General Criteria (From Computational Project 2 Slides)

- The input to your process is a flatfile with a list of student names.
- The output is a file with an evaluation of pipetting competence.
- It should include students delivering 0.5 uL of viscous liquid, 25 uL of watery liquid, and 1000 uL of watery liquid. Minimally. That is my standard in-person quiz. It may involve additional containers and the preparation of dilutions. Steps that require mixing of liquids would be good to include.
- Beyond that the project is pretty open-ended, and the rest of this is suggestions which you can ignore if you think of something better.
- The code will presumably ask students to do pipetting involving transfer of fluorescent liquids into positions of 96-well plates. The plate is then read for fluorescence and students are scored automatically from the data.
- You may ask an experimentalist to perform any actions required that can be completed in <<1 hr and return you data. It would be wise for you two to do it too so that you know exactly what you're dealing with.
- It would be nice if the liquid handling operations were expressed as a Semiprotocol file, which would then be compatible with the PipetteAid being built.
- 20 pipetting operations is a ballpark limit to avoid being excessively time-consuming
- You can work together or separately on different approaches

Project Goal

- Automated process for students to check their pipetting accuracy
    - Input: (Clarify: List of student names – as well as each student submitting their fluorescence plate readings?)
    - **Semiprotocol file for each student**
- Utilize fluorescence plate reader for 96-well plate
    - Normalize base fluorescence values for plate reader (Clarify: Ask students to do this process or should base values be in code depends on plate reader?)
    - **Compare to historical numbers**
    - **Fluorescence bleaching – variability**
        - **Can take standard deviation – throw out outlier based on cohort of students**
- Formulate procedure (20 pipette operations total) that will test a range of liquids
    - 0.5 uL of viscous liquid, 25 uL of watery liquid, and 1000 uL of watery liquid
    - (Clarify: What exact liquids will be available to use? Will the food coloring that is inserted into these liquids be performed before or will this be factored in the test? If so, how will these values be normalized)
    - Can buy anything – $500 of chemicals
- Output is an evaluation of the pipette performance
    - **Feedback on pipetting skill / diagnose what was wrong (based on graph)**
    - Clarify: Different categories? Will there be a need for viscous vs standard vs large volume of liquids?
        - 3 volumes
        - ½ microliter viscuous
        - 1 mL scale liquid
        - Mixing of an ependorph
            - Can you diagnose mixing
        - Mixing of PCR

    - Clarify: Score for accuracy with standard deviation based on normal distribution across the measured endpoints (probably < 20 different wells), as well as a final score /100 to evaluate overall performance, and then P/NP if > 70
    - Clarify: Need graphs to visualize different categories of performance?
    - Clarify: Use dynamic measurements (ie. measurements based on first well to normalize further dilutions)
- Extra: Clarify what is a semiprotocol file?
    - Use that to define protocol

Design Specifications

- User interface:
    - Clarify: Web service? Can use Python-Flask to build simple front-end, which would allow students to easily upload files, easily visualize results, read protocol, and also facilitate future iterations of training automation
        - AWS can work
        - Backup to run as a local thing
    - Clarify Command line: Students insert performance test-file with fluorescence scores into some folder in the project, and then run the (Java) code?
- Language:
    - Java simple math
    - Python
- User actions:
    - Assume students will perform the procedure as defined by the program, and upload appropriate files
    - Input: Name, Fluorescence values? – name somewhere
    - Output: Scores
- Backend:
    - Calculate (normalized) scores for student performance on pipetting based on (somewhat stochastic?) fluorescence reader data
    - Visualize results as needed

Project Resources

- Sample data to work with (just to see how the plate reader works / gives data)

Milestones

- Develop sample protocol next week to test
- Set up Tecan computer to run experiment sample