

## Lab04: Skills - Using a Debugger

**Getting Ready:** Before going any further, you should:

1. Setup your development environment.
2. Download the following files:  
PhoneDriver.java  
PhoneCard.java  
to an appropriate directory/folder. (In most browsers/OSs, the easiest way to do this is by right-clicking/control-clicking on each of the links above.)
3. If you don't already have one from earlier in the semester, create a project named eclipseskills.
4. Drag the file PhoneCard.java and PhoneDriver.java into the default package (using the "Copy files" option).
5. Open PhoneCard.java and PhoneDriver.java.


**Part 1. Review:** This part of the lab will review a few topics related to object-oriented programming in Java.

1. In the main() method in the PhoneDriver class, what kind of objects are end, now, and start?  
They are Date objects.
2. In the main() method in the PhoneDriver class, what kind of object is card?  
A PhoneCard object.
3. Where is the code for the PhoneCard class?  
In the current working directory.
4. Where is the code for the Date class?  
It is in the Java library (in the package java.util).
5. Read the documentation for the Date (<https://docs.oracle.com/javase/7/docs/api/java/util/Date.html>). Make sure you find the documentation for the Date class that is in java.util. (There are several Date classes in the Java library.)
6. When you construct a Date object using the default constructor (i.e., the constructor that has no parameters), what properties will it have?  
It will contain the current date.
7. When you construct a Date object using the default constructor (i.e., the constructor that has no parameters), what properties will it have?  
It will contain the current date.

**Part 2. Setting a Breakpoint:** One of the nice things about running an application in a debugger is that you can stop the execution at one or more pre-defined locations (called *breakpoints*). This part of the lab will teach you how.

1. Click on the tab containing PhoneDriver.java to make sure that it has the focus.
2. Right-click in line 33 of PhoneDriver.java and pull down to **Toggle Breakpoint**.
3. What happened?



A blue circle appeared on the left side of line 33.


4. Click on . This will run PhoneDriver and stop the execution at the breakpoint (i.e., line 33). Note: If prompted, allow Eclipse to enter the "Debug Perspective".
5. What happened?  
Eclipse changed to the "debug perspective". A blue arrow appeared on the left side of line 33 and the line was highlighted.


**Part 3. Checking State Information:** Another nice thing about running an application in a debugger is that, once you stop the execution at a breakpoint, you can check state information (e.g., the value of attributes and variables). This part of the lab will teach you how.

1. Click on the "Variables" tab on the left side of the debug window.
2. Click on the "tree icon" next to "Locals" to expand it.
3. What is the current value of availableMillis?  
5999999





**Part 4. Stepping Over Lines:** When running an application in a debugger, once you stop the execution at a breakpoint, you can continue the execution one "step" at a time. This part of the lab will teach you how.





1. Click on . This will run PhoneDriver again and stop the execution at the breakpoint (i.e., line 33).
2. Click on the  button.
3. What happened?  
The blue arrow and highlight moved down to the next executable statement. highlighted.

4. Click on the  button until the next if statement is highlighted.
5. What is the current value of availableMillis? (Hint: Look in the "Variables" tab. You may need to scroll.)  
5399999

6. Click on the  button to run to the end of the application.

**Part 5: Stepping Into Lines:** So far, all of the "stepping" you have done has been in one method in one class. This is called "stepping over". You can also "step into" a line of code to see what happens there. This part of the lab will teach you how.

1. Click on . This will run PhoneDriver and stop the execution at the breakpoint (i.e., line 33).
2. Click on the  button.
3. What happened?  
The blue arrow and highlight moved down to the next executable statement. highlighted.
4. Click on the  button again.
5. What happened?  
The blue arrow and highlight moved into the startCall() in the PhoneCard class.
6. Look at the call stack in the "Debug" tab. It tells you what class and method you are in and where this method was called from.
7. What method is currently being executed (and what class is it in)?  
The startCall() method in the PhoneCard class.
8. What line is currently being executed?  
92
9. Where was this method called from?  
The main() method in the PhoneDriver class (line 35).
10. Click on the "triangle icon" next to `this` to expand it.
11. What is the current value of balance?  
10.0
12. Click on the  button.
13. Click on the "triangle icon" next to `callNumbers` to expand it.
14. What is the current value of callNumbers[0]?  
"540-568-1671"

15. Click on the "triangle icon" next to `callStarts` to expand it.
16. What is the current value of `callStarts[0]`?  
Since `callStarts[0]` is a `Date` object, it is a reference type and it should contain a reference. jGrasp displays an ID instead.
17. Why does it have that value?  
Since `callStarts[0]` is an object it can have many attributes, making it somewhat difficult to display. You can either expand it or right-click on it and pull down to `View by Name` to see its attributes.
18. Click on the  button twice.
19. What happened?  
Execution returned to `PhoneDriver`.
20. Add a breakpoint at line 46 in `PhoneDriver.java` (i.e., the line that constructs a `Date`).
21. Click on the  button. This will run the application to the next breakpoint (i.e., line 46).
22. Click on the  button.
23. Why didn't the debugger step into the `Date` constructor?  
The debugger doesn't have the source code for the `Date` class.
24. Click on the  button to run to the end.
25. Click on `Window`+`Perspective`+`Close Perspective` to close the "Debug Perspective".

**Part 6: Advanced Topics:** This part of the lab will help you use the debugger more efficiently.

1. How can you display all of the breakpoints?  
Using the Breakpoints View.
2. What is a conditional breakpoint?  
A breakpoint that suspends execution either when a Boolean is true or when a Boolean changes value.
3. How can you see variable references while debugging?  
By managing the Variables View.