软件测试上机报告

第四次上机作业

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一、实验要求

1. **Install MuJava**. The instruction of how to install and use Mujava can be seen in https://cs.gmu.edu/~offutt/mujava/ .
2. Two small programs are given for your task. BubbleSort.java is an implementation of bubble sort algorithm and BackPack.java is a solution of 01 backpack problem. Try to **generate** Mutants of 2 given programs with MuJava.
3. **Write testing sets for 2 programs with Junit**, and run mutants on the test sets with MuJava.

Requirements for the experiment:

1. Finish the tasks above individually.
2. Check in your java code to github or gitee.
3. Post your experiment report to “智慧树”, the following information should be included in your report:

a) The brief description that you install MuJava
b) Steps for generating Mutants
c) Steps for making test sets and running mutants.
d) Your mutants result (The number of live mutants, killed mutants, etc.)

二、源代码

TestBackPack.java:

```
import org.junit.Test;
import static org.junit.Assert.*;

public class TestBackPack {
   private BackPack backpack;
   @Test
   public void testSolution() {
      int result[][] = new int[][]{
         {0,0,0,0,0,0,0,0,0,0,0},
         {0,0,0,4,4,4,4,4,4,4,4},
          {0,0,0,4,5,5,5,9,9,9,9},
         {0,0,0,4,5,6,6,9,10,11,11}
      };
      int m = 10;
      int n = 3;

      int w[] = {3, 4, 5};
      int p[] = {4, 5, 6};
      assertEquals(result, backpack.BackPack_Solution(m, n, w, p));
   }
}
```

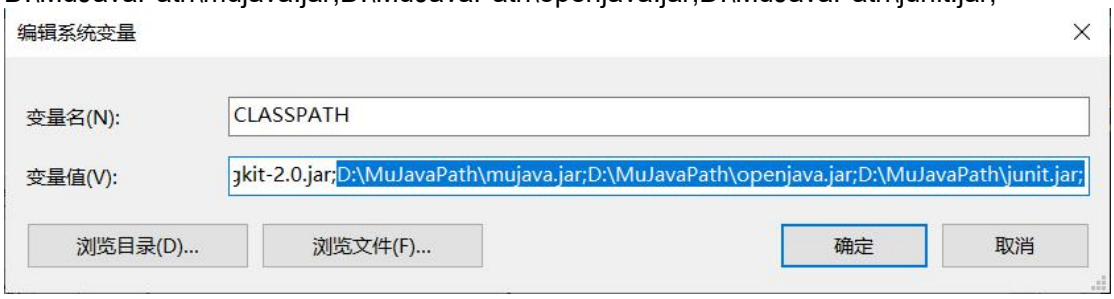
TestBubbleSort.java:

```
import static org.junit.Assert.*;
import java.util.Arrays;
import org.junit.Test;

public class TestBubbleSort {

    @Test
    public void test1() {

        int a[] = new int[]{1,8,2,2,5};
        int a1[] = new int[]{1,2,2,5,8};
        assertEquals(Arrays.toString(a1),
Arrays.toString(BubbleSort.BubbleSort(a)));
```

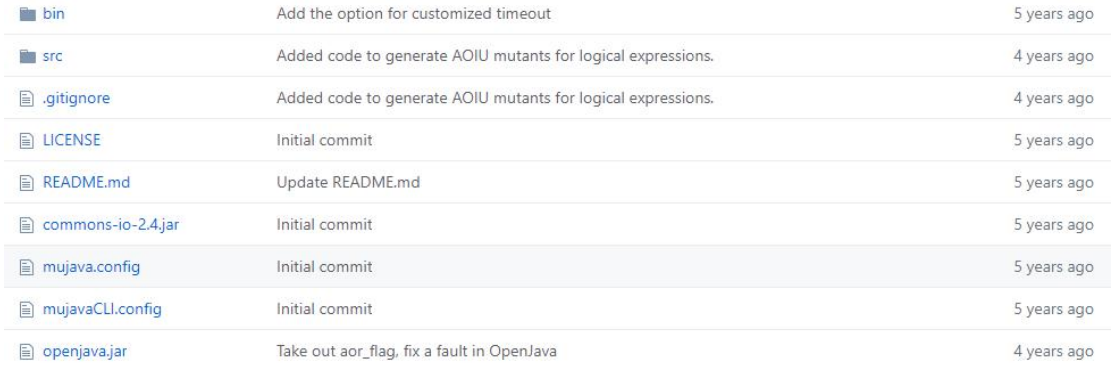
```
    }
}
```

三、运行结果

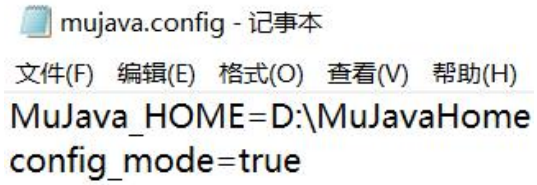
Add environment variables, add the following in CLASSPATH:
D:\MuJavaPath\mujava.jar;D:\MuJavaPath\openjava.jar;D:\MuJavaPath\junit.jar;



Download mujava.config file from github:
https://github.com/jeffoffutt/muJava



The mujava.config file is placed in the \ MuJavaHome folder. Change the content to the current path:



Next, create a command file: Create two txt files in D: \ MuJavaHome. The contents of txt are:

GenMutants.cmd: java mujava.gui.GenMutantsMain

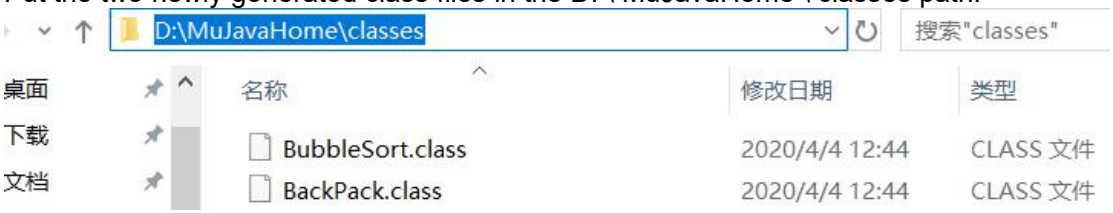
RunTest.cmd: java mujava.gui.RunTestMain >TestResult.txt

Save as cmd suffix, easy to run mujava program:

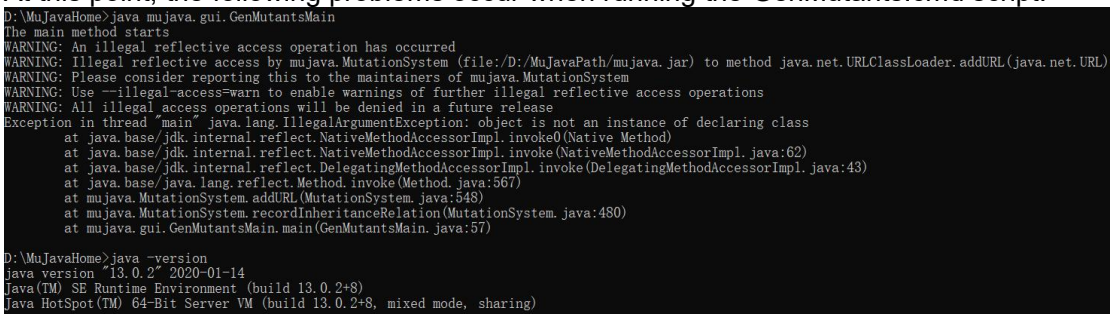
Put two Java files in the D: \ MuJavaHome \ src folder:

Enter the following command to compile the two files:
javac -encoding UTF-8 BackPack.java BubbleSort.java

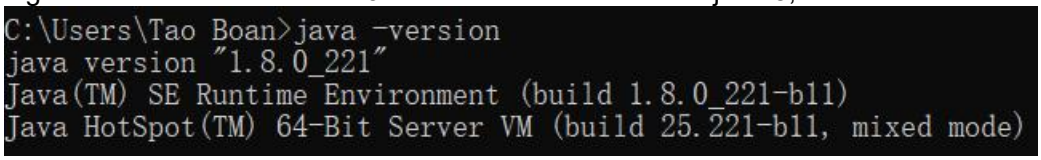
Put the two newly generated class files in the D: \ MuJavaHome \ classes path:



At this point, the following problems occur when running the GenMutants.cmd script:



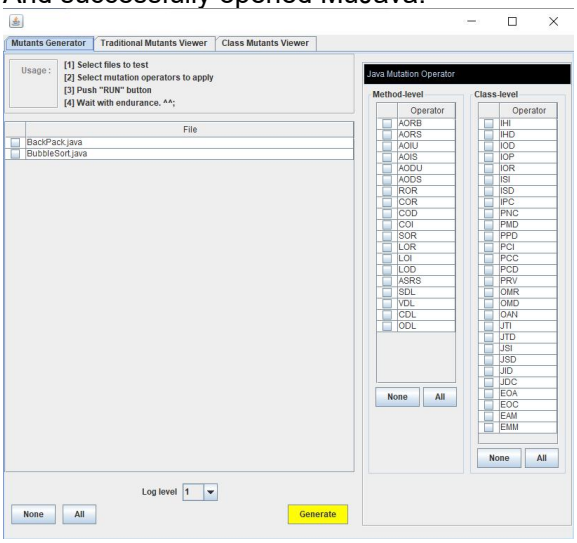
Looking for a way to check the Java jdk version of your computer is 13.0.2, which is too high. So uninstall the current Java version and download jdk1.8, as follows:



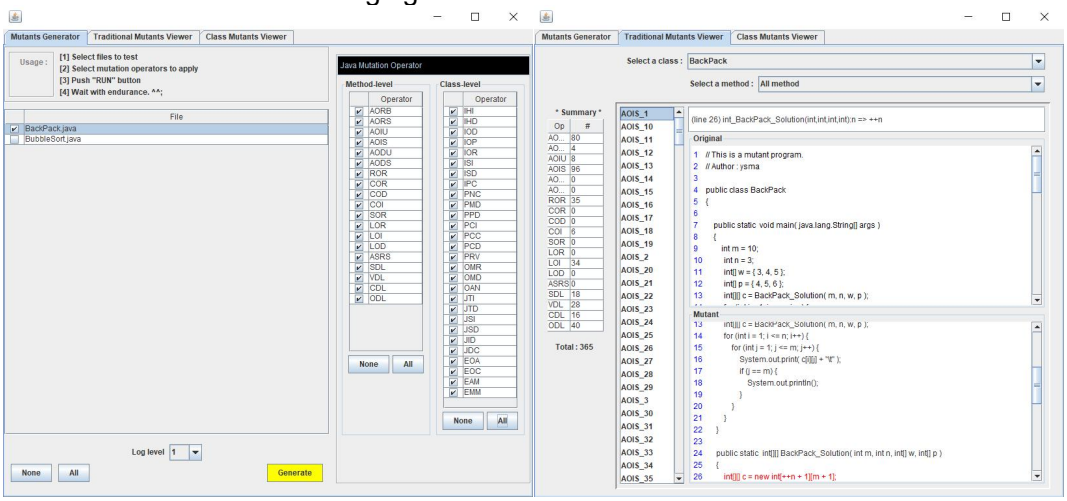
Then run the GenMutants.cmd script:

```
D:\MuJavaHome>GenMutants.cmd

D:\MuJavaHome>java mujava.gui.GenMutantsMain
The main method starts
[ERROR] for class BackPack => BackPack has been compiled by a more recent version of the Java Ru
ntime (class file version 57.0), this version of the Java Runtime only recognizes class file ver
sions up to 52.0
[ERROR] for class BubbleSort => BubbleSort has been compiled by a more recent version of the Jav
a Runtime (class file version 57.0), this version of the Java Runtime only recognizes class file
 versions up to 52.0
```

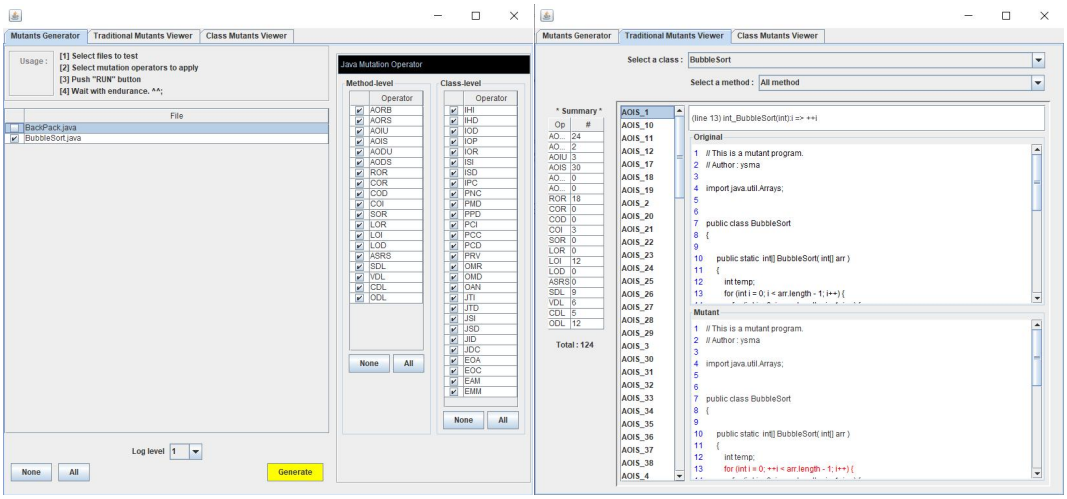
And successfully opened MuJava:



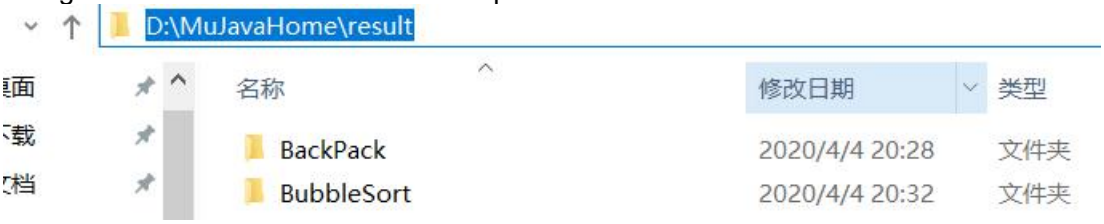
Select BackPack.java, select all mutation operators on the right, and click Generate. The result is shown in the following figure:



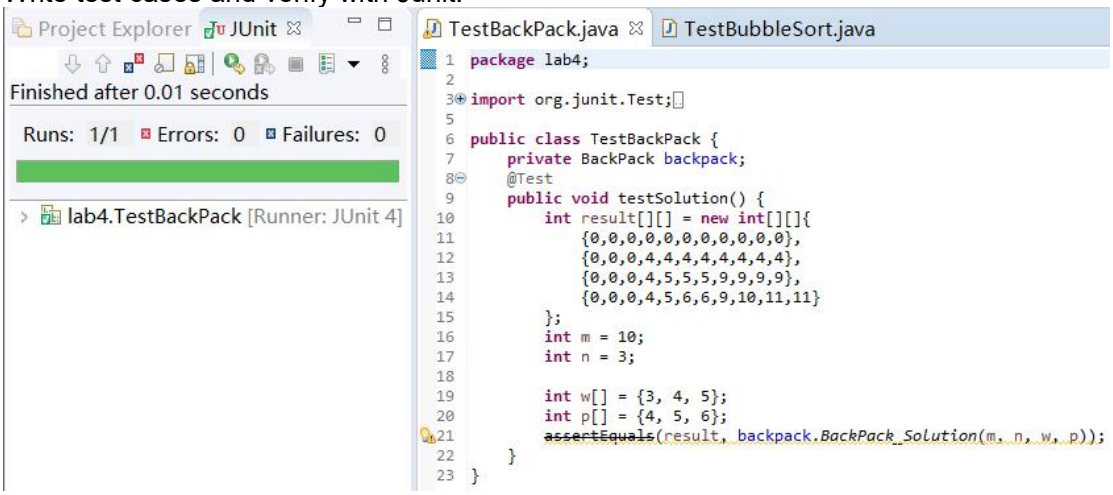
Select BubbleSort.java, select all mutation operators on the right, and click Generate. The result is shown below:

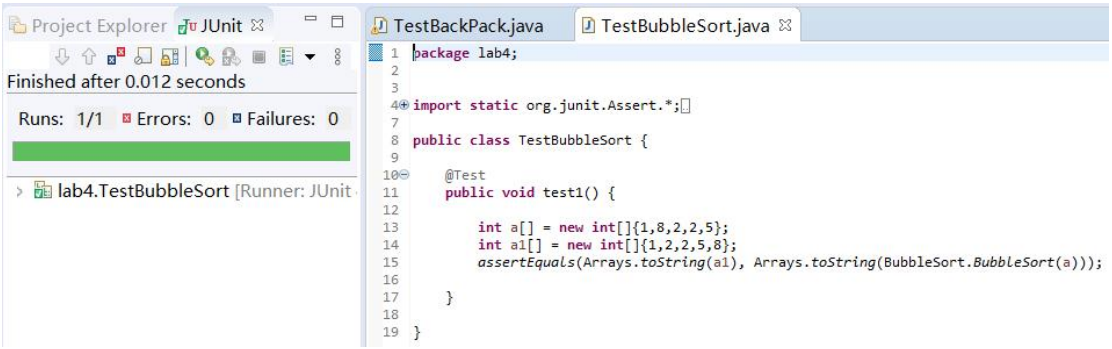


The generated results are stored in the path D: \ MuJavaHome \ result:



Write test cases and verify with Junit:



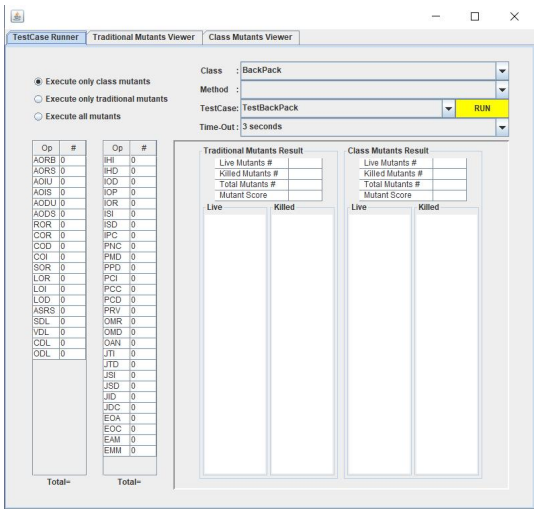


Put the two test files and the class file compiled by Eclipse into the D: \ MuJavaHome \ testset folder:

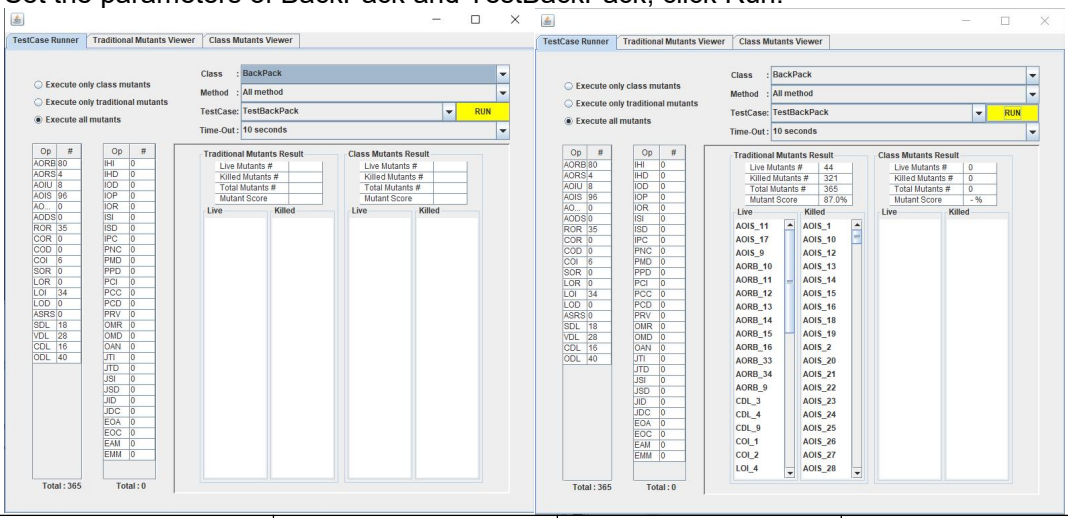
At this point, run the RunTest.cmd script:

```
D:\MuJavaHome>RunTest.cmd

D:\MuJavaHome>java mujava.gui.RunTestMain  1>TestResult.txt
```

The result is shown below:

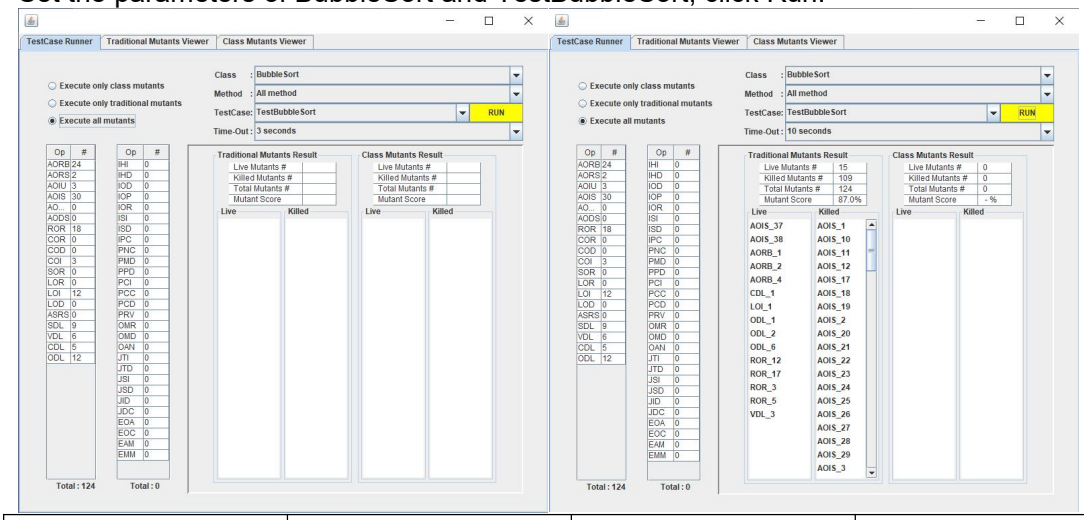


Set the parameters of BackPack and TestBackPack, click Run:



Live Mutants	Killed Mutants	Total Mutants	Mutant Score
44	321	365	87.0%

Set the parameters of BubbleSort and TestBubbleSort, click Run:



Live Mutants	Killed Mutants	Total Mutants	Mutant Score
15	109	124	87.0%