Homework 4:
Mutation Based Testing

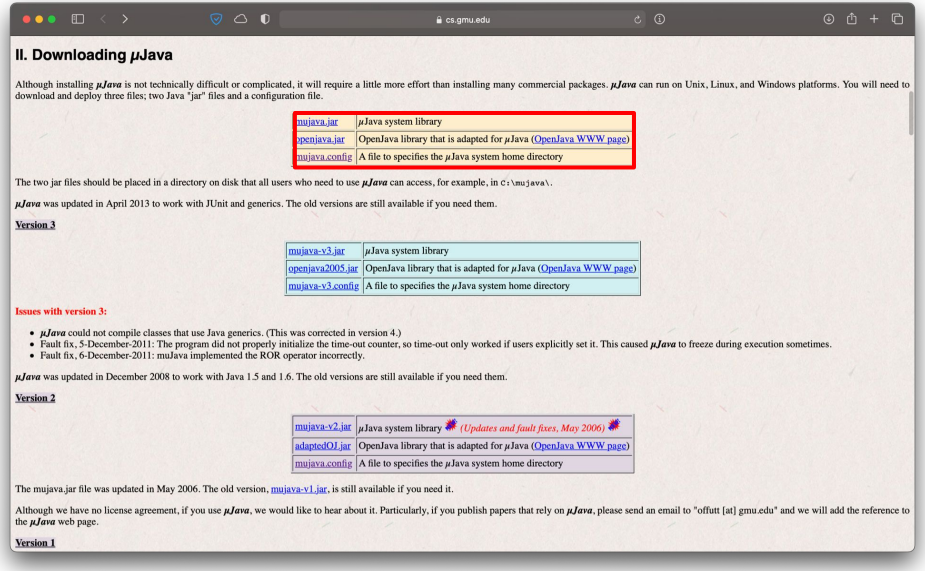
Software Testing 2023

2023/05/25

muJava

muJava

- Download **mujava.jar**, **openjava.jar** and **mujava.config**
  - From: https://cs.gmu.edu/~offutt/mujava/

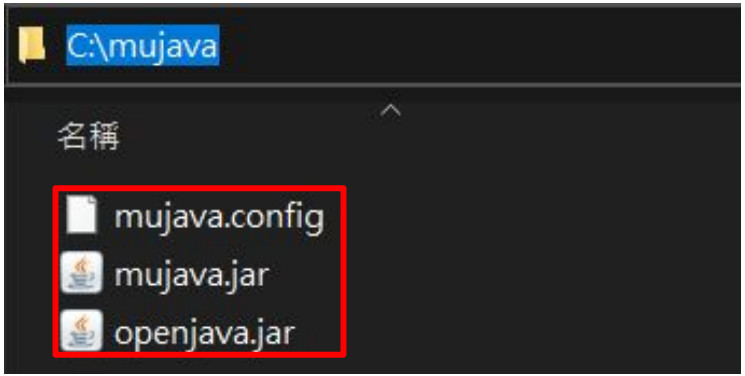


Installation - Windows 10

- ➔ Step 1 :
  - ◆ check jdk version (at least 1.8)
    - **$ java --version**

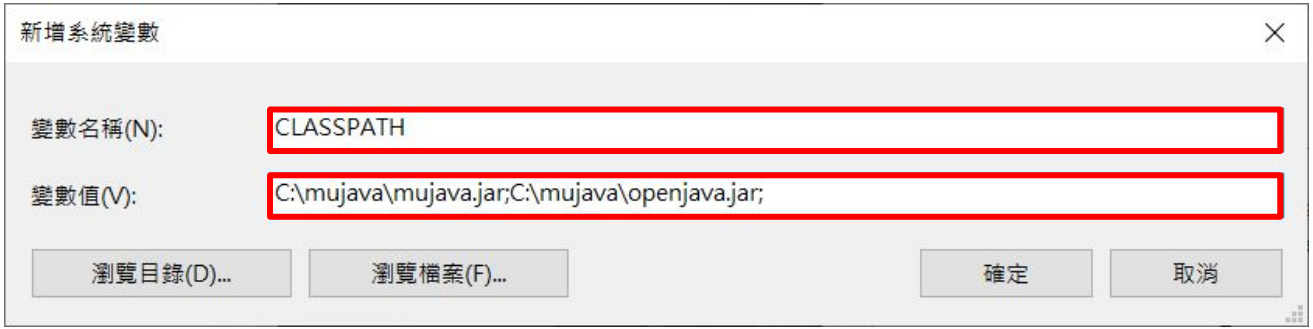
Installation - Windows 10

- ➔ Step 2 :
  - ◆ Put the file in here :
    - C:\mujava



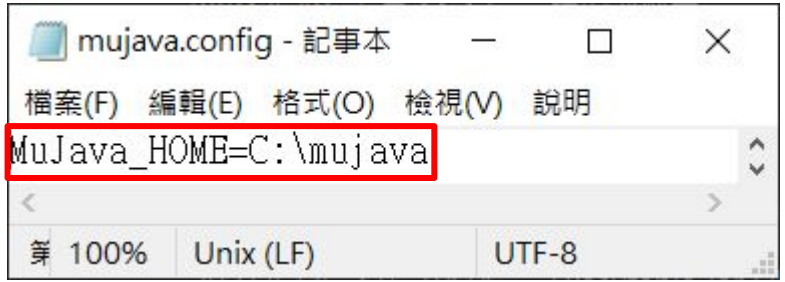
Installation - Windows 10

- ➔ Step 3 :
  - ◆ Set CLASSPATH
    - **本機 → 內容 → 進階系統設定 → 進階 → 環境變數 → 系統變數 → 新增**
      - 變數名稱: CLASSPATH
      - 變數值: C:\mujava\mujava.jar;C:\mujava\openjava.jar;



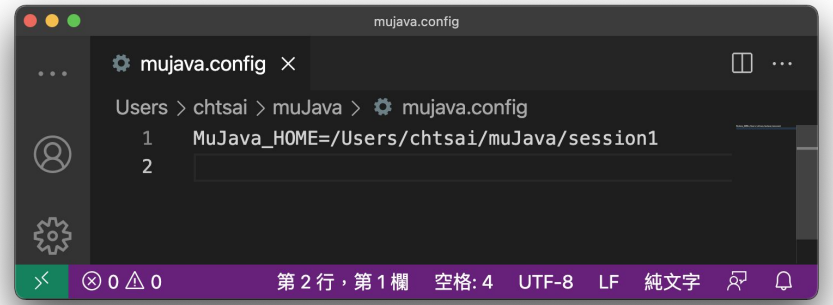
Installation - Windows 10

- ➔ Step 4 :
  - ◆ Modify the content of ***mujava.config***
    - MuJava_HOME=C:\mujava



Installation - macOS 11.4

- Steps
  - $ export CLASSPATH=$CLASSPATH:/Users/chtsai/muJava/mujava.jar:/Users/chtsai/muJava/openjava.jar
    - e.g. /Users/chtsai/muJava
  - $ java --version
    - openjdk 11.0.9 2020-10-20
    - OpenJDK Runtime Environment (build 11.0.9+11)
    - OpenJDK 64-Bit Server VM (build 11.0.9+11, mixed mode)



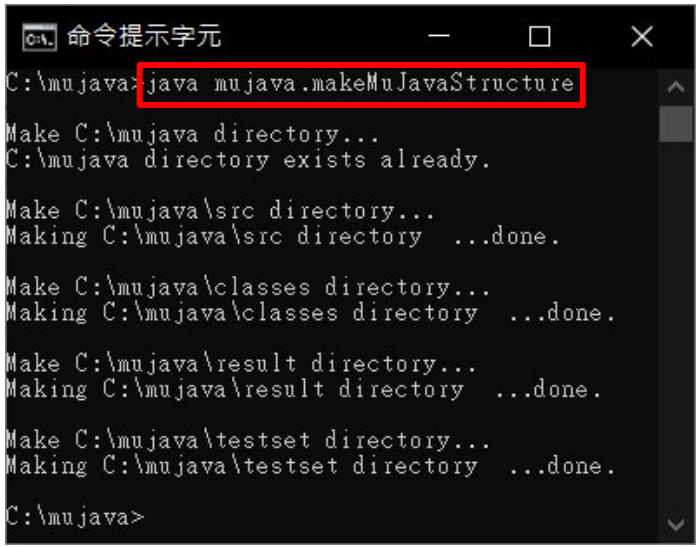
Installation - Ubuntu 20.04

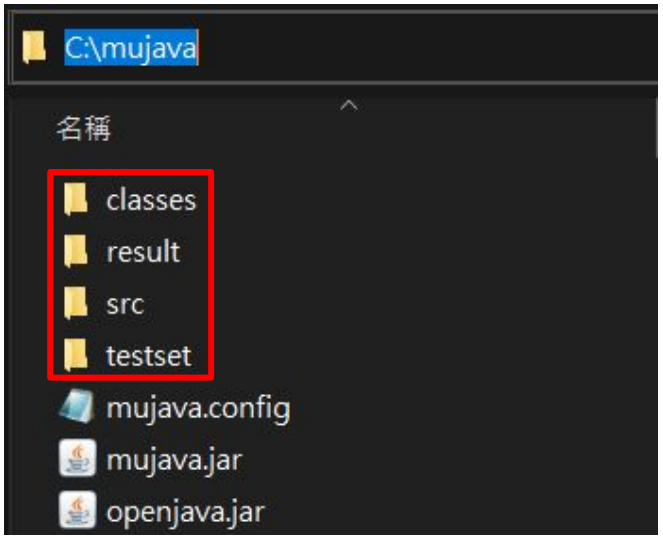
- Steps
  - install openjdk-11
    - sudo apt-get install openjdk-11-jdk
  - export CLASSPATH
    - export CLASSPATH=/DIR/mujava.jar:/DIR/openjava.jar
  - set mujava.config
    - MuJava_HOME=/DIR

```
 tl455047@tl455047-X556UR ≡ ~/st_hw4 ≡ java --version
openjdk 11.0.11 2021-04-20
OpenJDK Runtime Environment (build 11.0.11+9-Ubuntu-0ubuntu2.20.04)
OpenJDK 64-Bit Server VM (build 11.0.11+9-Ubuntu-0ubuntu2.20.04, mi
 tl455047@tl455047-X556UR ≡ ~/st_hw4 ≡ echo $CLASSPATH
/home/tl455047/st_hw4/mujava.jar:/home/tl455047/st_hw4/openjava.jar
 tl455047@tl455047-X556UR ≡ ~/st_hw4 ≡ cat mujava.config
MuJava_HOME=/home/tl455047/st_hw4
```

muJava

- Steps
  - Create src, classes, result, testset directories
    - **$ java mujava.makeMuJavaStructure**





muJava

- Steps
  - Add JUnit4 , hamcrest to CLASSPATH
    - junit-4.12.jar
    - hamcrest-core-1.3.jar

muJava

- ➔ Steps
  - ◆ Put your target java file in /src directory
    - Cal.java
  - ◆ Write test cases (CalTest.java) and compile
    - $ javac ./testset/CalTest.java ./src/Cal.java
    - output:
      - ./testset/CallTest.class
      - ./src/Cal.class

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testset/CalTest.java

```java
import org.junit.Assert;
import org.junit.Test;


public class CalTest {
    // Normal year
    @Test
    public void test1() {
        Assert.assertEquals(59, Cal.cal(1, 1, 3, 1, 2022));
    }

}
```

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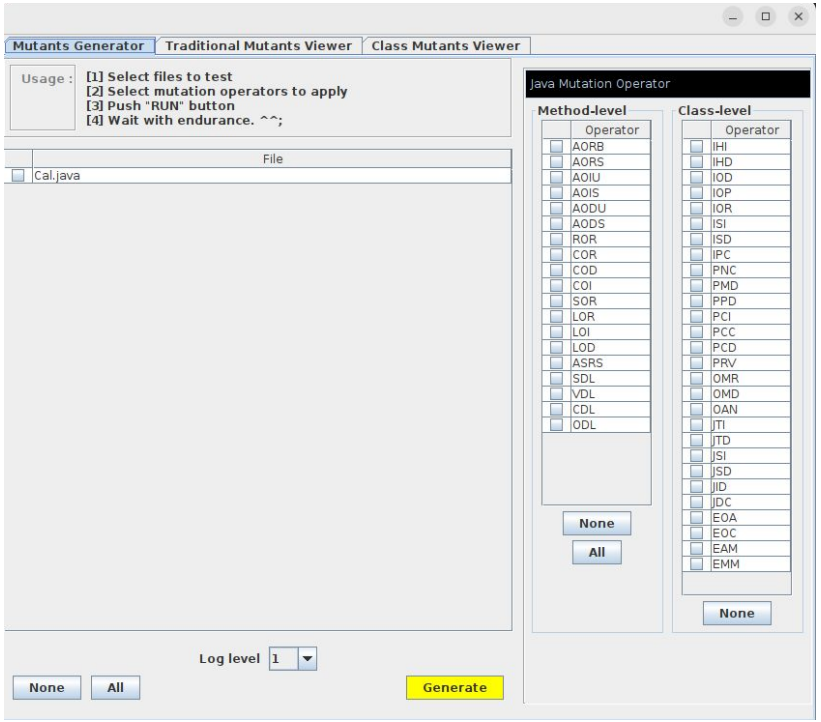
compile

```
oceane@lab547 ~/st_hw4> pwd
/home/oceane/st_hw4
oceane@lab547 ~/st_hw4> ls src
Cal.java
oceane@lab547 ~/st_hw4> ls testset/
CalTest.java
oceane@lab547 ~/st_hw4> javac ./testset/CalTest.java ./src/Cal.java
oceane@lab547 ~/st_hw4> ls src
Cal.class  Cal.java
oceane@lab547 ~/st_hw4> ls testset/
CalTest.class  CalTest.java
oceane@lab547 ~/st_hw4>
```

muJava

- ➔ Run muJava
  - $ java mujava.gui.GenMutantsMain



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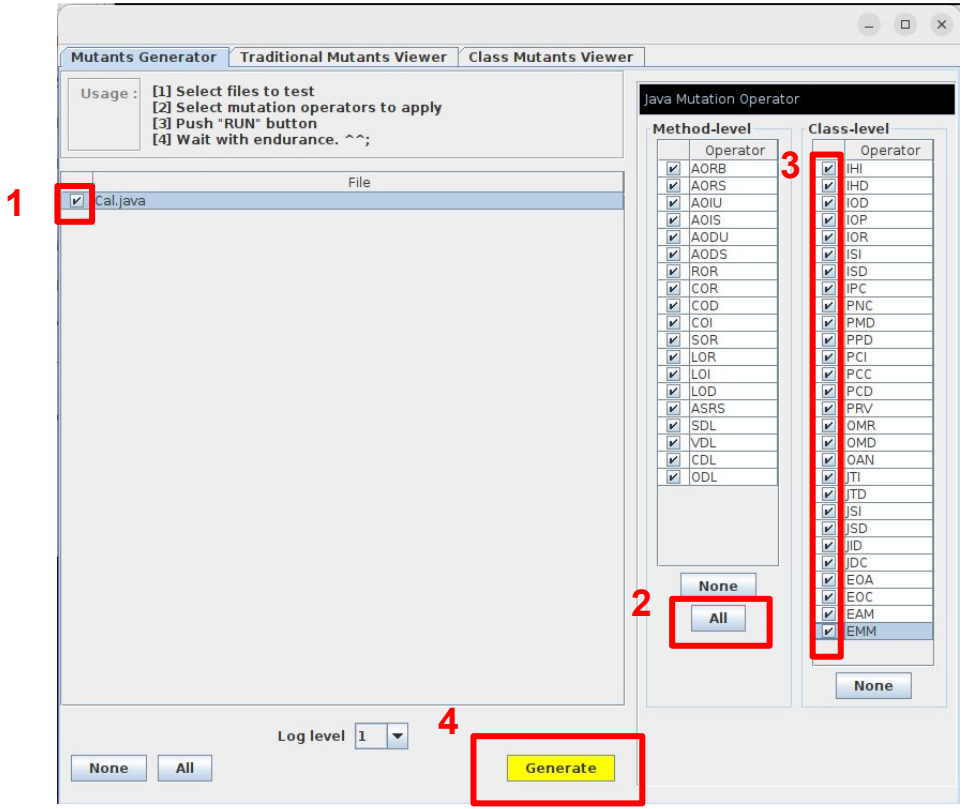
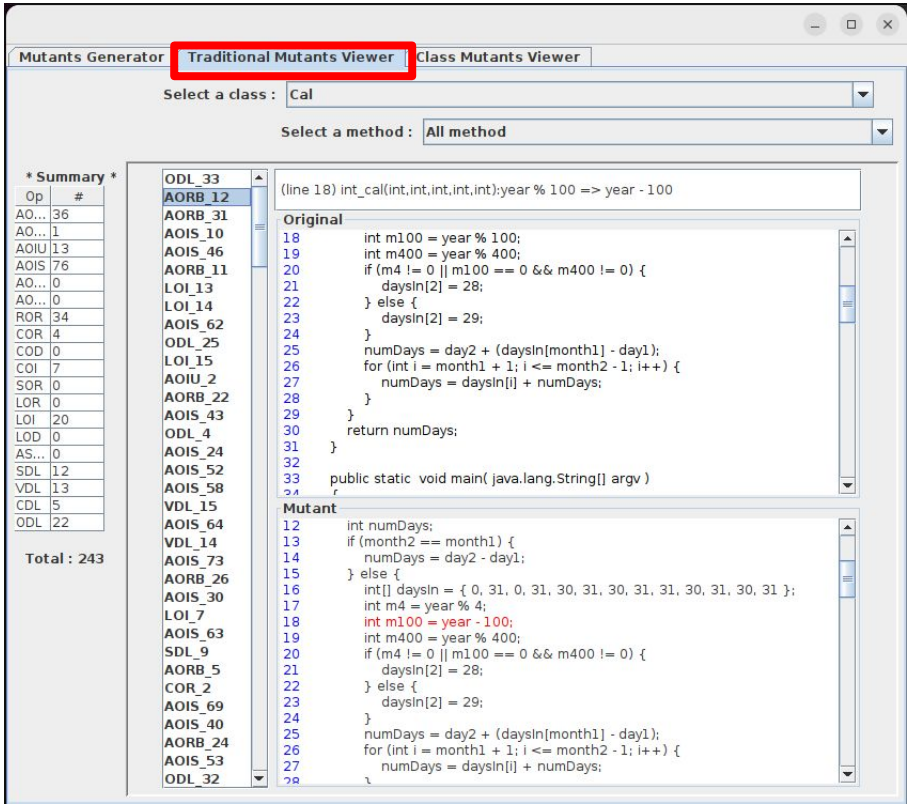

Mutants Generator
Traditional Mutants Viewer
Class Mutants Viewer
Usage :
[1] Select files to test
[2] Select mutation operators to apply
[3] Push "RUN" button
[4] Wait with endurance. ^^;
File
Cal.java
1
Java Mutation Operator
Method-level
Operator
AORB
AORS
AOIU
AOIS
AODU
AODS
ROR
COR
COD
COI
SOR
LOR
LOI
LOD
ASRS
SDL
VDL
CDL
ODL
None
All
2
3
Class-level
Operator
IHI
IHD
IOD
IOP
IOR
ISI
ISD
IPC
PNC
PMD
PPD
PCI
PCC
PCD
PRV
OMR
OMD
OAN
JTI
JTD
JSI
JSD
JID
JDC
EOA
EOC
EAM
EMM
None
Log level
1
4
None
All
Generate

muJava

```
oceane@lab547 ~/st_hw4> java mujava.gui.GenMutantsMain
The main method starts
File /home/oceane/st_hw4/src/Cal.java
 Exception at generating IOR mutant.  file : AllMutantsGenerator.java
File /home/oceane/st_hw4/src/Cal.java
----------------------------------------------
All files are handled
MutantsViewerPanel.mList_mouseClicked - mutant_log != null
MutantsViewerPanel.getMutatedContent --- start_index =7 : end_index =10
```

muJava

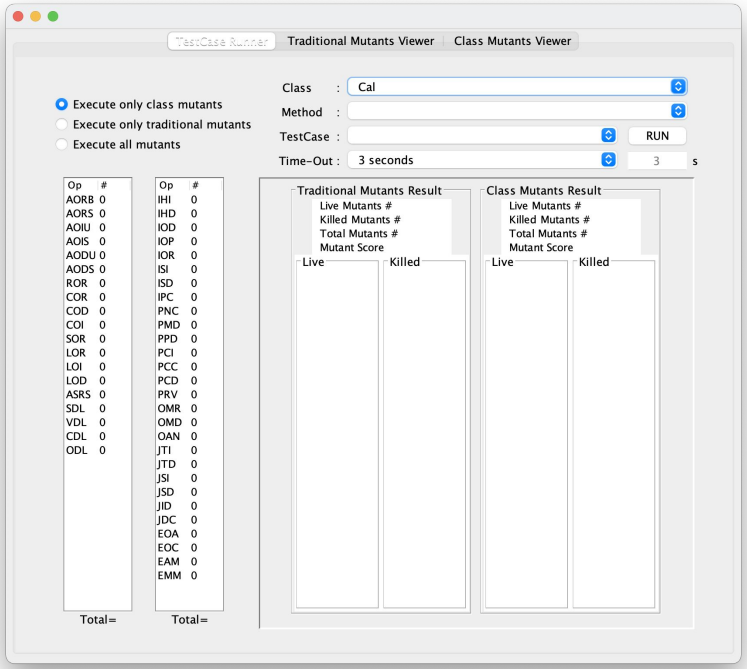

Mutants Generator
Traditional Mutants Viewer
Class Mutants Viewer
Select a class : Cal
Select a method : All method
* Summary *
Op # AO... 36 AO... 1 AOIU 13 AOIS 76 AO... 0 AO... 0 ROR 34 COR 4 COD 0 COI 7 SOR 0 LOR 0 LOI 20 LOD 0 AS... 0 SDL 12 VDL 13 CDL 5 ODL 22
Total : 243
ODL_33 AORB_12 AORB_31 AOIS_10 AOIS_46 AORB_11 LOI_13 LOI_14 AOIS_62 ODL_25 LOI_15 AOIU_2 AORB_22 AOIS_43 ODL_4 AOIS_24 AOIS_52 AOIS_58 VDL_15 AOIS_64 VDL_14 AOIS_73 AORB_26 AOIS_30 LOI_7 AOIS_63 SDL_9 AORB_5 COR_2 AOIS_69 AOIS_40 AORB_24 AOIS_53 ODL_32
(line 18) int_cal(int,int,int,int,int):year % 100 => year - 100
Original
18 int m100 = year % 100;
19 int m400 = year % 400;
20 if (m4 != 0 || m100 == 0 && m400 != 0) {
21 daysIn[2] = 28;
22 } else {
23 daysIn[2] = 29;
24 }
25 numDays = day2 + (daysIn[month1] - day1);
26 for (int i = month1 + 1; i <= month2 - 1; i++) {
27 numDays = daysIn[i] + numDays;
28 }
29 }
30 return numDays;
31 }
32
33 public static void main(java.lang.String[] argv)
Mutant
12 int numDays;
13 if (month2 == month1) {
14 numDays = day2 - day1;
15 } else {
16 int[] daysIn = { 0, 31, 0, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31 };
17 int m4 = year % 4;
18 int m100 = year - 100;
19 int m400 = year % 400;
20 if (m4 != 0 || m100 == 0 && m400 != 0) {
21 daysIn[2] = 28;
22 } else {
23 daysIn[2] = 29;
24 }
25 numDays = day2 + (daysIn[month1] - day1);
26 for (int i = month1 + 1; i <= month2 - 1; i++) {
27 numDays = daysIn[i] + numDays;

muJava

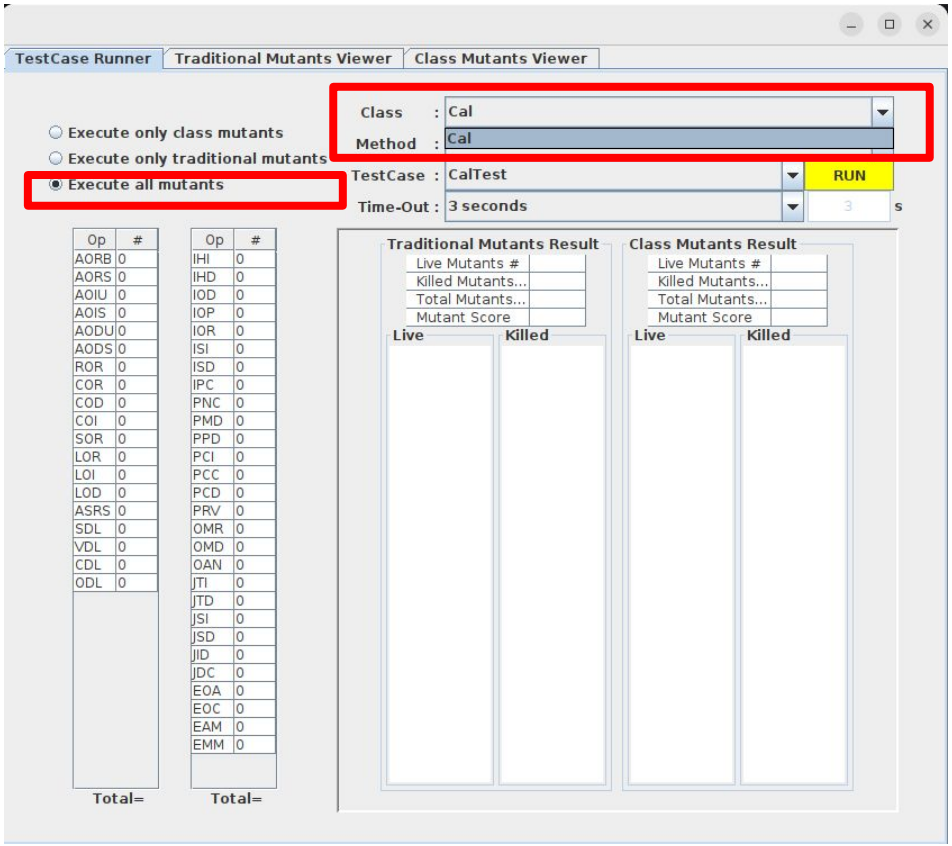
- ➔ **After** GenMutantsMain
  a. Avoid score is always 100%
  b. Prevent the warning
  c. **cp ./src/Cal.class ./classes**

muJava

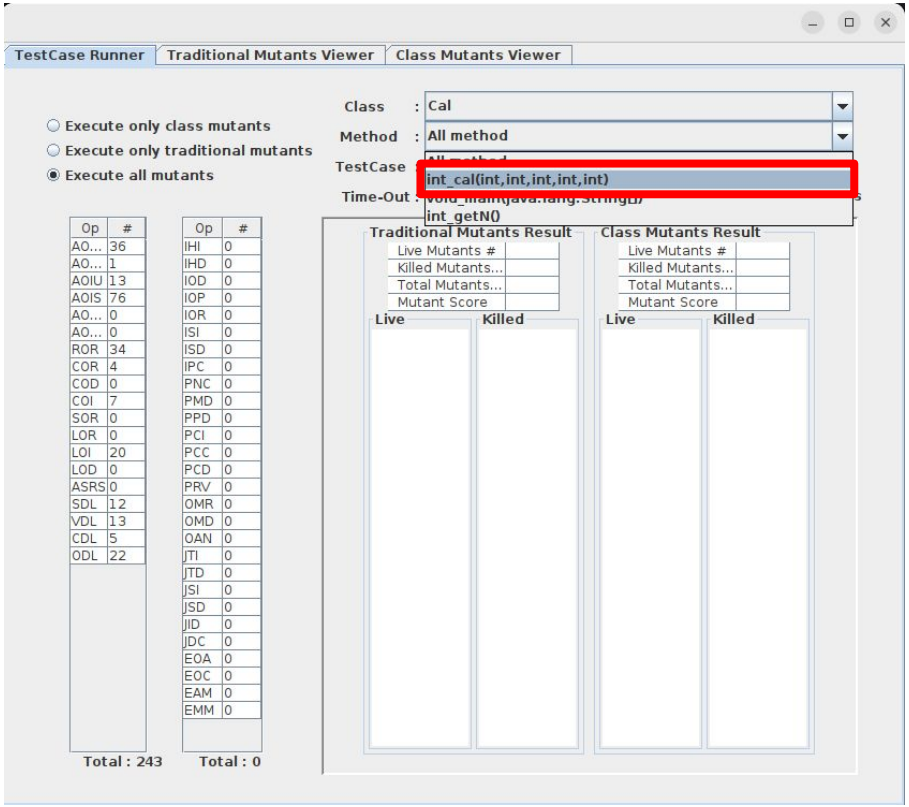
- Run Test
  - $ java mujava.gui.RunTestMain



muJava


TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Class : Cal
Method : Cal
TestCase : CalTest
RUN
Time-Out : 3 seconds
3
s
Execute only class mutants
Execute only traditional mutants
Execute all mutants
Op #
AORB 0
AORS 0
AOIU 0
AOIS 0
AODU 0
AODS 0
ROR 0
COR 0
COD 0
COI 0
SOR 0
LOR 0
LOI 0
LOD 0
ASRS 0
SDL 0
VDL 0
CDL 0
ODL 0
Total=
Op #
IHI 0
IHD 0
IOD 0
IOP 0
IOR 0
ISI 0
ISD 0
IPC 0
PNC 0
PMD 0
PPD 0
PCI 0
PCC 0
PCD 0
PRV 0
OMR 0
OMD 0
OAN 0
JTI 0
JTD 0
JSI 0
JSD 0
JID 0
JDC 0
EOA 0
EOC 0
EAM 0
EMM 0
Total=
Traditional Mutants Result
Live Mutants #
Killed Mutants...
Total Mutants...
Mutant Score
Live
Killed
Class Mutants Result
Live Mutants #
Killed Mutants...
Total Mutants...
Mutant Score
Live
Killed

muJava


TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Execute only class mutants
Execute only traditional mutants
Execute all mutants
Class : Cal
Method : All method
TestCase
Time-Out
int_cal(int,int,int,int,int)
int_getN()
Op # AO... 36 AO... 1 AOIU 13 AOIS 76 AO... 0 AO... 0 ROR 34 COR 4 COD 0 COI 7 SOR 0 LOR 0 LOI 20 LOD 0 ASRS 0 SDL 12 VDL 13 CDL 5 ODL 22
Total : 243
Op # IHI 0 IHD 0 IOD 0 IOP 0 IOR 0 ISI 0 ISD 0 IPC 0 PNC 0 PMD 0 PPD 0 PCI 0 PCC 0 PCD 0 PRV 0 OMR 0 OMD 0 OAN 0 JTI 0 JTD 0 JSI 0 JSD 0 JID 0 JDC 0 EOA 0 EOC 0 EAM 0 EMM 0
Total : 0
Traditional Mutants Result
Live Mutants #
Killed Mutants...
Total Mutants...
Mutant Score
Live
Killed
Class Mutants Result
Live Mutants #
Killed Mutants...
Total Mutants...
Mutant Score
Live
Killed

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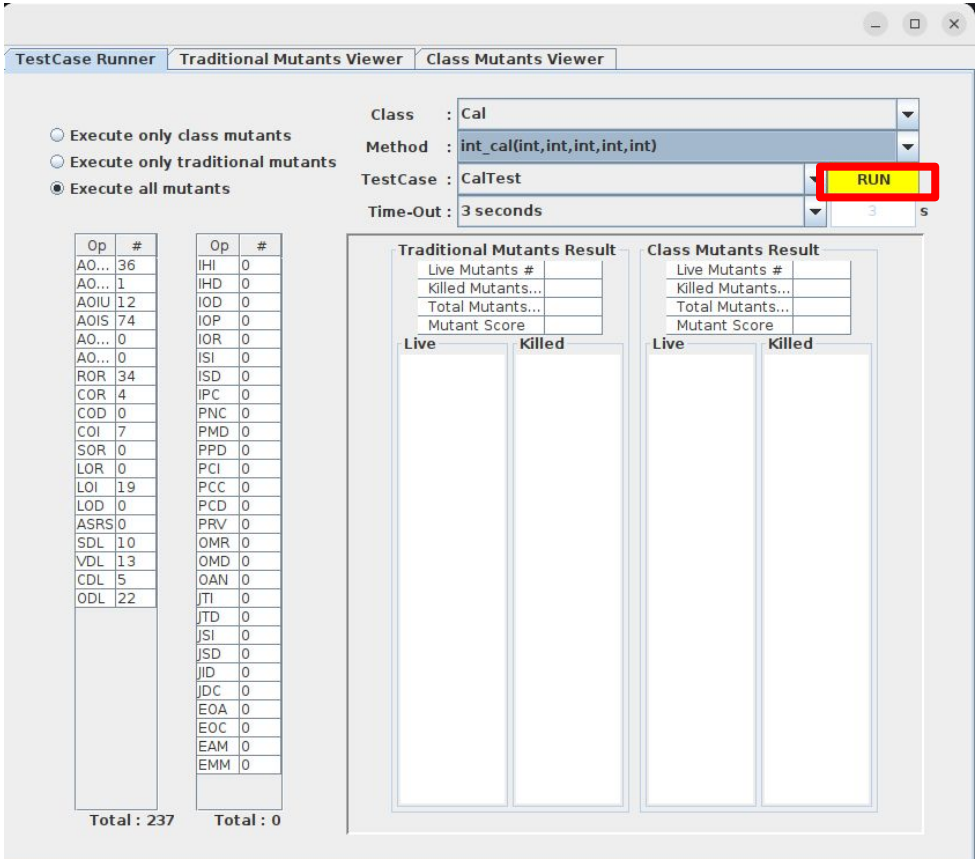
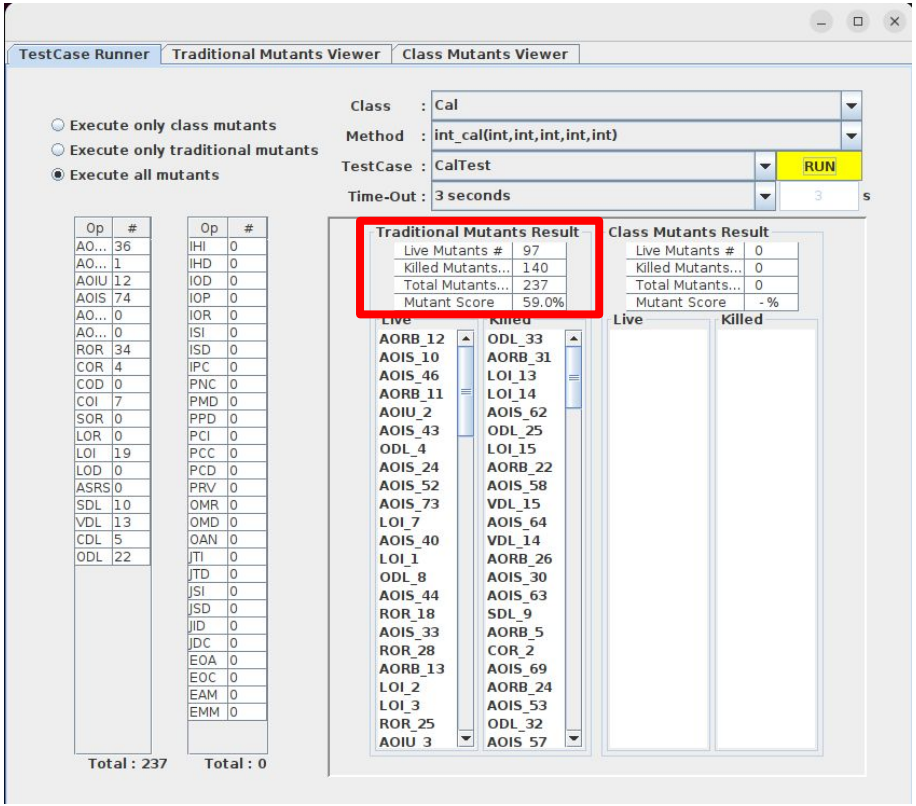

TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Execute only class mutants
Execute only traditional mutants
Execute all mutants
Class : Cal
Method : int_cal(int,int,int,int,int)
TestCase : CalTest
RUN
Time-Out : 3 seconds
3
s
Op # AO... 36 AO... 1 AOIU 12 AOIS 74 AO... 0 AO... 0 ROR 34 COR 4 COD 0 COI 7 SOR 0 LOR 0 LOI 19 LOD 0 ASRS 0 SDL 10 VDL 13 CDL 5 ODL 22
Total : 237
Op # IHI 0 IHD 0 IOD 0 IOP 0 IOR 0 ISI 0 ISD 0 IPC 0 PNC 0 PMD 0 PPD 0 PCI 0 PCC 0 PCD 0 PRV 0 OMR 0 OMD 0 OAN 0 JTI 0 JTD 0 JSI 0 JSD 0 JID 0 JDC 0 EOA 0 EOC 0 EAM 0 EMM 0
Total : 0
Traditional Mutants Result
Live Mutants #
Killed Mutants...
Total Mutants...
Mutant Score
Live
Killed
Class Mutants Result
Live Mutants #
Killed Mutants...
Total Mutants...
Mutant Score
Live
Killed

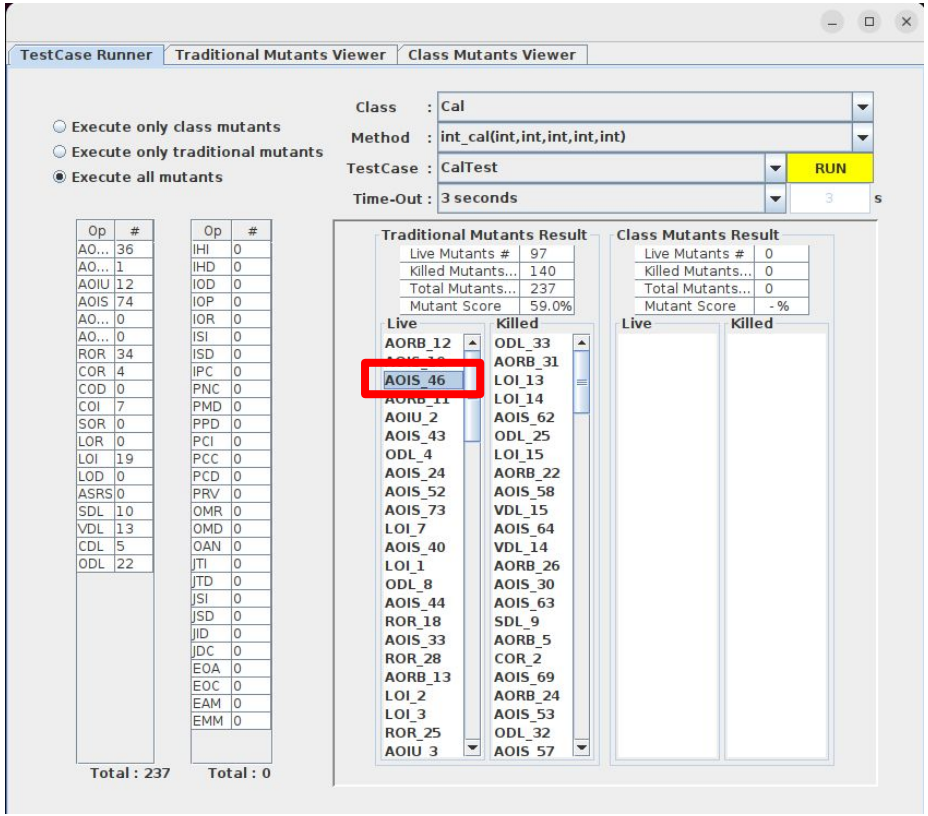
muJava

```
AOIU_2{test2=pass, test1=pass}
AORB_22{test2=test2: 15; expected:<121> but was:<90>, test1=test1: 9; expected:<59> but was:<28>}
AOIS_43{test2=pass, test1=pass}
ODL_4{test2=pass, test1=pass}
AOIS_24{test2=pass, test1=pass}
AOIS_52{test2=pass, test1=pass}
AOIS_58 time_out: more than 3000 milliseconds
VDL_15{test2=test2: 15; expected:<121> but was:<31>, test1=test1: 9; expected:<59> but was:<31>}
AOIS_64{test2=test2: 15; expected:<121> but was:<91>, test1=pass}
VDL_14{test2=test2: 15; expected:<121> but was:<152>, test1=test1: 9; expected:<59> but was:<90>}
AOIS_73{test2=pass, test1=pass}
AORB_26{test2=test2: 15; expected:<121> but was:<152>, test1=test1: 9; expected:<59> but was:<90>}
AOIS_30{test2=test2: 15; expected:<121> but was:<120>, test1=pass}
LOI_7{test2=pass, test1=pass}
AOIS_63{test2=test2: 15; Index 13 out of bounds for length 13, test1=test1: 9; Index 13 out of bounds for length 13}
SDL_9{test2=test2: 15; expected:<121> but was:<92>, test1=pass}
AORB_5{test2=test2: 15; expected:<121> but was:<120>, test1=pass}
COR_2{test2=test2: 15; expected:<121> but was:<120>, test1=pass}
AOIS_69{test2=test2: 15; expected:<121> but was:<124>, test1=test1: 9; expected:<59> but was:<60>}
AOIS_40{test2=pass, test1=pass}
AORB_24{test2=test2: 15; expected:<121> but was:<61>, test1=test1: 9; expected:<59> but was:<-1>}
AOIS_53{test2=test2: 15; expected:<121> but was:<92>, test1=test1: 9; expected:<59> but was:<31>}
ODL_32{test2=test2: 15; expected:<121> but was:<30>, test1=test1: 9; expected:<59> but was:<28>}
AOIS_57{test2=test2: 15; expected:<121> but was:<62>, test1=test1: 9; expected:<59> but was:<31>}
ODL_21{test2=test2: 15; expected:<121> but was:<122>, test1=test1: 9; expected:<59> but was:<60>}
AORB_34{test2=test2: 15; / by zero, test1=test1: 9; expected:<59> but was:<0>}
AOIU_9{test2=test2: 15; Index 13 out of bounds for length 13, test1=test1: 9; Index 13 out of bounds for length 13}
ROR_19{test2=test2: 15; expected:<121> but was:<120>, test1=pass}
CDL_8{test2=test2: 15; expected:<121> but was:<152>, test1=test1: 9; expected:<59> but was:<90>}
AOIS_48{test2=test2: 15; expected:<121> but was:<152>, test1=test1: 9; expected:<59> but was:<90>}
ROR_6{test2=test2: 15; expected:<121> but was:<0>, test1=test1: 9; expected:<59> but was:<0>}
LOI_1{test2=pass, test1=pass}
AOIS_49{test2=test2: 15; expected:<121> but was:<120>, test1=test1: 9; expected:<59> but was:<58>}
ODL_8{test2=pass, test1=pass}
AOIS_44{test2=pass, test1=pass}
ROR_13{test2=test2: 15; expected:<121> but was:<120>, test1=pass}
AOIU_7{test2=test2: 15; expected:<121> but was:<119>, test1=test1: 9; expected:<59> but was:<57>}
SDL_3{test2=test2: 15; expected:<121> but was:<0>, test1=test1: 9; expected:<59> but was:<0>}
COI_7{test2=test2: 15; expected:<121> but was:<31>, test1=test1: 9; expected:<59> but was:<31>}
ROR_5{test2=test2: 15; expected:<121> but was:<0>, test1=test1: 9; expected:<59> but was:<0>}
AOIU_10{test2=test2: 15; expected:<121> but was:<31>, test1=test1: 9; expected:<59> but was:<31>}
ROR_9{test2=test2: 15; expected:<121> but was:<120>, test1=pass}
AOIS_60
```

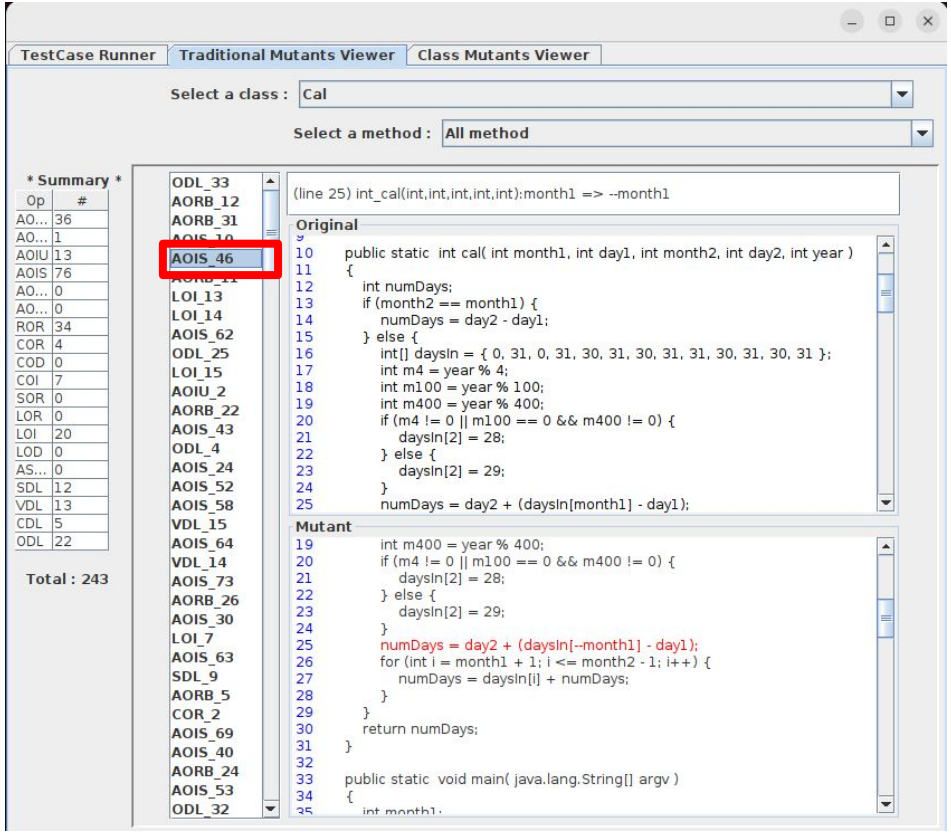
muJava


TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Execute only class mutants
Execute only traditional mutants
Execute all mutants
Class : Cal
Method : int_cal(int,int,int,int,int)
TestCase : CalTest
RUN
Time-Out : 3 seconds
3
s
Op # AO... 36 AO... 1 AOIU 12 AOIS 74 AO... 0 AO... 0 ROR 34 COR 4 COD 0 COI 7 SOR 0 LOR 0 LOI 19 LOD 0 ASRS 0 SDL 10 VDL 13 CDL 5 ODL 22
Total : 237
Op # IHI 0 IHD 0 IOD 0 IOP 0 IOR 0 ISI 0 ISD 0 IPC 0 PNC 0 PMD 0 PPD 0 PCI 0 PCC 0 PCD 0 PRV 0 OMR 0 OMD 0 OAN 0 JTI 0 JTD 0 JSI 0 JSD 0 JID 0 JDC 0 EOA 0 EOC 0 EAM 0 EMM 0
Total : 0
Traditional Mutants Result
Live Mutants # 97
Killed Mutants... 140
Total Mutants... 237
Mutant Score 59.0%
Live
AORB_12 AOIS_10 AOIS_46 AORB_11 AOIU_2 AOIS_43 ODL_4 AOIS_24 AOIS_52 AOIS_73 LOI_7 AOIS_40 LOI_1 ODL_8 AOIS_44 ROR_18 AOIS_33 ROR_28 AORB_13 LOI_2 LOI_3 ROR_25 AOIU_3
Killed
ODL_33 AORB_31 LOI_13 LOI_14 AOIS_62 ODL_25 LOI_15 AORB_22 AOIS_58 VDL_15 AOIS_64 VDL_14 AORB_26 AOIS_30 AOIS_63 SDL_9 AORB_5 COR_2 AOIS_69 AORB_24 AOIS_53 ODL_32 AOIS_57
Class Mutants Result
Live Mutants # 0
Killed Mutants... 0
Total Mutants... 0
Mutant Score - %
Live
Killed

muJava


TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Execute only class mutants
Execute only traditional mutants
Execute all mutants
Class : Cal
Method : int_cal(int,int,int,int,int)
TestCase : CalTest
RUN
Time-Out : 3 seconds
3
s
Op # AO... 36 AO... 1 AOIU 12 AOIS 74 AO... 0 AO... 0 ROR 34 COR 4 COD 0 COI 7 SOR 0 LOR 0 LOI 19 LOD 0 ASRS 0 SDL 10 VDL 13 CDL 5 ODL 22
Total : 237
Op # IHI 0 IHD 0 IOD 0 IOP 0 IOR 0 ISI 0 ISD 0 IPC 0 PNC 0 PMD 0 PPD 0 PCI 0 PCC 0 PCD 0 PRV 0 OMR 0 OMD 0 OAN 0 JTI 0 JTD 0 JSI 0 JSD 0 JID 0 JDC 0 EOA 0 EOC 0 EAM 0 EMM 0
Total : 0
Traditional Mutants Result
Live Mutants # 97
Killed Mutants... 140
Total Mutants... 237
Mutant Score 59.0%
Live
AORB_12
AOIS_46
AOIU_2
AOIS_43
ODL_4
AOIS_24
AOIS_52
AOIS_73
LOI_7
AOIS_40
LOI_1
ODL_8
AOIS_44
ROR_18
AOIS_33
ROR_28
AORB_13
LOI_2
LOI_3
ROR_25
AOIU_3
Killed
ODL_33
AORB_31
LOI_13
LOI_14
AOIS_62
ODL_25
LOI_15
AORB_22
AOIS_58
VDL_15
AOIS_64
VDL_14
AORB_26
AOIS_30
AOIS_63
SDL_9
AORB_5
COR_2
AOIS_69
AORB_24
AOIS_53
ODL_32
AOIS_57
Class Mutants Result
Live Mutants # 0
Killed Mutants... 0
Total Mutants... 0
Mutant Score -%
Live
Killed

muJava


TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Select a class : Cal
Select a method : All method
* Summary *
Op | #
AO... | 36
AO... | 1
AOIU | 13
AOIS | 76
AO... | 0
AO... | 0
ROR | 34
COR | 4
COD | 0
COI | 7
SOR | 0
LOR | 0
LOI | 20
LOD | 0
AS... | 0
SDL | 12
VDL | 13
CDL | 5
ODL | 22
Total : 243
ODL_33
AORB_12
AORB_31
AOIS_10
AOIS_46
LOI_13
LOI_14
AOIS_62
ODL_25
LOI_15
AOIU_2
AORB_22
AOIS_43
ODL_4
AOIS_24
AOIS_52
AOIS_58
VDL_15
AOIS_64
VDL_14
AOIS_73
AORB_26
AOIS_30
LOI_7
AOIS_63
SDL_9
AORB_5
COR_2
AOIS_69
AOIS_40
AORB_24
AOIS_53
ODL_32
(line 25) int_cal(int,int,int,int,int):month1 => --month1
Original
10 public static int cal(int month1, int day1, int month2, int day2, int year)
11 {
12 int numDays;
13 if (month2 == month1) {
14 numDays = day2 - day1;
15 } else {
16 int[] daysIn = { 0, 31, 0, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31 };
17 int m4 = year % 4;
18 int m100 = year % 100;
19 int m400 = year % 400;
20 if (m4 != 0 || m100 == 0 && m400 != 0) {
21 daysIn[2] = 28;
22 } else {
23 daysIn[2] = 29;
24 }
25 numDays = day2 + (daysIn[month1] - day1);
Mutant
19 int m400 = year % 400;
20 if (m4 != 0 || m100 == 0 && m400 != 0) {
21 daysIn[2] = 28;
22 } else {
23 daysIn[2] = 29;
24 }
25 numDays = day2 + (daysIn[--month1] - day1);
26 for (int i = month1 + 1; i <= month2 - 1; i++) {
27 numDays = daysIn[i] + numDays;
28 }
29 }
30 return numDays;
31 }
32
33 public static void main(java.lang.String[] argv)
34 {

muJava

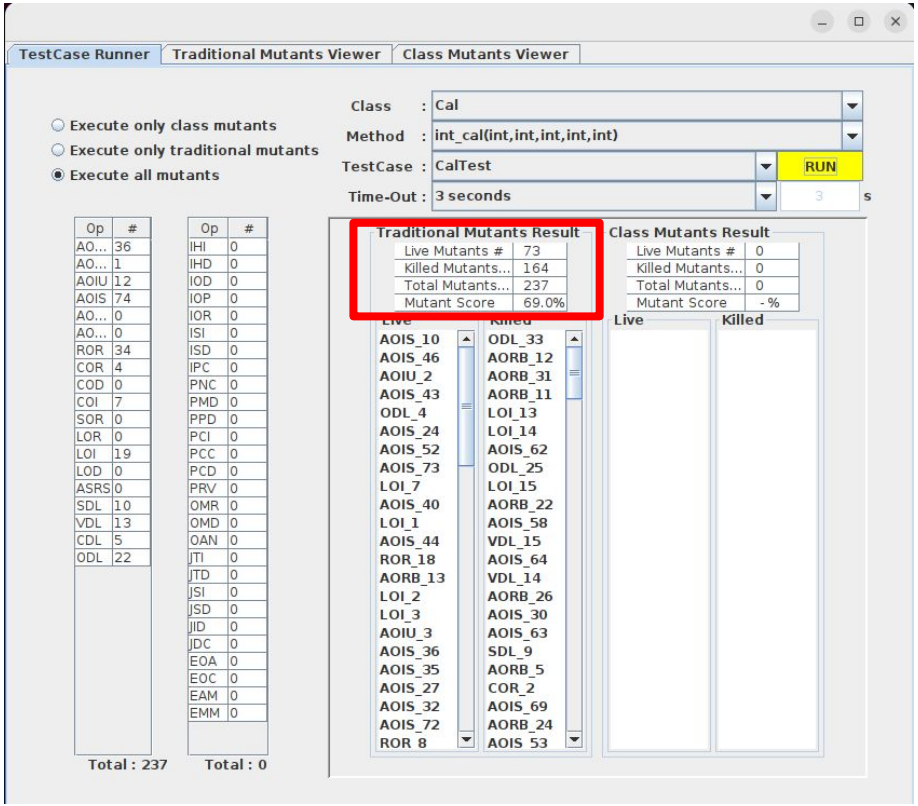
modify testset/CalTest.java

```java
import org.junit.Assert;
import org.junit.Test;


public class CalTest {
    // Normal year
    @Test
    public void test1() {
        Assert.assertEquals(59, Cal.cal(1, 1, 3, 1, 2022));
    }

    // leap year
    @Test
    public void test2() {
        Assert.assertEquals(121, Cal.cal(1, 1, 5, 1, 2020));
    }

    // (m100 == 0) && (m400 != 0)
    @Test
    public void test3() {
        Assert.assertEquals(181, Cal.cal(1, 1, 7, 1, 2100));
    }

}
```

muJava

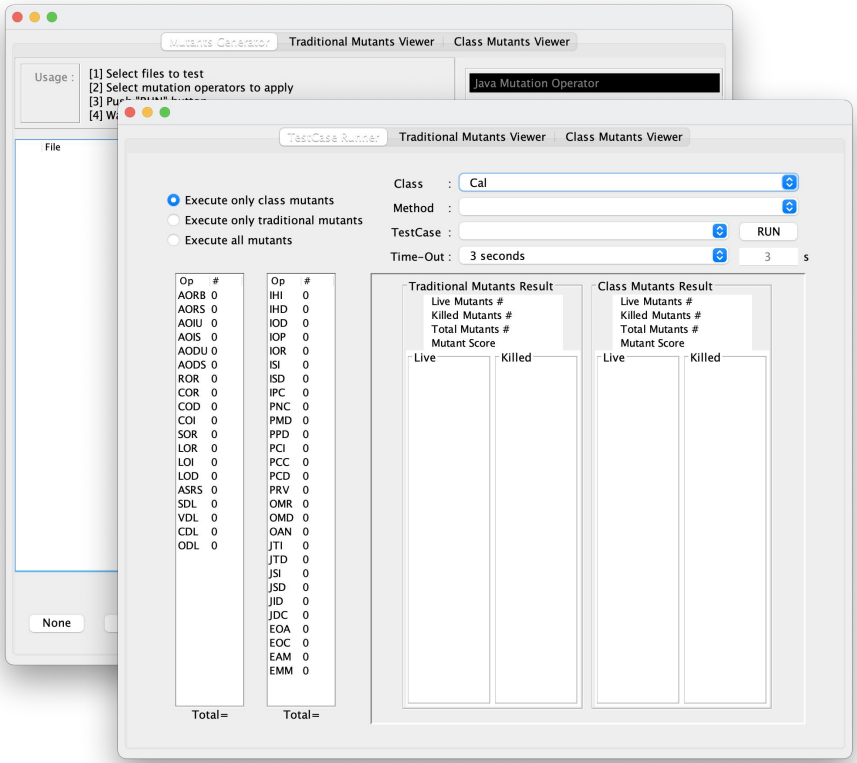
```
oceane@lab547 ~/st_hw4> vim testset/CalTest.java
oceane@lab547 ~/st_hw4> javac ./testset/CalTest.java ./src/Cal.java
oceane@lab547 ~/st_hw4> java mujava.gui.RunTestMain
```

muJava


TestCase Runner
Traditional Mutants Viewer
Class Mutants Viewer
Execute only class mutants
Execute only traditional mutants
Execute all mutants
Class : Cal
Method : int_cal(int,int,int,int,int)
TestCase : CalTest
RUN
Time-Out : 3 seconds
3
s
Op # AO... 36 AO... 1 AOIU 12 AOIS 74 AO... 0 AO... 0 ROR 34 COR 4 COD 0 COI 7 SOR 0 LOR 0 LOI 19 LOD 0 ASRS 0 SDL 10 VDL 13 CDL 5 ODL 22
Total : 237
Op # IHI 0 IHD 0 IOD 0 IOP 0 IOR 0 ISI 0 ISD 0 IPC 0 PNC 0 PMD 0 PPD 0 PCI 0 PCC 0 PCD 0 PRV 0 OMR 0 OMD 0 OAN 0 JTI 0 JTD 0 JSI 0 JSD 0 JID 0 JDC 0 EOA 0 EOC 0 EAM 0 EMM 0
Total : 0
Traditional Mutants Result
Live Mutants # 73
Killed Mutants... 164
Total Mutants... 237
Mutant Score 69.0%
Live
AOIS_10 AOIS_46 AOIU_2 AOIS_43 ODL_4 AOIS_24 AOIS_52 AOIS_73 LOI_7 AOIS_40 LOI_1 AOIS_44 ROR_18 AORB_13 LOI_2 LOI_3 AOIU_3 AOIS_36 AOIS_35 AOIS_27 AOIS_32 AOIS_72 ROR_8
Killed
ODL_33 AORB_12 AORB_31 AORB_11 LOI_13 LOI_14 AOIS_62 ODL_25 LOI_15 AORB_22 AOIS_58 VDL_15 AOIS_64 VDL_14 AORB_26 AOIS_30 AOIS_63 SDL_9 AORB_5 COR_2 AOIS_69 AORB_24 AOIS_53
Class Mutants Result
Live Mutants # 0
Killed Mutants... 0
Total Mutants... 0
Mutant Score -%
Live
Killed

Homework

- ➔ Installation
  a. Get Java version
  b. Export CLASSPATH
     - jar files
  c. Set muJava configuration
     - specify muJava home directory
- ➔ Run muJava
  a. $ java mujava.gui.GenMutantsMain
  b. $ java mujava.gui.RunTestMain



Hint

1. Junit 4 only

2. Method is blank
   a. choose **“class” list** first