CIS 121 Tutorial

Using the Debugger

Learning how to properly debug your code

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As coding projects become much more complex, you might want to think about debugging your code properly. While using print statements is a valid way of finding easy bugs, it is extremely hard to fix many other bugs due to the complexity of the code. To solve this issue, you should familiarize yourself with the debugger, a tool not only available within Eclipse, but in almost all Integrated Development Environments. In short, learning to use the debugger is important if you're serious about making functioning code.

NOTE: We expect you to know how to use the debugger. We know that some students give up on debugging REALLY fast and resort to Office Hours for any sort of problems in their code. That is legitimate, but more than once you'll find out that a TA will ask you to use the debugger, which ends up fixing most if not all issues. **In short, please learn how to use the debugger, use it rigorously, then ask questions!**

In-depth video tutorial

We made a video tutorial that can be found here that explains all the basics of using the debugger.

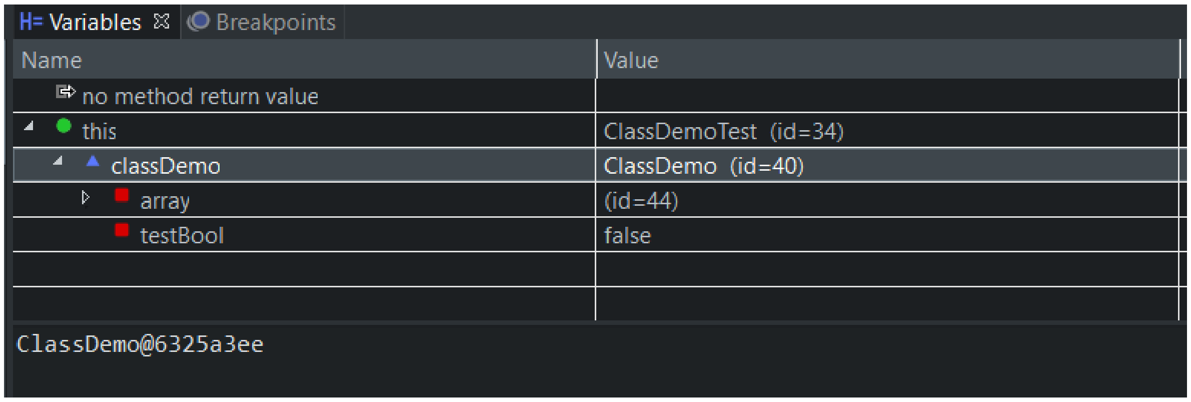
Alternative Guide

If you wish to review the steps on paper here they are here:

1. **Setting up a Breakpoint**
   a. Make sure to place breakpoints in places you think you want to examine. This might be inside a test case, inside a class method, etc...
   b. To set up a break point, double click on the sidebar
2. **Running the Debugger**
   a. After you have set-up some break points, you can run the debugger by either clicking on the **Bug icon**, or by clicking on **Run → Debug**
   b. Once you run the Debugger, the runtime machine will stop executing at the first breakpoint it encounters
3. **Stepping through your code**
   a. Once you stopped at a breakpoint, you can do the following:
      i. **Step Into:** goes inside an instruction (for example a function, so you can examine what that function does)
      ii. **Step Over:** executes the current instruction and jumps to the next instruction
      iii. **Step Return:** pops back up a call stack. For example, if you are inside a function *bar()* that was called within *foo(),* you would return back to where *bar()* was called. **Keep in mind that this will first execute the remaining of *bar().***

      iv. **Resume:** executes everything up until the next breakpoint, or completes your program
      v. **Terminate:** terminates the execution cleanly

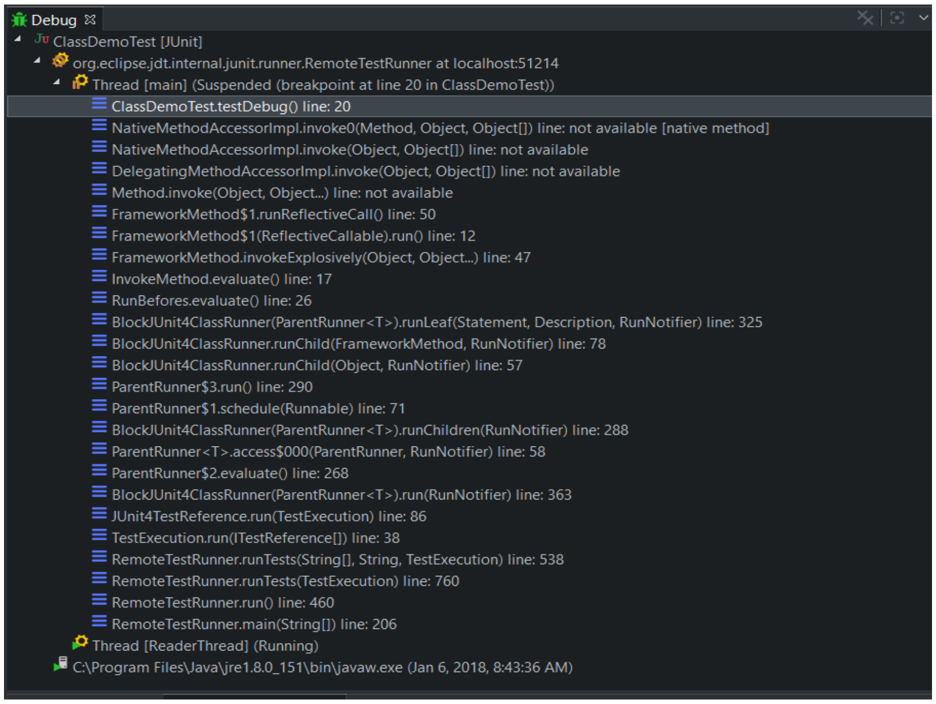
4. **Checking the Variables view**
   a. To check how your variables are being updates, it is handy to have the Variables view ready on the Debugger. When you call the debugger, the Variables view should already appear. If that is not the case, click on **Window → Show View → Variables**
   b. In the Variables view, you can see the fields on the current object (this), the global variables, any local variables, etc... Use this to make sanity checks!



Name	Value
no method return value	
this	ClassDemoTest (id=34)
classDemo	ClassDemo (id=40)
array	(id=44)
testBool	false

```
ClassDemo@6325a3ee
```

5. **Checking the Call Stack**
   a. The Callstack is the same as the Debug view. You can find this the same way you open up the Variables view.
   b. You probably do not need this as much, but it will become handy in some cases (example: calling functions recursively). The call stack is meant to show you the sequence of functions currently called in order. This way, you can make sure the correct methods are called at the correct line numbers



```
Debug
ClassDemoTest [JUnit]
  org.eclipse.jdt.internal.junit.runner.RemoteTestRunner at localhost:51214
    Thread [main] (Suspended (breakpoint at line 20 in ClassDemoTest))
      ClassDemoTest.testDebug() line: 20
      NativeMethodAccessorImpl.invoke0(Method, Object, Object[]) line: not available [native method]
      NativeMethodAccessorImpl.invoke(Object, Object[]) line: not available
      DelegatingMethodAccessorImpl.invoke(Object, Object[]) line: not available
      Method.invoke(Object, Object...) line: not available
      FrameworkMethod$1.runReflectiveCall() line: 50
      FrameworkMethod$1(ReflectiveCallable).run() line: 12
      FrameworkMethod.invokeExplosively(Object, Object...) line: 47
      InvokeMethod.evaluate() line: 17
      RunBefores.evaluate() line: 26
      BlockJUnit4ClassRunner(ParentRunner<T>).runLeaf(Statement, Description, RunNotifier) line: 325
      BlockJUnit4ClassRunner.runChild(FrameworkMethod, RunNotifier) line: 78
      BlockJUnit4ClassRunner.runChild(Object, RunNotifier) line: 57
      ParentRunner$3.run() line: 290
      ParentRunner$1.schedule(Runnable) line: 71
      BlockJUnit4ClassRunner(ParentRunner<T>).runChildren(RunNotifier) line: 288
      ParentRunner<T>.access$000(ParentRunner, RunNotifier) line: 58
      ParentRunner$2.evaluate() line: 268
      BlockJUnit4ClassRunner(ParentRunner<T>).run(RunNotifier) line: 363
      JUnit4TestReference.run(TestExecution) line: 86
      TestExecution.run(ITestReference[]) line: 38
      RemoteTestRunner.runTests(String[], String, TestExecution) line: 538
      RemoteTestRunner.runTests(TestExecution) line: 760
      RemoteTestRunner.run() line: 460
      RemoteTestRunner.main(String[]) line: 206
    Thread [ReaderThread] (Running)
  C:\Program Files\Java\jre1.8.0_151\bin\javaw.exe (Jan 6, 2018, 8:43:36 AM)
```

6. **Going back to Java View**
    a. Once you're done debugging, you should terminate the debugger, then go back to the Java view (top right button)

If you have any questions, do not hesitate to post questions on Piazza or go to TA Office Hours. Please note again that we expect you to be learn how to use the Debugger. Going to Office Hours without having thoroughly debugged your code and asking for help immediately is not a good way to learn how to program. Debugging is a skill, and this tutorial offers everything you need to know about it (for this class at least!)