EECS3311 Tutorial 1: Class Diagrams.

In this tutorial, you will become familiar with class diagrams, and furthermore, practice them usin g the online tool https://app.diagrams.net/.

Exercise 1: Generate class diagrams based on code.

Draw (by hand) a UML class diagram to represent as much of the following Java program fragment as possible. Did you miss any element? Discuss with your classmates.

```
class GameClock extends MasterClock {
 protected RenjuGame game;
 protected int timeLeft;
 private Player player;
 public int getTimeLeft() { ... }
 }
public abstract class MasterClock implements Subject {
 private Thread clockThread;
 public void start() { ... }
 public void run() { ... }
 }
final class Player {
 public static final int EXPERT = 0;
 public static final int NOVICE = 1;
 private final int rating;
 private final Collection activeGames;
 public void beginGame( RenjuGame game ) { ... }
 public void endGame( RenjuGame game ) { ... }
 }
interface Subject {
 void update();
}
```

Exercise 2: Aggregration versus composition

Recall composition is stronger than aggregation, in the sense that in a composite, if the whole goes away, so does the part (if the book goes away, so do all of its pages); in an aggregate, parts may exist even if the aggregate goes away (if the library goes away, the books may still exist, if you think of the libray as an aggregate of books).

Using the composition and aggregation, describe the reationship between:

- The car and its wheels
- The University and its Departments

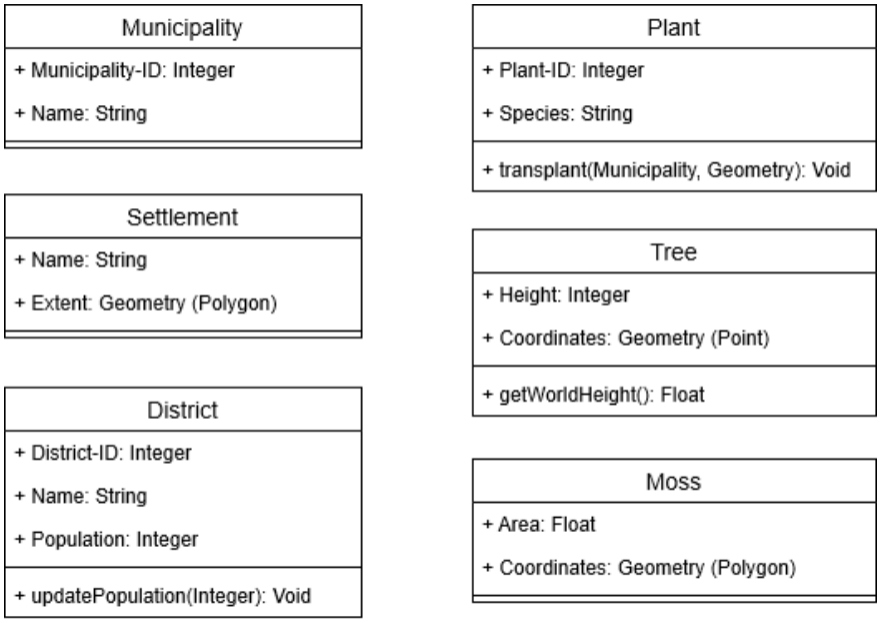
Using the online tool, draw two simple class diagram, illustrating the scenarios above. If you are wondering about multiplicity, a car must have precisely 4 wheels, and a University must have at least one department.

Exercise 3: Complete the class diagram.

Suppose we are building a system tracking various plants spread in municipailities. Each individual plant is located in some municipality, whereas a municipality may contain any number of plants (zero plants is also a possibility). A plants can be either a tree or a moss.

Let's assume that the administrative unit under the municipality is called "district". In addition, there are usually several settlements (villages, cities, etc.) in a municipality, which can possibly be located across a border in two municipalities. The district is a bureaucratic classification, the settlement a real existing construct. One of these relationships is an aggregation, the other a composition. Why?

Consider the following partial UML class diagram:



Port this diagram in the online tool. Complete the missing relationships based on the narrative above. Identify aggregation and compisition. Argue why one of the relations is aggregation (which one?) and the other composition (which one?).

Exercise 4: Bank account

Identify classes, attributes and operations according to the following description and draw a classs diagram.

- Consider a bank and their customers. A customer can open any number of accounts. For each customer the name, address and date of birth.
- A customer can close any of his/her accounts.
- All accounts have a common interest rate.
- Every account has a unique account number
- A customer can deposit and withdraw an arbitrary amount.
- To calculate the interest, for each account movement the date and the amount has to be noted.

For the sample data draw an object diagram for a customer John Smith (born 01/02/1970, living in 792 Yonge St, Toronto) who has a checking account with number 800 who deposited 1000$ on 01/01/2021 and withdrew 300$ on 02/02/2021.