CPSC 4140 Human and Computer Interaction SP17
Homework 4 – 50 points – Fitts's Law

Assignment Objectives:
- Implement a basic graphical user interface using Swing or JavaFX that uses event-handling
- Implement an application based upon specifications that allow some flexibility in interpretation

Delivery Instructions:
- This assignment is due by 5PM on **Friday, March 17th**. No late assignment submissions will be graded.
- You should upload to Canvas a single .ZIP file that contains:
  - All thoroughly commented `.java` source files needed to compile your project
  - A `makefile` containing the following directives:
    - `compile` which compiles all of the source code
    - `run` which runs an example of your program
    - `clean` which removes all class files
  - The readme and writeup files, as specified below. If needed, a readme.txt file that contains your name, course information, and clear instructions on how to compile and run your program.

Collaboration Policy:
- You should work on this assignment yourself. Do not discuss any code or program design with classmates. Do not resubmit any existing projects. If you have general questions, please post on Piazza.
- You may use the Oracle Java Tutorials and the Oracle Java API as resources.

The Assignment: A Simple GUI

One of the main "laws" of modern graphical user interfaces is Fitts' Law. Fitts' law states that the amount of time it takes to move quickly to a target area is a function of the distance ot the target and the size of the target. Originally, Fitts' Law experiments were conducted using pencils where an experimenter would measure how quickly a person could touch the middle of targets of different sizes. Fitts' original work is available in the *Journal of Experimental Psychology,* volume 45, number 6, pages 381-391.

In particular: $MT = a + b \log_2(2A/W + c)$

Where MT = movement time, a and b are empirically determined constants, that are device dependent, c is a constant that's typically 0, 0.5, or 1 (see), and A is the distance of movement from start to the target's center, and W is the width of the target. Note, there are other formulations of this equation.

In this project, you will build upon your HW-1 and make a Fitts's Law program.

Specifications:
- Operation of the program:
  - Your program launches and you prompt for any initialization steps
  - Once a user selects "Go!",
    - You will display an initially blank field
    - You will give a countdown from 5 to 0
    - You will present the user with an on-screen target
      - The user should move the pointer to click on the target
      - You will measure the amount of time it takes for the user to move the mouse and click to the display
    - Once the target is clicked, the target goes away and is replaced by another target somewhere else of a different, random size.
    - Repeat 4 and 5 for as many trials you are measuring

- You will need to decide how and when you should be starting the experiment. You will provide a 1 to 2 - page PDF document along with your source code where you list your design justifications. This file should be called `readme.pdf`.
- Your experiment should consist of at least 50 trials (but you may have more, if you desire).
- Your program should generate a comma separate value (CSV) file that contains the information in the following format:
  - Trial Number, Target Size (in pixels), distance to target (in pixels), time to click (in milliseconds)
  - An example row might look like 1, 100, 800, 50
- Conduct a series of tests and graph the results. In a 1-page document called `writeup.pdf`, include the graph and a brief discussion about the relationship that you see.
- Any PDF document should include your name, HW-4, and CPSC 4140 in the upper right corner.
- Your program should compile and work on a SoC Linux machine running Java 1.7 or a MacOS machine running Java 1.8.[1]

Extra Credit (Variable Amounts)
1. Using a tabbed pane, create a second version of the program that's geared as a kid's game. This requires making the application look appealing for young children and "fun features." You'll need to include your source code under a sub folder called "Extra Credit" along with a 1-2 page document called extra_credit_hw4.pdf that details your design decision and features. You should also have a `makefile` in this folder.
2. Conduct a series of trials using a variety of pointing devices, display sizes, target sizes, etc. Graph these results and prepare a PDF document that includes the graphs and a substantial about discussion about your findings.

Grading Criteria:
- **Proper documentation**: using pre- and post-statements, commenting appropriately.
- **Exceptional condition handing**: your program should never exit without you being in control. (In other words, there should be no way for me or the TA to make your program crash!)
- **Test cases**: do you satisfy the operational specifications?
- **Design justifications**: for any decisions that you make in the design of your program, indicate why you chose to do so and why it's appropriate.

---

[1] You may request to use a programming language other than Java for this project. Any requests should be made via email and include a detailed justification of why you are seeking to use this language.