Bilkent University

Department of Computer Science

# Object-Oriented Software Engineering
# Final Report

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# Table of Contents

# 1. Introduction

- **Additional Features for Monopoly Game**

1. **Alien Attack**

   In addition to the classic Monopoly Game, Monopoly Space Edition Game has an alien feature. There are four alien compartments on the board and when the player comes to these compartments, they are subject to alien invasion. This alien invasion occurs as follows; There are aliens who have 3 different missions. When it comes to that section, a random alien type appears on the screen and that alien punishes the player according to his mission. One of the aliens sends that player to a black hole. In the black hole, the player waits 3 rounds and can then continue the game. (While waiting for 3 rounds, the turn must press the dice every time it comes back to itself, but cannot move). An alien steals 200M from the player and the player's bank account changes accordingly. The last of the aliens seizes a random planet of the player and the player no longer has that plane, that planet is wasted.

- **Replacements**

1. **Background image**
   The background of the game has been renewed to suit the space edition.

2. **Game start priority**
   Before starting the game in the classic monopoly game, the dice are thrown and the player who is the biggest starts. In Monopoly Space Edition Game, on the enter requirements page, the game progresses with the order that the players are registered to the game.

3. **Planet**
   While the classic monopoly game features cities, Monopoly Space Edition has planets instead. House, hotel or forest can be planted on the planets.

4. **Spaceship**
   The spaceships in the Monopoly Space Edition Game replace the vehicle stations in the classic monopoly. Spaceship can only be purchased. A house, hotel or forest cannot be erected on it.

5. **Tokens**
   The shape of the tokens in the classic monopoly has changed. In the Monopoly Space Edition Game, tokens are in the form of spaceships.

6. **Money Amounts**
   The money amounts in the classic monopoly game have been changed.

7. **Mortgage Process**

   The mortgage transaction in the classic Monopoly Game has been changed in Monopoly Space Edition and is as follows: If the player wants to mortgage a planet he owns, the whole house, hotel and forest prices and the price of the plane are added up and divided into two. This amount of money is given to the player and the planet is taken from the player. If the player wants to mortgage the spaceship, the money is given to the player and taken away from the hands of the spaceship. There is no remove mortgage feature in the game, so the mortgaged property cannot be taken back.

8. **Black Hole**

   The free parking place in classic Monopoly has black hole and once the player arrives at the black hole, they have to wait 3 rounds. In these waiting times, whenever his turn comes, he rolls the dice, but cannot move.

- **Current Situation of the Game**

  Monopoly Space Edition game opens and the game starts when necessary information for player names and choosing tokens are provided in the Requirements Page. The logic of the Monopoly Space Edition is worked correctly. Players move correctly in the board according to the total of the rolled dice. Logic of the buy planet and spaceship, pay rent for planet and spaceship, mortgage, build forest, build home, build house on planet, go to jail, wait 3 turns in the jail, alien attack, go to black hole and wait 3 turn in the black hole, drawing chance card and chest card is worked correctly. For the UI (User Interface) part, there are no problems about changing screens and showing alerts and pop-ups (indicating operations done on Planets and Spaceships).

- **Missing Parts**

  Remove mortgage operation is not added to the game, so players can not remove the mortgage on their planets or spaceships.
  Although the major part of the file system manager such as (loading music files, reading information of planets and spaceships from the text file) is completed. The loading and writing the game history to the files is missed.
  Bankrupt operation and showing history at the top of the screen are missed.

# 2. Lessons Learnt

Development process of Monopoly Space Edition Game was beyond a regular project development process since it was the second time for all of us to develop a software using tools and procedures a software engineer uses. Waterfall project

management methodology has been used throughout the process. We have gone through requirements analysis, design, implementation and testing steps. We learnt how to use UML to model and document our software using class, sequence, activity and state diagrams. We used the Visual Paradigm tool to draw UML diagrams and experienced how to use UML in a professional manner. We have chosen to utilize strategy and design patterns in our software and observed that it may be difficult to include those patterns in our design in the first iteration but they make software easy to modify and minimize code smell. Also learning how to use Git and GitHub during the course and benefiting from GitHub while developing our software have been a giant step for some of us who have not used GitHub before and changed our habits in terms of collective software development.

Moreover, we can argue that this project has been a simulation to a real-life software development process as we had a manager - engineer and customer - developer relationship with Mr. Tüzün and TAs. We got feedback and arranged meetings with TAs and made presentations which simulate these relationships. Furthermore, despite Covid-19 pandemic, we arranged group meetings through Zoom and have met many times as group members. Last but not the least, getting used to Slack was essential throughout the semester since it is widely used by numerous companies.

# 3. User's Guide

## a. Game Overview

Monopoly Space Edition Game starts by clicking the play button in the main menu. This button redirects players to the requirements page. After entering usernames and choosing tokens in that page Monopoly Space Edition Game Board will be displayed. Each player rolls the dice by clicking on the roll dice button when their turn comes and tokens will move accordingly. Planets, spaceships, chest card and chance card options, black hole and jail cells are available on the game board and players can get further information by being with their tokens on them. Player actions, current player and bank accounts of players are also visible on the Monopoly Space Edition game board.

Purpose of the game is to be the only player who does not go bankrupt. But if the finish button is clicked, the richest among all players will be declared as the winner. Monopoly Space Edition Game can be played again by clicking the replay button.

## b. Objects

**Game Board:** Board that the game is played on.

**Dice:** Decides a player's movement.

**Tokens:** Unique objects that represent each player and their locations on the game board.

**Start Location:** The cell which each player starts the game. Each player who passes through this position receives 500 M unless sent to the starting point by a chest card or chance card.

**Planet:** A type of property which  users can own and build a house, hotel or forest on.

**Spaceship:** A type of property which users can own but cannot build a house, hotel or forest on.

**Alien:** One of the unique features of the game. There are three aliens who have different duties which are to throw the player to black hole,  seize one of the planets of the player and steal 200M from the player.

**Chance Card:** One of the two card types in the middle of the game board. By arriving on a chance card location, a chance card will appear on the screen and duty written on the card is done.

**Chest Card:**  One of the two card types in the middle of the game board. By arriving on a chest card location, a chest card  will appear on the screen and duty written on the card is done.

**Jail:** The cell which a player has to wait for 3 turns if his/her token is on the 'Go To Jail' cell. If the player comes jail part without arriving the "Go To Jail" location, the turn continues with the next player and nothing happens.

**Black Hole:** The cell similar to Jail which blocks a player's movement for 3 turns.

## c. Controls

Monopoly Space Edition Game is playable by only using left mouse click. Keyboard is required only when entering player names in the requirements page.
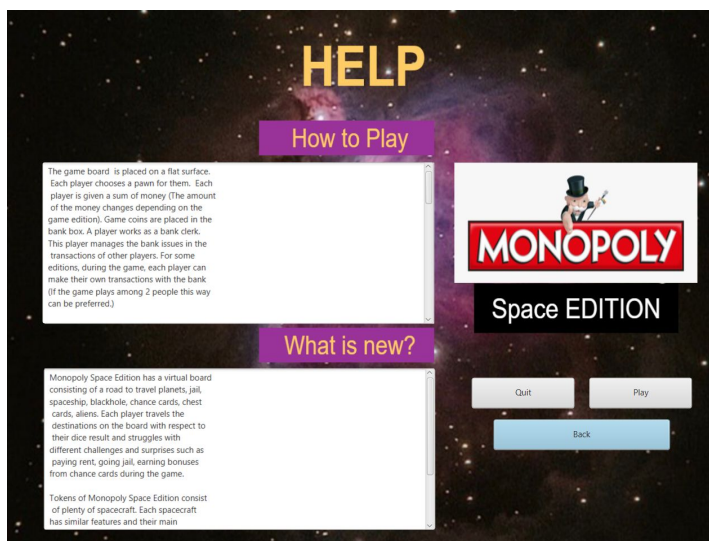
## d.    In-Game Screenshots

1.    **Main Page of Monopoly Space Edition Game**

This page appears first when the game is opened. Click the Play button to go to the enter requirements page. By pressing the Help button, you can see the help page. Quit button closes the game.

**2.      Help Page of the Monopoly Space Edition Game**



You can get information about how to play the game from the how to play section on the Help page. What is new section is what has been added to this game about for those who know the classic monopoly game. The play button takes you to the enter requirements page. Back button returns you to the main page. Quit button closes the game.

**3.      Enter Requirements Page of Monopoly Space Edition Game**

Click on the leftmost circles to indicate how many people played the game. Clicking on each circle will open a pane where you need to select your player name and token. Write a separate nickname for each player in the player name section and choose a separate token for each player. You will be found with these nicknames in the game and you will proceed with these tokens on the board. The back button returns you to the main page. You can start the game by clicking the Start The Game button.

4. **Monopoly Space Edition Game Playing Page**



From the Bank Accounts section on the right, you can see the nickname of the players and how much money they have in their current bank accounts. You can see which player owns which property by pressing the Deeds button. You can restart the game with the Replay button in the lower left corner and end the game with the finish button.

**4.1. How to Start the Game**

By pressing the roll dice button on the left of the Monopoly Space Edition Game Playing Page, you can move on the board on the right. The game progresses in the

order in which players are entered on the enter requirements page. The first player who is entered starts the game first.
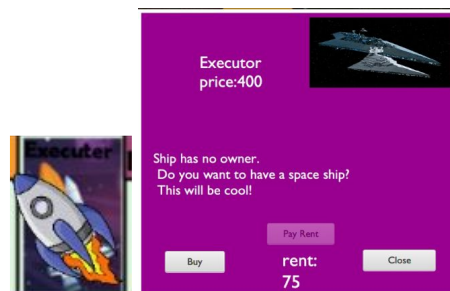


## 4.2. What Happens The Player Comes to a Planet

When you come to a planet, a window appears where you can find out the price and rent of that planet. If you want to buy, click the buy button. If you don't want it, press the close button. When the owner comes to a planner, the buy and build buttons are disabled. Only the pay rent button becomes active. You have to pay rent by clicking this button, then the close button becomes active and you close the window by clicking it. When you come to the planet you bought before, you can use the build button to build a house, hotel or forest. The buttons are either available or disabled depending on the relationship between the planet and the player coming to the plane.
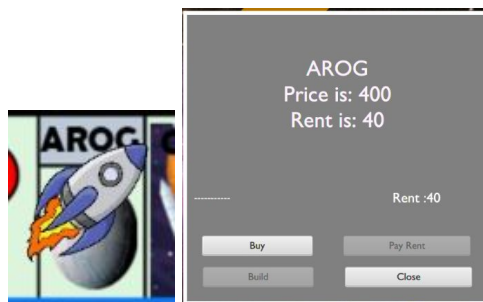


## 4.3. What Happens The Player Comes to a Spaceship

When you come to a planetary, a window appears where you can find out the price and rent of that planet. If you want to buy, click the buy button. If you don't want it, press the close button. If you come others' spaceship, you have to pay rent by clicking this button, then the close button becomes active and you close the window by clicking it. The buttons are either available or disabled depending on the relationship between the spaceship and the player coming to the plane.

### 4.4. What Happens The Player Comes to an Alien Invasion Part

When you arrive at the alien invasion part, one of the 3 alien species arrives randomly and punishes you according to his characteristics.
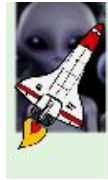




Click the close button to do the duty.

Three Alien Species:

1. **Black Hole Alien**: Throw you into the black hole and have to wait 3 rounds.



2. **Money Thief Alien**: Receives 200M from your bank account.

3. **Planet Thief Alien**: Seizes a random planet from your deeds. If you have no planet, it does nothing and the turn continues.

### 4.5. What Happens The Player Comes to an Chance Card Part

One of the five different chance cards is displayed randomly and the task required by that chance card is completed when the arrow button is pressed.
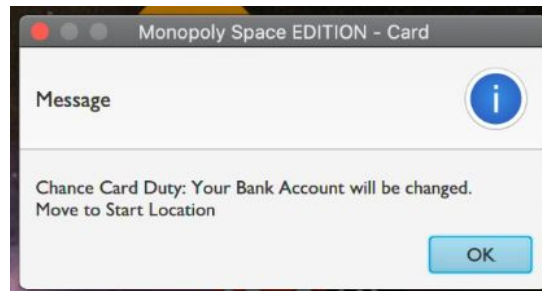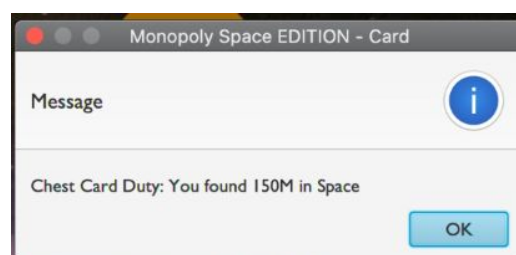
Click the ok button to do the duty.

Five Chance Card Tasks:

1. **Alien Attack**: One of the 3 alien species arrives randomly and punishes you according to his characteristics.

2. **Put Jail**: Puts you into the jail and you wait for 3 turns.

3. **Change Bank Account**: You lose your 100M and your bank account changes accordingly.

4. **Change Position:** You return to the start location, but this time you cannot get a pass from the starting point.

5. **Change Bank Account and Change Position (Together):** You lose your 100M and your bank account changes accordingly and return to the start location, but this time you cannot get a pass from the starting point.

### 4.6. What Happens The Player Comes to an Chest Card Part

One of the four different chest cards is displayed randomly and the task required by that chance card is completed when the arrow button is pressed.

Click the ok button to do the duty.

Four Chest Card Tasks:

1. **Found Money**: You earn 150M and your bank account changes accordingly.

2. **Covid Help:** You go to Earth Planet to help covid pandemic.

3. **Found Money and Covid Help (Together):** You earn 150M and your bank account changes accordingly and go to Earth Planet to help covid pandemic.

4. **Found Money and Change Position (Together):** You earn 150M and your bank account changes accordingly and you go to the start location, but this time you cannot get a pass from the starting point.


### 4.7. What Happens The Player Comes to the Jail Visiting Part

Nothing happens in this part. The turn continues with the next player. This location is also jail but to be used as jail, first you must come to the go to jail part on the board.



### 4.8. What Happens The Player Comes to the Black Hole

When you come to the black hole, you wait for three turns. You roll dice each your turn but you cannot move.



### 4.9. What Happens The Player Comes to the Go To Jail

When you come to the go to jail part in the Monopoly board, your token automatically goes to jail and you wait for three turns. You roll dice each your turn but you cannot move.

**4.10. Mortgage Process**

When you mortgage the Planner or Spaceship, get this page out, press the arrow button, the property is mortgaged and the bank gives you money.
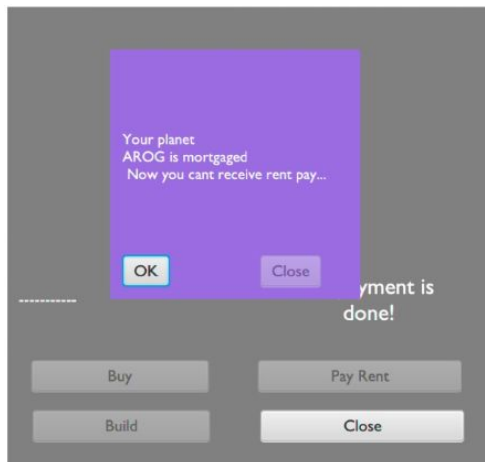


# 4.Build Instructions

## a. System Requirements

The Standard Java Runtime Environment must be installed to your machine in order to launch the game.

Download link: https://www.java.com/en/download/

Minimum System Requirements:
Windows

- Windows Vista SP2
- 128 MB RAM or higher
- 124 MB Disk Space for JRE; 2MB Disk Space for Java Update
- Intel Pentium 2 266 MHz processor or higher
- Screen resolution 800*600
- For JavaFX Graphics Support: NVIDIA GeForce 8 and 100 series or higher or ATI Radeon 2400, 3000, 4000, 5000, and 6000 series or Intel GMA 4500 and GMA HD

Mac OS X

- Intel-based Mac running Mac OS X 10.8.3+
- Administrator privileges for installation
- 64-bit browser
- Screen resolution 600*800

# b. Installation How-To

To install and run the game directly, clone MonopolyGameTest file from Github repository https://github.com/AhmetIsk/CS-319-Project--3C--Monopoly unzip it to a valid directory on your computer and execute monopoly.jar in the MonopolyGameTest/src directory.

To launch the game by viewing and executing the code, you should have Java Development Kit (JDK) version 15 and JavaFX Software Development Kit (SDK) version 11 or higher on your computer and configured with your IDE. You should also have a Java Integrated Development Environment (IDE) such as IntelliJ IDEA, Eclipse IDE or NetBeans IDE installed on your machine.

To make changes to gui easier install SceneBuilder.

To download JavaFX: https://openjfx.io/

To download Standard Edition JDK: https://www.oracle.com/java/technologies/javase-jdk15-downloads.html

To download SceneBuilder: https://gluonhq.com/products/scene-builder/

After your machine have above conditions met, you should follow steps below:

1. Go to Github repository https://github.com/AhmetIsk/CS-319-Project--3C--Monopoly that you have access permission and basically click 'Download ZIP' suboption of green 'Code' button.
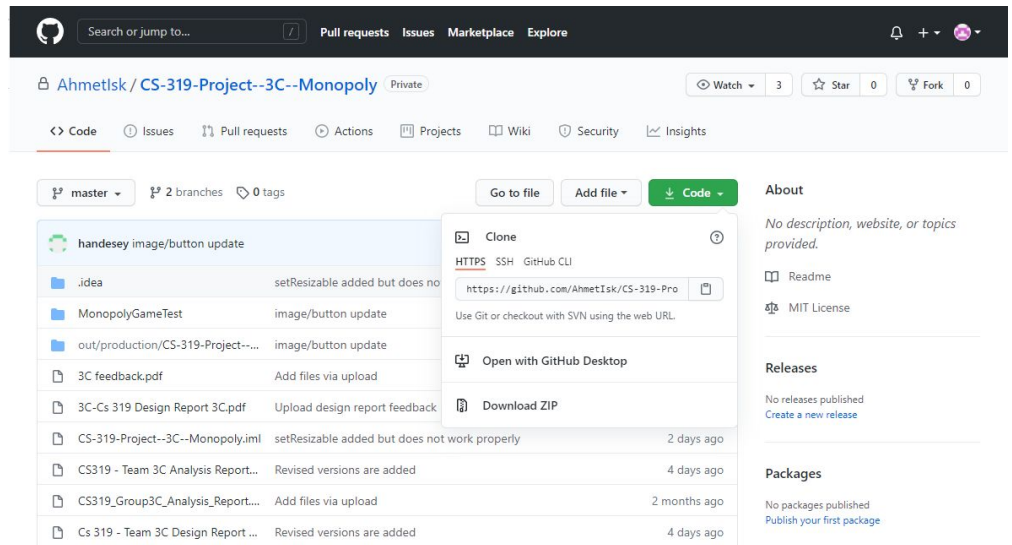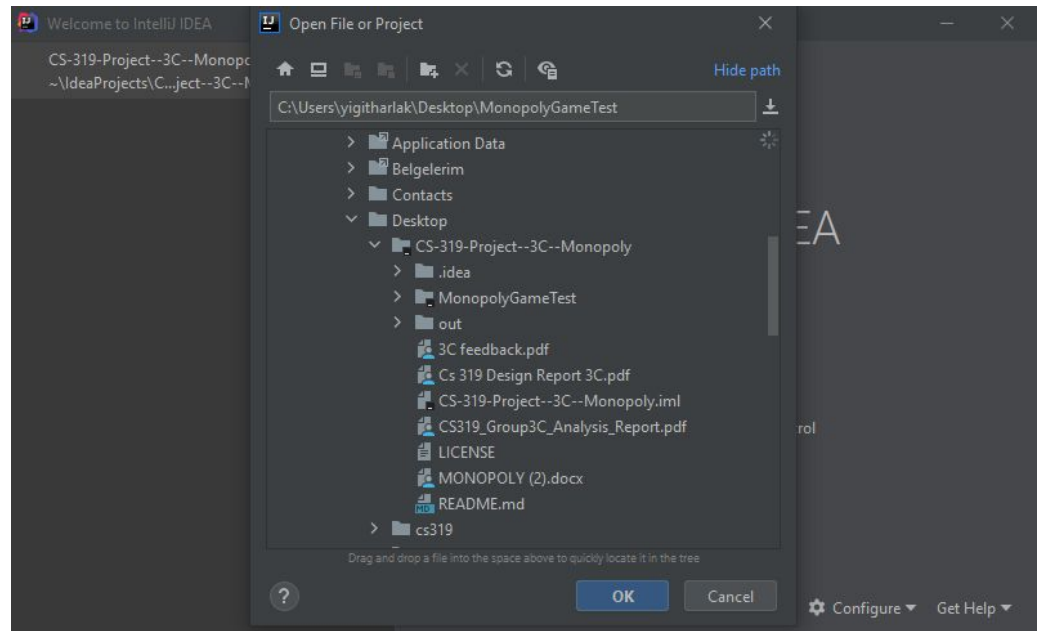
If you are using any software such as Sourcetree, Github Desktop you can clone using these software or via terminal.

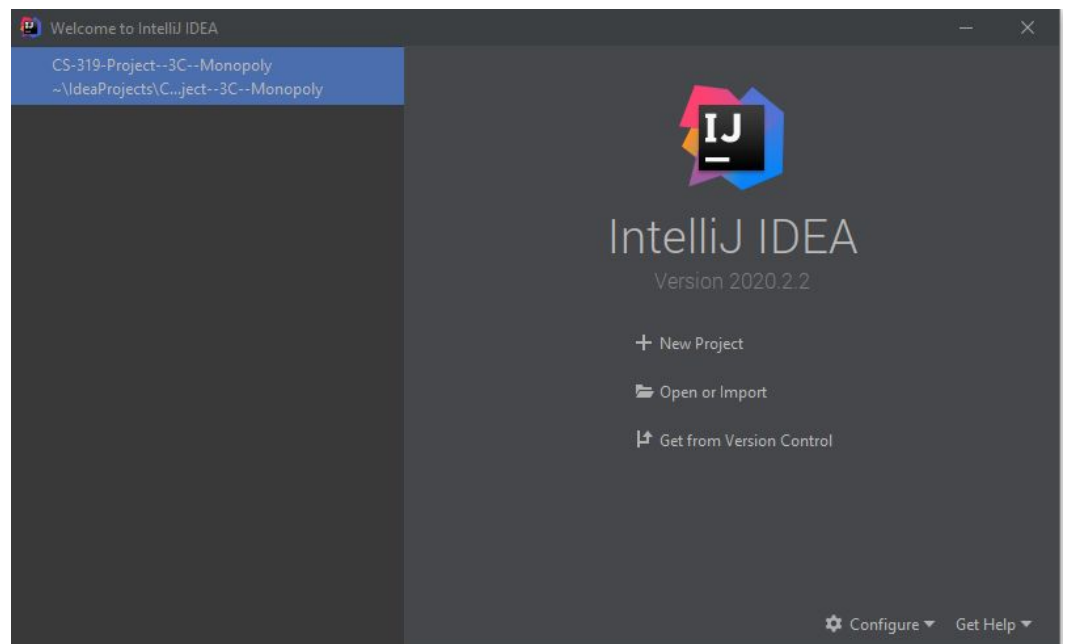2. Extract the zipped file that you downloaded and launch Java IDE installed on your computer.
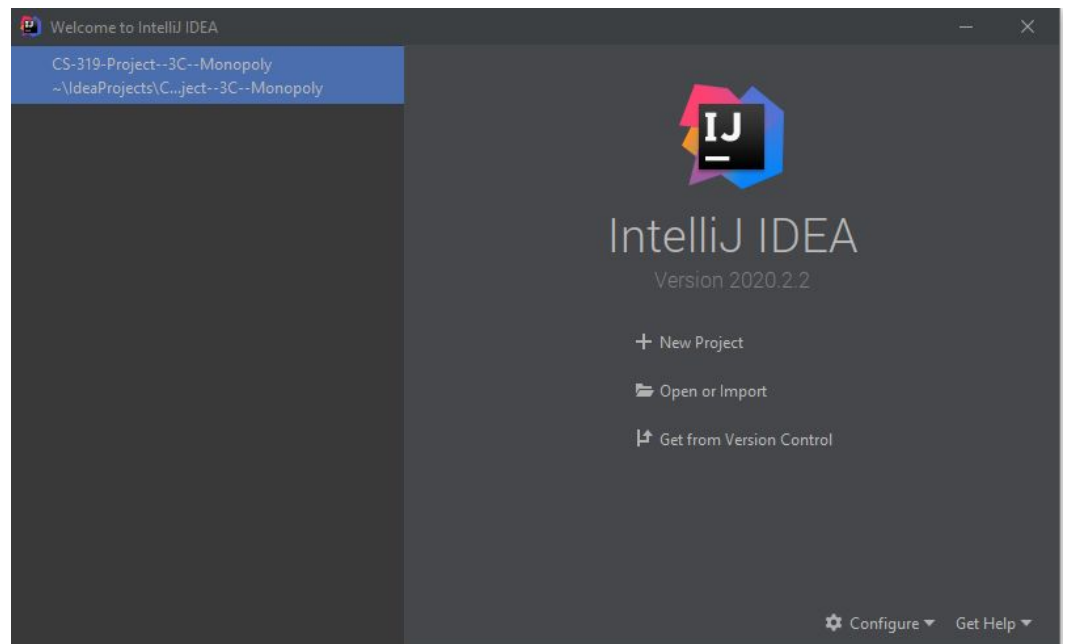


Click Open or Import to open the project. Find the path of the extracted file and open the project.
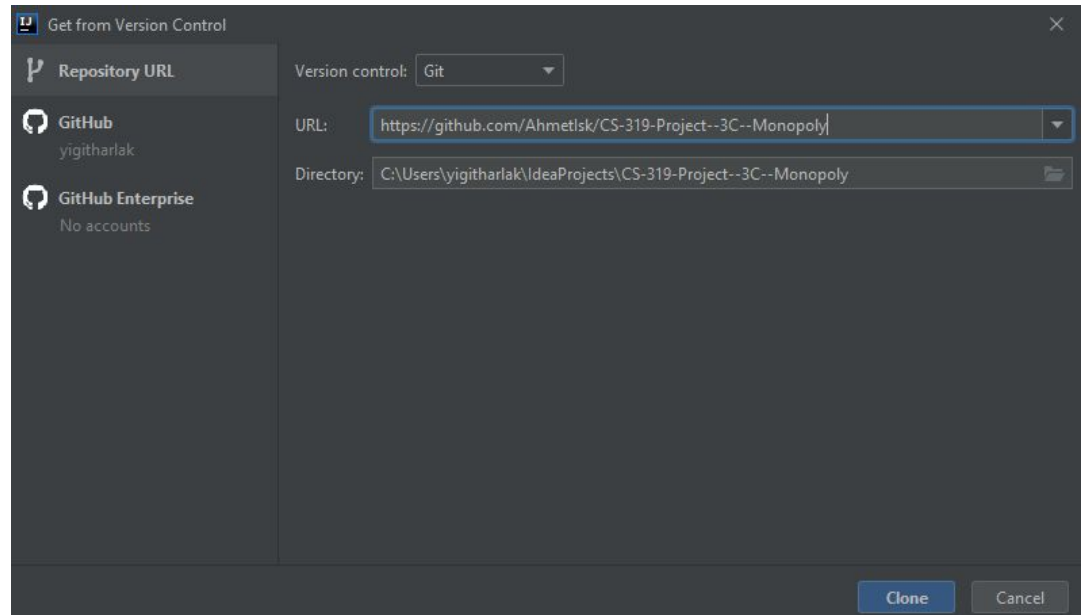
3. If your IDE has GitHub integration, you can clone the project via IDE.
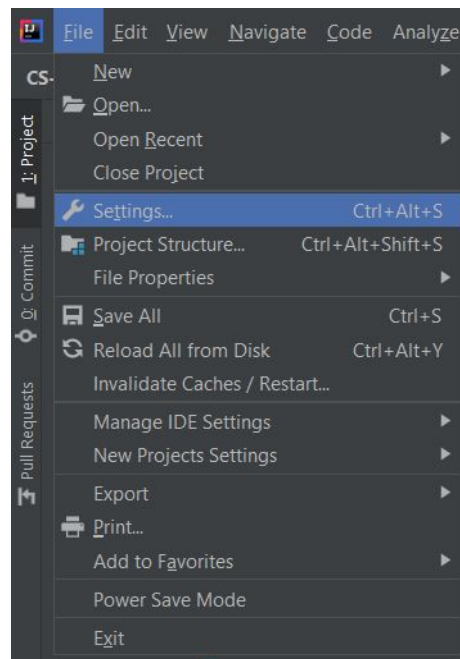
   Click the 'Get from Version Control' button.

Choose Repository URL from left frame and enter the URL
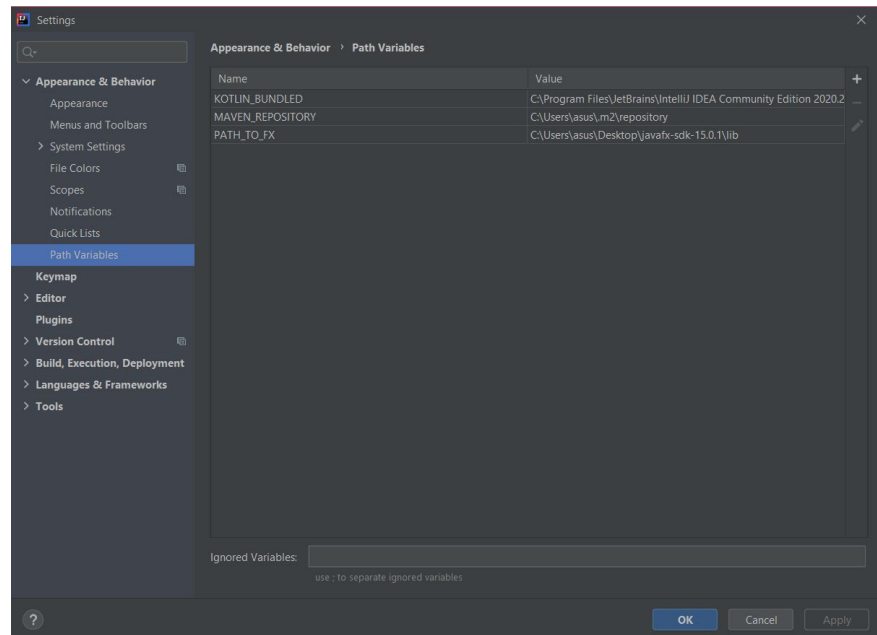https://github.com/AhmetIsk/CS-319-Project--3C--Monopoly



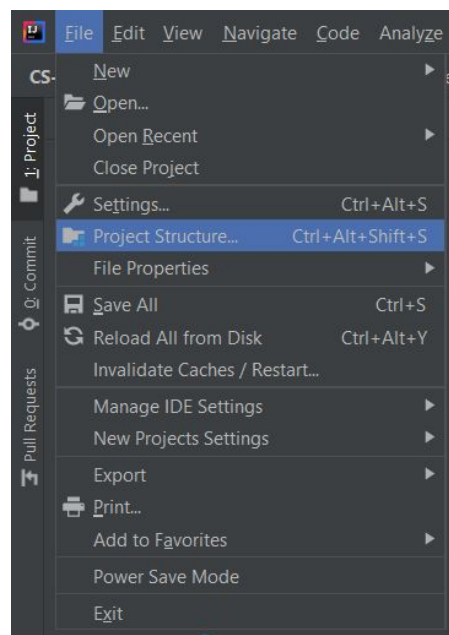Choose your local directory to clone and click the 'Clone' button.
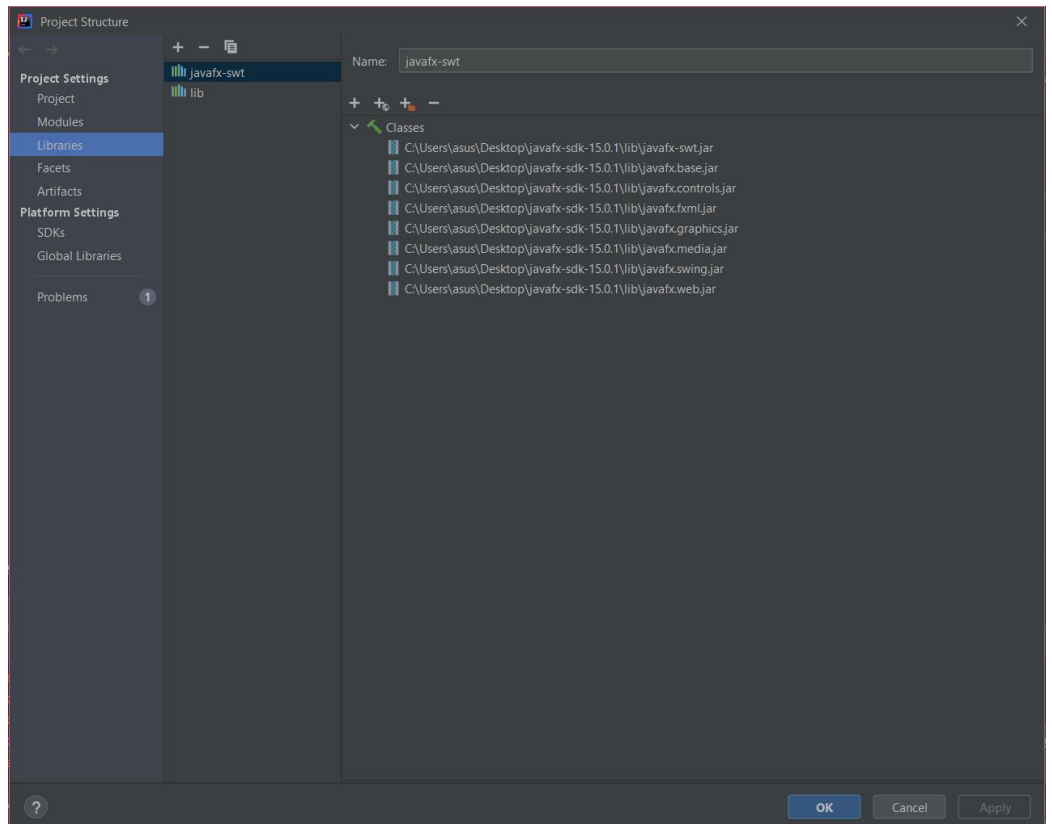
4. After importing or cloning the project



Click the settings button from the file section.

Click Path Variables and add PATH_TO_FX as name. As a value, copy the library of the javafx-sdk and paste here. Then first click the apply button, then click the ok button.
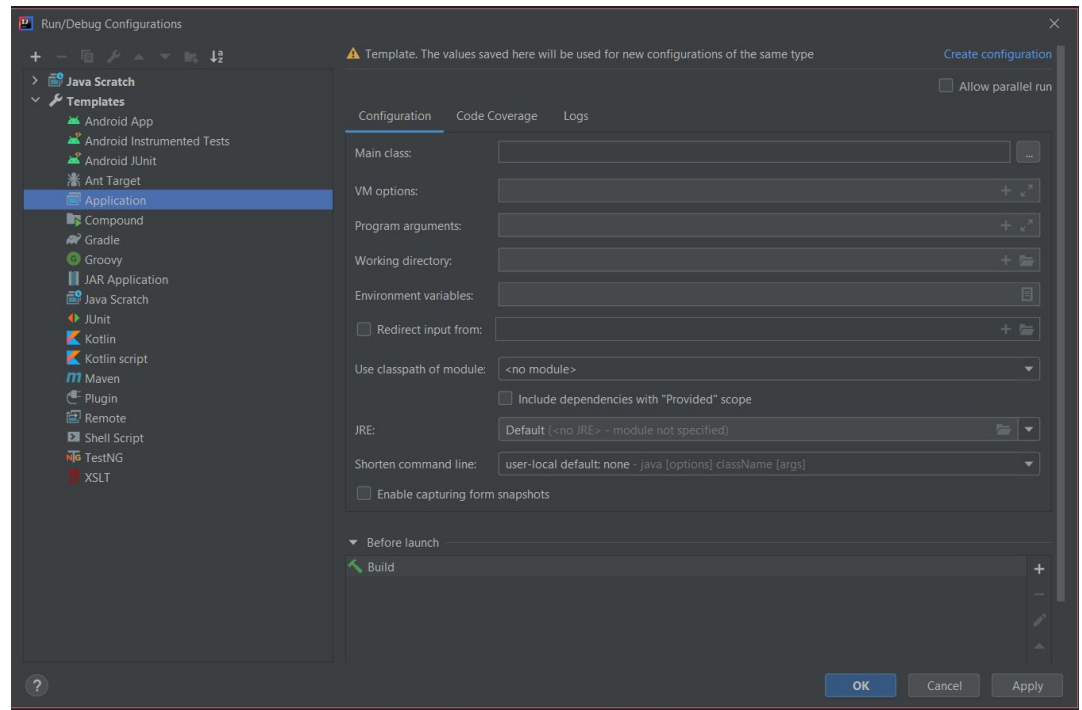


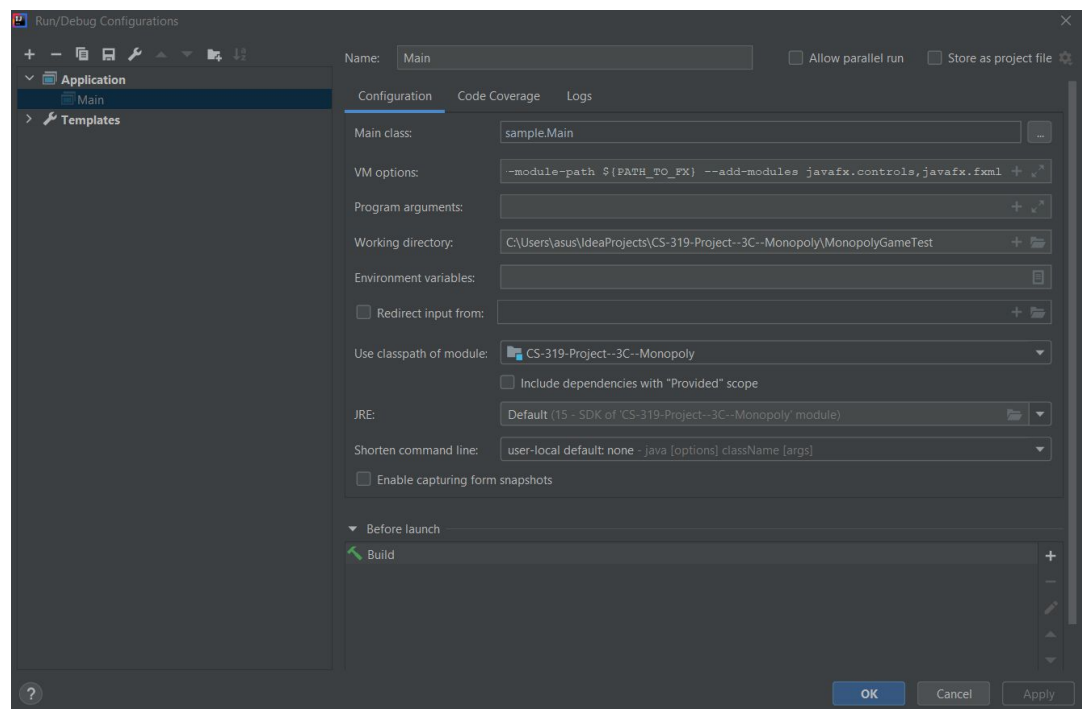Click the project structure button from the file section.

Choose java and then add the library of the javafx-sdk. Then first click the apply button, then click ok button.
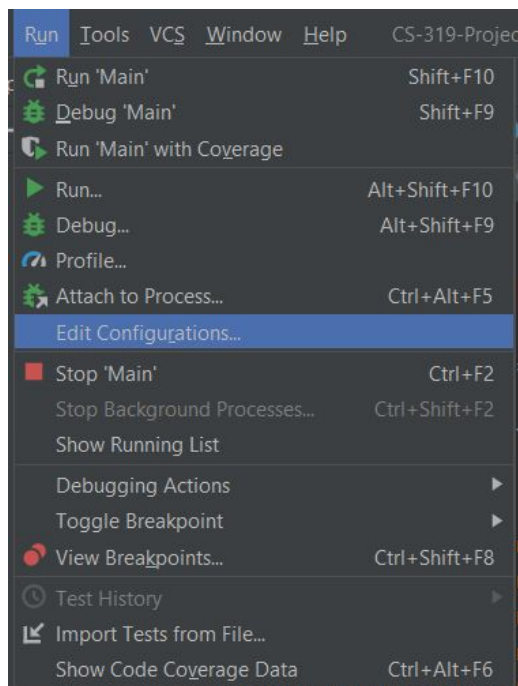


Click the Edit Configurations from the run section.

Click the application from templates.



Here, choose sample.Main for main class. Then, add VM options the sentence below:

```
--module-path ${PATH_TO_FX} --add-modules javafx.controls,javafx.fxml
```

Then, arrange the working directory as the file that the projects in it. If there is no \MonopolyGameTest at the end, add it. Then first click the apply button, then click the ok button.

5. Then, open the main class in the sample(in MonopolyGameTest src file) click the green hammer icon to build the project and the green start icon to run the game or click left and choose Run Main.main() to run the project.
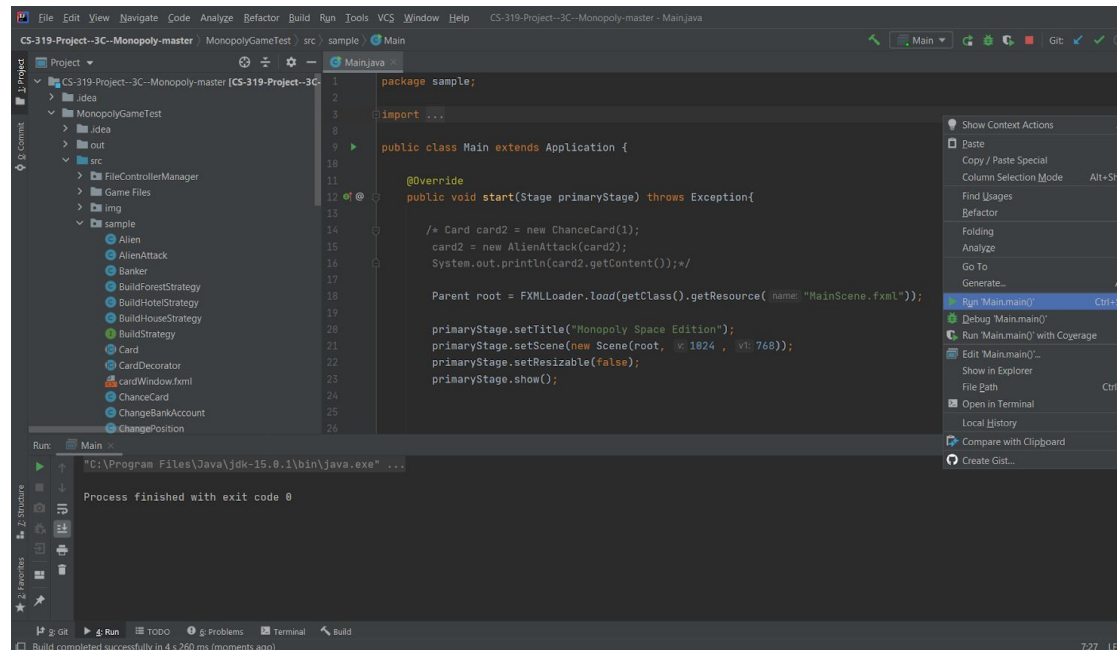


Note: Screenshots and instructions are given for IntelliJ IDEA version 2020.2 and may be different for different IDEs.

# 5. Work Allocation in Group

### Ahmet Işık

- In Analysis Report; Sequence Diagram is completed.

- In Design Report; class diagram is completed with Hande Sena Yılmaz and trade-offs are completed.

- In the implementation part of the code, player information and tokens for each player are initialized to start the game and passed to the Monopoly Board.

- File System Manager is handled to read the planet and spaceship information to use them in the game. Music player is added via file system and mute music operation is handled.

- For the logic of the game, put jail and send black hole parts are implemented with Pelin Çeliksöz.

- Seize the planet of the Alien logic is implemented.

- In the GameController class, initial() and replay() methods are completed. Bugs in alien attack and card are solved with Pelin Çeliksöz. rollDice() method is extended to keep trace of the turns in the game.

- Bugs are solved with group members.

- GUI implementation is handled with Elif Özer.

## Elif Özer

- In Analysis Report; Scenarios, User Interface parts, Mockups are completed.

- The System Model part of the Analysis Report is completed by Pelin Çeliksöz and Elif Özer.

- In Design Report; Subsystem Decompositionis completed and Decorator Design Pattern is integrated into the object(class) diagram.

- In the implementation part of the code, Mortgage Strategy Pattern is implemented with Hande Sena Yılmaz and the logic of finishing the game and bankrupt is tried to be implemented with Hande Sena Yılmaz

- Buy, Pay Rent, Show Properties, Change Bank Account Table parts of the logic of the Monopoly game is handled.

- In the GameController class, showDeeds(), showProperty(), buyPlanet(), buySpaceShip(), payRent(), payRentShip(), acceptMortgage(), changeTable() and rollDice() methods are implemented.

- In the model part of the implementation, CovidHelp, FoundMoney, Card, CardDecorator classes are implemented with Pelin Çeliksöz.

- Planet and SpaceShip classes are extended.

- Player's movement in the board and GUI implementation is handled with Ahmet Işık.

## Pelin Çeliksöz

- In Analysis Report; Current System, Overview, Functional Requirements, Non-Functional Requirements, Scenarios, User Interface parts are completed.

- The System Model part of the Analysis Report is completed by Pelin Çeliksöz and Elif Özer.

- In Design Report; Hardware/software mapping, Persistent data management, Access control and security, Boundary conditions sections are completed.

- Introduction, nonfunctional requirements and system models part were explained in the presentation.

- In the implementation part of the code, duty () methods of Alien, AlienAttack, ChangeBankAccount, ChangePosition, CovidHelp, FoundMoney, PutJail classes were implemented. Later, codes were written in the GameController class to enable the game to perform the alien and card party. In gameBoard.fxml, necessary arrangements have been made for the alien and card part of the game.

- Some of the introduction, In-Game screenshots, some of the build instructions part are completed.

**Hande Sena Yılmaz**

- In Analysis Report; Introduction, Overview, Object and Class Model Diagram, and Conclusion are completed.

- In Design Report; Low-level design sections are completed with Final Object Design Diagram and its details.

- Object Model and the classes were explained in the presentation.

- In the Model part of the implementation, Property, Planet, Spaceship, BuildStrategy (BuildHouseStrategy, BuildHotelStrategy, BuildForestStrategy, NoBuildStrategy), MortgageStrategy(PlanetMortgageStrategy, ShipMortgageStrategy), and Player classes are implemented.

- In the Controller part of the implementation, integration of the strategy design pattern is made. Build strategy is integrated and implemented with showBuildStructure() and necessary additions are made to showProperty() method in GameController class. The GUI of this part is also implemented and added.

- In the implementation part of the code, Mortgage Strategy Pattern is implemented and succeeded, and the logic of finishing the game and bankruptcy is tried to be implemented but not succeed with Elif Özer.

- Final mockup design is completed for the game board with editing pictures of planets, spaceship, alien and their names are added.

**Mehmet Yiğit Harlak**

- In Analysis Report; Dynamic Models such as User and Player state diagrams and Main Menu and Game Board activity diagrams are completed.

- In Design Report; System Purpose and Design Goals: Trade Offs and Criteria parts are completed.

- Dynamic models: State and activity diagrams have been explained in the first iteration presentation.

- Lessons Learnt, Build Instructions, Game Overview, Objects and Controls parts of final report are completed.

- Implementation of various methods of Banker class and some methods of Alien and Player classes are completed. Read and write from text file has been implemented but not used. Scenario and editing of Monopoly Space Edition demo video have been completed.