Homework #1: A Friendship Graph

Due Tuesday, January 19 at 11:59 p.m.

The goals of this assignment are to familiarize you with our course infrastructure and to let you practice object-oriented programming with Java. To complete this homework you will implement a simple graph class that could represent a network of friends.

Your learning goals for this assignment are to:

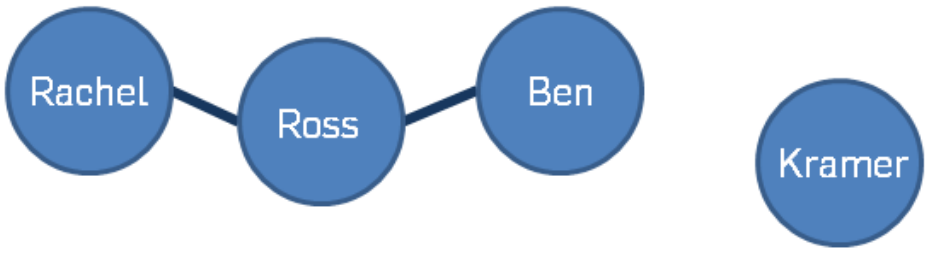
- Use Git and GitHub to revise and share (with course staff) your work.
- Become familiar with a Java development environment, Eclipse.
- Write a first Java program.
- Practice Java style and coding conventions, using Checkstyle to check and enforce the conventions.
- Practice using general build automation and testing tools, Gradle and Travis-CI.

Instructions

To begin your work, clone your course repository from GitHub and import the homework project into Eclipse from the `homework/1` directory in your repository.

Implement and test a `FriendshipGraph` class that represents friendships in a social network and can compute the distance between two people in the graph. You should model the social network as an *undirected* graph where each person is connected to zero or more people.

For example, suppose you have the following social network:



Your solution must work with the following client implementation (located in `Main.java`).

```
FriendshipGraph graph = new FriendshipGraph();
Person rachel = new Person("Rachel");
Person ross = new Person("Ross");
Person ben = new Person("Ben");
Person kramer = new Person("Kramer");
graph.addVertex(rachel);
graph.addVertex(ross);
graph.addVertex(ben);
graph.addVertex(kramer);
graph.addEdge(rachel, ross);
graph.addEdge(ross, ben);
System.out.println(graph.getDistance(rachel, ross));   //should print 1
System.out.println(graph.getDistance(rachel, ben));    //should print 2
System.out.println(graph.getDistance(rachel, rachel)); //should print 0
System.out.println(graph.getDistance(rachel, kramer)); //should print -1
```

Evaluation

Overall this homework is worth 50 points. To earn full credit you must follow these requirements:

- Your solution should work with the client code above. The `getDistance` method should take two people (as `Person`s) as arguments and return the shortest distance (an `int`) between the people, or `-1` if the two people are not connected.
- Your graph implementation should be reasonably scalable: the cost for computing the distance between two people should be $O(\texttt{n})$, where `n` is the number of people in the graph. We will test your graph with several thousand vertices and edges.
- Your solution must build on Travis CI using our Gradle and Checkstyle build configuration.
- Use proper access modifiers (`public`, `private`, etc.) for your fields and methods. If a field/method can be private, it should be private.
- Do not use `static` fields or methods except for the `main` method(s) and constants. Note that we will not penalize the appropriate use of `static` in constants.

- Follow the Java code conventions, especially for naming and commenting. Hint: use **Ctrl + Shift + F** to auto-format your code!
- Add short descriptive comments (`/** ... */`) to all `public` methods.

Additional hints/assumptions:

- For your implementation of `getDistance`, review breadth-first search.
- You may use the standard Java libraries, including classes from `java.util`, but no third-party libraries.
- In addition to being compatible with our client code, you may create any number of files, classes, or methods to complete this task.
- Different Person objects with the same name are to be treated as distinct people in the graph.
- You may handle incorrect inputs however you want (printing to standard out/error, silently failing, crashing, throwing a special exception, etc.)
- Refer back to the handout from recitation 1 (it should be available in your course repository) for instructions on using git. Remember to use `git add ...`, `git commit ...`, and `git push ...` in that order. Using `git add dir` with a directory rather than individual files will help ensure you don't miss any files that you changed. Be sure to confirm that all your added and changed files show up on GitHub.com, and that your build was successful on travis-ci.org.
- Some of the Java conventions will be enforced mechanically by Checkstyle during a build with Gradle. Passing the Checkstyle check is necessary, but not sufficient.
- You should write additional samples to test your graph, similar to our main method. You may modify the Gradle configuration to run your code automatically on Travis-CI, but that is not required.
- To print something to standard out, use `System.out.println`. For example:

```
System.out.println("DON'T PANIC");
```

We will grade your work approximately as follows:

- Successful use of Git and GitHub: 5 points
- Basic proficiency in Java: 15 points

- Fulfilling the technical requirements of the program specification: 12 points
- Successful use of build automation tools: 2 points
- Documentation and code style: 16 points