# Software Engineering: Lamp

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# HFOSS +

Language





Languages





## Requirements

- JDK 11.0.5
- Gradle 4.4.1
- Java 1.8.0\_222
- Android SDK 27
- VirtualBox 6.0.10
- Android Studio 3.5
- Linux Ubuntu (64-bit) 18.4

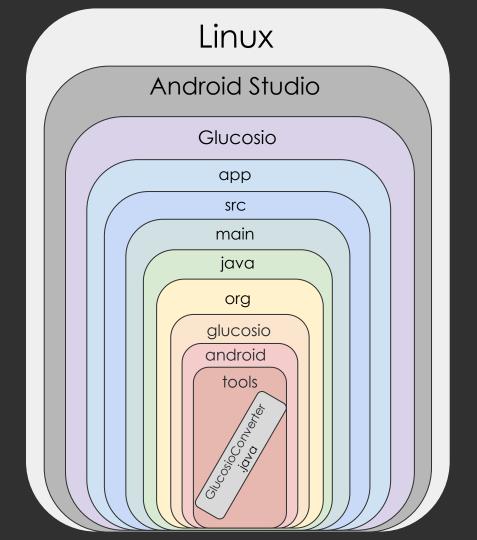
## Testing Schedule

- Sprint 1
  - Build project without modifications
- Sprint 2
  - Produce Test Plan + 5 methods to develop
- Sprint 3
  - Design & Build Driver
  - Architecture & Formal Documentation
- Sprint 4
  - Create 25 test cases
- Sprint 5
  - Design & Inject 5 faults into the code
- Sprint 6
  - o Finalize Driver, Presentation, Project, Paper

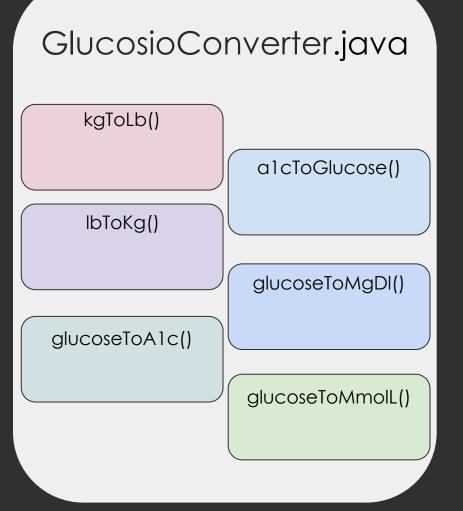
## Build Project

- Command Line
  - Run Script
- Android Studio
  - \*Helped identify initial build issues.

## Java File Tested



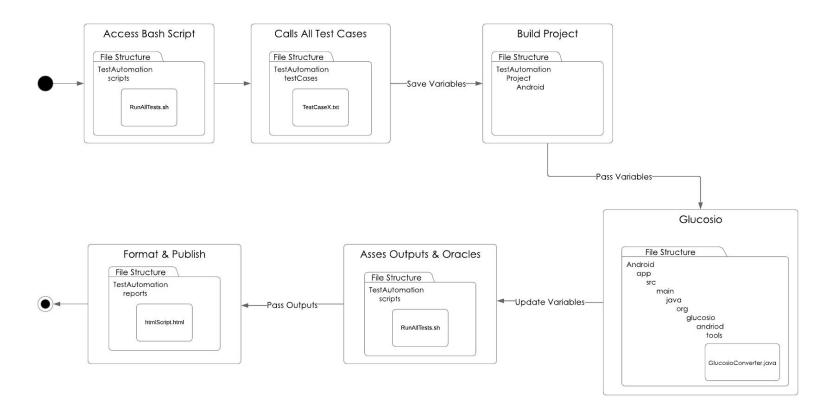
## Methods Tested



### Test Cases



### Architecture



# Demo

## Faults Injected

- 5 Changes to 4 Methods
- Mutations
- Pre-Change Results
- Post-Change Results

• Example

### Original

return round((a1c \* 28.7) - 46.7, 2);

### Mutated

return round((a1c \* 28.7) + 46.7, 2);

### Fault Results

Test Number	Method Name	Requirement	Input Value	Output Value	Oracle	Result
1	kgToLb()	$\label{thm:converts} Double\ input\ converts\ from\ kilograms\ to\ pounds.\ Output\ must\ also\ be\ double.\ Used\ in\ other\ conversion\ methods.$	0.0	0.0	0.0	PASSED
2	kgToLb()	Double input converts from kilograms to pounds. Output must also be double. Used in other conversion methods.	1.0	2.2	2.20462	FAILED
3	kgToLb()	$Double\ input\ converts\ from\ kilograms\ to\ pounds.\ Output\ must\ also\ be\ double.\ Used\ in\ other\ conversion\ methods.$	-1.0	-2.2	-2.20462	FAILED
4	lbToKg()	$Double\ input\ converts\ from\ pounds\ to\ kilograms.\ Output\ must\ also\ be\ double.\ Used\ in\ other\ conversion\ methods.$	0.0	0.0	0.0	PASSED
5	lbToKg()	$\label{thm:converts} Double\ input\ converts\ from\ pounds\ to\ kilograms.\ Output\ must\ also\ be\ double.\ Used\ in\ other\ conversion\ methods.$	2.20462	1.0020999999999998	1.0	FAILED
6	lbToKg()	Double input converts from pounds to kilograms. Output must also be double. Used in other conversion methods.	-2.20462	-1.0020999999999998	-1.0	FAILED
7	lbToKg()	Double input converts from pounds to kilograms. Output must also be double. Used in other conversion methods.	2.20462	1.0020999999999998	1.0	FAILED
8	lbToKg()	Double input converts from pounds to kilograms. Output must also be double. Used in other conversion methods.	-2.20462	-1.0020999999999998	-1.0	FAILED
9	a1cToGlucose()	Converts from A1C to Glucose. A1C Input, Glucose Output (Double): A1C X 28.7 - 46.7.	0.0	46.7	-46.7	FAILED
10	a1cToGlucose()	Converts from A1C to Glucose. A1C Input, Glucose Output (Double): A1C X 28.7 - 46.7.	10000000.0	287000046.7	286999953.3	FAILED
11	a1cToGlucose()	Converts from A1C to Glucose. A1C Input, Glucose Output (Double): A1C X 28.7 - 46.7.	1.0	75.4	-18.0	FAILED
12	a1cToGlucose()	Converts from A1C to Glucose. A1C Input, Glucose Output (Double): A1C X 28.7 - 46.7.	-1.0	18.0	-75.4	FAILED
13	a1cToGlucose()	Converts from A1C to Glucose. A1C Input, Glucose Output (Double): A1C X 28.7 - 46.7.	10.0	333.7	240.3	FAILED
14	glucoseToA1C()	Converts from Glucose to A1C. Glucose Input, A1C Output (Double): AVG glucose + 46.7 / 28.7.	0.0	1.5574912891986064	1.63	FAILED
15	glucoseToA1C()	Converts from Glucose to A1C. Glucose Input, A1C Output (Double): AVG glucose + 46.7 / 28.7.	1.0	1.5923344947735194	1.66	FAILED
16	glucoseToA1C()	$Converts\ from\ Glucose\ to\ A1C.\ Glucose\ Input,\ A1C\ Output\ (Double):\ AVG\ glucose\ +\ 46.7\ /\ 28.7.$	-1.0	1.5226480836236935	1.59	FAILED
17	glucoseToA1C()	Converts from Glucose to A1C. Glucose Input, A1C Output (Double): AVG glucose + 46.7 / 28.7.	10.0	1.9059233449477353	1.98	FAILED
18	glucoseToMmolL()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Millimoles per liter.	0.0	0.0	0.0	PASSED
19	glucoseToMmolL()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Millimoles per liter.	100.0	6.0	5.56	FAILED
20	glucoseToMmolL()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Millimoles per liter.	-100.0	-6.0	-5.56	FAILED
21	glucoseToMgDl()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Milligrams per 100 millilitres.	10.0	180.0	180.0	PASSED
22	glucoseToMgDl()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Milligrams per 100 millilitres.	0.0	0.0	0.0	PASSED
23	glucoseToMgDl()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Milligrams per 100 millilitres.	100.0	1800.0	1800.0	PASSED
24	glucoseToMgDl()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Milligrams per 100 millilitres.	-100.0	-1800.0	-1800.0	PASSED
25	glucoseToMgDl()	Calculate concentration of glucose. Input(Double): glucose, Output(Double): Milligrams per 100 millilitres.	1000.0	18000.0	18000.0	PASSED

### Problems Encountered

- Building Project Version Requirements
  - Android Studio
  - Gradle
  - Java
  - VirtualBox
- Unable to create an Android Virtual Machine on VirtualBox/Ubuntu.
- the learning curve with android development
- Hard disk allocated space on VirtualBox

## Hindsight

- No Previous Exposure Pros and Cons
  - o Gradle
  - Android Studio
  - GitHub
  - Automated testing framework
  - Linux OS
  - Command line
- Format of the project

### Lessons Learned

- Communication
  - Slack
  - GitHub
  - Consistent Meetings and Conversation
- Roles
  - Balance
- Resources
  - Google
  - School vs. Industry
- Time Management
  - Agile development



### Abstract

Glucasio is a free and open-source software intended to aid in both type 1 and type 2 diabetes management. It consists of a Research APIL android app and IoS app. Our project's aim is to design and build an automated testing framework to evaluate the functionality of Silucasio.

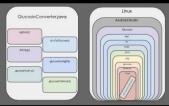
### Background

Diabetes management has evolved greatly in modern history. Changes in glucose management, types of insulin, and the administration of the insulin has offered significant improvement to the lives of those living with diabetes. Glucosio is an example of those improvements in the field of diabetes management. It has both Android and iOS functionality and is designed to track blood glucose test results.

### **Testing Schedule**

- Evaluate and Build current project without modifications
- 2. Produce Test Plan including at least 5 test cases that will be developed
- 3. Design & Build an automated testing framework
- 4. Test Project by utilizing a driver and 25 test cases
- 5. Design and inject 5 faults into the code that will cause at least 5 tests to fail, but not all tests to fail. Exercise framework and analyze the results.
- 6. Present Final Project with 30 test cases

### Java File and Methods Tested



### An Automated Testing Framework: HFQSS Glucosio

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### The Framework

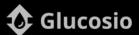
The automated framework involves a bash script and java drivers which correspond to specific test cases. The team has developed 25 test cases from 6 methods. The test cases are soved as tat filles which only contain the necessary information detailed in the "Test Case Template." Depending on the method being tested, a corresponding driver will need to be used to instantiate an object of the class and pass the proper values to the tested method.

User runs "runAll'asts.sh" in their command line once the project has been cloned to user's computer. The script will begin a loop to access each of the ".txt" files. It will save the test case information as variables, run the appropriate driver with the test case information, and then output "Test #Complete" in the command line. The output values are compared to the expected output from the .txt file and assigned as "Passed" or "Failed". Upon completion of the loop, and all test case .txt files being processed, the cript will open the users browser and display the .html file that has been generated with the results. A table has been formatted to display all pertinent information, including the date and time the report was generated, as well as test number, method name, requirement, input value, output value, oracle, and result.



### **Test Cases Examples**

■ ■ Testsasof.bit ~	0 0 0   Taxtoses2/st =	■ □ □ testcase3.txt >
1	,	2
kgTeLb(1	kgToLb()	Refresh()
1.2	2,28452	-2.28462
2.2	1.0	-1.8
Touble input converts from kilograms to provide. Output must also be double. ised in other conversion cethods.	Double input converts from hillograms to pounds. Dusput rout also be double. Used in other conversion methods.	Souble input converts from Milegrams to pounds. Output must also be double. Hed in other correlate methods.
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6 1276Kg()	3	•
Destroyed(st) - (atakgt)	S lbToKg()	6 teteKg()



### **Test Case Template**

- The team has written a script to execute the methods with test values. We chose five methods to test five different times and the results are outputted to an .html file opened in the user's web browser.
- The test cases contain:
- 1. Test number or ID
- 2. Method being tested
- 3. Expected outcome(s)
- 4. Test input(s) including command line argument(s)
- 5. Requirements

### **Problems Encountered**

- Building Project Version Requirements
- Android Studio
- o Gradle
- JavaVirtualBox
- Unable to create an Android Virtual Machine on VirtualBox/Ubuntu.
- The learning curve with android development
- Hard disk allocated space on VirtualBox

### **Run Test Cases**

- 1. Clone project to computer
- 2. Open terminal
- 3. Navigate to Lamp-master/TestAutomation/
- 4. Use command ./scripts/runAllTests.sh
- 5. Testing should complete and output to html file in browser

### **Tools**









### References

- http://logo-load.com/4445-virtualbox-logo.html
- https://commons.wikimedia.org/wiki/File:Breezeicons-apps-48-android-studio.svg
- https://pngio.com/images/png-614970.html
- https://www.pngtube.com/viewm/hmwRxJi\_bash-logo-shell-script-logo/
- https://www.stickpng.com/img/icons-logos-emojis/tech-companies/java-logo
- https://about.gitlab.com/press/press-kit/
- https://www.stickpng.com/img/icons-logos-emojis/tech-companies/gradle-logo