### Problem 1 (25 Points)

Please briefly explain or answer the following questions.

(a). Please sketch the engineering stress-strain and true stress-strain curves for a typical low carbon steel. Please also label the necessary information on them. (10 Points)

(b). consider a cantilever beam with the dimension: length L, width W, and thickness T. It can resist a concentrating load F acting vertically at the tip. Now, without changing the material, if the length of the beam increases from L to 2L, width from W to 2W, and thickness from T to 2T. What is the force it can resist? (5 Points)

(c). A rod is elongated by an end load as indicated below. The displacement at point A is measured to be $u_A = u_0$. What is the displacement at point B? (5 Points)
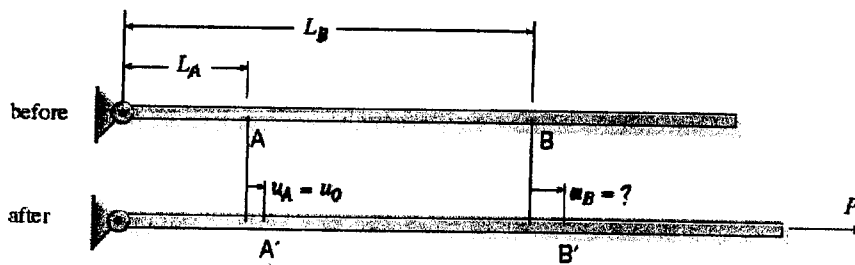


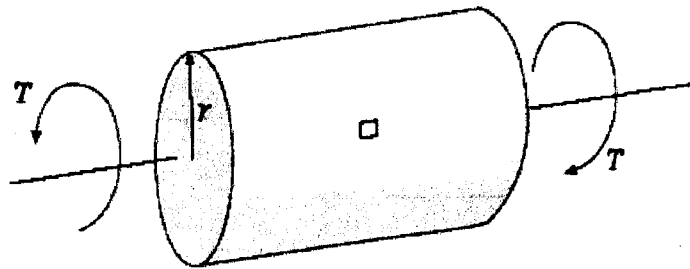(d). What is the absolute maximum shear stress for the stress state shown? (5 Points)
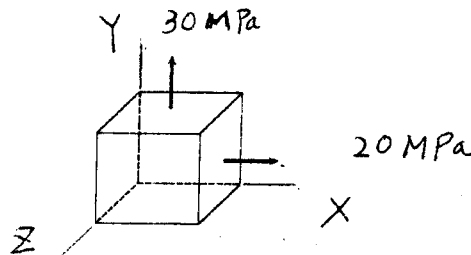


（背面仍有題目，請繼續作答）

本試題是否可以使用計算機：　☑可使用　，　□不可使用　（請命題老師勾選）

## Problem 2:　　(25 Points)

The thin-walled cylinder shown below is loaded both by an internal pressure, p = 20 psi, and an applied torque, T = 4000 in.lbs. The radius of the cylinder is r = 4:0 inches and the wall thickness is t = 0:125 inches.

(a)　Determine the stress components and show them on a material block aligned with the axes of the cylinder.　(7 Points)

(b)　Construct a Mohr's circle plot for this stress state.　(7 Points)

(c)　Determine the maximum tensile stress for this stress state and show this stress on an appropriately oriented stress block.　(6 Points)

(d)　What would be the effect of increasing the pressure (p) in the cylinder on the absolute maximum shear stress (i.e., would it increase, decrease, or stay the same)? Please use Mohr's circle to explain. (5 Points)
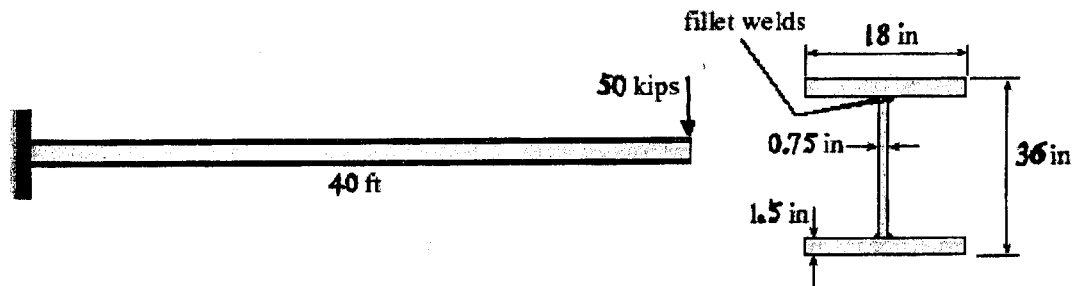
## Problem 3　　(25 Points)

The cantilever beam shown below has a built-up cross section as indicated.

(a)　Please construct the bending moment diagram. (5 Points)

(b)　Determine the maximum bending stress in the beam. The section's moment of inertia is $I = 18325$ $in^4$.　(10 Points)

(c)　Determine the weld capacity (kip/in/weld) required for the fillet welds shown. (10 Points) Notice that 1kip = 1000 lbs.



## Problem 4:　　(25 Points)

Determine an expression relating the applied load, P, to the force in the rod CD. The shafts are fixed at A and E, there is a bearing at B, and the drive disk shown has a radius of a. (You do not need to simplify your expression.) (25 Points)