Tutoral Plan:
12:00 - 12:15 - Students work on Q1-4
(Join one of the Gather Lab rooms)
12:15: Dr. M explains Qs on BBC

The University of the West Indies, St. Augustine
COMP 3607 Object Oriented Programming II
2020/2021 Semester 1
Lab Tutorial #4

This tutorial focuses on the SOLID design principles.

Learning Objectives:

- Reinforce your knowledge on each of the SOLID design principles
- Discuss examples of SOLID design principles in code snippets
- Refactor existing code to conform to one or more SOLID design principles

Section A: Interface Segregation Principle

The following files are used in this section. Download the java source and examine the code.

```
.
├── Door.java
├── SensingDoor.java
├── Sensor.java
├── TimedDoor.java
└── Timer.java
```

1. What is the purpose of `timeOutCallback()` method of the `Door` interface?

2. What is the purpose of `proximityCallback()` method of the `Door` interface?

3. What method(s) of the `Door` interface is `TimedDoor` class forced to implement, even though it doesn't need it?

4. What method(s) of the `Door` interface is `SensingDoor` class forced to implement, even though it doesn't need it?

Discuss at 12:45pm

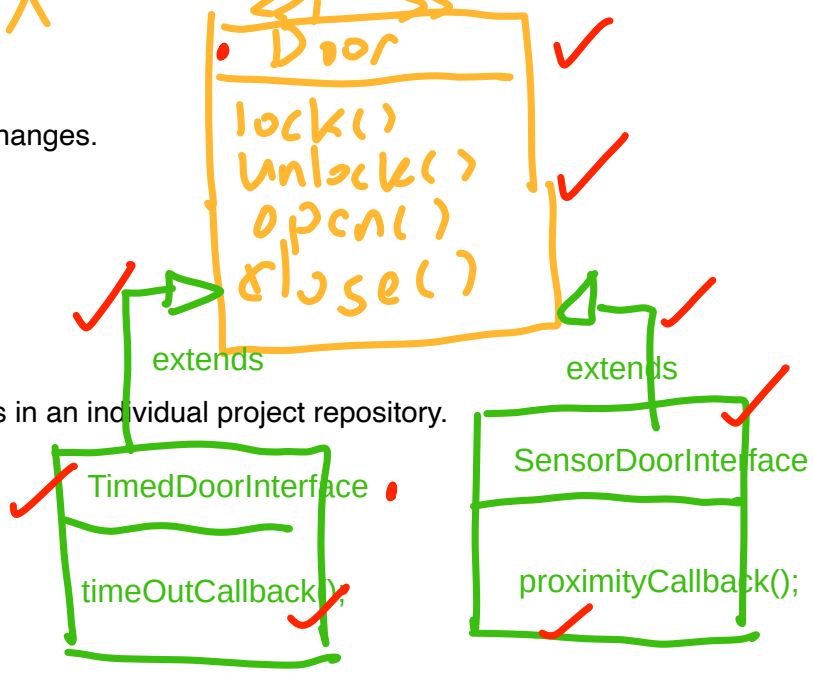
5. How does this design violate Interface Segregation Property?

1. code
2. impact on principle

6. How would you change the design so that ISP is not violated?

use 2 interfaces in addition to Door.

7. Draw a class diagram to capture these design changes.



Subtype (interface implemented by a class; interface specialised by another interface)
Subclass (class inheriting from another class)

8. Refactor the code to reflect your design changes in an individual project repository.

Section B: Dependency Inversion Property

The following files are used in this section. Download the java source and examine the code.

```
.
├── Button.java
└── Lamp.java
```

1. There are two classes defined here: Button and Lamp. Are there any dependencies between them? Which class depends on the other?

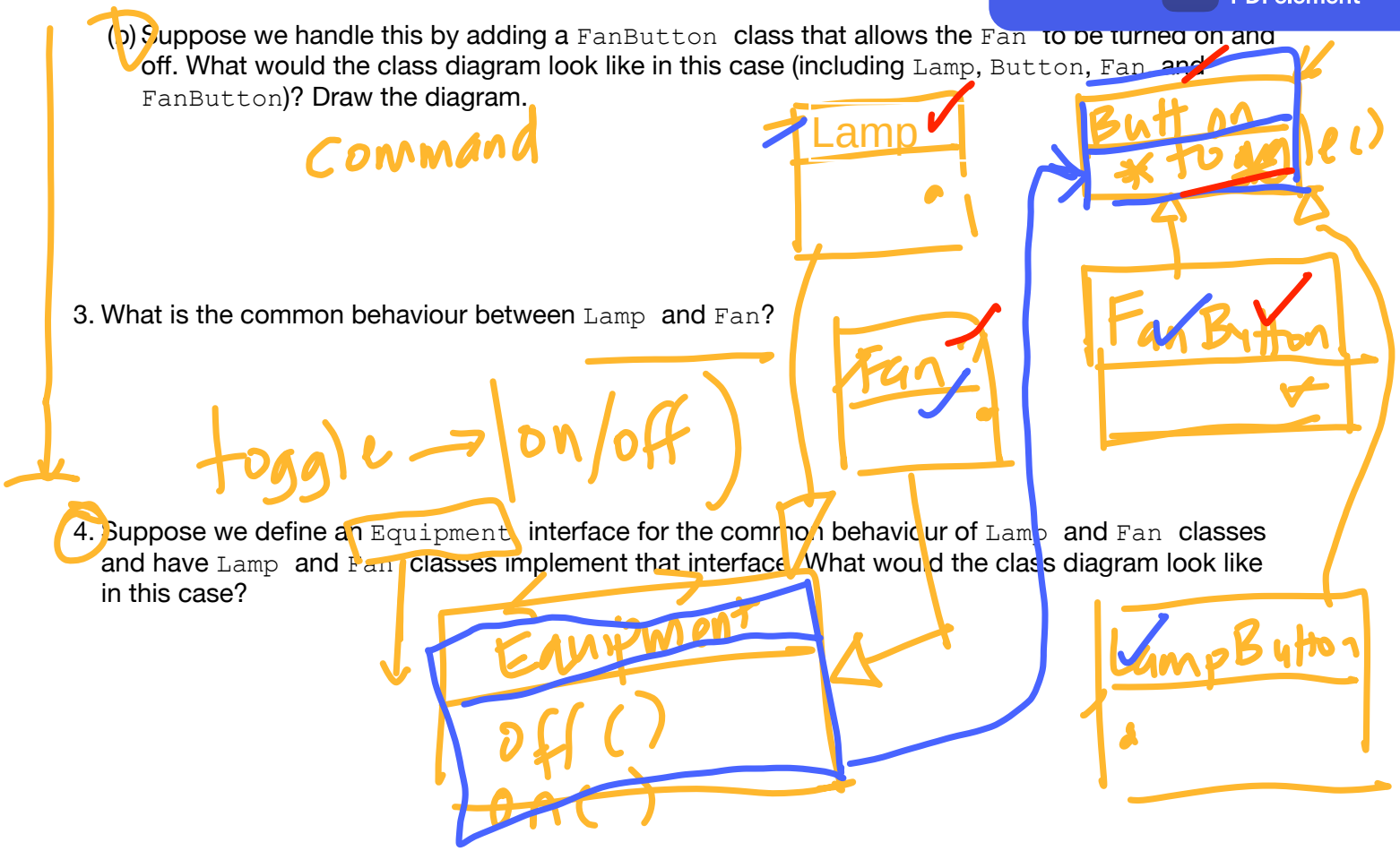
yes

Button depends Lamp

2. Suppose we wanted to add a `Fan` class that can be turned on and off to this design and a `Fan` also needed a button.
   (a) Describe the problems that may occur.

1:15pm
(discuss)

(b) Suppose we handle this by adding a `FanButton` class that allows the `Fan` to be turned on and off. What would the class diagram look like in this case (including `Lamp`, `Button`, `Fan` and `FanButton`)? Draw the diagram.



3. What is the common behaviour between `Lamp` and `Fan`?

4. Suppose we define an `Equipment` interface for the common behaviour of `Lamp` and `Fan` classes and have `Lamp` and `Fan` classes implement that interface. What would the class diagram look like in this case?

5. We can now modify the `Button` class to have a reference to an instance of `Equipment` object. Draw the class diagram after this modification:

6. Refactor the code to reflect your final design in an individual project repository.

Section C: Multiple Principles

1. Explain how the Open/Closed and the Liskov Substitution principles are automatically satisfied when the Dependency Inversion principle is adhered to.

2. Consider the code snippet below in relation to the Single Responsibility (SR) Principle

```
public class Customer{
   //state variables and constructors
   public void storeOrder(Order o){ ... }
   public Order findOrder(int orderID){ ... }
   public boolean cancelOrder(Order o){ ... }
   public String getCustomerName(){ ... }
   public String getCustomerAddress(){ ... }
   public String getCustomerEmail(){ ... }
}
```

Figure 1

Assuming that there are no errors in the code in Figure 1:

(a) Explain how the SR principle is being violated.

(b) Discuss how you would refactor the code so that the SR principle is followed.

(c) Identify ONE substantial benefit of following the SR principle.

(d) Suggest a simple technique that a programmer can use to avoid violating the SR principle when adding a new feature to an existing class.