class for performing an affine transform on an image.

Chapter 6 - Essential Algorithm

The essential algorithm in this SnakeGame class revolves around the game logic, including movement, collision detection, and updating the game state.

6.1 Action Performed

```java
public void actionPerformed(ActionEvent e) {
    move();
    repaint();
    if (gameOver) {
        gameLoop.stop();
        stopBackgroundMusic();
    }
}
```

Figure 6.12

This method is invoked by the Timer at regular intervals. It's the core of the game loop. move() updates the game state by moving the snake, checking for collisions, and updating the score. repaint() refreshes the graphical representation of the game board. If gameOver is true, the game loop stops, and the background music is stopped.

6.2 KeyPressed

```
public void keyPressed(KeyEvent e) {
    if (e.getKeyCode() == KeyEvent.VK_UP && velocityY != 1) {
        velocityX = 0;
        velocityY = -1;
    } else if (e.getKeyCode() == KeyEvent.VK_DOWN && velocityY != -1) {
        velocityX = 0;
        velocityY = 1;
    } else if (e.getKeyCode() == KeyEvent.VK_LEFT && velocityX != 1) {
        velocityX = -1;
        velocityY = 0;
    } else if (e.getKeyCode() == KeyEvent.VK_RIGHT && velocityX != -1) {
        velocityX = 1;
        velocityY = 0;
    }
}
```

Figure 6.21

This method handles user input for controlling the snake's direction. It's triggered when a key is pressed. Depending on the pressed key (up, down, left, right), the snake's velocity is updated accordingly. The snake cannot reverse its direction instantly (e.g., if it's moving up, it cannot immediately move down).

6.3 Move

```java
public void move() {
    if (collision(snakeHead, food)) {
        snakeBody.add(new Tile(food.x, food.y));
        placeFood();

        // Play the eat sound effect
        playSoundEffect( filePath: "C:\\Users\\USER\\OneDrive\\Documents\\Binus\
    }

    for (int i = snakeBody.size() - 1; i >= 0; i--) {
        Tile snakePart = snakeBody.get(i);
        if (i == 0) {
            snakePart.x = snakeHead.x;
            snakePart.y = snakeHead.y;
        } else {
            Tile prevSnakePart = snakeBody.get(i - 1);
            snakePart.x = prevSnakePart.x;
            snakePart.y = prevSnakePart.y;
        }
    }

    snakeHead.x += velocityX;
    snakeHead.y += velocityY;

    for (Tile snakePart : snakeBody) {
        if (collision(snakeHead, snakePart)) {
            gameOver = true;
        }
    }
```

Figure 6.31

```java
if (snakeHead.x < 0 || snakeHead.x >= boardWidth / tileSize ||
        snakeHead.y < 0 || snakeHead.y >= boardHeight / tileSize) {
    gameOver = true;
}
```

Figure 6.32

This method updates the game state by moving the snake and handling collisions. If the snake collides with food, it grows, and new food is placed. The snake's body is moved segment by segment, with each segment taking the position of the segment before it. The snake's head is moved based on its velocity. Collisions with the snake's body or the wall result in a game over.

6.4 Dynamic Speed Control

```java
public void keyPressed(KeyEvent e) {
    if (e.getKeyCode() == KeyEvent.VK_UP && velocityY != 1) {
        velocityX = 0;
        velocityY = -1;
    } else if (e.getKeyCode() == KeyEvent.VK_DOWN && velocityY != -1) {
        velocityX = 0;
        velocityY = 1;
    } else if (e.getKeyCode() == KeyEvent.VK_LEFT && velocityX != 1) {
        velocityX = -1;
        velocityY = 0;
    } else if (e.getKeyCode() == KeyEvent.VK_RIGHT && velocityX != -1) {
        velocityX = 1;
        velocityY = 0;
    } else if (e.getKeyCode() == KeyEvent.VK_1) { // changing the  speed of the snake
        gameLoop.setDelay(200); // Slow
    } else if (e.getKeyCode() == KeyEvent.VK_2) {
        gameLoop.setDelay(100); // Normal
    } else if (e.getKeyCode() == KeyEvent.VK_3) {
        gameLoop.setDelay(50);  // Fast
    }
}
```

Figure 6.41

In the public void KeyPressed there is a code that by pressing the keys '1', '2', or '3', the player can adjust the speed of the snake. The timer's delay is changed, which directly affects how often the game loop updates the game state and redraws the snake, thereby increasing or decreasing the snake's movement speed.
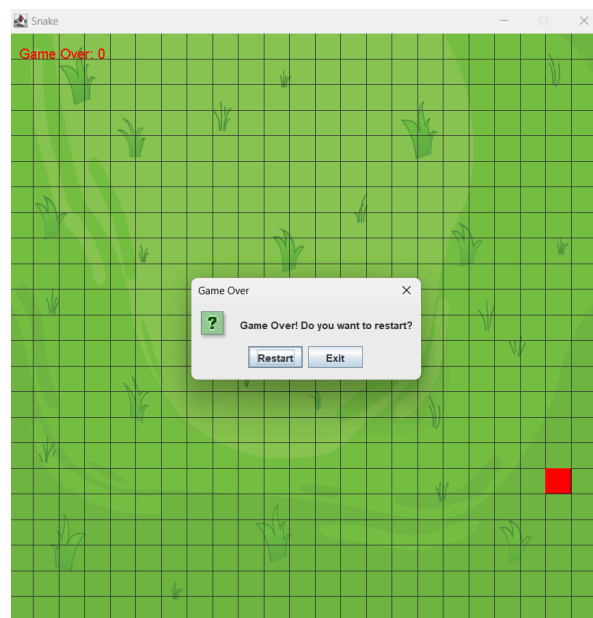
Chapter 7 - Screenshot of The Project

1. The Gameplay

Figure 7.1

2. Game Over

Chapter 8 - Lesson Learned

Implementing the Snake game project provided valuable lessons. Modular design and code organization were crucial for managing complexity, while event-driven programming highlighted the importance of responsiveness. Handling collision detection and game state management emphasized robust error handling and thorough testing. Overall, the project underscored the significance of structured design, user interaction, and error management in software development.

Chapter 9 - Source Code and Poster

Githhub = https://github.com/rlaxNstdy/OPP_FinalProject

Poster =

https://www.canva.com/design/DAGHvU4r5tg/vcyG9_7-8YSlF0PqFbpEzw/edit?utm_content=DAGHvU4r5tg&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton