EECS2030 (B & E) Fall 2021
Lab3
Programming with the `equals` Method and Copy Constructor

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Release Date: Wednesday, October 20
Due Date: 14:00 EST, Monday, November 1

- You are required to **work on your own** for this lab. **No** group partners are allowed.

  Plagiarism checks will be run on all submissions, and suspiciously similar ones will be reported to Lassonde.

- To complete this lab, it is **strictly forbidden** for you to use any library class (e.g., `ArrayList`). Instead, use **primitive arrays** (e.g., `String[]`) to implement collections/lists for the classes and methods. Violating this requirement will cause a **50% penalty** on your lab marks.

- For this lab, you will be graded not only by JUnit tests given to you, **but also additional tests** covering some other input values. This is to encourage you to take more responsibility for the correctness of your code, by writing your own tests.

- Your lab assignment is **not** graded during the weekly scheduled lab sessions.
  - Follow the instructions to submit (via eClass) the required file(s) for grading.
  - Emailing your solutions to the instructor or TAs will **not** be acceptable.

- Texts in blue are hyperlinks to the corresponding documents/recordings.

Policies

- **Your (submitted or un-submitted) solution to this lab exercise (which is not revealed to the public) remains the property of the EECS department. Do not distribute or share your code in any public media (e.g., a non-private Github repository) in any way, shape, or form. The department reserves the right to take necessary actions upon found violations of this policy.**

- When you submit your lab, you claim that it is **solely** your work. Therefore, it is considered as **a violation of academic integrity** if you copy or share **any** parts of your Java code during **any** stages of your development.

- When assessing your submission, the instructor and TA may examine your code, and suspicious submissions will be reported to the department if necessary. **We do not tolerate academic dishonesty**, so please obey this policy strictly.

- You are entirely responsible for making your submission to the TA in time. Back up your work **periodically**, so as to minimize the damage should any sort of computer failures occur. Follow this tutorial series on setting up a **private** Github repository for your Java projects.

- The deadline is **strict** with no excuses: late submissions will **not** be accepted.

Contents

Learning Outcomes

By completing the assigned exercises of this lab, you are expected to be able to:

1. Exercise a simple workflow of Github.
2. In the Eclipse IDE (Integrated Development Environment):
   - Import a starter project archive file.
   - Given a computational problem, develop a Java solution composed of:
     - Numerical Literals and operators
     - String Literals and operators
     - Variables and assignments
     - (Nested) Selections/Conditionals/If-Statements
     - OOP Basics: Classes, Attributes, Constructors, Accessor and Mutator Methods, Method Invocations, Context Objects, Dot Notation
     - Declaring and manipulating (single-valued vs. multi-valued) reference-typed attributes
     - Programming with Exceptions: the Catch-or-Specify Requirement
     - Overriding the `equals` method.
     - Implementing copy constructors.
     - Inferring Java Classes from JUnit Tests
   - Use the given JUnit tests to guide the development.
   - Use the **debugger** features (step over/into/out/return) to find defects in programs.
   - Export an existing project as an archive file.

Assumptions

- You have already setup a Github account and stored work in a **private** repository: e.g., `EECS2030-F21-workspace`.

  Note. You only submit your lab through eClass, not Github. Though not required, it is highly recommended that you adapt to the practice of backing your work using a versioning tool like Github.

- You are able to use Eclipse to complete this lab on either your own machine or the EECS remote labs.

  Note. The starter project was created using Eclipse and an Eclipse project archive file is expected to be submitted. Therefore, you may not want to use other IDE such as IntelliJ.

Requirements of this Lab

- To complete this lab, it is **strictly forbidden** for you to use any library class. Violating this requirement will cause a **50% penalty** on your lab marks.
  - Here are some examples of ***forbidden*** classes/methods: `Arrays` class (e.g., `Arrays.copyOf`), `System` class (e.g., `System.arrayCopy`), `ArrayList` class, `String` class (e.g., `substring`).
  - The use of some library classes does not require an `import` statement, but these classes are ***also forbidden*** to be used.
  - Here are the exceptions (library methods which you ***are allowed*** to use if needed):
    - `String` class (`equals`, `format`)
- The grading of your lab will **start** by automatically **unzipping** the submitted Java project archive file (**.zip**) and extracting the required class(es). It is therefore crucial for you to follow **precisely** the spelling of the archive file name. **Penalty** will be taken if the grading cannot proceed due to carelessness on following the instructions in Section 2.5.
- For this lab, you will be graded not only by JUnit tests given to you, **but also additional tests** covering some other input values. This is to encourage you to take more responsibility for the correctness of your code, by writing your own tests.
- For the JUnit test class `StarterTests.java` given to you:
  - Do **not** modify the test methods given to you.
  - You are allowed to add new test methods.
- Derived from the given JUnit test methods:
  - Each class you introduce and implement must be placed under the `model` package.
  - Do **not** add any class that is not required by the starter tests.
  - All attributes you declare must be **private**. Use public accessors/mutators if needed.
  - Besides the required methods required by the starter tests, you are **free** to implement additional public/private helper methods as you see fit.
  - For each method you implement:
    - No `System.out.println` statements should appear in it.
    - No Scanner operations (e.g., `input.nextInt()`) should appear in it.
      Instead, declare input parameters of the method as indicated by the JUnit tests.
- You are welcome to ask questions related to this lab on the forum. However, please be **cautious**:
  - You can help your fellow students understand the requirements of tasks.
  - **Do not share the code you developed to ask, or to answer, questions.**
    - Questions specific to the code you write would be best and most effectively addressed by TAs (during scheduled labs) or your instructor (during office hours or appointments).
    - The Review Tutorial (Part 1 and Part 2) addresses how to use **debugger in Eclipse**. You are advised to **set breakpoints and launch the debugger** when you are stuck at your own program.
  - **Hints** on how the solution should look like are **left only to the instructors** who moderate the forum.

1 Task 1: Complete the Background Studies

1. This lab requires knowledge and skills covered in exceptions and JUnit lectures:
   - Lecture 2a (Week 3): Exceptions [PDF]
   - Lecture 2b (Week 4): Test-Driven Development (TDD) via JUnit [PDF]
   - **Lecture 3 (Week 5): Object Equality** [PDF]
   - **Lecture 4 (Week 6): Aggregation and Composition** [PDF]
2. This lab still covers topics discussed in the Review Tutorial Series (Part 1 and Part 2):

   `https://www.eecs.yorku.ca/~jackie/teaching/tutorials/index.html#refurbished_store`

   You can find the iPad notes of illustrations from the tutorial videos here:

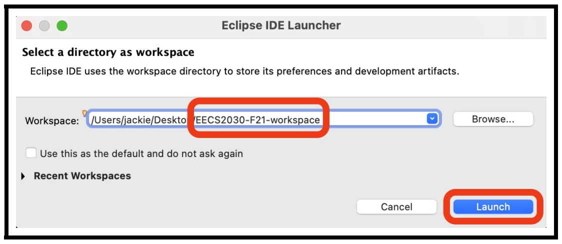
   `https://www.eecs.yorku.ca/~jackie/teaching/tutorials/notes/Building%20an%20Apple%20Refurbished%20Store%20App%20in%20Java.pdf`
3. It is also required that you review these two written notes supplementing the above Review Tutorial Series:
   - How to manipulate objects with reference-typed, multi-valued attributes:
     `https://www.eecs.yorku.ca/~jackie/teaching/lectures/2021/F/EECS2030/notes/EECS2030_F21_Tracing_PointCollectorTester.pdf`
   - See this notes on how to infer classes and methods from given JUnit tests:
     `https://www.eecs.yorku.ca/~jackie/teaching/lectures/2021/F/EECS2030/notes/EECS2030_F21_Inferring_Classes_from_JUnit.pdf`
   - You can find here the example covered in the notes for practice:
     - Starter: `https://www.eecs.yorku.ca/~jackie/teaching/lectures/2021/F/EECS2030/notes/EECS2030_F21_Inferring_Classes_from_JUnit.zip`
     - Solution: `https://www.eecs.yorku.ca/~jackie/teaching/lectures/2021/F/EECS2030/notes/EECS2030_F21_Inferring_Classes_from_JUnit_Solution.zip`

2 Task 2: Complete Programming Exercises

Starting Task 2 should mean that you have *already completed* the background studies as outline in Section 1.

2.1 Step 1: Download and Import the Starter Project

1. Download the Eclipse Java project archive file from eClass: `EECS2030_F21_Lab3.zip`
2. Launch Eclipse and browse to, e.g., `EECS2030-F21-workspace`, as the `Workspace` then click on `Launch`, e.g.,



Eclipse IDE Launcher

Select a directory as workspace

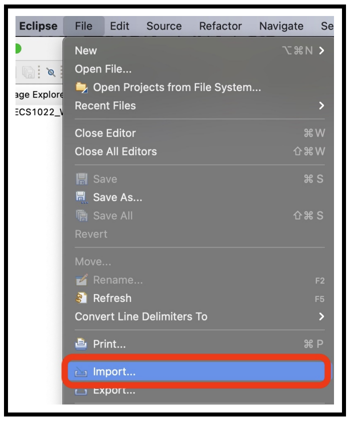
Eclipse IDE uses the workspace directory to store its preferences and development artifacts.

Workspace: /Users/jackie/Deskto/EECS2030-F21-workspace

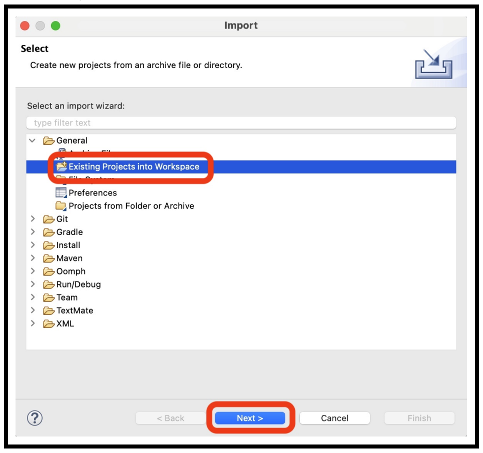
Use this as the default and do not ask again

3. In Eclipse:

3.1 Choose `File`, then `Import`.



3.2 Under `General`, choose `Existing Projects into Workspace`.



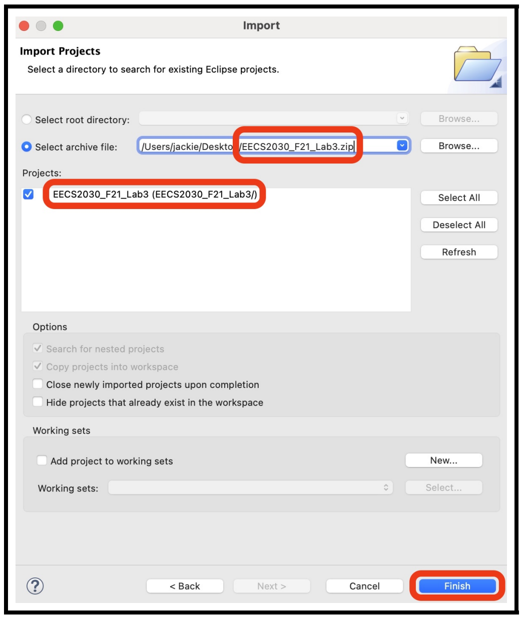
Import

Select

Create new projects from an archive file or directory.

Select an import wizard:

3.3 Choose `Select archive file`. Make sure that the `EECS2030_F21_Lab3` box is checked under `Projects`. Then `Finish`.



Import

Import Projects

Select a directory to search for existing Eclipse projects.

Select root directory:

Select archive file: /Users/jackie/Deskto/EECS2030_F21_Lab3.zip

Projects:

☑ EECS2030_F21_Lab3 (EECS2030_F21_Lab3/)

Options

☑ Search for nested projects

☑ Copy projects into workspace

☐ Close newly imported projects upon completion

☐ Hide projects that already exist in the workspace

Working sets

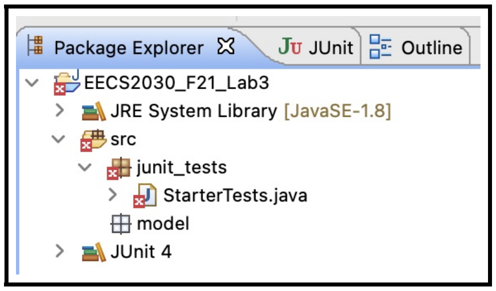
☐ Add project to working sets

Working sets:

2.2 Step 2: Programming Tasks

From the `Package Explorer` of Eclipse, your imported project has the following structure.

- The `console_apps` package is empty. You may add new console application classes here to test the implemented methods if you wish. However, these added console application classes will **not** be graded.
- It is **expected** that the `StarterTests` JUnit class contains **compilation errors**. This is because that declarations and definitions of the required class(es) and method(s) it references are missing.



```
EECS2030_F21_Lab3
  JRE System Library [JavaSE-1.8]
  src
    junit_tests
      StarterTests.java
    model
  JUnit 4
```

- The `model` package is empty. Class(es) and method(s) derived from the given JUnit class **must** be added to this package. Class(es) added to a package other than `model` will **not** be graded.

  Therefore, your tasks are:

  1. Inferring from the given JUnit tests, add the missing class(es) and method(s) into the `model` package. For example, if you add class `Foo` in the model package, make sure that you write a line in the beginning of the `StarterTests` class (after the line `package junit_tests;`):

     ```
     import model.Foo;
     ```

  2. Pass **all** JUnit tests given to you (i.e., a **green bar**).

     To run them, as shown in the Review Tutorial Series, right click on `StarterTests.java` and run it as JUnit tests. Of course, none of the given tests would pass to begin with.

  You must not modify these given JUnit tests, as they suggest how the intended class(es) and method(s) should be declared.

How to Deal with a Failed JUnit Test? From the JUnit panel from Eclipse, click on the failed test, then **double click** on the first line underneath `Failure Trace`, then you can see the **expected value** versus the **return value** from your implemented method. Furthermore, when needed, you should a **breakpoint** at the line of the failing assertion, then launch the **debugger** to pinpoint where the error came from.

2.3 The Building Design Problem

You are required to develop an object-oriented program solving a simplified building design problem, where a building blueprint consists of plans for floors, and each floor plan contains specifications of various units.

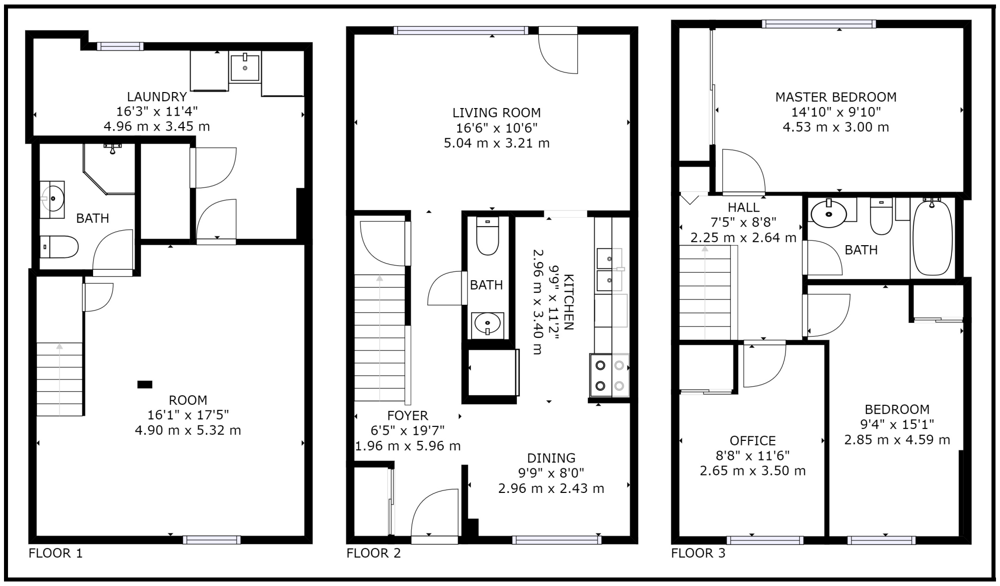


Figure 1: An Example 3-Floor Building Blueprint

Here are the relevant entities involved in this problem:

- Each *unit* is characterized by its intended function (e.g., Master Bedroom, Office) and dimension (width $\times$ length). Default measurement, when first creating a unit object, is in feet, whereas a user may request it to be switched to one in meters. Two units are considered *equal* if their intended functions are the same (case-sensitive) and their areas (in square feet) are the same (even if the dimensions may be different). You are required to use the following formula for conversion: 1 foot is `0.3048` meter.
- Each *floor* is characterized by a maximum capacity (measure in square feet, abbreviated as sq ft) and a list of added units (whose summed amount of space does not exceed, i.e., $\leq$, the maximum capacity). A floor may be added up to and including **20 units** to a floor (and you need not perform error handling for this). In an attempt to add a unit whose space is such that the floor's maximum capacity will be exceed, an exception is expected. Two floors are considered *equal* if: **1)** their maximum capacities are the same; and **2)** their spaces are utilized in the same way (meaning that for each added unit in one floor, we can find its equivalent in the other floor, despite the orders in which units are added to the two floors).
- Each building *blueprint* is characterized by the number of floors (of the building under design) and a list of added floor plans. You can assume that the current number of added floor plans always dose not exceed, i.e., $\leq$, the specified number of floors. Given a blueprint, one may inquire about its completion rate (e.g., 60% if plans for 3 out of the 5 floors have been added). One may retrieve the list of floor plans added so far, but the property of *composition* should be preserved: each of the retrieved floor plans is a brand new copy of the corresponding *floor* object. One may also create a *blueprint* from another, by copying all the relevant attributes. To determine whether a shallow copy or a deep copy is needed, consult with the starter tests.

  Notes:
  - **Other intended functionalities of the above kinds of entities/objects can be inferred from the: 1) given JUnit test method; and 2) comments in class `StarterTests`.**
  - **Error handling (via exceptions) is only required if it is either explicitly mentioned in the above problem description or test comments, or indicated by the JUnit tests.**
  - For each of the above-mentioned **maximum capacities**, **no** error handling is needed when the limit is exceeded. For example, where the maximum capacity is 200, given that the private, primitive array is created with the corresponding size, attempting to add an 201st object is expected to result in an `ArrayIndexOutOfBoundsException`.

2.4 Hints and Requirements

- See this notes on how to declare and manipulate reference-typed, multi-valued attributes:

  https://www.eecs.yorku.ca/~jackie/teaching/lectures/2021/F/EECS2030/notes/EECS2030_F21_Tracing_PointCollectorTester.pdf

- See this notes on how to infer classes and methods from given JUnit tests:

  https://www.eecs.yorku.ca/~jackie/teaching/lectures/2021/F/EECS2030/notes/EECS2030_F21_Inferring_Classes_from_JUnit.pdf

  Programming IDEs such as Eclipse are able to fix such compilation errors for you. **However, you are advised to follow the guidance as specified in the notes to fix these compilation errors manually, because: 1) it helps you better understand how the intended classes and methods work together; and 2) you may be tested in a written test or exam without the assistance of IDEs.**

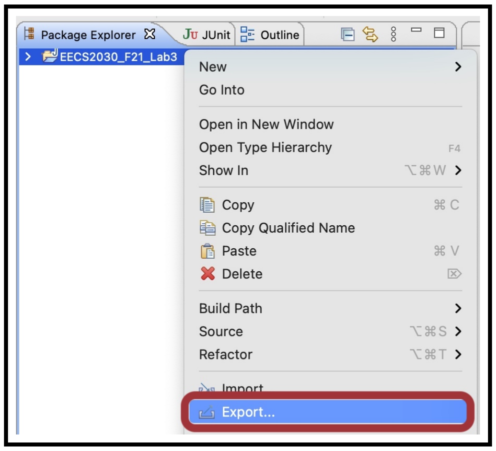
- Any new class(es) you add must reside in the `model` package.
  - All attributes you declare must be **private**. Use public accessors/mutators to retrieve/change their values from other classes.
  - Once the necessary class(es) and method(s) are declared, you can add as many attributes as necessary to implement the body of each method.
  - Study carefully example manipulations of the relevant objects as specified in `StarterTests.java`: they suggest the how the intended class(es) and method(s) should be declared and implemented.
  - Focus on *gradually* passing one test at a time.
  - You **cannot** use any Java library classes (e.g., `ArrayList`) or methods for implementation. That is, there must **not** be any `import` statement in the class(es) you add to the `model` package.

2.5 Step 3: Exporting the Completed Project

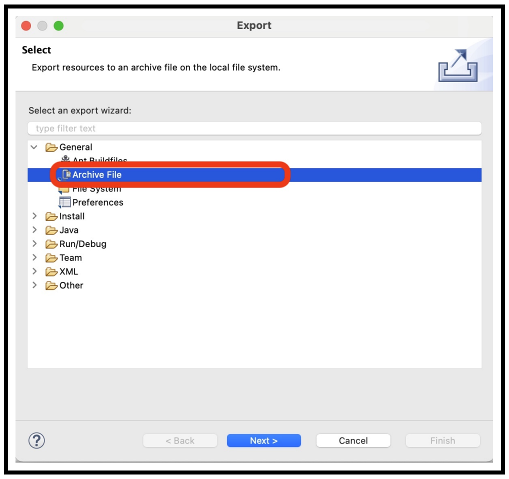
You are required to submit a Java project archive file (.zip) consisting all subfolders.

In Eclipse:

1. Right click on project `EECS2030_F21_Lab3`. Then click `Export`



2. Under `General`, choose `Archive File`.



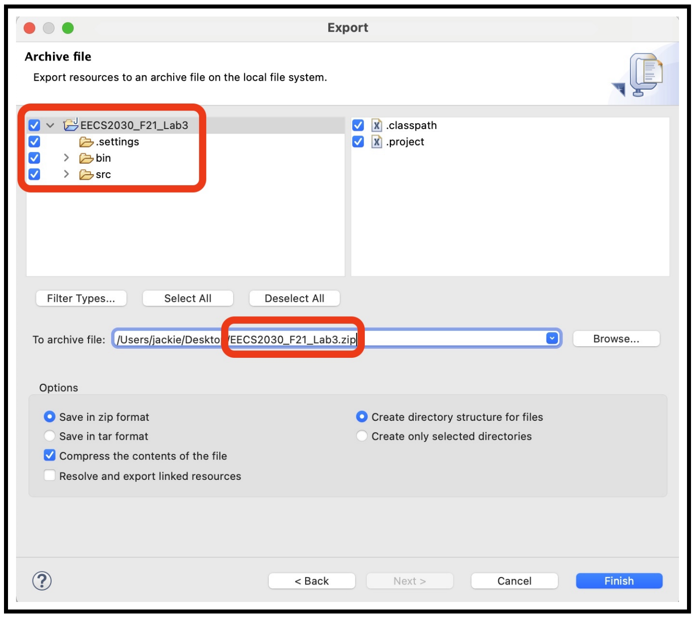
Export resources to an archive file on the local file system.

3. Check the top-level `EECS2030_F21_Lab3`

Make sure that all subfolders are checked: `.settings`, `bin`, and `src`.

Under `To archive file:` browse to, e.g., desktop, and save it as `EECS2030_F21_Lab3.zip` (**case-sensitive**)

Then `Finish`.



Export resources to an archive file on the local file system.

- [✓] EECS2030_F21_Lab3
  - [✓] .settings
  - [✓] bin
  - [✓] src
- [✓] .classpath
- [✓] .project

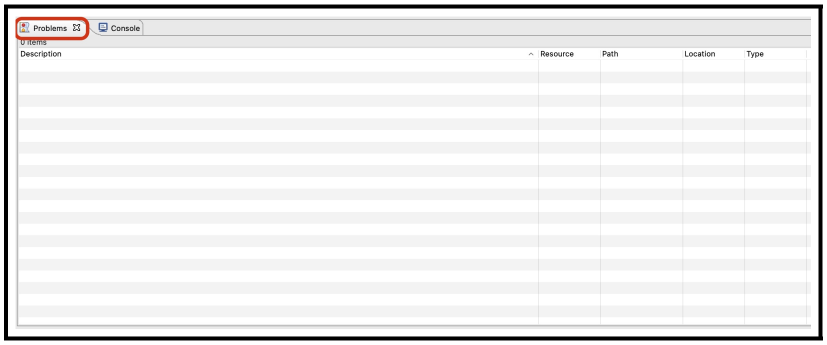
To archive file: /Users/jackie/Deskto EECS2030_F21_Lab3.zip

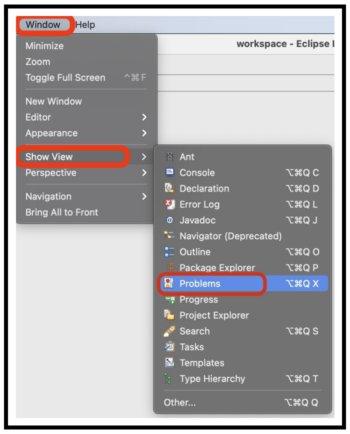
- [✓] Save in zip format
- Save in tar format
- [✓] Compress the contents of the file
- Resolve and export linked resources
- [✓] Create directory structure for files
- Create only selected directories

Note. In case you have concerns about exporting and submitting the **.setting** subfolder: it will be kept confidential and access-protected on eClass.

3 Submission

1. Before you submit, you must make sure that the `Problems` panel on your Eclipse shows **no errors** (warnings **<u>are</u>** acceptable). In case you do not see the `Problems` panel: click on `Window`, then `Show View`, then `Problems`.





Submitting programs with errors (meaning that it cannot be run for grading) will result in possible partial, but low, marks.

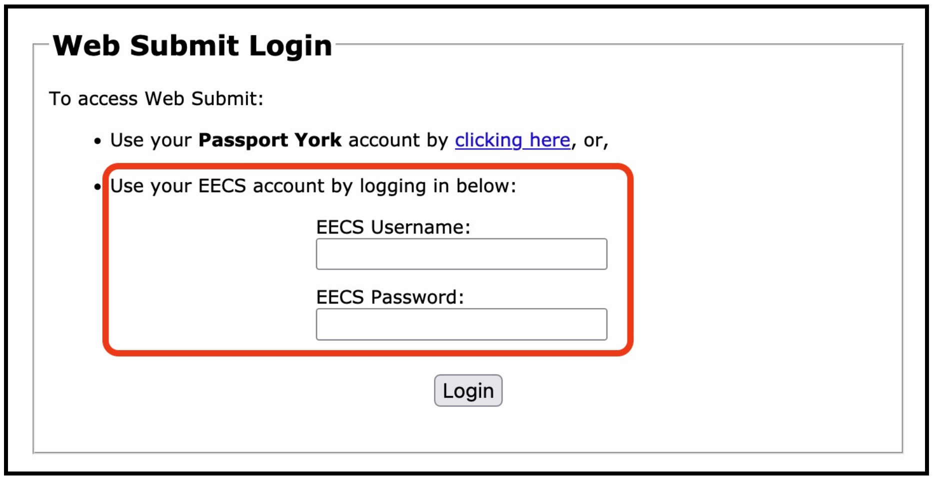
2. Section 2.5 asks you to **export** the Java project as an archive file:

`EECS2030_F21_Lab3.zip`

Click on the following link (for which you will be prompted to enter your <u>EECS account</u> login credentials):

https://webapp.eecs.yorku.ca/submit/?acadyear=2021-22&term=F&course=2030&assignment=Lab3

- You **must** login into the web submit page using your EECS login credentials (otherwise, your submitted folder on the EECS server may <u>not</u> be identified properly):



Web Submit Login

To access Web Submit:

- Use your **Passport York** account by <u>clicking here</u>, or,
- Use your EECS account by logging in below:

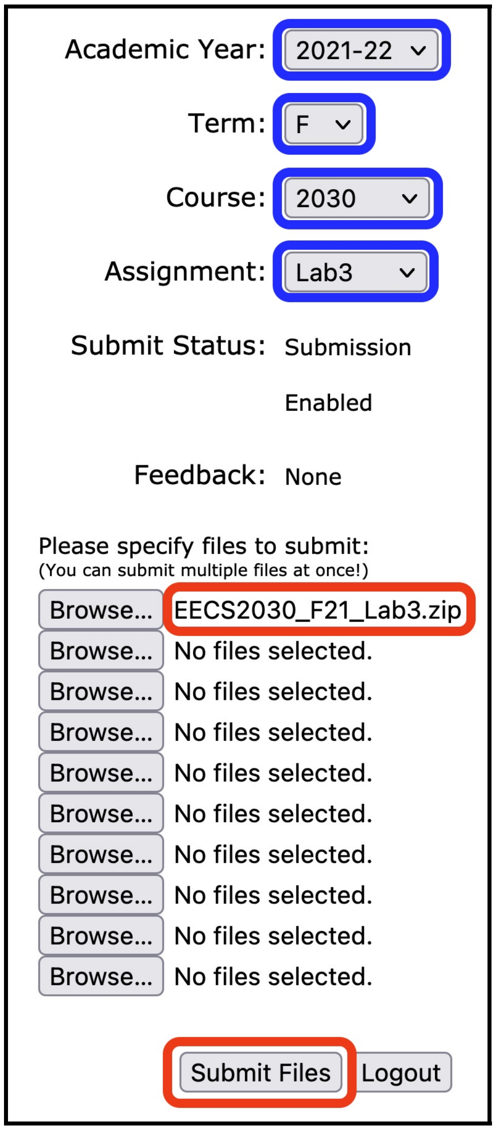
EECS Username:

EECS Password:

Login

Note. If you are prompted for your PPY login instead, then it might be due to an earlier login session. In this case, login first with your PPY account credentials, then <u>log out</u>. Then, clicking on the above submission link should lead you to the login page for EECS account credentials.

- Ensure that the correct academic year, term, course, and assignment are chosen. Then, browse to the archive file `EECS2030_F21_Lab3.zip` and click on `Submit Files`.



Academic Year:	2021-22
Term:	F
Course:	2030
Assignment:	Lab3
Submit Status:	Submission Enabled
Feedback:	None

Please specify files to submit:
(You can submit multiple files at once!)

Browse... EECS2030_F21_Lab3.zip
Browse... No files selected.
Browse... No files selected.
Browse... No files selected.
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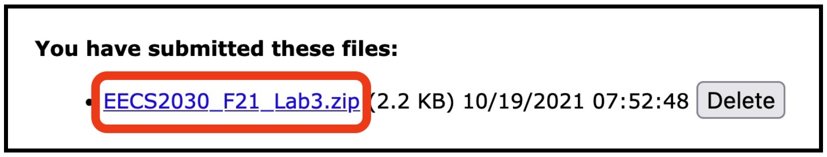
- You may upload as many draft versions as you like before the deadline – only the **latest** submitted version of your work before the deadline will be graded.
- It is your **sole responsibility** to **download and ensure** that:
  - The submitted zip file is the one you intend to be graded (e.g,. non-empty, not the starter project).



You have submitted these files:

- EECS2030_F21_Lab3.zip (2.2 KB) 10/19/2021 07:52:48

4 Amendments

Clarifications or corrections will be added to this section.

-