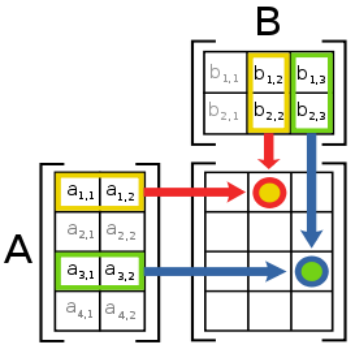
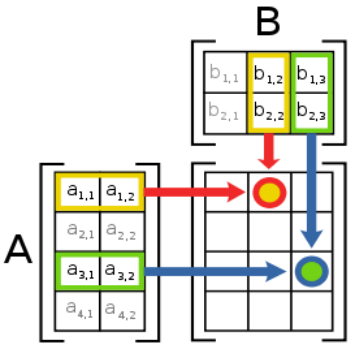


Matrix Calculator Functional Testings Documentation

Ka Son Chan



Matrix Calculator User Guide

Ka Son Chan

Prerequisites and steps for functional tests

- You have installed Eclipse, the Android SDK, and ADT.
- You have been able to deploy a Java application to an Android device (physical or virtual).

Step 1: Install Scala-IDE

- You have installed the Scala-IDE that matches your version of Eclipse.
- Scala IDE Lithium works with Eclipse 4.2 and 4.3 (Juno and Kepler). http://download.scala-ide.org/nightly-scala-ide-4.0.x-210x

Step 2: Install AndroidProguardScala

- Point Eclipse to the update site at https://androidproguardscala.s3.amazonaws.com/UpdateSiteForAndroidProguardScala and install.

Step 3: Download the zip files MatrixCalculator and MatrixCalculatorTest

- Unzip both MatrixCalculator and MatrixCalculatorTest files.
- Import them into Eclipse environment.

Step 4: Check MatrixCalculatorTest Build Path

- Remove All Android libraries if you see them in MatrixCalculatorTest Build Path.
- As shown in Figure U1 below, MatrixCalculatorTest Build Path should contain only Robotium and JUnit4 libraries.

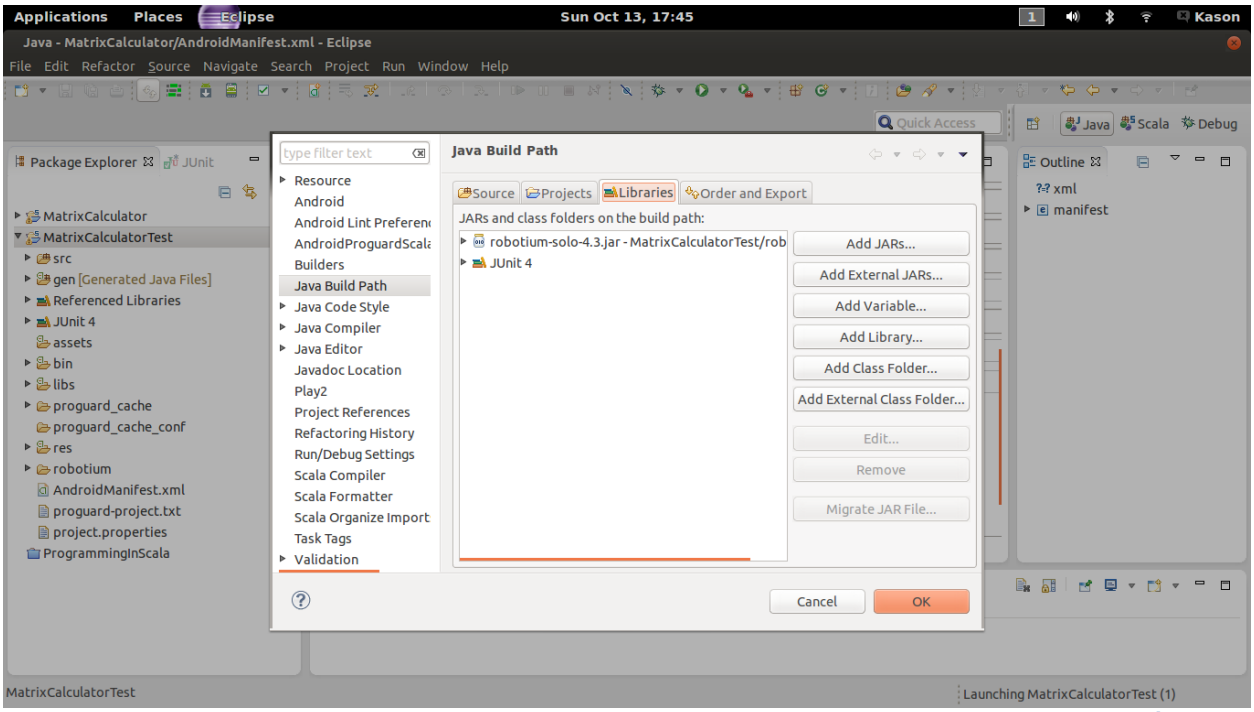


Figure U1

After installing all the prerequisties, Scala, AndroidProguardScala, you can import the source codes folder to Eclipse, compile and execute.

Steps for execute the functional tests:

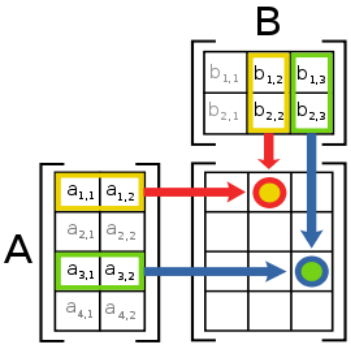
Step 1: Right click on the MatrixCalculatorTest folder in the Package Explorer.
Step 2: Choose Run as Android JUnit Test.

Notes:

- There are equivalent test cases listed below to the implementation in the MatrixCalculatorTest zip file. The implementations of each test case name starts with **test**. I.e. Equivalence Partitioning (EP) test case number one is **testEP01** and so forth.
- For easy reading, there are comma (,) and space between each test input written in the table below.
- There are two different status reports attached to the submission – **log.txt** and **MatrixCalculatorTest (1) 20131013-175952.xml**

References:

- http://scala-ide.org/download/nightly.html
- http://scala-ide.org/docs/tutorials/androiddevelopment/index.html
- https://code.google.com/p/robotium/
- http://www.youtube.com/watch?v=T_8euppCz3k



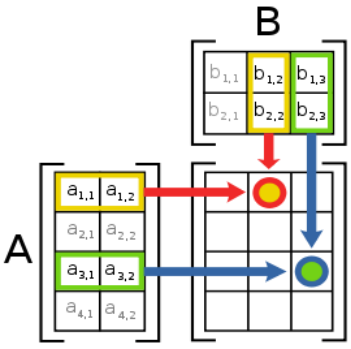
Matrix Calculator Specifications

Ka Son Chan

This Matrix Calculator Multi-threaded Android Application allows the user to enter 2 matrices row and column sizes, the number data and performs matrix operation – Multiplication. This application is utilizing multi-threads in the operation, which enhance the speed of the application comparing to single thread app.

Below are the specifications of the functional (black box) tests:

1. Main activity
    1.1. The application allows the user to enter two matrices row size values and two column size values that are to be numeric integer (1, 2, 3, 4, or 5).
    1.2. The application allows the user to enter each matrices row and column size values that are to be one character in length.
    1.3. The column size value of matrix 1 need to be equal to the row size value of matrix 2.
2. Matrix activity
    2.1. The application generates two empty matrices according to the user valid entries of row and column size values.
    2.2. The application allows the user to enter positive or negative integers including numeric characters (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9) and negative character (-) in the matrices values to the empty matrices values.
3. Result activity
    3.1. The application shows the correct result of positive or negative integers after the user entering valid matrices values and application operation.



Matrix Calculator Test Cases

Ka Son Chan

Below are the numbers of functional (black box) tests for my application using the following techniques:

- Equivalence Partitioning (EP)
- Boundary Value Analysis (BVA)
- Extreme value analysis (EVA)
- Error Guessing (EG)

Notes:

- There are equivalent test cases listed below to the implementation in the MatrixCalculatorTest zip file. The implementations of each test case name starts with **test**. I.e. Equivalence Partitioning (EP) test case number one is **testEP01** and so forth.
- For easy reading, there are comma (,) and space between each test input written in the table below.
- There are two different status reports attached to the submission – **log.txt** and **MatrixCalculatorTest (1) 20131013-175952.xml**

Boundary Value Analysis (BVA)

Test cases:

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Comments	Pass/Fail
BVA 1.	BVA	1.1	1, 1, 1, 1	1 by 1 empty Matrix 1 and 1 by 1 empty Matrix 2 are generated		Pass
BVA 2.			0, 1, 1, 1	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
BVA 3.			1, 0, 0, 1			Pass
BVA 4.			1, 1, 1, 0			Pass
BVA 5.			3, 3, 3, 3	3 by 3 empty Matrix 1 and 3 by 3 empty Matrix 2 are generated		Pass
BVA 6.			5, 5, 5, 5	5 by 5 empty Matrix 1 and 5 by 5 empty Matrix 2 are generated		Pass
BVA 7.			6, 5, 5, 5	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
BVA 8.			5, 6, 6, 5			Pass
BVA 9.			5, 5, 5, 6			Pass
BVA 10.		1.2	10, 2, 2, 2	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		**Fail**
BVA 11.			2, 10, 2, 2			**Fail**
BVA 12.			2, 2, 10, 2			**Fail**
BVA 13.			2, 2, 2, 10			**Fail**
BVA 14.			, 1, 1, 1	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
BVA 15.			1, , 1, 1			Pass
BVA 16.			1, 1, , 1			Pass
BVA 17.			1, 1, 1,			Pass

Error Guessing (EG)

Test cases:

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Comments	Pass/Fail
EG 1.	EG	1.1	`, @, #, *	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
EG 2.			``, @@, ##, **			Pass
EG 3.		2.2	1, 1, 1, 1 [, M	Error Message "Empty matrix." is prompted		Pass
Test Case #	**Technique Used**	**Specifications Covered**	**Test Input**	**Expected Outcome**	**Comments**	**Pass/Fail**

Equivalence Partitioning (EP)

Derived Equivalence classes

1. Main activity
   - 1.1.
     - 1.1.1. Size value is numeric character. Valid
     - 1.1.2. Size value contains non-numeric character. Invalid
     - 1.1.3. Size value is numeric character (1, 2, 3, 4 or 5). Valid
     - 1.1.4. Size value is numeric character (>= 6). Invalid
     - 1.1.5. Size value is numeric character (<1). Invalid
   - 1.2.
     - 1.2.1. Size value is empty. Invalid
     - 1.2.2. Size value is one character in length. Valid
     - 1.2.3. Size value is more than one character in length. Invalid
   - 1.3.
     - 1.3.1. Column size value of matrix 1 equals to the row size value of matrix 2. Valid
     - 1.3.2. Column size value of matrix 1 does not equal to the row size value of matrix 2. Invalid
2. Matrix activity
   - 2.1.
     - 2.1.1. User valid entries of row and column size values of empty matrices are generated.
   - 2.2.
     - 2.2.1. Matrix value is numeric. Valid
     - 2.2.2. Matrix value is non-numeric excluding the negative character (-). Invalid
     - 2.2.3. Matrix value contains negative character (-) only. Invalid
     - 2.2.4. Matrix value contains negative character (-) at the first character position. Valid
     - 2.2.5. Matrix value contains negative character (-) at the position other than the first character. Invalid
     - 2.2.6. Matrix value is a whole number. Valid
     - 2.2.7. Matrix value is a decimal number. Invalid
3. Result activity
   - 3.1.
     - 3.1.1. Correct result matrix is computed.
     - 3.1.2. Incorrect result matrix is computed.

Equivalence Partitioning (EP)

Test cases:

Test Case #	Technique Used	Cases Covered	Test Input	Expected Outcome	Comments	Pass/Fail
EP 1.	EP	1.1.1, 1.1.3, 1.2.2, 1.3.1, 2.1.1	2, 3, 3, 2	2 by 3 empty Matrix 1 and 3 by 2 empty Matrix 2 are generated		Pass
EP 2.		1.1.2	a, 3, 3, 2	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
EP 3.			2, a, 3, 2			Pass
EP 4.			2, 3, a, 2			Pass
EP 5.			2, 3, 3, a			Pass
EP 6.		1.1.4	6, 4, 4, 1	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
EP 7.			5, 6, 5, 5			Pass
EP 8.			2, 3, 6, 2			Pass
EP 9.			5, 3, 3, 6			Pass
EP 10.		1.1.5	0, 1, 1, 2	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
EP 11.			1, 0, 1, 1			Pass
EP 12.			2, 3, 0, 4			Pass
EP 13.			5, 2, 2, 0			Pass
EP 14.		1.2.1	, 3, 3, 2	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		Pass
EP 15.			2, , 3, 2			Pass
EP 16.			2, 3, 3,			Pass
EP 17.			2, 3, , 2			Pass

Test Case #	Technique Used	Cases Covered	Test Input	Expected Outcome	Comments	Pass/Fail
EP 18.		1.2.3	10, 1, 1, 1	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted		**Fail**
EP 19.			1, 10, 1, 1			**Fail**
EP 20.			1, 1, 10, 1			**Fail**
EP 21.			1, 1, 1, 10			**Fail**
EP 22.		1.3.2	5, 1, 2, 5	Error Message "Matrix Multiplication: Matrix 1 column size should be equal to Matrix 2 row size." is prompted		Pass
EP 23.		2.2.1, 2.2.4, 2.2.6	1, 1, 1, 1 -1, -1	Result 1 is displayed		Pass
EP 24.		2.2.2	1, 1, 1, 1 1, abc	Error Message "Empty matrix." is prompted		Pass
EP 25.	EP	2.2.3	1, 1, 1, 1 1, -	Error Message "Invalid matrix data "-"." is prompted		Pass
EP 26.		2.2.5	1, 1, 1, 1 1, 1-	Error Message "Invalid matrix data." is prompted		**Fail**
EP 27.		2.2.7	1, 1, 1, 1 1.1, 1	Error Message "Invalid matrix data." is prompted		**Fail**
EP 28.		3.1.1	1, 1, 1, 1 1, 2	Result 2 is displayed		Pass
EP 29.		3.1.2	1, 1, 1, 1 100000, 100000	Result 10000000000 is displayed		**Fail**
Test Case #	**Technique Used**	**Cases Covered**	**Test Input**	**Expected Outcome**	**Comments**	**Pass/Fail**

Extreme Value Analysis (EVA)

Test cases:

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Pass/Fail
EVA 1	EVA	1.1	100000, 100000, 100000, 100000	Error Message "Empty matrix row or column size. Enter size range between 1 and 5" is prompted	**Fail**
EVA 2			-100000, -100000, -100000, -100000		**Fail**
EVA 3		2.2	1, 1, 1, 1 100000, 100000	Result 10000000000 is displayed	**Fail**
EVA 4			1, 1, 1, 1 -100000, -100000	Result 10000000000 is displayed	**Fail**
EVA 5		3.1	1, 1, 1, 1 1000, 1000	Result 1000000 is displayed	Pass
EVA 6			1, 1, 1, 1 -1000, -1000	Result 1000000 is displayed	Pass
Test Case #	**Technique Used**	**Specifications Covered**	**Test Input**	**Expected Outcome**	**Pass/Fail**

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Pass/Fail
EVA 7	EVA	3.1	5, 5, 5, 5 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1 1, 1, 1, 1, 1	Result 5, 5, 5, 5, 5 5, 5, 5, 5, 5 5, 5, 5, 5, 5 5, 5, 5, 5, 5 5, 5, 5, 5, 5 is displayed	Pass
EVA 8			5, 5, 5, 5 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1 -1, -1, -1, -1, -1	Result 5, 5, 5, 5, 5 5, 5, 5, 5, 5 5, 5, 5, 5, 5 5, 5, 5, 5, 5 5, 5, 5, 5, 5 is displayed	Pass
Test Case #	**Technique Used**	**Specifications Covered**	**Test Input**	**Expected Outcome**	**Pass/Fail**

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Pass/Fail
EVA 9	EVA	3.1	5, 5, 5, 5 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100 100, 100, 100, 100, 100	Result 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 is displayed	Pass
EVA 10			5, 5, 5, 5 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100 -100, -100, -100, -100, -100	Result 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 50000, 50000, 50000, 50000, 50000 is displayed	Pass
Test Case #	**Technique Used**	**Specifications Covered**	**Test Input**	**Expected Outcome**	**Pass/Fail**

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Pass/Fail
EVA 11	EVA	3.1	5, 5, 5, 5 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000 1000, 1000, 1000, 1000, 1000	Result 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 is displayed	Pass
EVA 12			5, 5, 5, 5 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000 -1000, -1000, -1000, -1000, -1000	Result 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 5000000, 5000000, 5000000, 5000000, 5000000 is displayed	Pass
Test Case #	**Technique Used**	**Specifications Covered**	**Test Input**	**Expected Outcome**	**Pass/Fail**

Test Case #	Technique Used	Specifications Covered	Test Input	Expected Outcome	Pass/Fail
EVA 13	EVA	3.1	5, 5, 5, 5 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000 10000, 10000, 10000, 10000, 10000	Result 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 is displayed	Pass
EVA 14			5, 5, 5, 5 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000 -10000, -10000, -10000, -10000, -10000	Result 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 500000000, 500000000, 500000000, 500000000, 500000000 is displayed	Pass
Test Case #	**Technique Used**	**Specifications Covered**	**Test Input**	**Expected Outcome**	**Pass/Fail**