Name:

Final Exam - version A

1. (10 pts) For the bar shown, find the maximum allowable load if the maximum allowable stress is $\sigma = 90\,\text{MPa}$

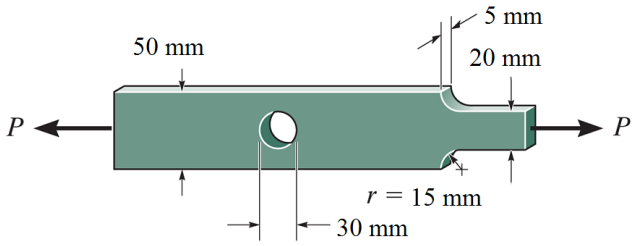

Figure 1: Problem 1

2. (15 pts) The column shown is pinned at both ends, find the maximum force allowable before buckling occurs if $I_{xx} = 303\,\text{in}^4$ and $I_{yy} = 103\,\text{in}^4$ and $E = 29\,\text{Msi}$. About which axis will buckling occur?

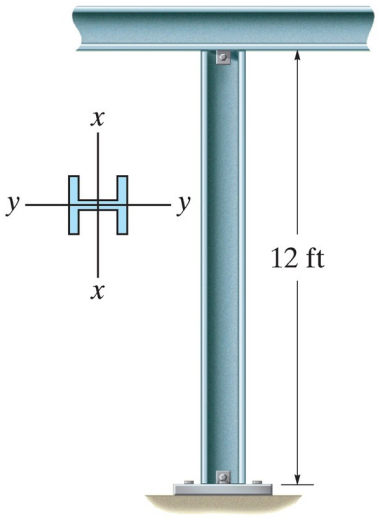

Figure 2: Problem 2

3. (20 pts) Find the deflection at C.

   Hint: There are three methods we have learned to solve this problem. If you choose the direct method, do NOT finish the solution, it is quite tedious by hand. Instead show the system of equations you would solve. If you prefer to use discontinuity functions, recall that for a concentrated load, $w = P\langle x - a\rangle^{-1}$.

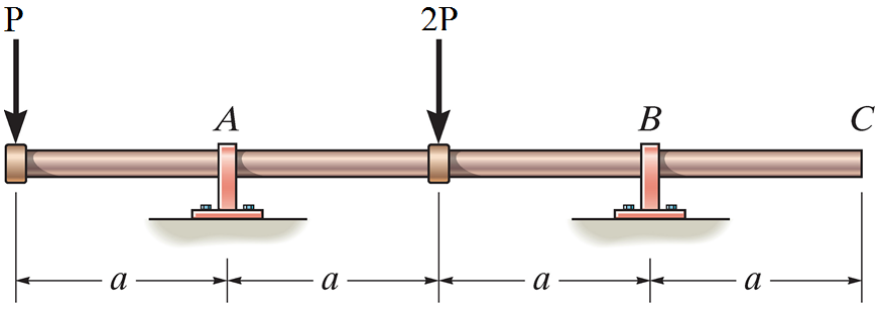

Figure 3: Problem 3

4. (15 pts) The 60° strain rosette shown has strain measurements of $\epsilon_a = -780\mu\epsilon$, $\epsilon_b = 400\mu\epsilon$, and $\epsilon_c = 500\mu\epsilon$, find the principal strains.

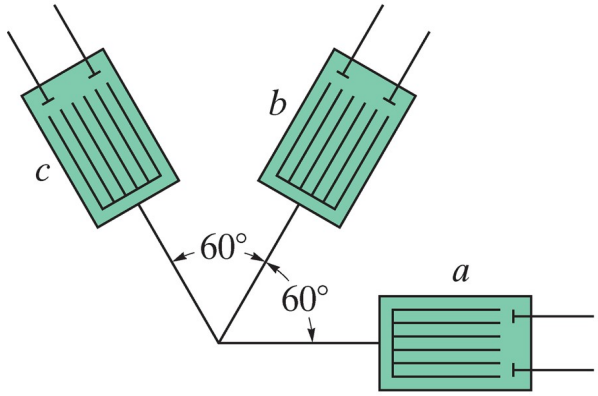

Figure 4: Problem 4

5. (15 pts) The screw of the clamp exerts a compressive force of 400 lb on the wood blocks. Find and sketch the state of stress along section $a - a$ of the clamp. The cross section is 0.75 in by 0.50 in.

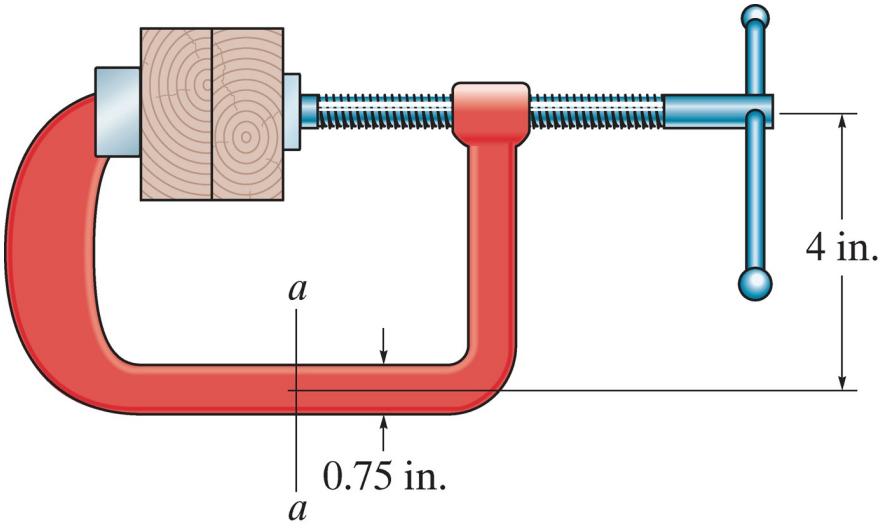

Figure 5: Problem 5

6. (10 pts) The stress-strain diagram for an aluminum alloy is shown below. If the specimen has a gage length of 3 in and an original diameter of 0.25 in, find the increase in gage length after being loaded to 3 kip. How much of this is plastic (permanent) deformation?

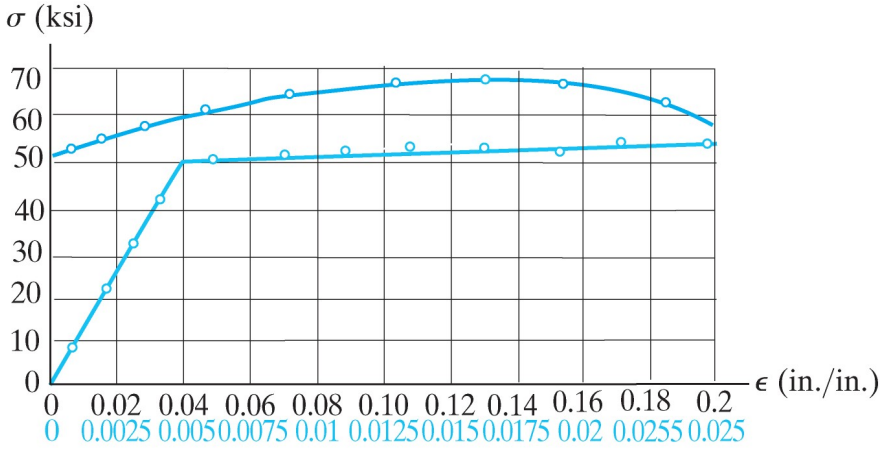

Figure 6: Problem 6

7. (15 pts) Find the maximum shear stress in the shaft shown below. The shaft has an outer diameter of 70 mm and the thickness of the hollow segment is 10 mm.

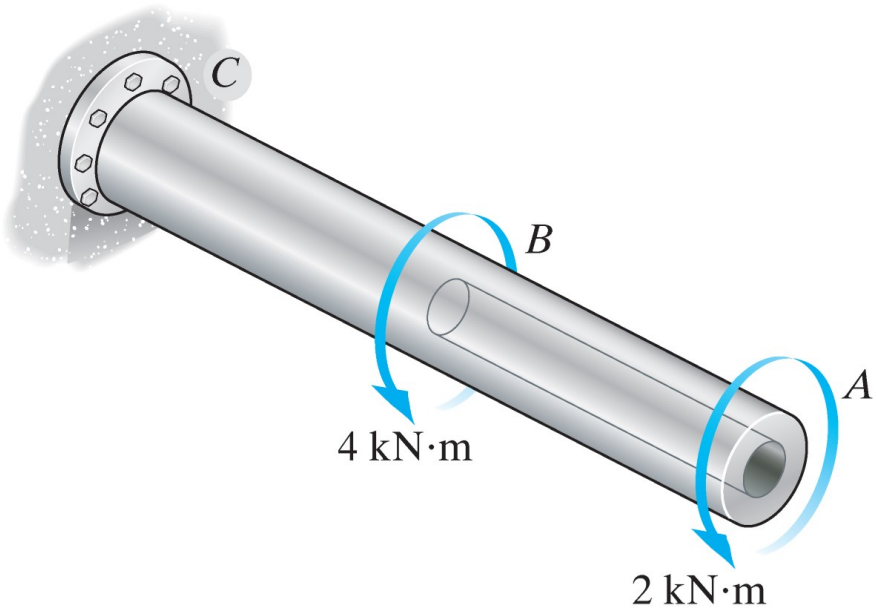

Figure 7: Problem 7