***Read all of the following information before starting the project:***

*Permitted on project*:

* Open book, open notes, open Python documentation, open internet (Google, etc.).
* You are **encouraged** to copy/modify your existing code from homework 1-10, exams 1-3, and Dr. Smay’s solutions as necessary. All new additions to the code should be your own work.
* You are permitted to work in teams of three (or four with permission).

*Not permitted on project*:

* You **MAY NOT** use any form of technology to communicate with, send to, or receive information from another person (other than the instructor, TA or partner), during the project.

*Project submission*:

* You should create a PyCharm project folder called **Project** to house all your files. Submit a Project.zip file that is a zipped version of that folder on the Canvas Project dropbox.
* You may include scans/pictures of your hand-written notes to augment your work on the problems. This is especially helpful when deciding partial credit on programs that don’t work fully.

*Grading*:

* A working program that satisfies all the requirements of the problem is easy to grade and receives full credit.
* A partially working program or non-functioning program likely deserves much partial credit, but this depends on your commenting in the code and/or submitting hand-written notes about your work.

1. (75 points) This is a collective class effort and depends on all of you to participate. On CANVAS, there is a link for Course Evaluations (SSI). If 90% of the class completes the SSI prior to the due date, you will all receive 75% of the credit on the project. If less than 90% complete the SSI, I will prorate the score.
2. (25 points) Choose one of the two options below:

**Option 1:** A Pipe Network Design and Analysis program has been uploaded to github (<https://github.com/profSmay/ProjectSP22> ). This program functions except for one feature: generating a ‘system curve’. A system curve reveals the Required Inlet Head vs. Flow Rate characteristics for the pipe network once the k-values for the sprinklers have been set.

Your job is to calculate the system curve after the pipe network has been designed and evaluated with the operating inlet and sprinkler flow rates expected during use. Your system curve should account for static pressure head if, for instance, we elevate all the nodes except the inlet.

**Option 2:** An updated Rankine cycle program has been uploaded to the same github repository as above. This program allows us to explore the Rankine cycle as before with varying P\_High and P\_Low, the inlet conditions to the turbine, and the turbine efficiency in SI or English units. The plotting has been updated to include the facility to plot any two thermodynamic properties.

Your job on the Rankine cycle is to find the optimum reheat for a second turbine. This means that you may choose an intermediate pressure between P\_High and P\_Low, where the discharge of turbine 1 is reheated and then passed through turbine 2 to exit at P\_Low. Of course both turbine 1 and turbine 2 have isentropic efficiencies. Your optimization routine should be focused on maximizing cycle efficiency by selecting the value of P\_Intermediate and T\_Intermediate. T\_Intermediate needs to be limited to reasonable temperatures as does the inlet temperature for turbine 1.

This option will require modifying the GUI to include inputs for P\_Intermediate, T\_Intermediate and turbine 2 isentropic efficiency. Additionally, you will need output line edits and labels for these intermediate states and the plot needs to be modified to show the intermediate states.