Homework #2

Problems 3.1, 3.2 (with extra below), 3.3, & extra problem below.

Extra for 3.2:
What is the relative difference in heat transfer area if you use a 1-2 heat exchanger (1 shell pass, 2 tube passes) instead of pure counter current flow? Consider both the water on shell side in one instance & on the tube side in another instance.

Extra problem:
You’d like to condense 5,000 lb/hr of propane in a 4-pass aerial cooler.

Consider the following:
- You want to condense propane at a sufficient pressure so that it will be saturated at 120°F.
- The propane enters as a saturated gas, exits as a saturated liquid, & there is no pressure drop through the exchanger.
- Ambient air is 85°F. Consider its heat capacity as 0.25 Btu/lb·°F.
- The exchanger should have a minimum 10°F approach temperature.

Answer the following:
- What mass flow rate of air is needed (in lb/hr)?
- If the heat transfer coefficient (based on the extended area) is 3.5 Btu/hr·ft²·°F then what surface area is needed (in ft²)?