MET 330 – Spring 2019
Pre-Test Reflection (2nd Test)
April 12, 2019
Al McClenney

1. To identify areas of the prompt that require clarification and questions, I will be utilizing the "purpose" component of our Problem Solution Rubric.
2. To indicate how I will solve each part of the problem, I will be utilizing the "procedure" component of our Problem Solution Rubric. At each step of the process of finding the solution, the type of equation used and reasons will be identified.
3. In reviewing the old tests provided on Blackboard, I was unable to find any that had to do with the Hardy-Cross. There were none. In considering the structure of how a problem solution is presented, I thought about the way I worked the first exam. The Problem Solution Rubric that was used in the last exam seemed logical and straight-forward. I will use this same strategy:
   - Purpose
   - Drawings & Diagrams
   - Sources
   - Design Considerations (assumptions, safety, cost, etc.)
   - Data and variables
   - Procedure
   - Calculations
   - Summary
   - Materials
   - Analysis
4. In considering the eight MET 330 Course Objectives (from our syllabus), I will give them letters a-h:
   a. Describe the nature of fluids and define different fluid properties, such as viscosity and pressure
   b. Compute pressure and the forces (magnitude, location, and direction) that are associated with them in a stagnant fluid.
   c. Discuss what buoyancy is and determine object stability while floating or submerged in a fluid.
   d. Explain the fluid dynamics in pipes and fittings.
   e. Apply the principles of conservation of energy (Bernoulli's equation) and mass to fluid flow systems.
   f. Compute friction losses in pipes for a variety of configurations (series, parallel, network, etc.).
   g. Identify and solve for different very specific industrial problems, such as open-channel flow, cavitation, water hammer, drag, lift, forces in pipes. Learn about different instruments to measure fluid flow quantities (such as pressure, fluid velocity, flow velocity, etc.).
   h. Explain how fluid-machinery works (focused on pumps)

Course objectives d, e, and f are being directly assessed. The last exam covered a, b, and c, among others. Economist John Kay said that goals are best achieved indirectly. In reference to fluid mechanics, as a student, there is no way that I could possibly know all the intricacies of a problem to understand how to directly solve it like the professor. I am probably going to use my understanding of d and h to figure things out.

Clarifying Questions for Dr. Ayala: Why does the turpentine have to go through two pipes for the paint mix? What is meant by "which valve" in problem one? I only see the one globe valve. Problem two has two gate valves.

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Problem 1:

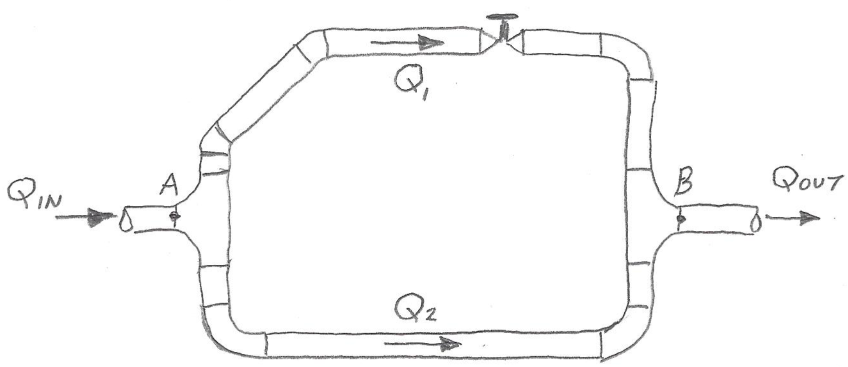
Purpose:

A system delivers turpentine to a mixing tank to prepare paint thinner. The system in shown in the figure below. Using the information provided for the system, the purpose is to determine the flow rate in each line and the pressure at A. Also, it should be determined if the fluid velocities are close to the critical velocity. The solution should be acquired using only the Hardy-Cross method.

Secondly, a second set of calculations is needed to determine the needed pipe diameter changes if the flow rate were increased to 150 gpm, without changing the pressures at points A and B. For these calculations, a Hardy-Cross spreadsheet will be utilized.

Finally, with the new pipe, it will need to be determined if the valve will need to be adjusted to assure exactly the flow rate of 150 gpm.

Drawings & Diagrams:



Sources:

Mott, R. & Untener, J. (2015). *Applied Fluid Mechanics.* 7th Edition. Boston: Pearson.

Design Considerations:

The following design considerations must be assumed:

1) Incompressible fluid
2) Isothermal process
3) Steady state
4) Minor losses are neglected
5) Turpentine is extremely flammable (NFPA rating of 3)
    a. Extreme caution must be exercised
6) Costs for schedule 40 commercial steel 1 ½" and 2" pipe are nominal
7) Globe valve is utilized

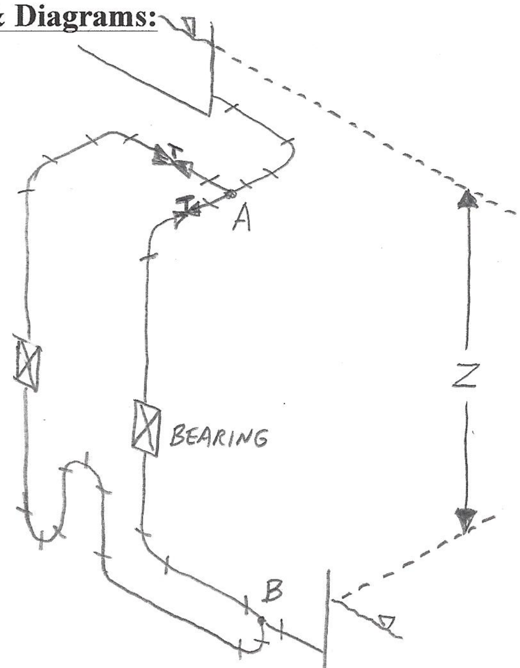
Problem 2:

Purpose:

An elevated tank containing oil drains through a flow line that splits two other lines. Each line provides oil to bearings of a rotating shaft within a machine; the bearings must be lubricated continuously. Downstream of the bearings, the flow lines join together and lead to a second tank. The system is shown in the figure below.

Using the information provided for the system, the purpose is to determine the flow rate of oil delivered to each bearing.

Drawings & Diagrams:



Sources:

Mott, R. & Untener, J. (2015). *Applied Fluid Mechanics.* 7th Edition. Boston: Pearson.

Design Considerations:

The following design considerations must be assumed:

1) Incompressible fluid
2) Isothermal process
3) Steady state
4) Minor losses are neglected
5) Oil is utilized in the system (s.g. = 0.888, $v = 9 \times 10^{-4}\ m^2/s$)
6) Type K copper tubing
7) Valves are both gate valves