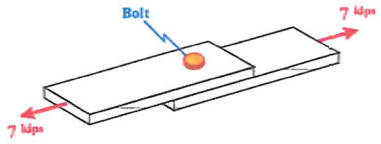
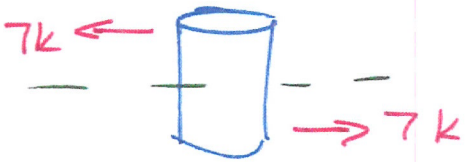
Worksheet 1E
Internal Shear Force / Stress

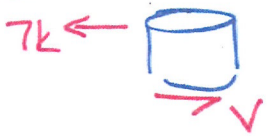
The steel lap joint is held together by a single, 1 inch bolt. Determine the shear force acting on the bolt and the corresponding shear stress?



y↑ →x FBD



Internal y↑ →x



$+\rightarrow \sum F_x = 0 = V - 7$

$V = 7$ kips

Stress

$A = \frac{\pi d^2}{4} = 0.785\ in^2$

$\tau = \frac{V}{A} = \frac{7}{.785}$

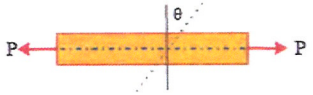
$= 8.91$ ksi

Worksheet 1F
Normal and Shear Stress

Given: A plane cut through a two force (centric axially loaded) member at an arbitrary angle θ from a vertical cut.

$\sigma = [P/A_{transverse}] \cos^2 \theta$

$\tau = [P/A_{transverse}] \cos \theta \sin \theta$

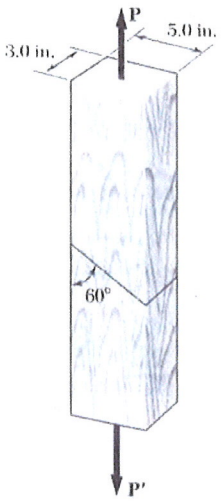


Plot the equations above for normal and shear stress. Use P and A from Worksheet 2A and vary the angle of the cut from θ = 0 degrees to 180 degrees. Plot both curves on the same graph.

See Excel File

Worksheet #2A-0
Internal Forces

GIVEN: Two wooden members of uniform cross section are joined by the simple scarf splice shown. Knowing that the maximum allowable tensile stress in the glued splice is 75 psi, determine (a) the largest load **P** that can be safely supported, (b) the corresponding shearing stress in the splice.



a) largest load "P"

restriction: tensile stress = 75 psi

$\therefore \sigma$ on plane = 75 psi

$$\sigma = \frac{P}{A_T}\cos^2\theta$$

$A_T = 3 \cdot 5 = 15 \text{ in}^2$

θ = ∠ msd from transverse cut

$= 30°$

$$75 = \frac{P}{15}\cos^2 30°$$

$$P = 1500 \text{ lbs}$$

b) corresponding shear stress

$$\tau = \frac{P}{A_T}\sin\theta\cos\theta$$

$$\tau = \frac{1500}{15}\sin 30°\cos 30°$$

$$\tau = 43.3 \text{ psi}$$