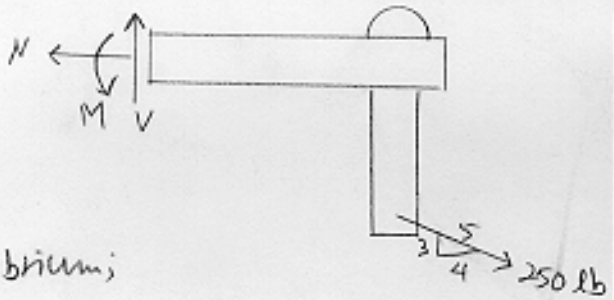
12-331 Solid Mechanics

HW #11 Due: 12/1/2000

8-17



- Equilibrium;

$\Sigma F_x = 0$; $\frac{4}{5}(250) - N = 0$; $N = 200$ lb

$\Sigma F_y = 0$; $\frac{3}{5}(250) - V = 0$; $V = 150$ lb

$\Sigma M = 0$; $M + \frac{4}{5}(250)(1.25) - \frac{3}{5}(250)(2) = 0$

$M = 50$ lb·in

- Section properties;

$A = (0.5)(0.75) = 0.375$ in^2

$I = \frac{1}{12}(0.75)(0.5^3) = 0.0078125$ in^4

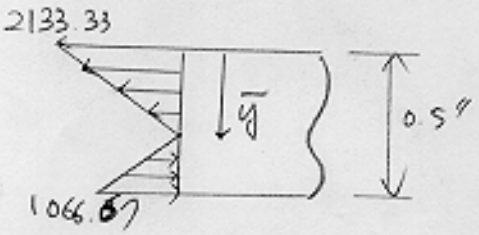
- Normal stress

$$\sigma = \frac{N}{A} \pm \frac{M}{I} \cdot c$$

$$= \frac{200}{0.375} \pm \frac{50(0.25)}{0.0078125}$$

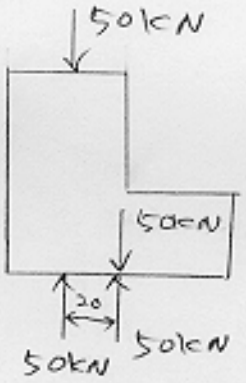
$\sigma_T = 533.33 + 1600 = 2133.33$ (psi) (T)

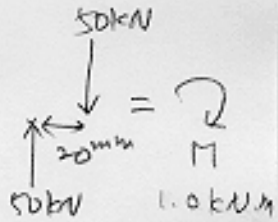
$\sigma_B = 533.33 - 1600 = -1066.67$ (psi) (C)



$$\frac{0.5 - \bar{y}}{1066.67} = \frac{\bar{y}}{2133.33} \qquad \bar{y} = 0.333 \text{ (in)}$$

8-27





$N = 50$ kN ; $M = 1.0$ kN·m

- Section properties;

$A_{top} = (0.06)(0.1) = 0.006$ m^2

$A_{bot} = (0.1)(0.1) = 0.01$ m^2

$I_{bot} = \frac{1}{12}(0.1)(0.1)^3 = 8.333(10^{-6})$ m^4

- Normal stress

(Top)

$$\sigma = \frac{N}{A} = \frac{-50(10^3)}{0.006} = -8.33 \text{ MPa}$$

(Bottom)

$$\sigma = \frac{N}{A} \pm \frac{M}{I} \cdot c$$

$$= \frac{-50(10^3)}{0.01} \pm \frac{1.0(10^3)(0.05)}{8.333(10^{-6})}$$

$\sigma_C = -5(10^6) - 6(10^6)$

$= -11.0$ MPa (C)

$\sigma_T = -5(10^6) + 6(10^6)$

$= 1.0$ MPa (T)

$\sigma_{max,c} = 11.0$ MPa

$\sigma_{min,c} = 8.33$ MPa