COMP 3021(Lab 3) : Java Debugging with Eclipse

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Overview

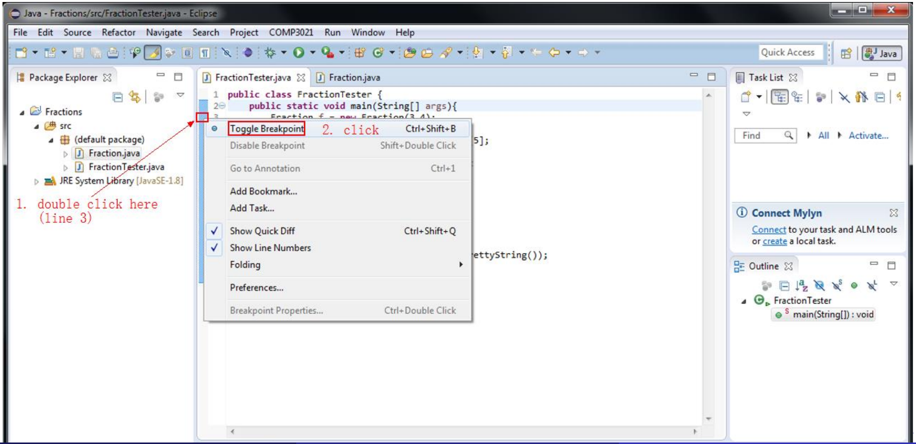
- What is debugging?
  Debugging allows you to run a program interactively while watching the source code and the variables during the execution.
  By breakpoints in the source code you specify where the execution of the program should stop. To stop the execution only if a field is read or modified, you can specify watchpoints .
  Breakpoints and watchpoints can be summarized as stop points.
  Once the program is stopped you can investigate variables, change their content, etc.
- Debugging support in Eclipse
  Eclipse allows you to start a Java program in Debug mode. Eclipse has a special Debug perspective which gives you a preconfigured set of views. In this perspective you control the execution process of your program and can investigate the state of the variables.

Using the Eclipse Debugger

- This tutorial is based on the YouTube Video(Using the Eclipse Debugger). For more details, you can refer to it.
  Link: `https://www.youtube.com/watch?v=9gAjIQc4bPU`

Debugging in Eclipse

- Setting Breakpoints
  To set breakpoints in your source code right-click in the small left margin in your source code editor and select Toggle Breakpoint. Alternatively you can double-click on this position.

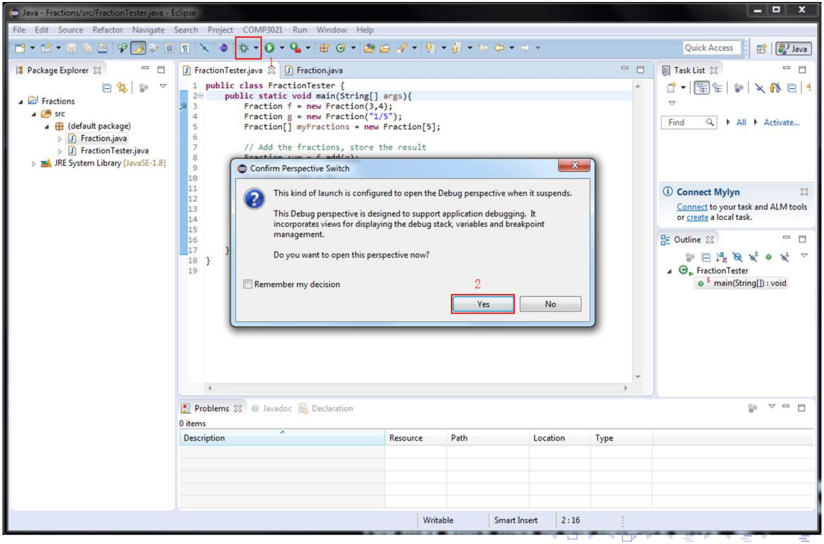


```
public class FractionTester {
    public static void main(String[] args){
        Fraction f = new Fraction(3,4);
```

Java - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project COMP3021 Run Window Help
Quick Access
Java
Package Explorer
Fractions
src
(default package)
Fraction.java
FractionTester.java
JRE System Library [JavaSE-1.8]
1. double click here (line 3)
FractionTester.java
Fraction.java
Toggle Breakpoint Ctrl+Shift+B
2. click
Disable Breakpoint Shift+Double Click
Go to Annotation Ctrl+1
Add Bookmark...
Add Task...
Show Quick Diff Ctrl+Shift+Q
Show Line Numbers
Folding
Preferences...
Breakpoint Properties... Ctrl+Double Click
5];
ettyString());
Task List
Find
All
Activate...
Connect Mylyn
Connect to your task and ALM tools or create a local task.
Outline
FractionTester
main(String[]) : void

Debugging in Eclipse

- Start the debugger by click the debug icon.



```
public class FractionTester {
    public static void main(String[] args){
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
```

Confirm Perspective Switch

This kind of launch is configured to open the Debug perspective when it suspends.

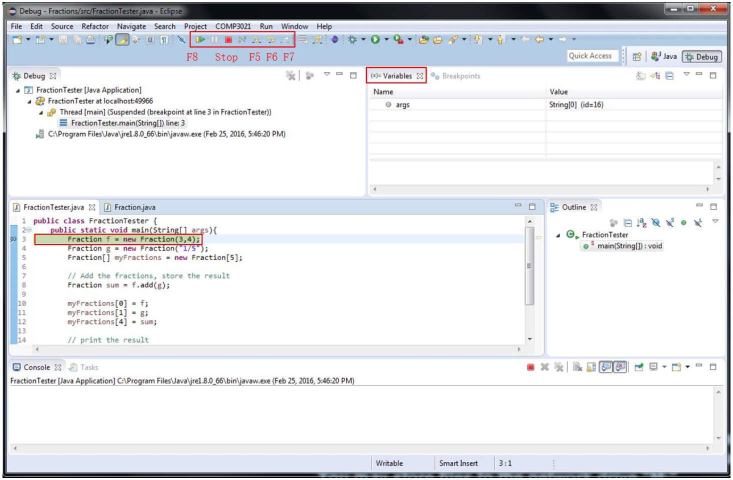
This Debug perspective is designed to support application debugging. It incorporates views for displaying the debug stack, variables and breakpoint management.

Do you want to open this perspective now?

☐ Remember my decision

Debugging in Eclipse

- Afterwards Eclipse opens this perspective, which looks similar to the following screenshot.


Debug - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project COMP3021 Run Window Help
F8
Stop
F5 F6 F7
Quick Access
Java
Debug
Variables
Breakpoints
Outline
Console
Tasks
Writable
Smart Insert
3 : 1

```
FractionTester [Java Application]
  FractionTester at localhost:49966
    Thread [main] (Suspended (breakpoint at line 3 in FractionTester))
      FractionTester.main(String[]) line: 3
  C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Name	Value
args	String[0] (id=16)

FractionTester.java | Fraction.java

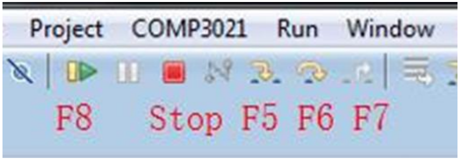
```java
public class FractionTester {
    public static void main(String[] args){
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;

        // print the result
```

```
FractionTester
  main(String[]) : void
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

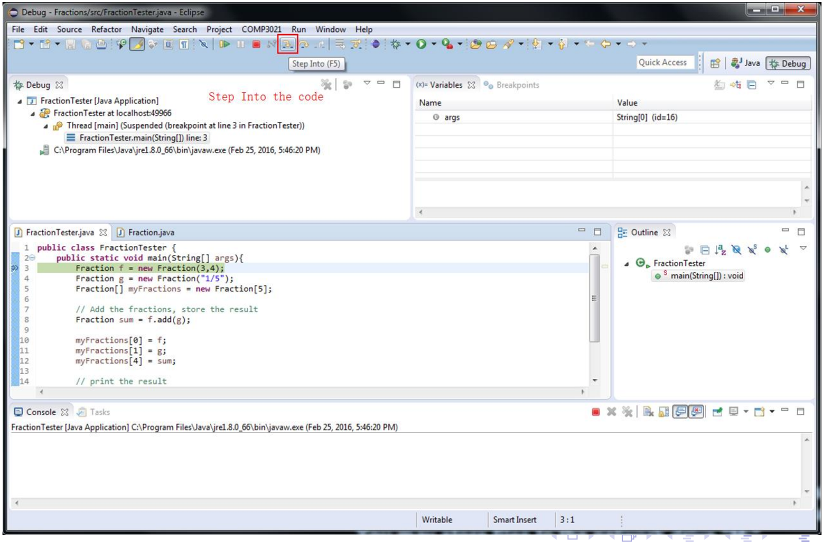
Debugging in Eclipse

- Debugging key bindings / shortcuts
  F5 – executes the currently selected line and goes to the next line in your program. If the selected line is a method call the debugger steps into the associated code.
  F6 – steps over the call, i.e. it executes a method without stepping into it in the debugger.
  F7 – steps out to the caller of the currently executed method. This finishes the execution of the current method and returns to the caller of this method.
  F8 – tells the Eclipse debugger to resume the execution of the program code until is reaches the next breakpoint or watchpoint.



Debugging in Eclipse

- Press the icon or F5 to step into the associated code.



```
Debug
FractionTester [Java Application]
  FractionTester at localhost:49966
    Thread [main] (Suspended (breakpoint at line 3 in FractionTester))
      FractionTester.main(String[]) line: 3
  C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Name	Value
args	String[0] (id=16)

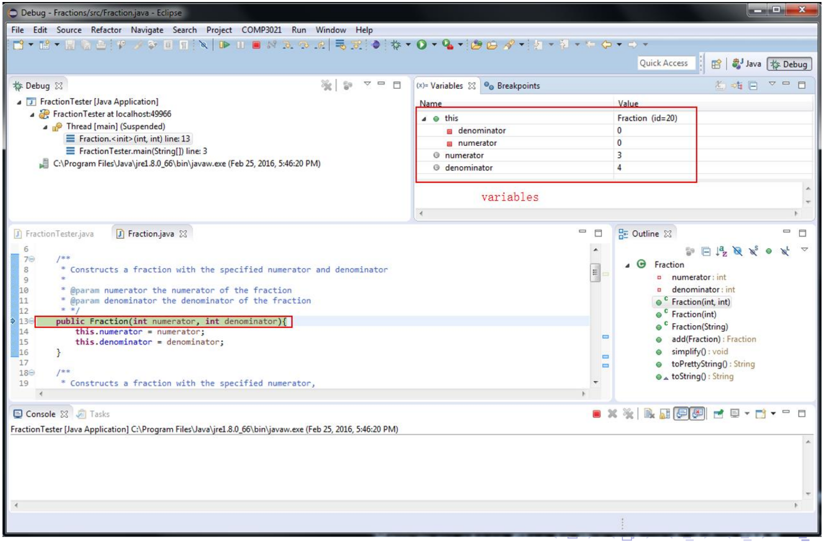
```java
public class FractionTester {
    public static void main(String[] args){
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;

        // print the result
```

```
FractionTester
  main(String[]) : void
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Debugging in Eclipse

- The result of Step into(F5).



Debug - Fractions/src/Fraction.java - Eclipse
File Edit Source Refactor Navigate Search Project COMP3021 Run Window Help
Quick Access
Java
Debug
Variables
Breakpoints
variables
FractionTester.java
Fraction.java
Outline
Console
Tasks

```
FractionTester [Java Application]
  FractionTester at localhost:49966
    Thread [main] (Suspended)
      Fraction.<init>(int, int) line: 13
      FractionTester.main(String[]) line: 3
  C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Name	Value
this	Fraction (id=20)
denominator	0
numerator	0
numerator	3
denominator	4

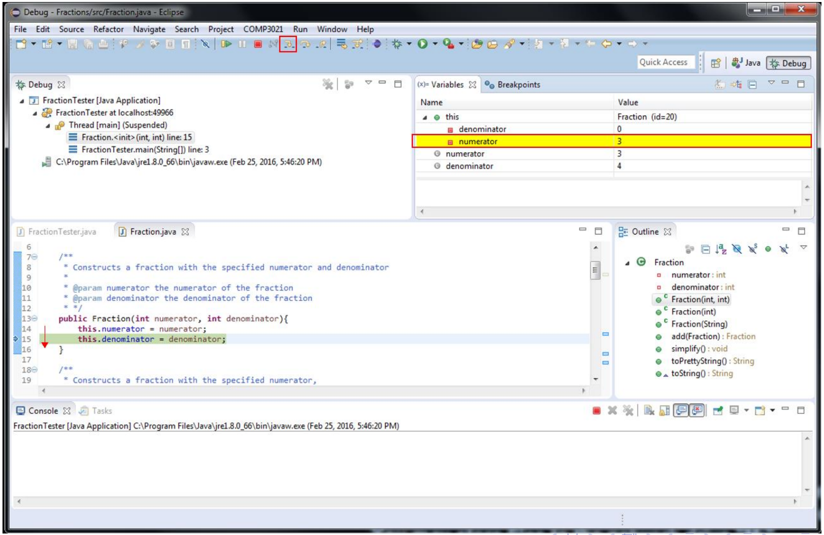
```
    /**
     * Constructs a fraction with the specified numerator and denominator
     *
     * @param numerator the numerator of the fraction
     * @param denominator the denominator of the fraction
     */
    public Fraction(int numerator, int denominator){
        this.numerator = numerator;
        this.denominator = denominator;
    }

    /**
     * Constructs a fraction with the specified numerator,
```

```
Fraction
  numerator : int
  denominator : int
  Fraction(int, int)
  Fraction(int)
  Fraction(String)
  add(Fraction) : Fraction
  simplify() : void
  toPrettyString() : String
  toString() : String
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Debugging in Eclipse

- Continue to press F5, we can see the change of variables.



Debug - Fractions/src/Fraction.java - Eclipse
File Edit Source Refactor Navigate Search Project COMP3021 Run Window Help
Quick Access
Java
Debug
Debug
(x)= Variables
Breakpoints
FractionTester.java
Fraction.java
Outline
Console
Tasks

```
FractionTester [Java Application]
  FractionTester at localhost:49966
    Thread [main] (Suspended)
      Fraction.<init>(int, int) line: 15
      FractionTester.main(String[]) line: 3
  C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Name	Value
this	Fraction (id=20)
denominator	0
numerator	3
numerator	3
denominator	4

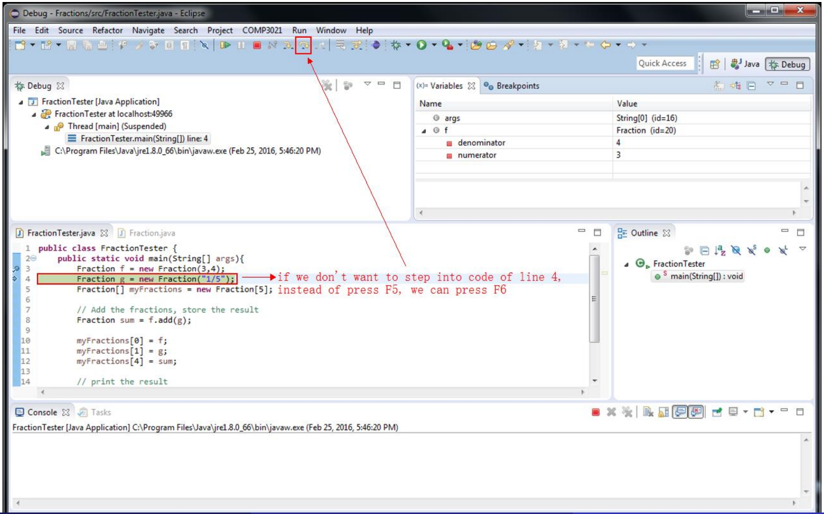
```
    /**
     * Constructs a fraction with the specified numerator and denominator
     *
     * @param numerator the numerator of the fraction
     * @param denominator the denominator of the fraction
     * */
    public Fraction(int numerator, int denominator){
        this.numerator = numerator;
        this.denominator = denominator;
    }

    /**
     * Constructs a fraction with the specified numerator,
```

```
Fraction
  numerator : int
  denominator : int
  Fraction(int, int)
  Fraction(int)
  Fraction(String)
  add(Fraction) : Fraction
  simplify() : void
  toPrettyString() : String
  toString() : String
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)
```

Debugging in Eclipse

- If we don't want to step into the code, we can step over the code(press F6).


Debug - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project COMP3021 Run Window Help
Quick Access
Java
Debug
Debug
Variables
Breakpoints
FractionTester.java
Fraction.java
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FractionTester [Java Application]
FractionTester at localhost:49966
Thread [main] (Suspended)
FractionTester.main(String[]) line: 4
C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)

Name	Value
args	String[0] (id=16)
f	Fraction (id=20)
denominator	4
numerator	3

```
1  public class FractionTester {
2      public static void main(String[] args){
3          Fraction f = new Fraction(3,4);
4          Fraction g = new Fraction("1/5");
5          Fraction[] myFractions = new Fraction[5];
6
7          // Add the fractions, store the result
8          Fraction sum = f.add(g);
9
10         myFractions[0] = f;
11         myFractions[1] = g;
12         myFractions[4] = sum;
13
14         // print the result
```

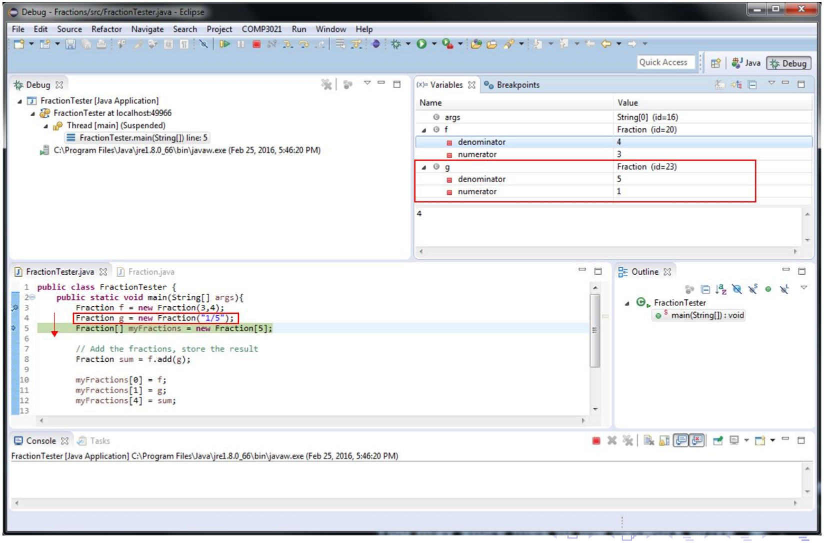
if we don't want to step into code of line 4, instead of press F5, we can press F6

FractionTester
main(String[]) : void

FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)

Debugging in Eclipse

- The result of step over the code(press F6).



Debug - Fractions/src/FractionTester.java - Eclipse

FractionTester [Java Application]
FractionTester at localhost:49966
Thread [main] (Suspended)
FractionTester.main(String[]) line: 5
C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)

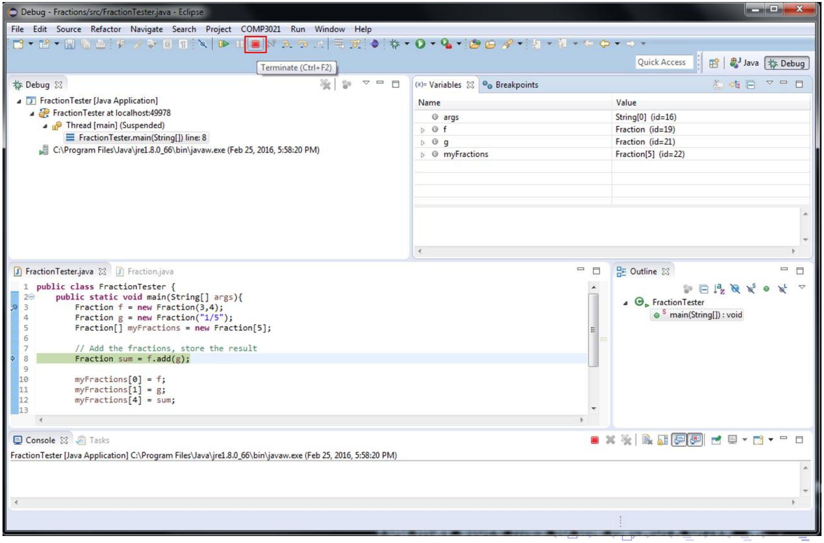
Name	Value
args	String[0] (id=16)
f	Fraction (id=20)
denominator	4
numerator	3
g	Fraction (id=23)
denominator	5
numerator	1

```
public class FractionTester {
    public static void main(String[] args){
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;
```

FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:46:20 PM)

Debugging in Eclipse

- If you want to stop the debug, click the icon or(press Ctrl+F2).


Debug - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project COMP3021 Run Window Help
Terminate (Ctrl+F2)
Quick Access
Java
Debug
Debug
Variables
Breakpoints
FractionTester.java
Fraction.java
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```
FractionTester [Java Application]
  FractionTester at localhost:49978
    Thread [main] (Suspended)
      FractionTester.main(String[]) line: 8
  C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:58:20 PM)
```

Name	Value
args	String[0] (id=16)
f	Fraction (id=19)
g	Fraction (id=21)
myFractions	Fraction[5] (id=22)

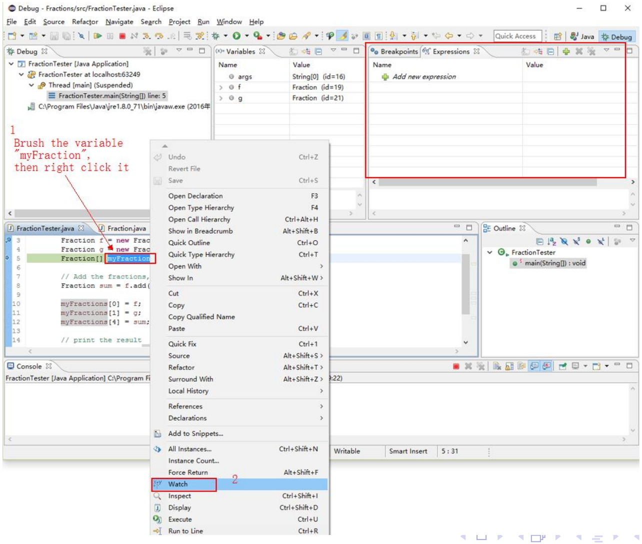
```java
public class FractionTester {
    public static void main(String[] args){
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;
```

```
FractionTester
  main(String[]) : void
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_66\bin\javaw.exe (Feb 25, 2016, 5:58:20 PM)
```

Debugging in Eclipse

- If you want to monitor variables, you can add a watch.



Debug - Fractions/src/FractionTester.java - Eclipse

FractionTester [Java Application]
FractionTester at localhost:63249
Thread [main] (Suspended)
FractionTester.main(String[]) line: 5
C:\Program Files\Java\jre1.8.0_71\bin\javaw.exe (2016年

Name	Value
args	String[0] (id=16)
f	Fraction (id=19)
g	Fraction (id=21)

1
Brush the variable
"myFraction",
then right click it

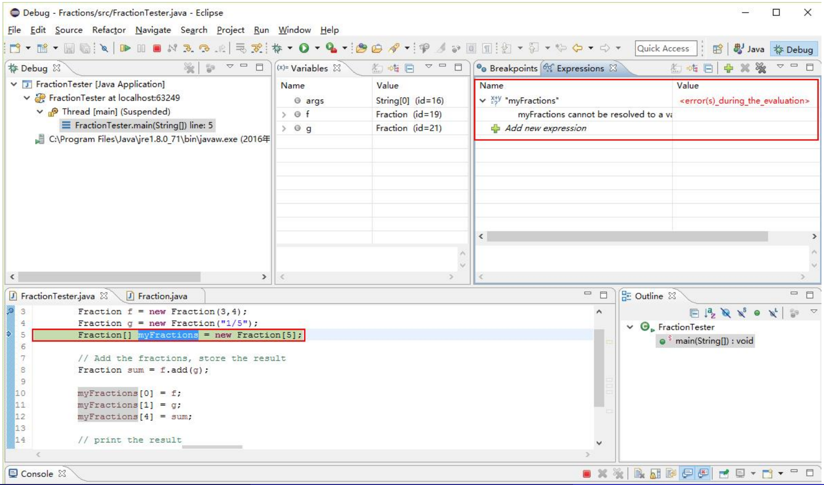
```
    Fraction f = new Frac
    Fraction g = new Frac
    Fraction[] myFraction

    // Add the fractions,
    Fraction sum = f.add(

    myFractions[0] = f;
    myFractions[1] = g;
    myFractions[4] = sum;

    // print the result
```

FractionTester [Java Application] C:\Program Fi

2

Debugging in Eclipse

- After adding a watch for variable "myFraction", we can see it in the Expressions window. But it is not defined right now, so it show some error value.



Debug - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
Debug
Debug
Variables
Breakpoints
Expressions
FractionTester.java
Fraction.java
Outline
Console

```
FractionTester [Java Application]
  FractionTester at localhost:63249
    Thread [main] (Suspended)
      FractionTester.main(String[]) line: 5
  C:\Program Files\Java\jre1.8.0_71\bin\javaw.exe (2016年
```

Name	Value
args	String[0] (id=16)
f	Fraction (id=19)
g	Fraction (id=21)

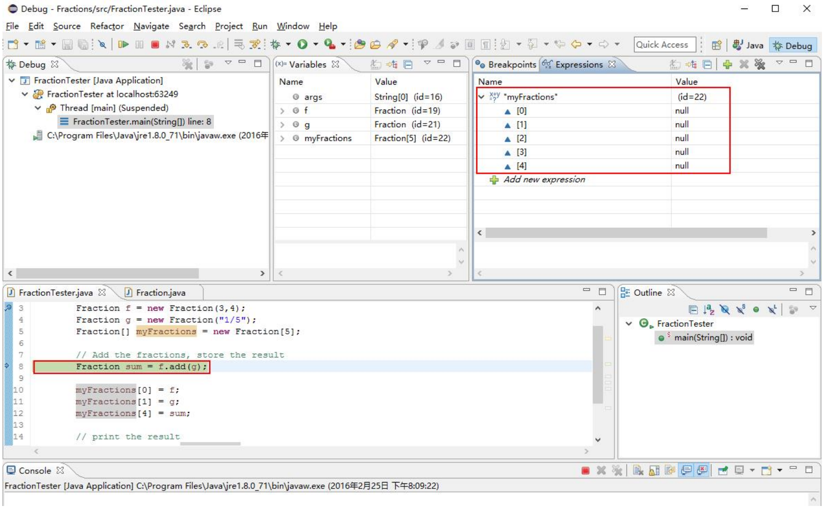
Name	Value
"myFractions"	<error(s)_during_the_evaluation>
myFractions cannot be resolved to a va	
Add new expression	

```
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;

        // print the result
```

```
FractionTester
  main(String[]) : void
```

Debugging in Eclipse

- Press F6, we step over the code, we can see the value of "myFractoin" now, all "null".



Debug - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
Debug
Debug
Variables
Breakpoints
Expressions
FractionTester.java
Fraction.java
Outline
Console

```
FractionTester [Java Application]
  FractionTester at localhost:63249
    Thread [main] (Suspended)
      FractionTester.main(String[]) line: 8
  C:\Program Files\Java\jre1.8.0_71\bin\javaw.exe (2016年
```

Name	Value
args	String[0] (id=16)
f	Fraction (id=19)
g	Fraction (id=21)
myFractions	Fraction[5] (id=22)

Name	Value
"myFractions"	(id=22)
[0]	null
[1]	null
[2]	null
[3]	null
[4]	null
Add new expression	

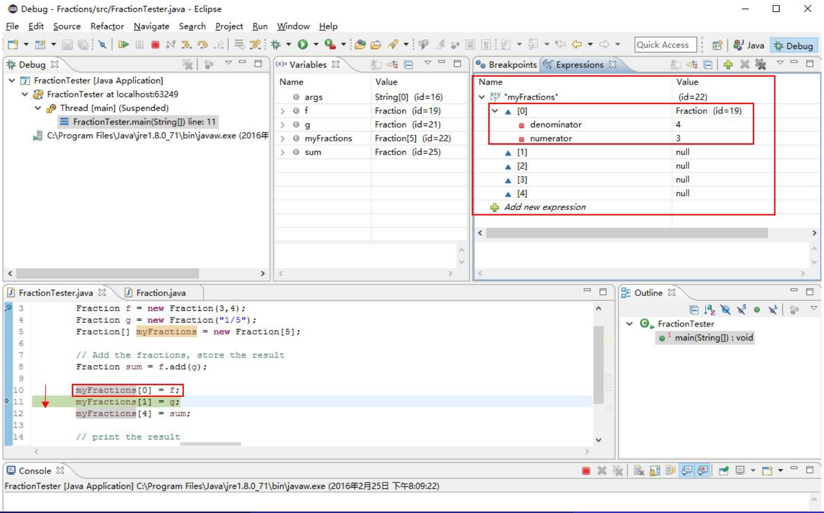
```java
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;

        // print the result
```

```
FractionTester
  main(String[]) : void
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_71\bin\javaw.exe (2016年2月25日 下午8:09:22)
```

Debugging in Eclipse

- After stepping over(F6) the code "myFractions[0] = f;", we can see the change of "myFraction[0]"


Debug - Fractions/src/FractionTester.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
Debug
Debug
Variables
Breakpoints
Expressions
FractionTester.java
Fraction.java
Outline
Console

```
FractionTester [Java Application]
  FractionTester at localhost:63249
    Thread [main] (Suspended)
      FractionTester.main(String[]) line: 11
  C:\Program Files\Java\jre1.8.0_71\bin\javaw.exe (2016年
```

Name	Value
args	String[0] (id=16)
f	Fraction (id=19)
g	Fraction (id=21)
myFractions	Fraction[5] (id=22)
sum	Fraction (id=25)

Name	Value
"myFractions"	(id=22)
[0]	Fraction (id=19)
denominator	4
numerator	3
[1]	null
[2]	null
[3]	null
[4]	null
Add new expression	

```
        Fraction f = new Fraction(3,4);
        Fraction g = new Fraction("1/5");
        Fraction[] myFractions = new Fraction[5];

        // Add the fractions, store the result
        Fraction sum = f.add(g);

        myFractions[0] = f;
        myFractions[1] = g;
        myFractions[4] = sum;

        // print the result
```

```
FractionTester
  main(String[]) : void
```

```
FractionTester [Java Application] C:\Program Files\Java\jre1.8.0_71\bin\javaw.exe (2016年2月25日 下午8:09:22)
```

Debugging in Eclipse

- Other useful tutorials:
  1. Java Debugging with Eclipse - Tutorial
  `http://www.vogella.com/tutorials/EclipseDebugging/article.html`
  2. Eclipse And Java: Free Video Tutorials(Using the Debugger)
  `http://eclipsetutorial.sourceforge.net/debugger.html`
  3. Using the Eclipse Debugger for Beginning Programmers
  `http://agile.csc.ncsu.edu/SEMaterials/tutorials/eclipse-debugger/`

The End