

# User's Manual

## **EpidemicSimulation.java**

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## **1.0 Application Features**

# 1.0 Application Features

The Application Features section provides a general overview of an epidemic and its implementation in EpidemicSimulation.java.

## 1.1 Concept Overview

An epidemic is “an outbreak or product of sudden rapid spread, growth, or development” according to the Merriam Webster dictionary. It could be an epidemic disease, meme, problem, etc.

## 1.2 Program Overview

The program EpidemicSimulation.java simulates this outbreak and spread by randomly infecting nodes and then beginning a simulation of the spread, followed by either recovery or death (a positive or negative outcome).

## **2.0 How to Run EpidemicSimulation.java**

## 2.0 How to Run EpidemicSimulation.java

This section shows how to run EpidemicSimulation.java from the command line.

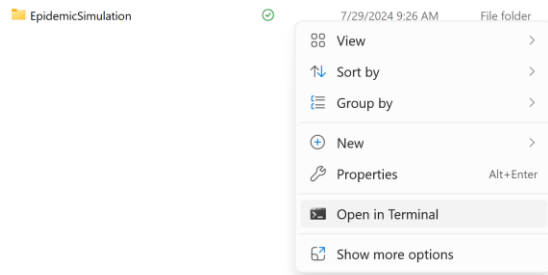
Prerequisites: **EpidemicSimulation, Java Development Kit, JavaFX**

JDK: (<https://www.javatpoint.com/javafx-how-to-install-java>)

JavaFX: (<https://gluonhq.com/products/javafx/>)

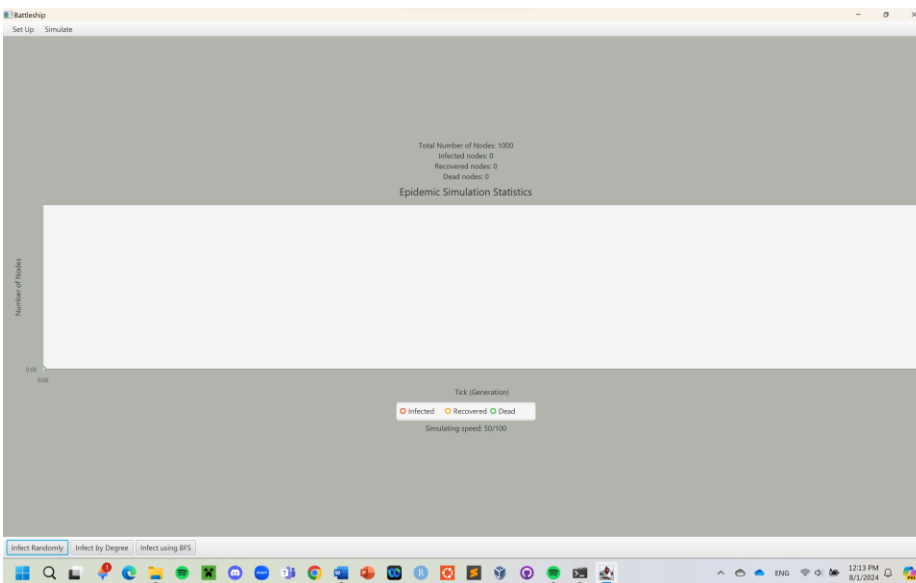
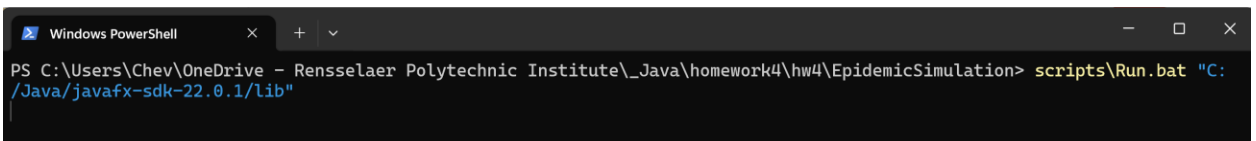
## 2.1 From the Command Line on Windows

- Step 0) Copy the path to your JavaFX\lib directory.
- Step 1) Open File Explorer.
- Step 2) Navigate to the EpidemicSimulation folder.
- Step 3) Right click on EpidemicSimulation and select “Open in Terminal”.



- Step 4) Type the following command into the terminal and then press the enter key:

```
scripts\Run.bat <PATH_TO_JAVAFX\lib>
```





## 2.2 From the Command Line on MacOS

- Step 0) Copy the path to your JavaFX\lib directory.
- Step 1) Click on Finder in the dock.
- Step 2) Navigate to the EpidemicSimulation folder.
- Step 3) Right click on EpidemicSimulation and select “New Terminal at Folder”.
- Step 4) Type the following commands into the terminal and then press the enter key:

```
scripts/Run.sh <PATH_TO_JAVAFX\lib>
```

### **3.0 Menus and Tool Bars**

## 3.0 Menus and Tool Bars

The Menus and Tool Bars section describes the usage of each item in each menu and the tool bar.

### 3.1 Set Up Menu








The setup menu items are only available for use while the simulation is not in progress.

#### 3.1.1 Upload Graph File

Opens a file chooser to upload a graph file. See section 4 for input file formatting instructions.

#### 3.1.2 Edit Configurations

Navigates to the configurations page where the user can edit various simulation variables.

- ✓ Death Chance
  -  The chance a node will die after their infection ends.
  -  (1 – death chance) represents the chance of recovery.
- ✓ Infection Duration
  -  The number of ticks a node will stay infected for, after which it either dies or recovers.
- ✓ Lambda
  -  The infection rate for each tick.
  -  Eg. If  $\lambda = 0.5$  and death/recovery is ignored:
    - Number of infected nodes will increase by 50%.
- ✓ Number of Threads
  -  The number of threads the simulation will use to run.
  -  The number of available cores on the machine running the application will also be displayed; simulation efficiency will increase directly with number of threads until that number.

## **3.2 Simulate Menu**

The simulate menu items are only available for use while the simulation is running.

### **3.2.1 Play**

Continues running the simulation if it is paused.

### **3.2.2 Pause**

Temporarily stops the simulation if it is running.

### **3.2.3 Slow Down**

Increases the pause time between each tick by 0.2 seconds (200 ms).

### **3.2.4 Speed Up**

Decreases the pause time between each tick by 0.2 seconds (200 ms).

### **3.2.5 Reset**

Restarts the simulation, allowing the user to setup once more.

## **3.3 Set Up Tool Bar**

The setup tool bar will only be visible while setting up. Pressing any button will prompt the user for a whole number, infects nodes based on that number, and then immediately begins the simulation.

### **3.3.1 Infect Randomly**

Randomly infects  $n$  nodes.

### **3.3.2 Infect by Degree**

Infects all nodes with a degree greater than  $s$ . The degree of a node is the number of edges connected to it (how many neighbors it has).

### **3.3.3 Infect using BFS**

Infects the first  $k$  nodes the BFS algorithm comes across. Begins at a random node. BFS stands for “Breadth First Search”.

## **3.4 Simulate Tool Bar**

The simulate tool bar will only be visible while simulating.

### **3.4.1 Slow Down**

Increases the pause time between each tick by 0.2 seconds (200 ms).

### **3.4.2 Play**

Continues running the simulation if it is paused.

### **3.4.3 Pause**

Temporarily stops the simulation if it is running.

### **3.4.4 Speed Up**

Decreases the pause time between each tick by 0.2 seconds (200 ms).

### **3.4.5 Reset**

Restarts the simulation, allowing the user to setup once more.

## **4.0 File Formatting**

## 4.0 File Formatting

The File Formatting section describes the required formatting for the graph input files.

### 4.1 Specifications

The graph input file must be formatted in adjacency list format.

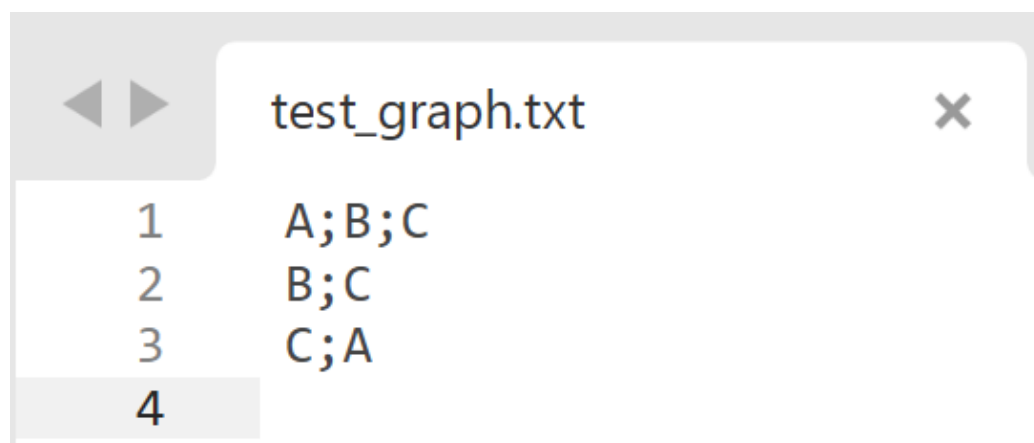
Adjacency list format:

- ✓ Each row contains at least one node label.
- ✓ Node labels are separated by a single semicolon.
- ✓ There is an edge between the first node label and every one of the other node labels in the row.
- ✓ For example, in “A;B;C” there is an undirected edge from A to B and from A to C.
- ✓ There does not need to be a row for each node.
- ✓ For example, a file containing only “A;B;C” represents a graph with 3 nodes and 2 undirected edges.
- ✓ Newlines before, between, or after properly formatted rows will not affect graph initialization.

Node labels may not contain the following characters:

- ❖ Semicolon: “;”
- ❖ Null character
- ❖ Newline

### 4.2 Example



## **5.0 Error Messages**



## 5.0 Error Messages

The Error Messages section lists all possible error messages in EpidemicSimulation.java and how to fix them.

### 5.1 Input File Error Messages

**See section 4.1 (Input file specifications)**

**ERROR: File [filename] does not exist.** – The file selected does not exist in the location specified.

**ERROR: File [filename] contains an invalid node label.** – The file selected contains a node label with an invalid character.

**ERROR: Scanner could not open file [filename].** – The file selected cannot be scanned. Try a different file.

### 5.2 Configurations Error Messages

**See section 3.1.2 (Edit Configurations)**

**Death chance must be a value between 0 and 1, inclusive.** – Enter a value that is between 0 and 1 that only contains digits and one decimal point.

**Infection duration must be an integer greater than 0.** – Enter a natural number.

**Lambda must be a value between 0 and 1, inclusive.** – Enter a value that is between 0 and 1 that only contains digits and one decimal point.

**Number of threads must be an integer greater than 0.** – Enter a natural number.