# TEAM COBOL

Bradley | Ayyan | Chris | Joel

## OVERVIEW

The premise of this program is to parse through the data of all students, teachers, and teacher's assistants and evaluate the likeliness of an individual's infectivity by the end of a single school day.

The output of the program will be the names and IDs of all persons in the school. This value represents the chance of them being infected by the virus at that point in time. This value is used throughout the program to calculate how the infection spreads throughout the day.

This program is written in Java, and simply provides a console output. This document will specify the assumptions and calculations used.

## CALCULATIONS

If any person in a class has an infectivity value higher than 0, then their infectivity is added to the sum of infectivities in that classroom. This number is multiplied by $R_0 = 3$, and then divided by the number of students that can get infected. This resulting value is the increment of all the class members' infectivities. This value is added to the potential likeliness of being infected by the room itself:

$$\Delta I = \frac{R_0 \sum_{k=1}^{n} I_k}{(n - \sum_{k=1}^{n} I_k)} + I_R$$

Where $I_n$ represents the infectivity of that single person, and n is the number of students in that classroom.

This $\Delta I$ value is the increment of the student's infectivity. After the period is over, each student's current infectivity will be increased by this amount (capped at 1.0).

Hence, if a class of 31 students has one student with 1.0 infectivity, then all students will have their likelihood of being infected increased by 0.1. If a class has 32 students and one student has 1.0 infectivity, while two others have 0.5, then the infectivity of everyone in the class will increase by 0.2.

$I_R$ is the room infectivity calculated separately, and only uses the number of infected students without accounting for the total number of students. $I_R$ is set to the room constantly (a value we chose arbitrarily to be 0.05) times the total infectivity of the room $\sum_{k=1}^{n} I_k$ .

For all students, this increment value is multiplied by any additional factors (1.7 for any health issues, and +25% per grade higher than 9) before being added to their infectivity.

There are 5 periods in total, hence 5 incubation periods (fifth period being extracurricular activities). $I_R$ is reset during lunch.

## CODE

The code is written in Java and depends on the following classes:

```
Main
Person
Student
Teacher
TeachersAssistant
Subject
Period
```

The ***Person*** class is a base class that ***Student***, ***Teacher***, and ***TeachersAssistant*** all extend. The base values that the Person class holds is infectivity and name.

The ***Subject*** class holds the list of all students, TAs and teachers for a specific period. Once that period is over, the infectivity of all the students is calculated, as well as the room's infectivity, and all entities have their infectivity values updated.

The ***Period*** class holds all the subjects taking place during that period and each of those subjects, as mentioned before, holds the details for all members in that class. The period class provides functionality to calculate and update the infectivities of all subjects and students in that period.

The ***Main*** class iterates through the provided XLXS file and extracts all student, teacher and TA data to store it into the local variables. It then iterates through all 6 periods and updates infectivity values.

# ROUGH PROJECT PLANNING

**Outlined Important Information:**

- There is a mandated lunch break after the first 2 class periods, where all the students are released for lunch. During this lunch period, all the classrooms are cleaned
- The virus can be completely eliminated by commonplace cleaning supplies.
- It is safe to assume that the virus has a chance of spreading every time somebody is in close contact with each other, or if somebody touches a contaminated surface, just like the flu.

- We can safely assume that during a student's spare period and during lunch time, they will hang out with other students that have a spare period and are more likely to hang out with peers in the same grade.
- It can be assumed that the school is small and the transition of periods happen quickly, it is likely that students leaving a class after a period ends will bump into or be in close contact with the new students coming into that same class
- The teaching assistants are highly dynamic, and will usually change classrooms every period, these travels are reflected in the record book. Teaching assistants interact very closely with teachers
- Students with the same last name may be related and therefore be in closer contact with each other.
- For simplicity you can assume that the base set of 20 classes are global for all students, there are no grade specific classes at this school.

- Older individuals have a higher chance of catching the virus, as the age difference increases by 2, the chance of catching the virus increases by 50% (for example, a 2 year old would have 50% less chance of catching the virus compared to a 4 year old).

- The CDC has ruled that any pre-existing health condition increases the risk of an individual catching the virus by 70%.

**Tracking the Virus:**

To track the virus, we will be keeping records of the likelihood of each individual's infectivity. This will be done by going through the entire school day in chronological order.
The school day will start from period 1 and progress throughout the day until extracurricular activities. A layout of the day is as follows:

- Period 1
- Period 2
- Lunch Break
- Period 3
- Period 4
- Extracurricular

**Calculating Infection:**
To track the virus, each student will be given a percent chance of infection.
At the start of the period, a student will be given a base % chance of infection.
This will be calculated as follows: If a student who is infected is in a specific class, the base % chance that each student in that class will be equal to: number of students in the class / 3.
Example, if 31 people are in an infected person's class; 3/30 = 10% chance that each student in this class is infected.

After calculating the base infectivity of each student, other factors will then be taken into account such as age and pre-existing health conditions.

Age calculations must all be relative to a grade 9 student, ex) if both students have a base % chance of 10% a student who is grade 10 will have an additional 25% of infection therefore, a total of 12.5%

Health conditions, regardless of type, will increase a person's likelihood of infectivity by 70%, therefore, a student with a base infection of 10% who also has a preexisting health condition will have a total infectivity of 17%, if the student is also in grade 12, you would subsequently calculate the % chance of infection by taking into account the updated infectivity chance.

**Overview of code:**
We will first extract the information from the spreadsheet to be stored with our code
Our code will then progress through the day chronologically.

Excel spreadsheet (1 iteration)

Period (Object):
- ClassList[]: holds all the classes in a period
    - StudentList[]: Holds student numbers in a class

```
for(int i = 0; i < 4; i++)
{
        ClassList = periods[i].ClassList;
        for(int j = 0; j < ClassList.length; j++)
        {
                StudentList = ClassList[i].StudentList;
                for(int k = 0; k < ClassList.StudentList.length; k++)
                {
                //DO INFECTIVITY CALCULATIONS HERE AND UPDATE STUDENT
                INFECTIVITY/CLASS INFECTIVITY
                }
        }
}
```

**Design Classes:**

Student Class {
    Student Number
    Grade
    fName
    lName
    Health Condition
    Extracurricular Activities
}

Teacher Class {
    Teacher Number
    fName
    lName
    Class
}

TA Class {
    fName
    lName
    Period 1
    Period 2
    Period 3
    Period 4

}

LectureHall Class {
    Infected
}

Assumptions:

- All health conditions are treated equally in terms of risk
- All 580 students attend every scheduled class (including infected ones)
- It is safe to assume that all extracurriculars run every day at the end of school, and that the majority of people signed up for them attend regularly.
- It is assumed that student of different grade levels can be in the same class
- It is assumed that the virus will infect someone instantaneously. ie someone may infect another individual immediately after receiving the virus.
- It is assumed that for the single day, each of the seed set will infect on average 3 people, and those people will go on to infect on average 3 more people each, etc
- It is assumed if, someone is infected in a period prior to the current period, and a cleaning has not been done, that the classroom is treated as “infected”
- It is assumed, with every increase in a students age, the chance of infection increases by 25%
- No one can have an ID lower than 1