SOFTENG 283 – Software Quality Assurance

Assignment 1

Version Control Systems

Assignment Due: Friday 6th August, 2021 @ 5pm

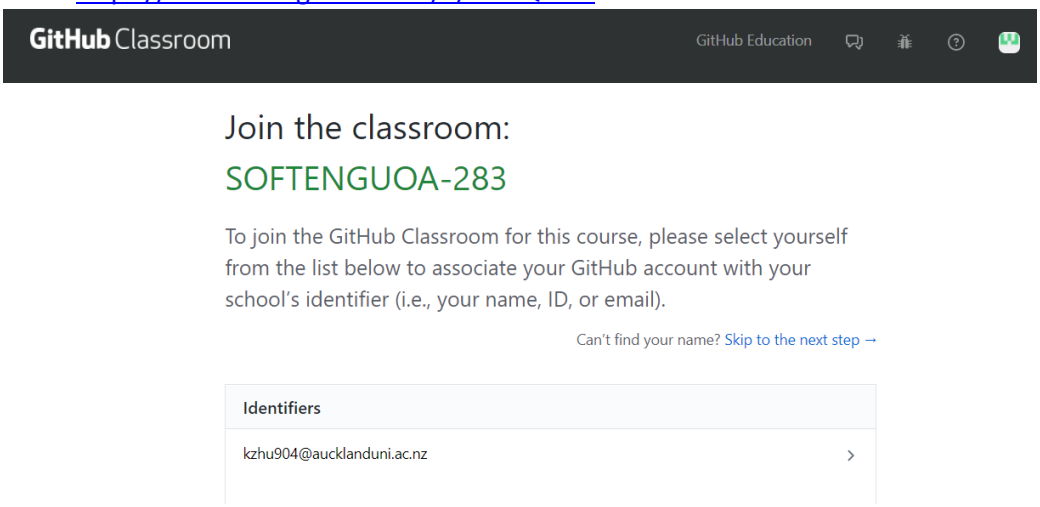
- This assignment is worth **7.5%** of your overall mark.
- Submissions must be made to *GitHub* by following the instructions embedded in this document. Failure to follow these instructions may result in your assignment not being marked!
- You are **strongly advised** to first read this **document in full** before starting to perform any of the tasks.

Getting Started - Setting up Git and Github

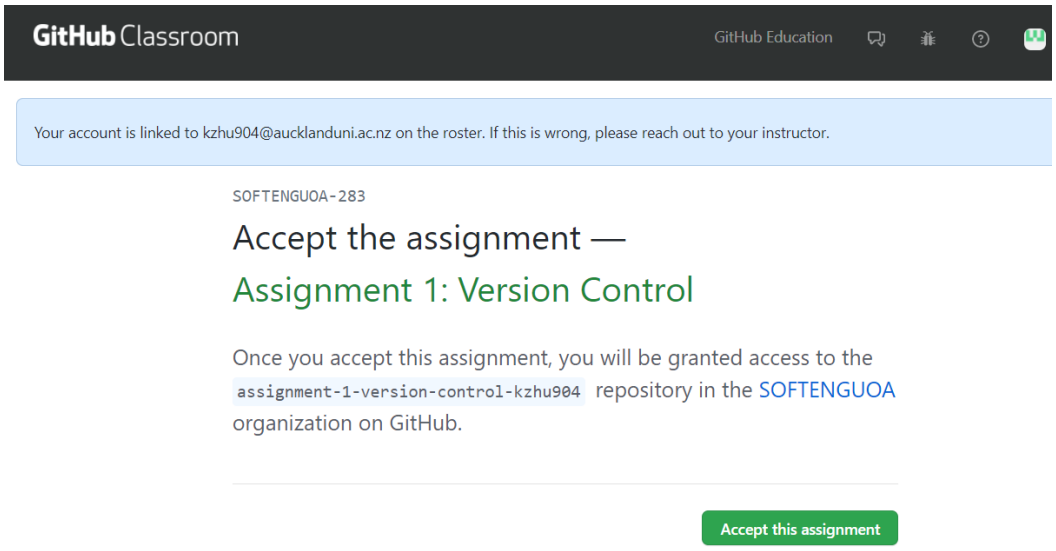
This assignment requires you to clone a Git repository from Github classroom into your IDE and perform **Task 1 to Task 3** on the same repository.

Follow the steps given below:

- Install **Git** from https://git-scm.com/downloads, and make sure you are able to run the basic git commands from Git *bash* or *cmd*.
- Connect **Eclipse** to Git and GitHub using the ***eGit*** plugin as explained in Lab 2 description.
- Go to https://classroom.github.com/a/JDmQ1lUo



- Pick your university email address from the list to connect your Github and university email accounts.



- Click "Accept this assignment".
- There will be a screen saying that it is creating your repository. Refresh the page to receive your repository link.
- The link to your repository is of the format "https://github.com/SOFTENGUOA/assignment-1-version-control-YOUR_GITHUB_USERNAME"
  e.g. "https://github.com/SOFTENGUOA/assignment-1-version-control-kzhu904"
- Clone the repository to your IDE and start working on your assignment tasks.
- For each of the tasks described further down in this document, you must create a new branch (and name it as listed below) for this repo from your IDE.
  - Task 1: "T1Branch"
  - Task 2: "T2Branch"
  - Task 3: "T3Branch"
- You **must finally merge** these three branches to the remote master branch **from GitHub**. See the *General* and *Task-Specific Instructions* to learn more.
- Follow on with the next tasks.

General Instructions – Applicable to All Tasks

In addition to the task specific instructions provided for each task, here are some general instructions applicable to all tasks:

- You **must** commit the final changes you make to your repo. You however may also commit prematurely but your committed versions **must not** have any compilation errors.
- The code changes and commits for a given task must be made on a new branch. So each task must have its dedicated branch (e.g. "*T1Branch", "T2Branch", "T3Branch*")
- After completing each task, **push your new branch (directly) to the remote repo**, *without merging* your branches to your local master branch. Then generate *pull requests* for each branch in your GitHub account repo and accept the pull requests.
- The markers would need to see **all three individual branches representing each of the tasks (along with all commits performed on them) merged into the master** on your Github private repo. It would be **your responsibility** to make that information visible from your Github repository.

Commit Message Format

You commit messages must contain the following information:

- Type of commit (*all types need not be used for this assignment*)
  - **feat** - a new feature
  - **fix** - a bug fix
  - **docs** - changes in documentation
  - **style** - everything related to styling
  - **refactor** - code changes that neither fixes a bug or adds a feature
  - **test** - everything related to testing
- Subject or Title of Commit
  - Short description (generally a one-liner)
- Description or Body
  - Explains your changes that you made after the last commit

Task 1: Java Reflection (30%)

This task requires you to use the concept of Java reflection to extract metadata for any given class. All code changes and relevant commits must be performed on a *new branch*.

- Use the **Java Reflection API** library (see *Resources*) to write a program that asks the user for a *class name*, loads that class, and creates an instance of it. We assume that the class has a constructor without any parameters.
- Then, the program prints out the names and values of the public fields of the created object, and also a list of the public methods that do not have any parameters.
- The program should let the user choose a method and execute that method on the created object.
- Afterwards, the program should again show the public variables with their values and allow the user to choose a method, and so on. You **MUST** use the following class (already provided in the repo) to test your implementation. You **MUST NOT** change this class in any way **for Task 1 only**.

```
public class Counter {
	public int _ctr;
	public int _multiplier;

	//method increments _ctr
	public void increment() {
		_ctr--; //faulty increment
	}

	//method decrements _ctr
	public void decrement() {
		_ctr++; //faulty decrement
	}

	//method resets _ctr
	public void reset() {
		_ctr = 1; //faulty reset, _ctr should rather be 0
	}

	//method multiplies _ctr by a number
	public void multiplyBy(int multiplier) {
		_multiplier = multiplier; //no fault here
		_ctr = _ctr * _multiplier; //no fault here
	}
}
```

- You must implement the functionality described above by writing code for class **`Reflector`** and class **`T1Main`**, skeleton code for which is provided in the repo. *Read the inline/Javadoc comments in the skeleton code for further instructions.*
- **Stage**, **commit** and **push** your changes (you **MUST** write a meaningful commit message to explain the changes committed) on the current branch.
- Task 1 must have at least **one** commit (representing the task completion).

Additional Instructions

- Users should be able to run the program by running the provided **`se283.a1.t1.T1Main`** class.
- Note the markers may also test this program by passing any other classes that they like.

Task 2: Adding Tests to your Repo (30%)

This task requires you to make further changes to your updated repo by adding unit tests for class **`Counter`**. All code changes and relevant commits must be performed on a *new branch*.

Follow the steps given below:

- Add the required *JUnit* tests to the class **`se283.a1.t2.CounterTest`** provided to you in the repo. These tests are meant to test all 4 methods defined in the class **`Counter`**.
- Your tests must be meaningful, have appropriate descriptions/rationales (in the test class' Javadoc comments). The first three tests ***must fail*** (the failures must be because of the known faults indicated in code comments). There is no such requirement for test 4.
- **Stage**, **commit** and **push** your changes (must write a meaningful commit message to explain the changes committed)
- Fix the faults in the class **`Counter`** as detected by your unit tests.
- **Stage**, **commit** and **push** your changes (must write a meaningful commit message to explain the changes committed)
- Task 2 must have at least **two** commits (representing the task completion)

Additional Instructions

- Users should be able to run the program by running the provided **`se283.a1.t2.CounterTest`** class as a JUnit test case.

Task 3: Improving Code Quality and Refactoring (40%)

This task requires you to work with a GitHub repository, and detect and refactor code smells in the repository code. Code smells are issues with source code that are potentially responsible for declining code quality. Refactoring are the code changes you can do to remove those code smells.

All code changes and relevant commits must be performed on a *new branch*.

- You will use the package **`se283.a1.t3`** for this task.
- Identify at least one instance of the following code problems or smells:
  - Duplicate code: Check if the class contains duplicate code.
  - Long method: Check if a method is more than 10 lines of code
  - Large class: Check if a class has more than 5 methods
  - Feature envy: Check if any part of your code defined in one class or method should rather be part of another class or method
- Apply appropriate (one of the following) refactorings to remove the two detected code smells.
  - Move method: Move a method from one class to another
  - Extract method: Extract some code from a method of a class to a method of another class
  - Rename method: fix the name of the method as appropriate
  - etc.
- **Stage**, **commit** and **push** your changes (you must write a meaningful commit message to explain the changes committed)
- Task 3 must have at least **one** commit (representing the task completion).

Additional Instructions

- Users should be able to run the program by running the provided **`se283.a1.t3.T3Main`** class.
- A successful refactoring of code must not change the runtime behaviour of **`se283.a1.t3.T3Main`** class, i.e. the output of the execution of the **`main()`** method must remain same.
- You must not change **`T3Main`** class. *Treat it as the "client code".* However, you may add more classes, methods and fields in the package **`se283.a1.t3.`**

Assessment

Your work will be assessed on the following:

- successful/correct completion of functionality desired for each of the three tasks;
- how well you follow the instructions on:
    - creating branches
    - performing various git operations (commit, push, etc.)
    - writing your commit messages for each commit
    - writing Javadoc and inline comments

Marks Distribution

- *Task 1 (30 marks)*
    - Reflection: **`Reflector`** functionality (15 marks)
    - Version control: Git/Github operations, branching and repo update (10 marks)
    - Commenting: Javadoc comments and commit messages (5 marks)
- *Task 2 (30 marks)*
    - JUnit tests: **`CounterTest`** unit tests (10 marks)
    - Bug Fixing: Class **`Counter`** fixes (5 marks)
    - Version control: Git/Github operations, branching and repo update (10 marks)
    - Commenting: Javadoc comments and commit messages (5 marks)
- *Task 3 (40 marks)*
    - Code quality: Detection of two code problems (10 marks)
    - Refactoring: Application of code refactorings (15 marks)
    - Version control: Git/Github operations, branching and repo update (10 marks)
    - Commenting: Javadoc comments and commit messages (5 marks)

Related Resources and Assistance

- Week 1 and 2 Lecture and Lab resources
- For any assistance (e.g. around assignment setup, task instructions, etc.), please email course TAs or bring your issues to the Week 3 lab.
- Using Java Reflection:
    - https://www.oracle.com/technical-resources/articles/java/javareflection.html