1. HospitalSystem Overview

HospitalSystem is a simple Java application for managing a hospital by checking in and out patients and doctors. This project was created as a sample project for this lab, therefore it should not be looked at as a complete system.

HospitalSystem allows you to:

- Add a doctor who is then automatically assigned to his favourite room. If the room is occupied, he/she is assigned to the first room available.
- Add a patient who is then automatically assigned to a doctor's waiting list with the desired specialty. If no such doctor is checked in, the patient is assigned to a general practitioner or, if no general practitioner is checked in, to the doctor with the shortest waiting list.
- Check out a doctor whose room is then freed and all patients added to the waiting list of the doctor with the shortest queue.
- Check out a patient.
- All checked in patients and doctors can be seen in the Overview tab.
- An overview of the rooms in the hospital can be seen in the Running rooms tab.

2. Add HospitalSystem to your workspace

If you use IntelliJ IDEA:
1. Unzip “HospitalSystem-src-v1.0.zip” to a known location on your hard drive.
2. On IntelliJ IDEA, go to Open project -> select the file build.gradle
3. On the window dialog, select “Open as a Project”

If you use Eclipse:
1. Unzip “HospitalSystem-src-v1.0.zip” to a known location on your hard drive.
2. Go to “File -> Import -> Existing Gradle Project”.
3. Navigate to the location where you extracted “HospitalSystem”.
4. “HospitalSystem” should be visible in the “Projects” box

3. Tool

We will use a tool which uses static analysis to look for bugs in Java code. The tool was originally known as FindBugs and, later on, evolved into SpotBugs. Although the tool has two different names, it is essentially the same. The only difference is that FindBugs currently works on Eclipse and SpotBugs on IntelliJ IDEA.

You can use either FindBugs or SpotBugs, depending on the IDE you prefer. The following sections describe how to install and use the tool on both IntelliJ IDEA and Eclipse environments.

3.1. SpotBugs for IntelliJ IDEA

SpotBugs is a program which uses static analysis to look for bugs in Java code. SpotBugs is the spiritual successor of FindBugs, carrying on from the point where it left off with support of its community.
Installation:
1. Click on “Plugins” on the welcome screen of IntelliJ IDEA (2020.3).
2. Write “SpotBugs” on the search box, select SpotBugs, and click on “Install”.
3. Restart IntelliJ IDEA.

Usage:
1. SpotBugs can be found on the bottom toolbar
2. Press the button “Analyze Project Files”
3. Press “Group by bug rank” for the deliverables exercise

To find ‘Confidence’ of the bugs:
1. Click on one of the found bugs
2. The upper right window contains the bug details and the data of the confidence (“Priority”) (needs to be scrolled down)
Additional hints for FindBugs setup:

1. File->Settings ( Other Settings)->FindBugs->IDEA
2. Press on Report tab
3. Set minimum rank to 20 (should be 20 by default)
4. Set minimum confidence to Low (should be Medium by default)
5. Tick all bug categories (should be done by default)
6. Press OK

3.2. FindBugs for Eclipse

1. In Eclipse, navigate to “Help > Eclipse Marketplace”.
2. Write “FindBugs” to the “Find” field.
3. Look up “FindBugs Eclipse Plugin 3.0.1” from the search results.
4. Select “Install > Confirm > I accept … > Finish > OK”.
5. Restart Eclipse.
6. Navigate to “Window > Preferences > Java > FindBugs”.
7. Set “Minimum rank to report” to 20.
8. Set “Minimum confidence to report” to “Low”.
9. Mark all categories from “Reported (visible) bug categories” to true.
10. Set all options from “Mark bugs with … rank as” to “Info”.
11. Click “Ok”

After these steps your preferences window should look like the following:
Run FindBugs:
1. Right click on the “HospitalSystem” project in the package explorer.
2. Select “Find Bugs > Find Bugs” from the context menu.
3. Wait for FindBugs to finish.
4. In the top right corner select “Open perspective > FindBugs > OK”.

You should now see the FindBugs perspective.
You can see all the information about bugs that have been found by FindBugs in the project code in the FindBugs perspective. To see a list of the problems, click on the small arrow in front of “HospitalSystem” in the “Bug Explorer” pane.

FindBugs categorizes bugs in three main ways.

1. **Rank** - a bug’s rank measures the severity of the problem. It varies from 20 (lowest) to 1 (highest) and the values are grouped into four categories: *Of Concern*, *Troubling*, *Scary* and *Scariest*.

2. **Confidence** - a bug’s confidence measures the likelihood that a real bug was flagged rather than a false-positive.

3. **Category** - a bug’s category notes the bug type. There are nine categories in total, some examples being Correctness, Bad Practice, Performance etc. In addition, FindBugs matches every bug with a pattern. If interested, you can read more about patterns here: http://findbugs.sourceforge.net/bugDescriptions.html

In Eclipse you can find individual bugs by navigating through the hierarchy of found problems.
After clicking on the bug description once, FindBugs navigates you to the location of the problem in code and further information about it is located in the “Bug Info” tab as shown below.

If there happens to be two bugs on the same line, a single click on the bug description will show you information about one of them, a double click about the other.