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MET330: Test 3 Reflection

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1) How and why the test demonstrates your work toward one, or more, of the course learning objectives. Be specific on the course objectives you decide to mention.

The test demonstrates my work towards several course learning objectives. One objective was to use Bernoulli's equation to solve for friction losses in the piping system. I met this course objective by solving for the energy losses in both branches of piping. Another course objective was to compute the friction losses in pipes for a variety of configurations. This objective was met while solving the test problem because the flow rates I found via iterations were a function of the friction factors of each pipe. Therefore, I had to determine the correct friction factors for each branch of piping as well.

2) How your test compares against the available solution. State the mistakes you made and what you will do next time to avoid making same mistakes. Please point out exactly where you made the mistake, say why you made the mistake, and how you should have done it. If you were taking this test again, what advice would you give yourself to ensure that you had a successful test?

Although I did not need to follow the writing rubric, I did so anyway because it results in a much more organized solution. My format is identical to the test solution by having sections for purpose, diagrams, sources, data and variables, materials, procedure, summary, and analysis in that specific order. When comparing my handwritten work against the available handwritten work of the solution, I only made one error that I can see. That error was not including the pipe reduction for the first sprinkler. I overlooked this when drawing my free-body-diagram and therefore didn't include the energy losses associated with the contraction in my branch 1 energy loss equation. In turn, this made my numbers for the branch 1 flow rate equation slightly different. This error was simply due to not paying close enough attention to the system drawing, I will be more thorough in the future. Luckily, the frictional loss due to this contraction was extremely small, so it had very little effect on the overall outcome. When comparing my excel calculations with the solution's, they have a difference of 1.94%. Although I would prefer this to be 0, I believe this is an acceptable amount of error and considered negligible for the given evaluation since it is well below 5% difference. In addition to not including the branch 1 reduction loss, I believe the variation in results is due to using slightly different values for specific weight of water and kinematic viscosity of water. This would be understandable due to the temperature of the fluid not being specified in the problem statement. To avoid this in the future, I will reach out to the professor and ask for specifics related to any characteristics that may not have been given in the problem. I suggested in my solution that the system should be modified because I didn't realize that the percentage difference of the flow rates was within an acceptable range. I don't believe I am incorrect in suggesting this because my suggestion to increase losses in the first sprinkler would in fact improve system output characteristics and better equalize flowrates, however, if the test solution says the difference is within allowable tolerance range, then no modification would be necessary because my percentage difference between branch flow rates was even lower than the test solutions (6.65% vs 6.77%).

3) What your grade should be. Base it on the ~~writing~~ rubric provided and the correctness of your solution. What are the strengths and weaknesses of your test?

1. PROBLEM 1

    1. Reasonable assumptions (reductions, valve, tubing diam, lengths) → 1/10
    2. Apply Bernoulli twice or get 2 equations from Bernoulli → 1/10
    3. Consider ALL minor losses? Handled them correctly? → 1.85/10 (I had 12 out of the 13 minor losses)
    4. Handled correctly the pipe losses? → 1/10
    5. Obtained 3 equations with 3 unknowns? → 1/10
    6. Solved system of equations correctly (Excel?)? → 3/10
    7. Final results → 1/10

    TOTAL = 9.85/10

FINAL GRADE: (90)*(9.85/10) = 88.65

4) Discuss the following:

a. What issues did you encounter in completing the test? How did you troubleshoot them?

The only issue I encountered when completing the test was getting my excel spreadsheet correct. I forgot to use $ with certain cells on the first iteration but quickly recognized my error and fixed it. I just followed the method discussed in the lecture problems and had no real issues.

b. What steps did you take to complete the whole test? Would you change something?

I took the steps in the format of the writing rubric. This led to an organized solution and made everything neat. I found all of my energy losses for each branch and included them in the Bernoulli's equation that I made for each branch. I then solved for the flow rate of the sprinkler for each equation. I then used the conservation of mass equation for my third equation. Using all three equations, I went to excel to perform iterations based on a guessed total flow rate and friction factors for each pipe. After several iterations of doing this and evaluating the percentage difference, I was able to obtain the correct answers. I would not change anything about this process.

c. What new concepts have you learned?

I learned how to solve for flow rates using three equations and three unknowns in excel by iteration method. I also learned how to equalize flow rates in a parallel system using energy losses.

d. Where you think engineers use those concepts (provide specific examples)?

Engineers use these concepts when designing piping systems that will be delivering required flow rates to multiple locations. An example would be a cooling system for machines in a production plant. The engineers could design a parallel system that will deliver specific flow rates to multiple machines for cooling purposes.

e. Where do you think you will be using everything you learned?

I believe I will be using this information if I am in an engineering position where I need to determine flow rates or velocities of fluids for different sections of piping systems. The information that I learned can be tailored to whatever the problem is that I am trying to solve by simply applying Bernoulli's equation as well as conservation of mass principles.

f. Do you think what you learn is important for your professional career?

Yes, I believe it is crucial that I learn these skills so that I am competent and don't make mistakes when designing or evaluating systems. If not able to be done correctly, this could result in damage to components resulting in high costs for repair and replacement or the endangerment of others.

g. How, when, where and why you might use this information or skill in the future?

If or when I become a practicing engineer, I would use this information for designing/evaluating system characteristics for customers or my company. I would use this information because if done carefully and correctly, it will produce an accurate result everytime.

h. Have you been able to apply concepts you have learned in the course to what you do at work or in other courses?

Yes, definitely. I am currently an engineering technician that deals with fluid mechanical systems everyday. For my position, I develop technical documents and system tagouts for work to be performed on reactor plant mechanical systems. I also test these systems after all work has been completed for certification before it is handed over to the customer. I honestly wish that I was able to take this class sooner because the things that I learn in here are 100% applicable to what I do. I have a better understanding of why systems are designed the way that they are and am better at troubleshooting unexpected system responses due to my better understanding of fluid mechanics in general.

i. What areas did you feel you were most successful, or improved the most?

The area that I have improved the most is problem solving. I am now able to look at a problem and figure out a good starting point to build from and how to analyze what I know, don't know, and what to solve for. The types of problems in this course can be overwhelming but through practice, familiarizing myself with the material, and learning from mistakes I am much better at solving these types of problems. I may not get them correct all of the time, but I am able to get farther than I ever would have at the beginning of the course. I have gotten far better at using excel to perform iterations. This was something that was really hard when we started doing it, but now I can basically develop a spreadsheet without referring to previous ones because I understand the method very well and how things tie in to each other.

j. How do you see this course's content intersecting with your field or career?

Because I want to be a mechanical engineer, I can see the knowledge that this course provides being an integral part for being successful in my future career.

k. How much time did you spend on the test? How was the time organized? What would you do differently? Why?

I would say I spent around 12 hours total on this test (including the extra credit problem). This was partially due to double and triple checking everything to ensure that my algebra and calculations

were 100% correct. If I could do anything differently it would be to get more practice manipulating formulas so that I don't second guess myself as much. I waste a lot of time because I constantly go back to make sure I don't make any errors with manipulating formulas and plugging in data.