Encapsulation

Lab 03

Overview

- Announcement
- Project Path
- Import built-in packages
- Encapsulation Example : RSP (Rock Scissors Paper) Game System
  - Packaging
  - Access Control

Announcement - 1

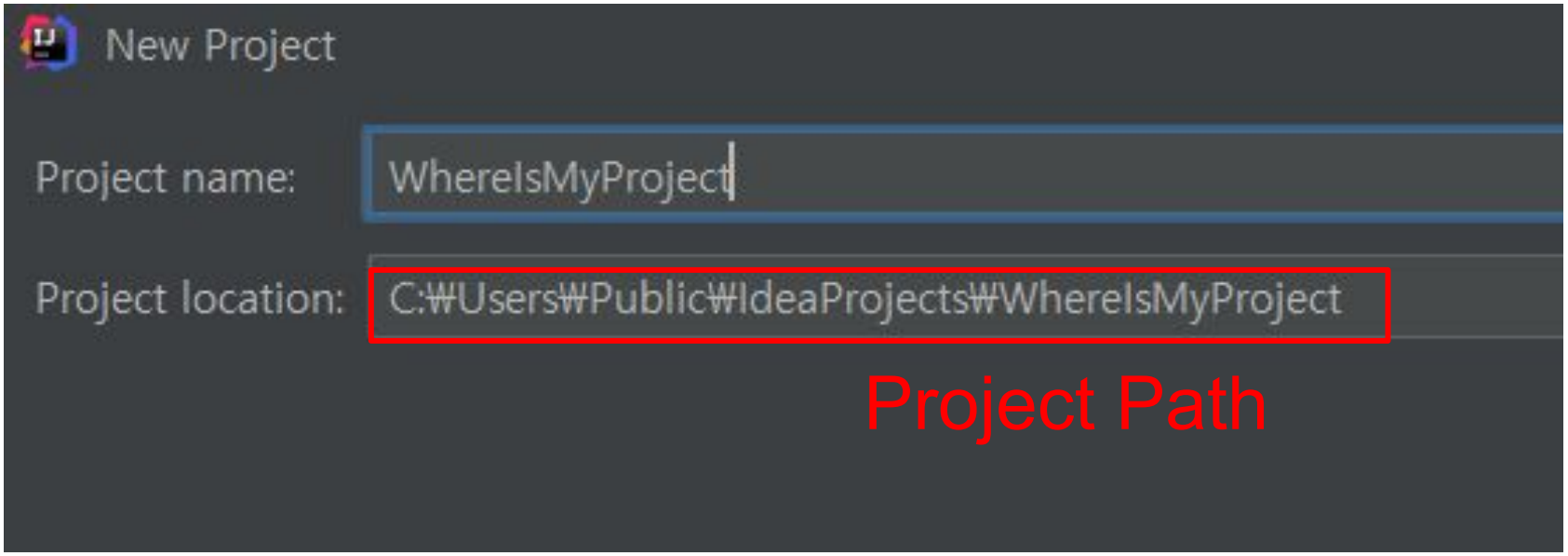
- Homework will be assigned in every 2~3 weeks, combining related programming subjects.
- FAQ will be uploaded on the ETL announcement board, and not replied individually. FAQ will be continuously updated. Please check the board before email or ask to TAs.
- Labtest 1 is re-evaluated. Please check them in the ETL, and ask TAs if you have any problems.

Announcement - 2

- We evaluated Labtest 1 leniently this time. From now on, we will evaluate Labtests strictly without any exception. Please read Labtest specifications carefully.
- If you want to change your Lab Pair, 1) ask for consents of the desired partner, current partner, and the current partner of the desired partner, and 2) email us with all four students' names until 10/1 (Tue).

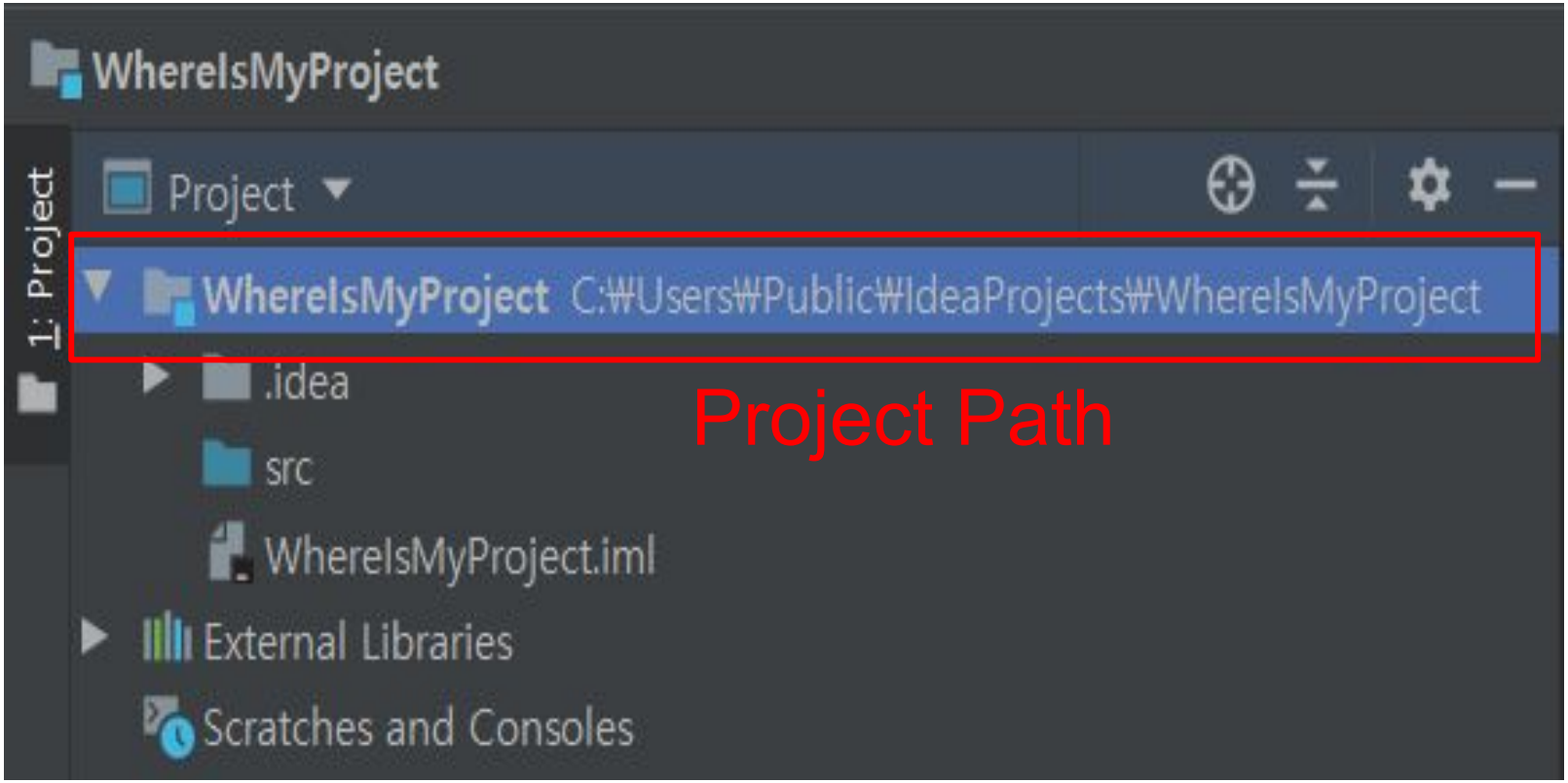
Project Path

- When we make the project, we can set the path of the projects.

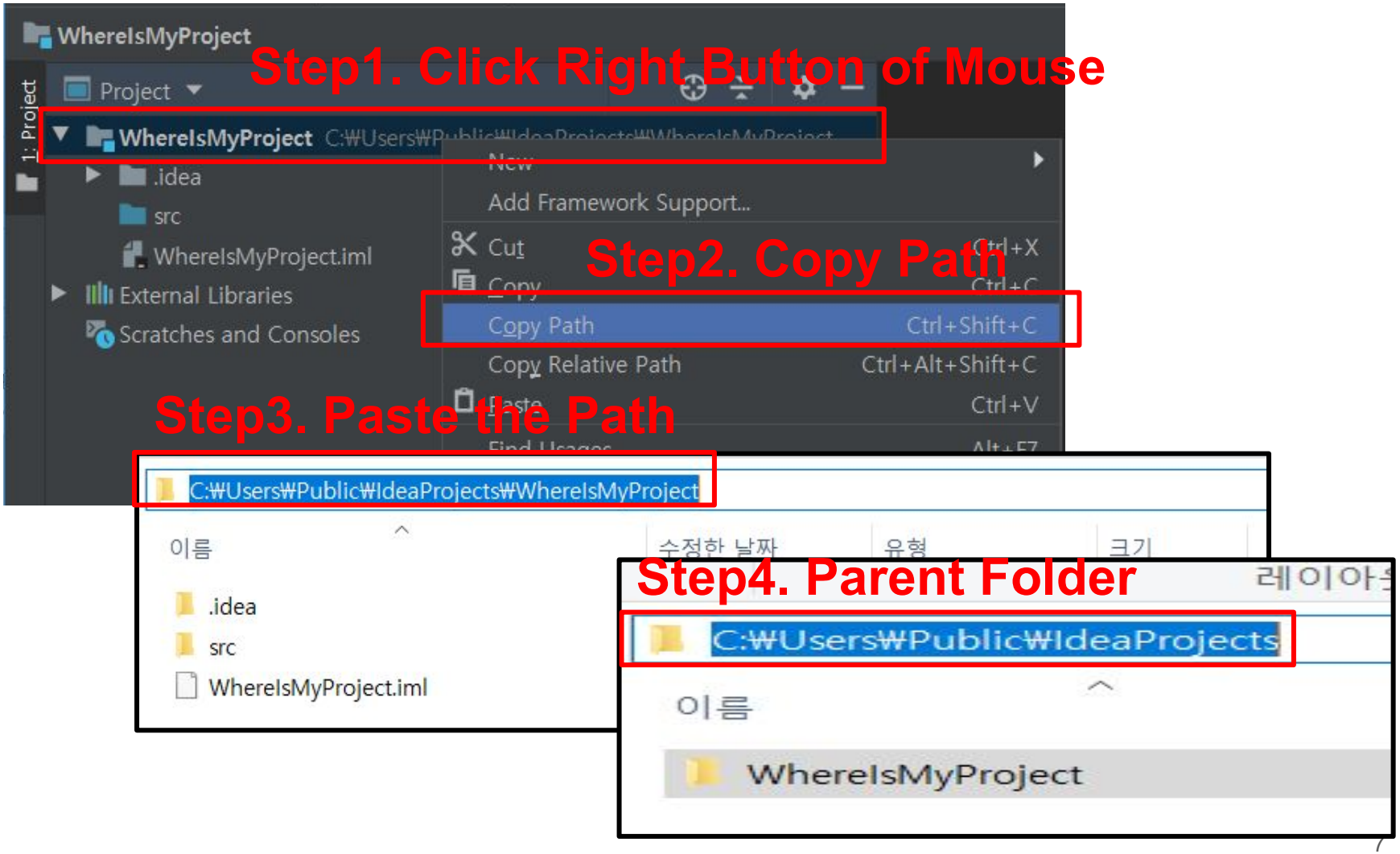


Project Path

- We can get the project path from the Project Tree.



Project Path



Import Built-In Packages

- Package in Java is a mechanism to encapsulate a group of classes and there are various and useful built-in Packages.
- java.lang* is automatically imported.
  - `import java.util.Scanner;` **Recall Scanner Class**
  - `import java.time.*;`

Java Api : java.time.*;

- The main API for dates, times, instants, and durations.
- https://docs.oracle.com/javase/8/docs/api/java/time/

OVERVIEW PACKAGE CLASS USE TREE DEPRECATED INDEX HELP

PREV PACKAGE NEXT PACKAGE FRAMES NO FRAMES ALL CLASSES

Package java.time

The main API for dates, times, instants, and durations.

See: Description

Class Summary

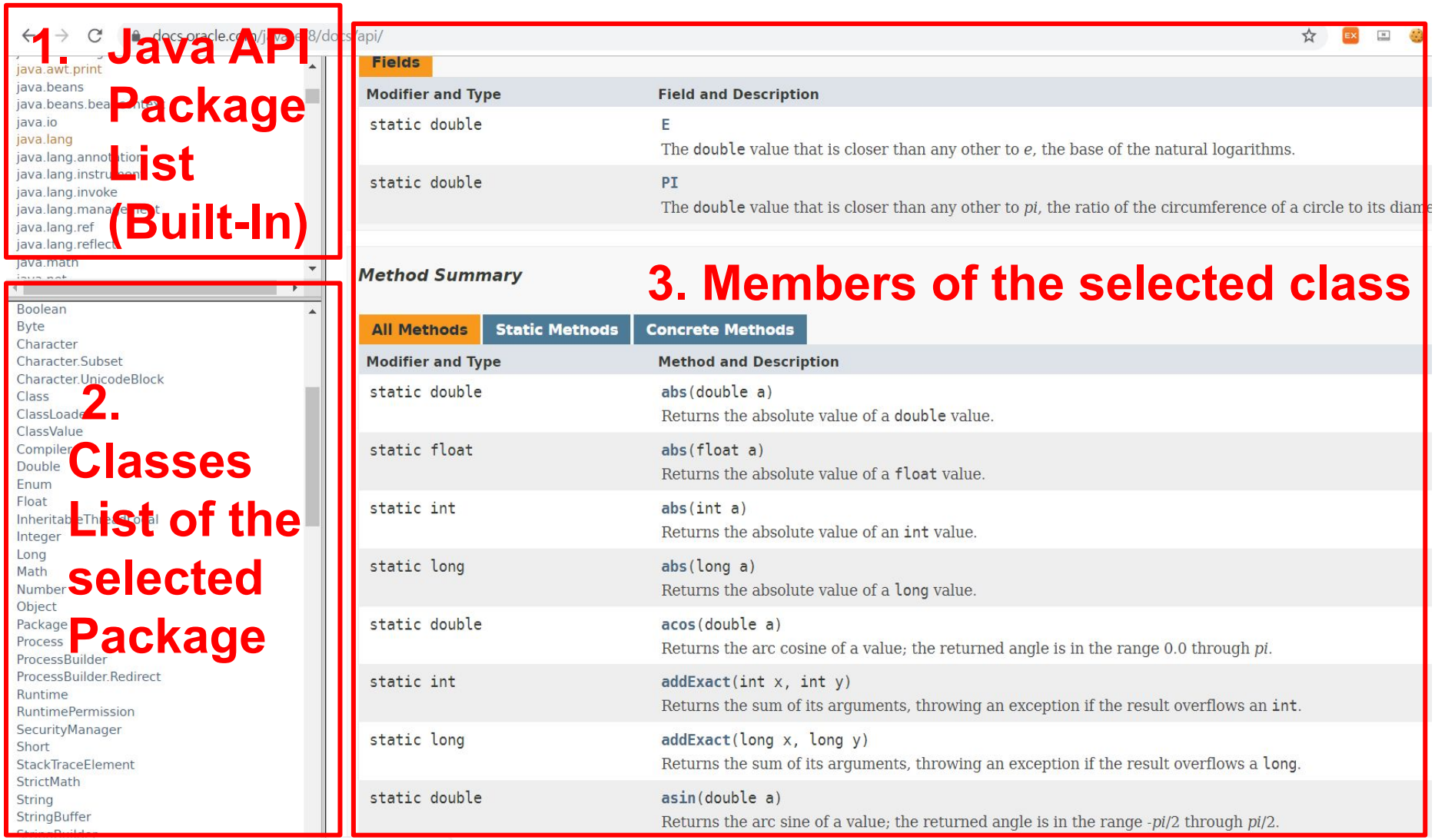
Class	Description
Clock	A clock providing access to the current instant, date and time using a time-zone.
Duration	A time-based amount of time, such as '34.5 seconds'.
Instant	An instantaneous point on the time-line.
LocalDate	A date without a time-zone in the ISO-8601 calendar system, such as 2007-12-03.
LocalDateTime	A date-time without a time-zone in the ISO-8601 calendar system, such as 2007-12-03T10:15:30.
LocalTime	A time without a time-zone in the ISO-8601 calendar system, such as 10:15:30.
MonthDay	A month-day in the ISO-8601 calendar system, such as --12-03.
OffsetDateTime	A date-time with an offset from UTC/Greenwich in the ISO-8601 calendar system, such as 2007-12-03T10:15:30+01:00.

After Example, these classes will be used

Java API Documents

- The list and usage of Java APIs are organized systematically in this site. (https://docs.oracle.com/javase/8/docs/api/)
- Let's find a list of candidates for the package that we expect to have the logic we need.

Java API Documents

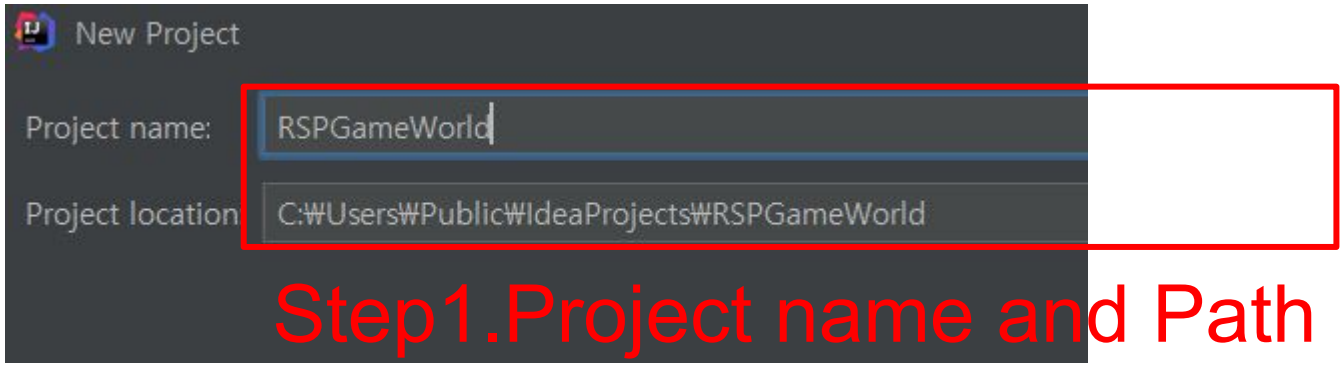


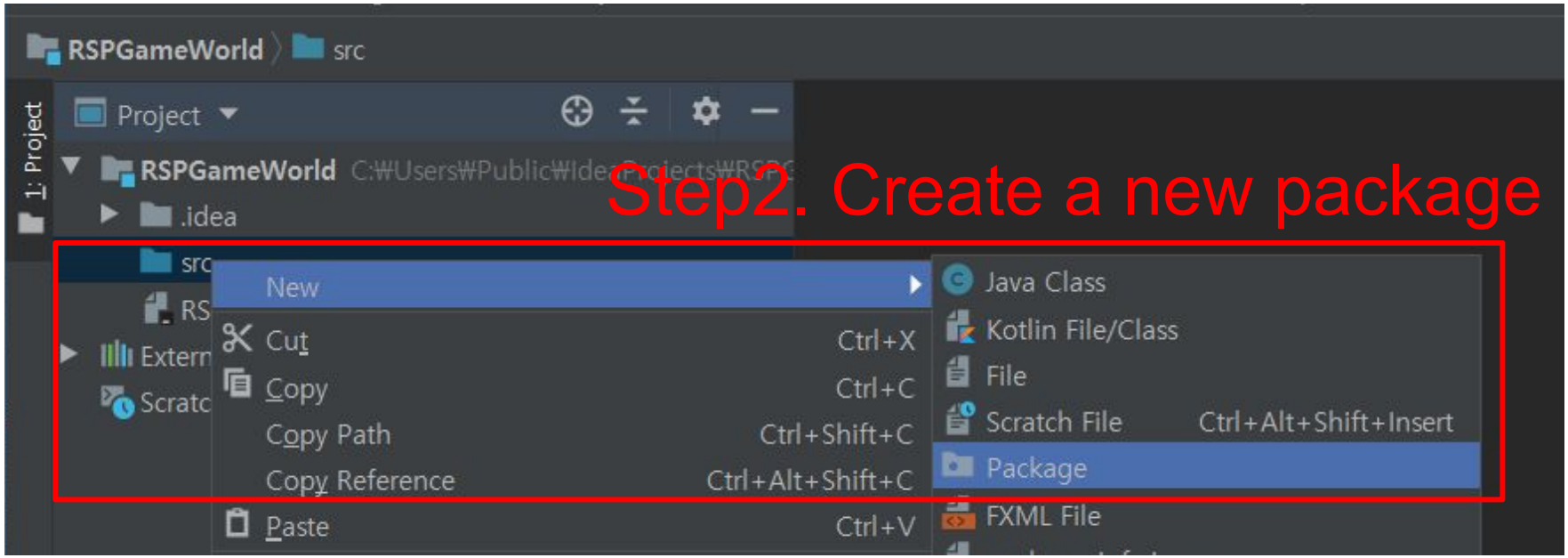
Encapsulation Example - overview

- “ Rock Scissors Paper Game”

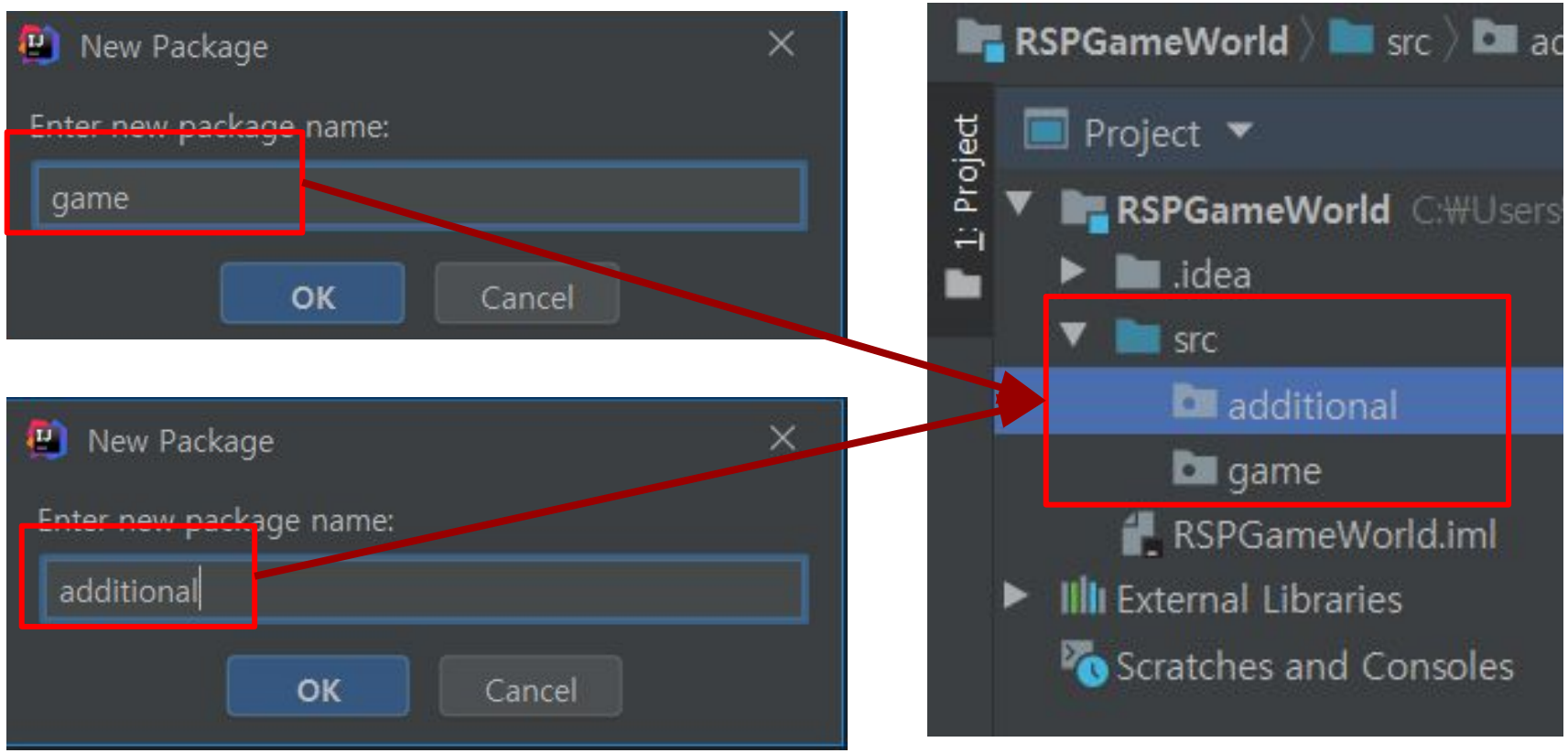
- This Project is consisted of 2 Modules
  - game package :
    Provides components and UI for the game.
    - RSPGame.java, GameSystem.java
  - additional package :
    Provides components for additional services
    - Analyzer.java, Summary.java

Create Packages



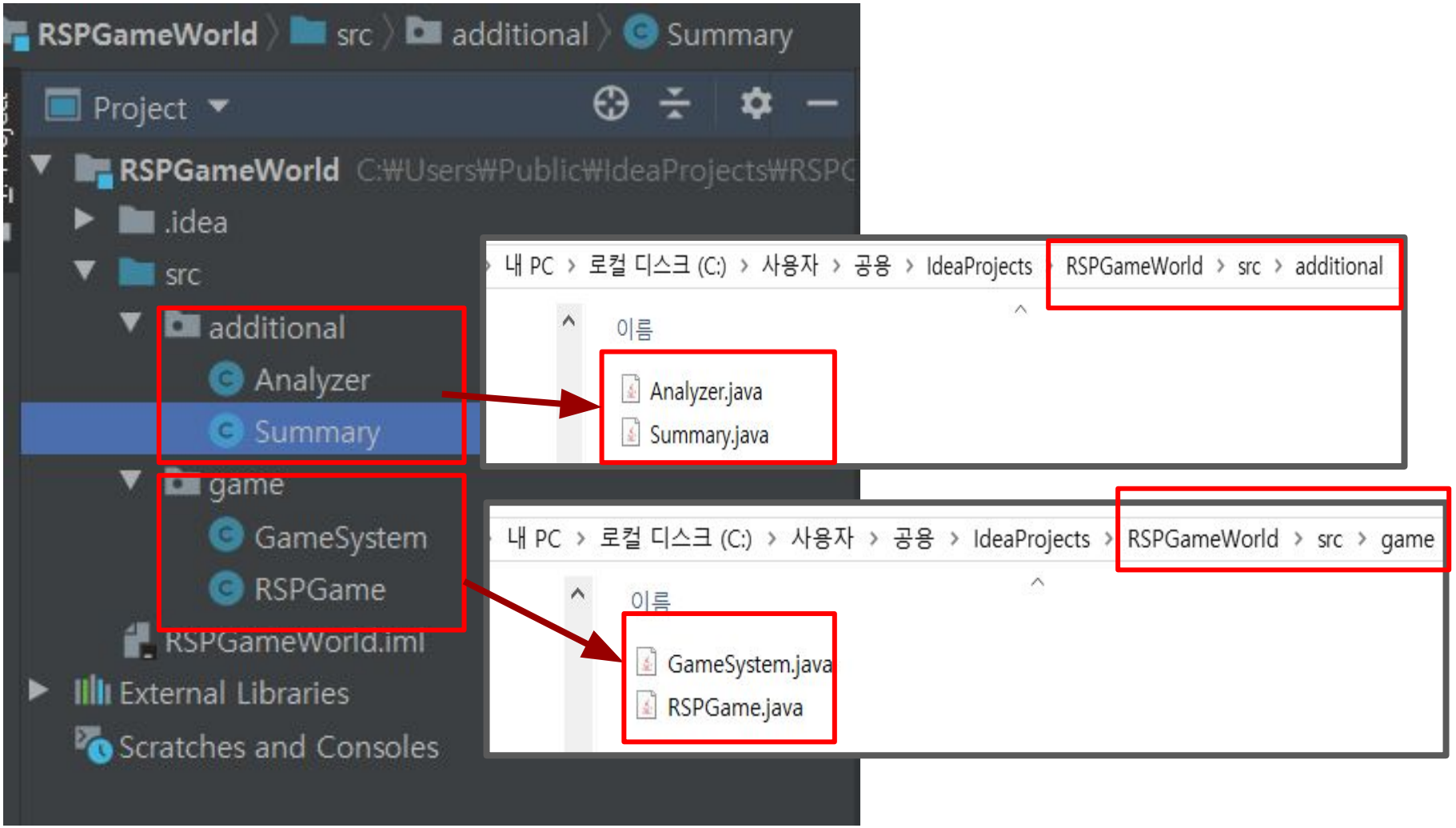


Create Packages



Step4. Create 2 packages Under the src folder.
(‘game’ and ‘additional’)

Create Class files



Project Description

- GameSystem.java : offer the UI and overall systems between game program and User.

- Game.java : offer the “Rock Scissors Paper Game” with computer system
  (2 mode : i) Draw Allow ii) Draw Not Allow)

- Analyzer.java : Analyze module the result of game

- Summary.java : offer summarized informations of results

GameSystem.java Structure

GameSystem.java

```java
package game;
// Import Sentences
public class GameSystem {
    // Field members will be filled

    public void main(String[] arg) {
        // Overall System flow will be filled
    }

    // Method members will be filled
}
```

GameSystem.java

- In our system, we don't need a string of GameSystem instances.

  => We will manage the system with `static` variables.

Field Members

```
private static int rounds;
private static boolean mode;
private static RSPGame.History[] histories;
private static Summary summary;
static RSPGame rspGame;
```

```
import additional.Summary;
```

Related fields with game settings

GameSystem.java

Method members

```
private static void setEnvironment() {
// set static fileds of GameSystem Class
}
private static boolean setRounds(int num) {
// check the validation of setting Rounds values
}
private static boolean setMode(int num) {
// check the validation of mode value and determine
draw's valid
}
```

GameSystem.java

- Overall flow of system and communication with User will be offered by main() Method in GameSystem.java

main() Method

```
// Overall System flow will be filled


// Step1. Get the values about game setting from
user input. Then create the environment for game.
// Step2. Proceed games
// Step3. Report the end of games
// Step4. Show the summarized result of the games
```

GameSystem.java

main() Method

```
setEnvironment(); // Step1

for (int i = 0; i < rounds; i++) {
    histories[i] = rspGame.playGame(); // Step2
}

System.out.println("Game is over!\n"); // Step3

summary = new Summary(histories); // Step4
summary.printSummary();
```

GameSystem.java

```
private static void setEnvironment() -(1)
```

```
System.out.println("Welcome to RSP GAME World!\n");
System.out.println("How many times? ( with natural
number)");

Scanner scanner = new Scanner(System.in);

int input;
do {
    input = scanner.nextInt();
} while (!setRounds(input));
```

import java.util.Scanner;

Until pass the validation

GameSystem.java

```java
private static void setEnvironment() - (2)
```

```java
System.out.println("Draw Allow? (Yes : 1 /No : 0)");

do {
    input = scanner.nextInt();
} while (!setMode(input));

rspGame = new RSPGame(mode);
String modeName;
```

GameSystem.java

```
private static void setEnvironment() - (3)
```

```
if (mode) {
    modeName = "Draw Valid Mode";
} else {
    modeName = "Draw not Valid Mode";
}
System.out.println(rounds + " game(s) will be started( "
                    + modeName + " )\n");

histories = new RSPGame.History[rounds];
```

Access inner Class from External

GameSystem.java

```
private static boolean setRounds(int num)
```

```
if (num > 0) {
    rounds = num;
    return true;
}
return false;
```

Validation and Setting

GameSystem.java

```
private static boolean setMode(int num)
```

```
if (num == 0) {
    mode = false;
    return true;
} else if (num == 1) {
    mode = true;
    return true;
} else {
   System.out.println("Not a valid mode");
}
return false;
```

RSPGame.java

RSPGame.java
Overall Structure

```java
package game;
// import sentences
public class RSPGame {
    // field members and constructor
    History playGame() { }
    private int checkUserInput(String userInput) { }
    private int generateSystemPick() { }
    private void recordHistory(int userPick,
                               int systemPick) { }
    public class History{ /* inner class */ }
}
```

History Class

History Class Definition

```
public class History{
    // field members
    // Constructor
    public boolean printHistory() {
        // validaiton check,print the histories
    }
    private void setPresentDT() {
        // set the present Data and Time
    }
    public int getResult() {
        // get the result of the game
    }
}
```

History Class

- History Class's field must be written when history is recorded (in RSPGame Class : outer class)

Few accesses from external.

Field Members

```
private int round;
private String userPick;
private String systemPick;
private String result;
private LocalDate date;
private LocalTime time;
private boolean update = false;
```

History Class

- A History instance will be created by round value
- To use LocalDate & LocalTime Class, import java.time.* package

Constructor

```
public History(int round) {
    this.round = round;
}
```

```
import java.time.*;
```

```
private void setPresentDT()
date = LocalDate.now();
time = LocalTime.now();
```

History Class

```java
public boolean printHistory()
```

```java
if (!update) {
    System.out.println("History is not valid.");
    return false;
}
System.out.println("\n< Result of Round " + round +" >");
System.out.println("Date : " + date);
System.out.println("Time : " + time);
System.out.println("User Pick : " + userPick);
System.out.println("System Pick : " + systemPick);
System.out.println("Game result : " + result);
return true;
```

History Class

- find the index of game result for external accesses (if not valid => return -1)

```
public int getResult()
```

```
for (int i = 0; i < resultCases.length; i++) {
    if (resultCases[i].equals(result)) {
        return i;
    }
}
return -1;
```

filed from RSPGame

```
private static String[] resultCases =
    {"Draw!\n","User Win\n","User Lose!\n"};
```

RSPGame.java

Field Members

```
private int round = 0;
private static String[] rsp =
    {"scissors", "rock", "paper"};
private static String[] resultCases =
    {"Draw!\n", "User Win\n", "User Lose!\n"};
private History history ;
private boolean drawValid;
private Scanner scanner;
```

```
RSPGame(boolean drawValid) {
    this.drawValid = drawValid;
    this.scanner = new Scanner(System.in);
}
```

Constructor Method

RSPGame.java

History playGame() -(1)

```
this.round++;
history = new History(this.round);
System.out.println("Round " + round);
String input;
int userPick;
int systemPick;

do {
    systemPick = generateSystemPick();
    System.out.println("Please enter one of the 'scissors',
'rock', or 'paper'");
    input = scanner.next();
    userPick = checkUserInput(input);

...
```

RSPGame.java

History playGame() -(2)

```
...
```

Pick Again!

```
    if(!drawValid && (systemPick == userPick)) {
        System.out.println("Draw case! pick one more time for
this round !");
        userPick = -1;
    }
} while (userPick < 0);
```

Not Valid pick => Pick Again!

```
recordHistory(userPick, systemPick);
history.printHistory();

return history;
```

RSPGame.java

```
private int checkUserInput(String userInput)
```

```
for (int i = 0; i < rsp.length; i++) {
    if (rsp[i].equals(userInput)) {
        return i;
    }
}
System.out.println("Not valid input!\n");
return -1;
```

```
private int generateSystemPick()
```

```
return (int) (3 * Math.random());
```

Static Method

RSPGame.java

```
private void recordHistory(int userPick, int systemPick)
```

```
int result = (userPick - systemPick + 3) % 3;
history.userPick = rsp[userPick];
history.systemPick = rsp[systemPick];
history.result = resultCases[result];
history.setPresentDT();
history.update = true;
```

```
private static String[] rsp =
    {"scissors", "rock", "paper"};
```

// idx = 0, 1 , 2

Lose : My index is smaller 1(Larger 2) than opponent's

RSPGame.java(package & import)

```
package game;


import java.util.Scanner;
import java.time.*;
```

Analyzer.java Structure

```java
package additional;
import game.RSPGame;

public class Analyzer {
    // Field Members

    public Analyzer(RSPGame.History[] histories) { }
    private void updateRecords(RSPGame.History history) { }
    private float computWiningRate() { }
    public float getWinningRate() { }
}
```

Analyzer.java

```
private float winningRate;
int TotalGames = 0;
int TotalWins = 0;
int TotalLoses = 0;
int TotalDraws = 0;
boolean IsComputed = false;
```

Field Members

```
public Analyzer(RSPGame.History[] histories)
```

```
TotalGames = histories.length;
for (RSPGame.History history : histories) {
    updateRecords(history);
}
```

Analyzer.java

```
private void updateRecords(RSPGame.History history)
```

```
int result = history.getResult();
switch (result) {
   case 0:
      TotalDraws++;
      break;
   case  1:
      TotalWins++;
      break;
   case 2:
      TotalLoses++;
      break;
   default:
      System.out.println("Not valid history");
}
```

Analyzer.java

```
private float computWiningRate()
```

```
winningRate = (float) TotalWins / TotalGames;
isComputed = true;
return winningRate;
```

Check the Setting of winningRate Value

```
private float computWiningRate()
```

```
if (!isComputed) {
    computWiningRate();
}
return winningRate;
```

Summary.java Structure

```java
package additional;

import game.RSPGame;

public class Summary {

    Analyzer analyzer;

    public Summary(RSPGame.History[] histories) { }
    public void printSummary() { }
}
```

Summary.java

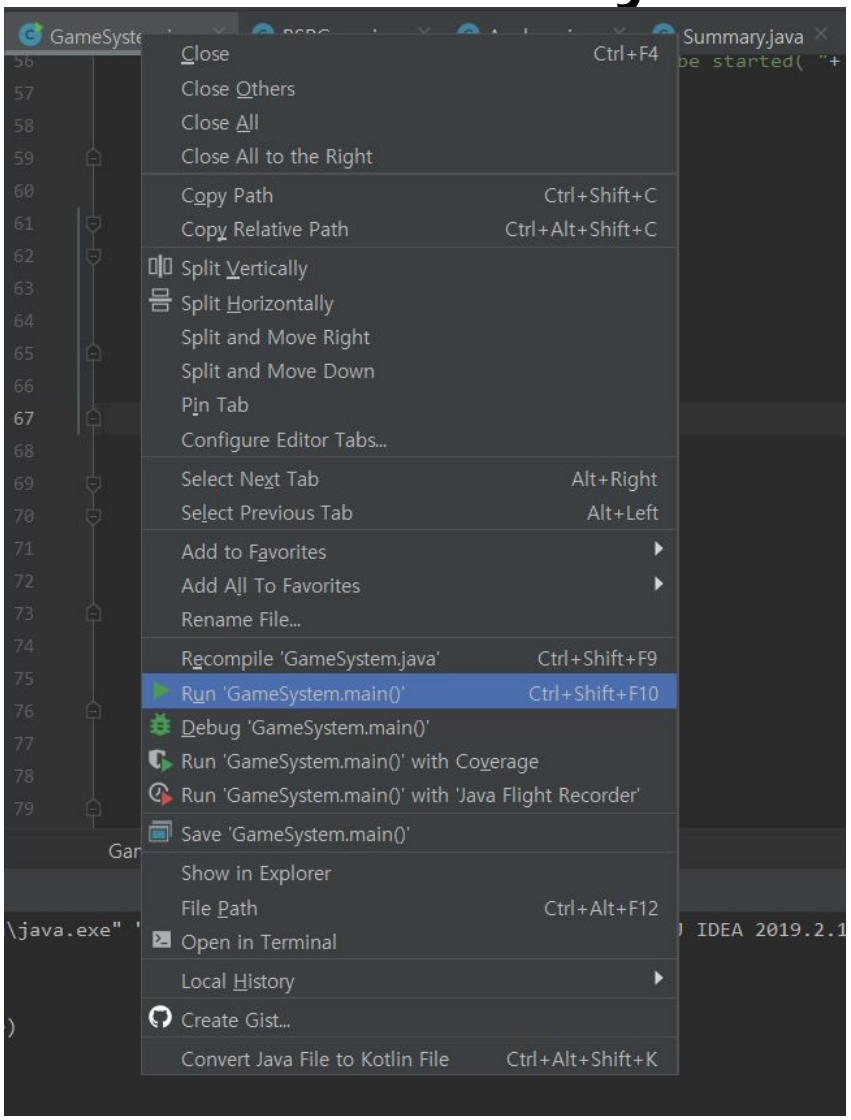
```
public Summary(RSPGame.History[] histories)
```

```
analyzer = new Analyzer(histories);
```

```
public void printSummary()
```

```
System.out.println("< Summary >\n" );
System.out.println("TotalGames: "+ analyzer.TotalGames);
System.out.println("TotalWins: " + analyzer.TotalWins);
System.out.println("TotalDraws: " + analyzer.TotalDraws);
System.out.println("TotalLoses: " + analyzer.TotalLoses);
System.out.println("Wining Rate: " +
                    analyzer.getWinningRate());
```

Run GameSystem.main()



Outputs (Draw Valid Mode)

```
Welcome to RSP GAME World!

How many times? ( with natural number)
3
Draw Allow? (Yes : 1 /No : 0)
1
3 game(s) will be started( Draw Valid Mode )

Round 1
Please enter one of the 'scissors', 'rock', or 'paper'
rock

< Result of Round 1 >
Date : 2019-09-25
Time : 10:40:07.642856400
User Pick : rock
System Pick : scissors
Game result : User Win
```

Outputs (Draw Valid Mode)

```
Round 2
Please enter one of the 'scissors', 'rock', or 'paper'
rock

< Result of Round 2 >
Date : 2019-09-25
Time : 10:40:11.181480100
User Pick : rock
System Pick : paper
Game result : User Lose!
```

```
Round 3
Please enter one of the 'scissors',
'rock', or 'paper'
paper

< Result of Round 3 >
Date : 2019-09-25
Time : 10:40:13.003058900
User Pick : paper
System Pick : scissors
Game result : User Lose!

Game is over!
```

Outputs (Draw Valid Mode)

```
< Summary >

TotalGames: 3
TotalWins: 1
TotalDraws: 0
TotalLoses: 2
Wining Rate:
0.33333334
```

Outputs (Draw Not Valid Mode)

```
Welcome to RSP GAME World!

How many times? ( with natural number)
4
Draw Allow? (Yes : 1 /No : 0)
0
4 game(s) will be started( Draw not Valid Mode )

Round 1
Please enter one of the 'scissors', 'rock', or 'paper'
rock

< Result of Round 1 >
Date : 2019-09-25
Time : 13:36:52.922228300
User Pick : rock
System Pick : paper
Game result : User Lose!
```

Outputs (Draw Not Valid Mode)

```
Round 2
Please enter one of the 'scissors', 'rock', or 'paper'
rock

< Result of Round 2 >
Date : 2019-09-25
Time : 13:36:54.477738200
User Pick : rock
System Pick : paper
Game result : User Lose!
```

Outputs (Draw Not Valid Mode)

```
Round 3
Please enter one of the 'scissors', 'rock', or 'paper'
rock
Draw case! pick one more time for this round !
Please enter one of the 'scissors', 'rock', or 'paper'
rock

< Result of Round 3 >
Date : 2019-09-25
Time : 13:36:58.711766400
User Pick : rock
System Pick : paper
Game result : User Lose!
```

(Because, Draw is not valid case in this mode)

Outputs (Draw Not Valid Mode)

```
Round 4
Please enter one of the 'scissors', 'rock', or 'paper'
paper

< Result of Round 4 >
Date : 2019-09-25
Time : 13:37:01.430157400
User Pick : paper
System Pick : scissors
Game result : User Lose!

Game is over!
```

```
< Summary >

TotalGames: 4
TotalWins: 0
TotalDraws: 0
TotalLoses: 4
Wining Rate: 0.0
```