ES 3053 Homework Set #4
Due: October 23, 2020

1. 20 points
A 0.2 m^3 rigid container, initially empty, is filled with water from a line at 500 kPa, 200°C until the container reaches the pressure of the fill line. Assume the process is adiabatic and find the final mass, final temperature and the total entropy generation.

2. 20 points
Saturated water vapor at 1 MPa is compressed to 17.5 MPa, where the actual exit temperature is 650°C. Find the isentropic compressor efficiency and the entropy generation.

3. 20 points
A pump has a power input of 1.5 kW and takes in water at 100 kPa, 15ºC. It delivers water at 1.2 kg/s with a velocity of 30 m/s. The pump has an isentropic efficiency of 75%. Find the exit pressure.

4. 20 points
Steam at 400ºC, 600 kPa enters a turbine and exhausts as saturated vapor at 20 kPa. What is the isentropic efficiency of the turbine, and what is the specific work output of the turbine?

5. 20 points
R-500 is compressed from a saturated vapor at 40ºF to 300 psia in a compressor with 85% thermal efficiency. Assuming the compressor is adiabatic, find the final temperature of the R-500. If the flowrate of R-500 is 10 lbm/min, what is the horsepower requirement for the compressor? Use the R-500 diagram which is attached, and using a highlighting pen, highlight the actual process on the diagram, and use a dotted line to highlight the isentropic base case. Be sure to turn that back in with your solution.