

Lab 3: Continuous Integration

Software Testing 2022

2022/03/10

Parameterization & Exception

Parameterization

- Execute a single test method **multiple times** with different parameters

Parameterization - Example 1

Target function:

```
1 public class Numbers {  
2     public static boolean isOdd(int number) {  
3         return number % 2 != 0;  
4     }  
5 }
```

Test case:

```
1 @ParameterizedTest  
2 @ValueSource(ints = {1, 3, 5, -3, 15, Integer.MAX_VALUE}) // six numbers  
3 void isOdd_ShouldReturnTrueForOddNumbers(int number) {  
4     assertTrue(Numbers.isOdd(number));  
5 }
```

Parameterization - Example 2

A static method that returns a **Stream** of Arguments:

```
1 private static Stream<Arguments> provideStringsForIsBlank() {  
2     return Stream.of(  
3         Arguments.of(null, true),  
4         Arguments.of("", true),  
5         Arguments.of(" ", true),  
6         Arguments.of("not blank", false)  
7     );  
8 }
```

Test case:

```
1 @ParameterizedTest  
2 @MethodSource("provideStringsForIsBlank")  
3 void isBlank_ShouldReturnTForNullOrEmptyS(String input, boolean expected) {  
4     assertEquals(expected, Strings.isBlank(input));  
5 }
```

Exception

- **JUnit 5** Jupiter assertions API introduces the **assertThrows** method for asserting exceptions

Exception - Example

```
1  @Test
2  public void whenExceptionThrown_thenAssertionSucceeds() {
3      Exception exception = assertThrows(NumberFormatException.class, () -> {
4          Integer.parseInt("1a");
5      });
6
7      String expectedMessage = "For input string";
8      String actualMessage = exception.getMessage();
9
10     assertTrue(actualMessage.contains(expectedMessage));
11 }
```

Continuous Integration

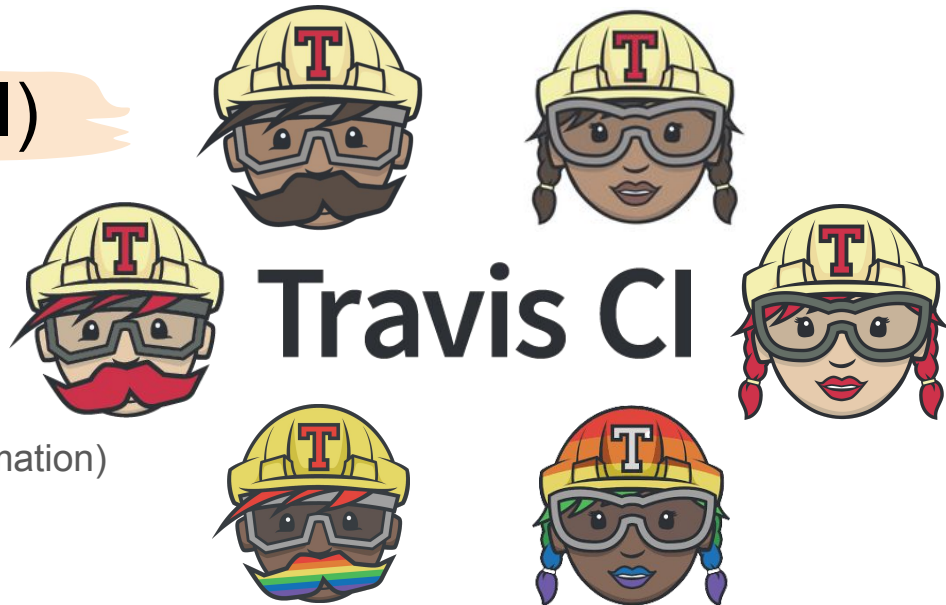
Continuous Integration (CI)

- **Features**

- Build
- Test
- Source code analysis
- Other related work ... (deployment automation)

- **Advantages**

- Reduces risk
- Reduces manual and complex processes
- A deployable version can be generated at any time
- Increases system transparency
- Builds team confidence



Jenkins

Travis CI

The screenshot displays the Travis CI web interface in a browser. The address bar shows the URL `app.travis-ci.com/search/NYCU-Software-Testing-2022-Lab_3`. The page header includes the Travis CI logo and navigation links: Dashboard, Changelog, Documentation, and Help. A search bar on the left contains the repository name `NYCU-Software-Testing-2022-Lab_3`. Below the search bar, a sidebar lists 'My Repositories' with a 'Running (0/0)' status. The main content area shows the repository `a4865g / NYCU-Software-Testing-2022-Lab_3` with a 'build passing' status. The build details section shows a successful build on the `master` branch for the commit `cc35e4d`, with a duration of 36 seconds and completion 4 minutes ago. The build log is visible at the bottom, showing steps such as 'Worker information', 'Build system information', 'Installing openjdk11', and 'git clone'. The log output includes the command `$ git clone --depth=50 --branch=master https://github.com/a4865g/NYCU-Software-Testing-2022-Lab_3.git` and the resulting OpenJDK Runtime Environment version 18.9.

Travis CI - Test and Deploy with

app.travis-ci.com/search/NYCU-Software-Testing-2022-Lab_3

Travis CI Dashboard Changelog Documentation Help

NYCU-Software-Testing-2022-Lab_3

My Repositories Running (0/0) +

✓ a4865g/NYCU-Software-Testing-2022-Lab_3 # 6

Duration: 36 sec
Finished: 4 minutes ago

a4865g / NYCU-Software-Testing-2022-Lab_3 build passing

Current Branches Build History Pull Requests More options

✓ master Update README.md

Commit cc35e4d
Compare d5418ab...cc35e4d
Branch master

WuLearn

JDK: openjdk11 Java
AMD64

#6 passed
Ran for 36 sec
4 minutes ago

Restart build
Debug build

Job log View config

Remove log Raw log

1 Worker information 0.06s

6 0.01s

7 Build system information 0.01s

173 2.34s

174 docker-rtu-and-registry-mirrors

175 Installing openjdk11 0.00s

176 resolvconf

177 Installing SSH key from: default repository key 0.00s

178 Using /home/travis/.netrc to clone repository. ssh-key

180

181 \$ git clone --depth=50 --branch=master https://github.com/a4865g/NYCU-Software-Testing-2022-Lab_3.git a4865g/NYCU-Software-Testing-2022-Lab_3 git-checkout 0.72s

182 \$ java -Xmx30m -version 0.01s

183 openjdk version "11.0.2" 2019-01-15

184 OpenJDK Runtime Environment 18.9 (build 11.0.2+9)

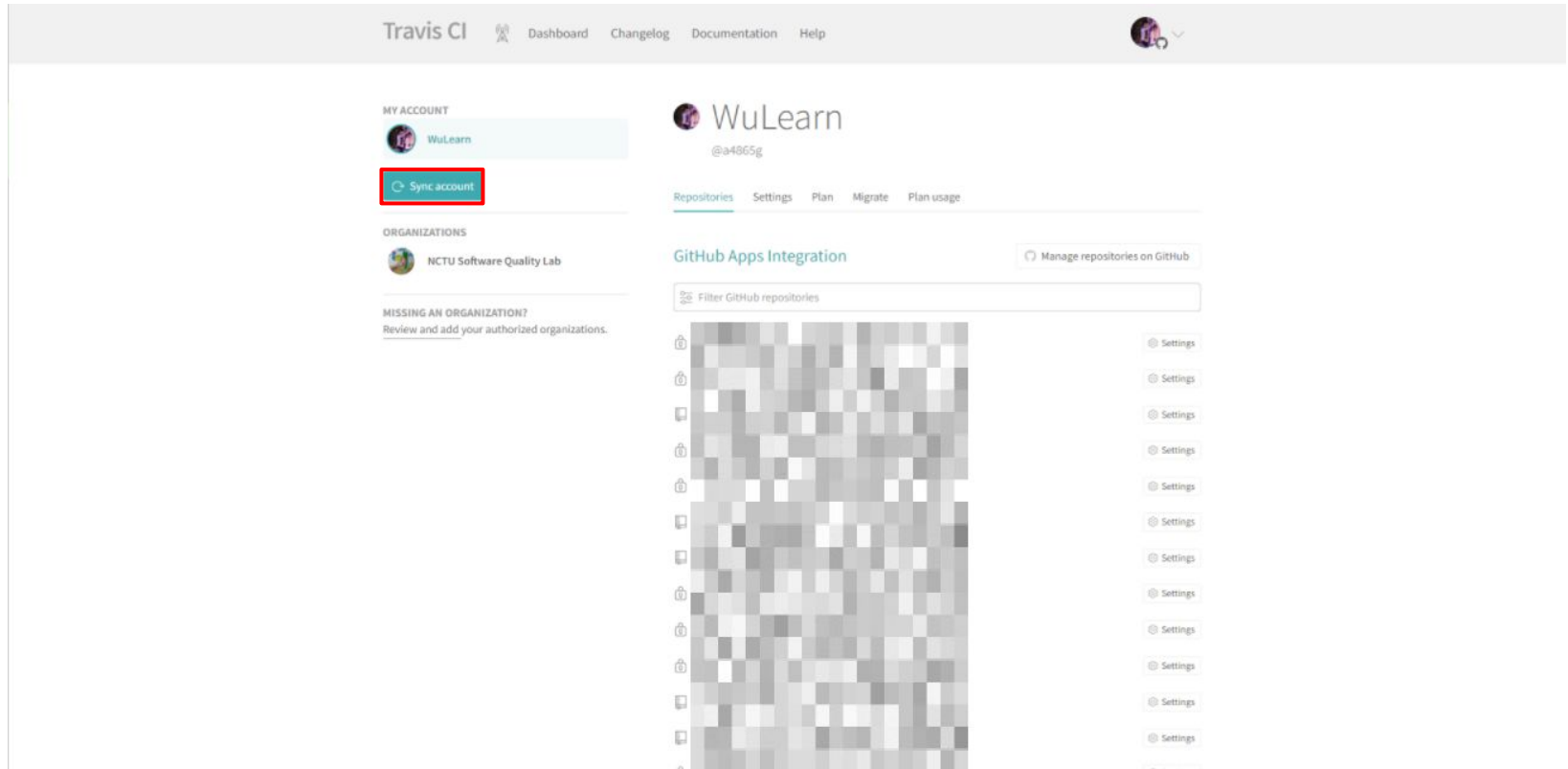
Top

Travis CI - Homepage

The screenshot displays the Travis CI web interface in a browser. The address bar shows the URL `app.travis-ci.com/search/NYCU-Software-Testing-2022-Lab_3`. The page header includes the Travis CI logo and navigation links: Dashboard, Changelog, Documentation, and Help. A search bar on the left contains the repository name. The main content area shows the repository `a4865g / NYCU-Software-Testing-2022-Lab_3` with a green `build passing` status. Below this, the `master` branch is highlighted with the commit message `Update README.md`. The build details show it ran for 36 seconds and finished 4 minutes ago. The job log is expanded, showing the following steps and durations:



- 1 Worker information (0.06s)
- 6 Build system information (0.01s)
- 173 Installing openjdk11 (2.34s)
- 175 Installing SSH key from: default repository key (0.00s)
- 179 Using /home/travis/.netrc to clone repository.
- 180 \$ git clone --depth=50 --branch=master https://github.com/a4865g/NYCU-Software-Testing-2022-Lab_3.git a4865g/NYCU-Software-Testing-2022-Lab_3 (0.72s)
- 181 \$ java -Xmx32m -version (0.01s)
- 182 openjdk version "11.0.2" 2019-01-15
- 184 OpenJDK Runtime Environment 18.9 (build 11.0.2+9)


Travis CI - Sync



The screenshot shows the Travis CI user interface for a user named WuLearn. The top navigation bar includes links for Dashboard, Changelog, Documentation, and Help. The left sidebar contains sections for 'MY ACCOUNT' with a 'Sync account' button highlighted in a red box, and 'ORGANIZATIONS' listing 'NCTU Software Quality Lab'. The main content area displays the user's profile, tabs for Repositories, Settings, Plan, Migrate, and Plan usage, and a 'GitHub Apps Integration' section with a 'Manage repositories on GitHub' button. Below this is a search bar for 'Filter GitHub repositories' and a list of repository entries, each with a 'Settings' link. The repository list is heavily blurred.

Travis CI - Build

Travis CI  [Dashboard](#) [Changelog](#) [Documentation](#) [Help](#) 



NYCU-Software-Testing-2022-Lab_3 

My Repositories Running (0/0) +

✓ a4865g/NYCU-Software-Testing- # 6




⌚ Duration: 36 sec
📅 Finished: 9 minutes ago

make sure your correct repo

 a4865g / NYCU-Software-Testing-2022-Lab_3  build passing

Current Branches Build History Pull Requests

✓ master Update README.md


🔗 Commit cc35e4d 
🔗 Compare d5410ab...cc35e4d 
🔗 Branch master 

👤 WuLearn

🔗 JDK: openjdk11 Java
🔗 AMD64

➡ #6 passed

⌚ Ran for 36 sec
📅 9 minutes ago

More options 

- Settings
- Requests
- Caches
- Trigger build

Travis CI - Build (Trigger)

Trigger a custom build

Beta Feature



Custom builds exist only on Travis CI and will not appear in your Git history.

BRANCH

master

CUSTOM COMMIT MESSAGE

Commit message

CUSTOM CONFIG

Enter config as YAML

Trigger custom build

Travis CI - Build (Failed)

Travis CI

[Dashboard](#) [Changelog](#) [Documentation](#) [Help](#)



My Repositories

Running (0/0)

+

✖ a4865g/NYCU-Software-Testing- # 3

⌚ Duration: 37 sec

📅 Finished: about a minute ago

🔒 a4865g / NYCU-Software-Testing-2022-Lab_3

 build failing

Current

Branches

Build History

Pull Requests

More options

⋮

✖ master fail

🔗 -> #3 failed

⌚ Ran for 37 sec

📅 about a minute ago

Restart build

Debug build

🔗 Commit d38efd0

🔗 Compare 2adf579...d38efd0

🔗 Branch master

 WuLearn


🔗 JDK: openjdk11 Java

🔗 AMD64

Travis CI - Build (Success)

Travis CI

[Dashboard](#) [Changelog](#) [Documentation](#) [Help](#)



My Repositories

Running (0/0)

+

✓ a4865g/NYCU-Software-Testing- # 2

⌚ Duration: 45 sec

📅 Finished: less than a minute ago

 a4865g / NYCU-Software-Testing-2022-Lab_3  build: passing

Current

Branches

Build History

Pull Requests

More options

⋮

✓ master init

📄 Commit 2adf579 [🔗](#)

🌿 Branch master [🔗](#)

 WuLearn

🔧 JDK: openjdk11 Java

🏠 AMD64

🟢 #2 passed

⌚ Ran for 45 sec

📅 less than a minute ago

🔄 Restart build

🔍 Debug build

Travis CI

- Travis CI
 - <https://travis-ci.com/> (For: private / public repo) **(Please use it for this Lab)**
 - <https://travis-ci.org/> (For: public repo) (Since June 15th, 2021, the building on travis-ci.org is ceased)



Lab

Lab - Part A

- Test *java.util.PriorityQueue class* with Junit.
 - import java.util.PriorityQueue;
- Parameterization
 - Each testcase : { *random array* } , { *correct array* }.
 - *Random array* means to specify **your own input array**.
 - *Correct array* means the **PriorityQueue polling correct order** instead of using toArray().
 - e.g. arguments(new int[]{5, 4, 2, 3}, new int[]{2, 3, 4, 5});
 - Your test must have at least **5** unique testcases.
- Exception
 - You have to test at least **3** unique Exceptions that is thrown by PriorityQueue.
 - The same type of exception in different ways is accepted.

Lab - Part A (Example)

```
1 public class PriorityQueueTest {
2     static Stream<Arguments> streamProvider() {
3         // TODO: return Stream
4     }
5
6     @ParameterizedTest(name="#{index} - Test with Argument={0},{1}")
7     @MethodSource("streamProvider")
8     public void PriorityQueue_RunTest(int[] random_array,int[] correct_array){
9         PriorityQueue<Integer> test = new PriorityQueue<Integer>();
10        int index = 0; //for cnt index
11        Integer s; // for PriorityQueue.poll()
12        int[] result=new int[random_array.length];
13
14        // TODO: random_array add to PriorityQueue
15
16        // TODO: get PriorityQueue result
17
18        assertEquals(correct_array,result);
19    }
20
21    // TODO: 3 unique Exceptions
22
23 }
```


Lab - Part A (Example)


✓ Test Results	139 ms
✓ PriorityQueueTest	139 ms
✓ PriorityQueue_RunTest(int[], int[])	121 ms
✓ #1 - Test with Argument=[3, 1, 2],[1, 2, 3]	91 ms
✓ #2 - Test with Argument=[-3, -1, -2, 5],[-3, -2, -1, 5]	4 ms
✓ #3 - Test with Argument=[3, -2, -5, -1, 2],[-5, -2, -1, 2, 3]	3 ms
✓ #4 - Test with Argument=[-3, 1, 11, 0, 9, 3],[-3, 0, 1, 3, 9, 11]	2 ms
✓ #5 - Test with Argument=[3, 7, 2, -1, -2],[-2, -1, 2, 3, 7]	21 ms
✓ whenExceptionThrown_thenOfferEisNull()	5 ms
✓ whenExceptionThrown_thenInitialCapacityNotGreaterThanOne()	10 ms
✓ whenExceptionThrown_thenNoElementCanRemove()	3 ms


Lab - Part B

- Travis-CI
 - Authorize Travis CI with your Github account.
 - Make sure that Travis CI can be built and test automatically.
- Github
 - Deploy your **Part A (PriorityQueueTest.java)** on Github in public.
 - The name of repository : **ST-2022-student_id**
 - You have to commit twice:
 - Pass all test cases
 - Unable to pass one of the test cases
 - Add *Travis CI status image* and *screenshots* (both pass and fail) to your *README.md*.
- Submit your Github repository link to E3.

Lab - Part B (Status Image)

 master ▾


 1 branch

 0 tags






Go to file


Add file ▾

Code ▾

 a4865g Update README.md

✓ cc35e4d 3 minutes ago ⌚ 5 commits

 src/test/java	fix & update README	11 minutes ago
 .gitignore	init	26 minutes ago
 .travis.yml	init	26 minutes ago
 README.md	Update README.md	3 minutes ago
 pom.xml	init	26 minutes ago

README.md 

NYCU-Software-Testing-2022-Lab_3

build passing

Lab - Part B (Screenshot - pass)

The screenshot shows the Travis CI web interface. At the top, there's a navigation bar with 'Travis CI', 'Dashboard', 'Changelog', 'Documentation', and 'Help'. On the right, there's a user profile icon. Below the navigation bar, there's a search bar labeled 'Search all repositories'. On the left, under 'My Repositories', there's a list showing 'a4865g/NYCU-Software-Testing' with a status of 'Running (0/0)'. The main content area shows the build details for 'a4865g / NYCU-Software-Testing-2022-Lab_3'. The build status is 'passing'. The build log shows 'master init' with a commit hash '2adf579' and branch 'master'. The build was initiated by 'WuLearn'. The build environment is 'JDK: openjdk11 Java' and 'AMD64'. The build log also shows 'Running PriorityQueueTest' and 'Tests run: 8, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.198 s - in PriorityQueueTest'. The build was successful, with a total time of 4.579 s and finished at 2022-03-07T08:53:48Z.

```
920 [INFO] -----
921 [INFO] T E S T S
922 [INFO] -----
923 [INFO] Running PriorityQueueTest
924 [INFO] Tests run: 8, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.198 s - in PriorityQueueTest
925 [INFO]
926 [INFO] Results:
927 [INFO]
928 [INFO] Tests run: 8, Failures: 0, Errors: 0, Skipped: 0
929 [INFO]
930 [INFO] -----
931 [INFO] BUILD SUCCESS
932 [INFO] -----
933 [INFO] Total time: 4.579 s
934 [INFO] Finished at: 2022-03-07T08:53:48Z
935 [INFO] -----
```


Lab - Part B (Screenshot - fail)

Travis CI Dashboard Changelog Documentation Help

Search all repositories

a4865g / NYCU-Software-Testing-2022-Lab_3 **Build failed**

My Repositories Running (0/0)

✖ a4865g / NYCU-Software-Testing-2022-Lab_3 #3

Duration: 37 sec
Finished: about a minute ago

✖ master fail

Commit d39ef49
Compare 2aef576...d39ef49
Branch master

Wulcan

jdk: openjdk:11.0.10
os: linux

Restart build
Debug build

```
921 [INFO] -----
922 [INFO] T E S T S
923 [INFO] -----
924 [INFO] Running PriorityQueueTest
925 [ERROR] Tests run: 8, Failures: 5, Errors: 0, Skipped: 0, Time elapsed: 0.156 s <<< FAILURE! - in PriorityQueueTest
926 [ERROR] PriorityQueue_RunTest(int[], int[])[1] Time elapsed: 0.078 s <<< FAILURE!
927 org.opentest4j.AssertionFailedError: array contents differ at index [0], expected: <-1> but was: <-2>
928     at PriorityQueueTest.PriorityQueue_RunTest(PriorityQueueTest.java:37)
929
930 [ERROR] PriorityQueue_RunTest(int[], int[])[2] Time elapsed: 0.003 s <<< FAILURE!
931 org.opentest4j.AssertionFailedError: array contents differ at index [0], expected: <-3> but was: <-2>
932     at PriorityQueueTest.PriorityQueue_RunTest(PriorityQueueTest.java:37)
933
934 [ERROR] PriorityQueue_RunTest(int[], int[])[3] Time elapsed: 0.002 s <<< FAILURE!
935 org.opentest4j.AssertionFailedError: array contents differ at index [0], expected: <-5> but was: <-4>
936     at PriorityQueueTest.PriorityQueue_RunTest(PriorityQueueTest.java:37)
937
938 [ERROR] PriorityQueue_RunTest(int[], int[])[4] Time elapsed: 0.002 s <<< FAILURE!
939 org.opentest4j.AssertionFailedError: array contents differ at index [0], expected: <-3> but was: <-2>
940     at PriorityQueueTest.PriorityQueue_RunTest(PriorityQueueTest.java:37)
941
942 [ERROR] PriorityQueue_RunTest(int[], int[])[5] Time elapsed: 0.002 s <<< FAILURE!
943 org.opentest4j.AssertionFailedError: array contents differ at index [0], expected: <-2> but was: <-1>
944     at PriorityQueueTest.PriorityQueue_RunTest(PriorityQueueTest.java:37)
945
946 [INFO]
947 [INFO] Results:
948 [INFO]
949 [ERROR] Failures:
950 [ERROR] PriorityQueueTest.PriorityQueue_RunTest:37 array contents differ at index [0], expected: <-1> but was: <-2>
951 [ERROR] PriorityQueueTest.PriorityQueue_RunTest:37 array contents differ at index [0], expected: <-3> but was: <-2>
952 [ERROR] PriorityQueueTest.PriorityQueue_RunTest:37 array contents differ at index [0], expected: <-5> but was: <-4>
953 [ERROR] PriorityQueueTest.PriorityQueue_RunTest:37 array contents differ at index [0], expected: <-3> but was: <-2>
954 [ERROR] PriorityQueueTest.PriorityQueue_RunTest:37 array contents differ at index [0], expected: <-2> but was: <-1>
955 [INFO]
956 [ERROR] Tests run: 8, Failures: 5, Errors: 0, Skipped: 0
957 [INFO]
958 [INFO] -----
959 [INFO] BUILD FAILURE
960 [INFO] -----
961 [INFO] Total time: 5.183 s
962 [INFO] Finished at: 2022-03-07T08:58:52Z
963 [INFO] -----
```

Lab - Part B (Hint)

- Create your own ***pom.xml*** and ***.travis.yml***.
 - *Maven: pom.xml*
 - *Travis-CI: .travis.yml*

Reference

Reference

- [連猴子都能懂的Git入門指南](#)
- [Travis CI Tutorial](#)