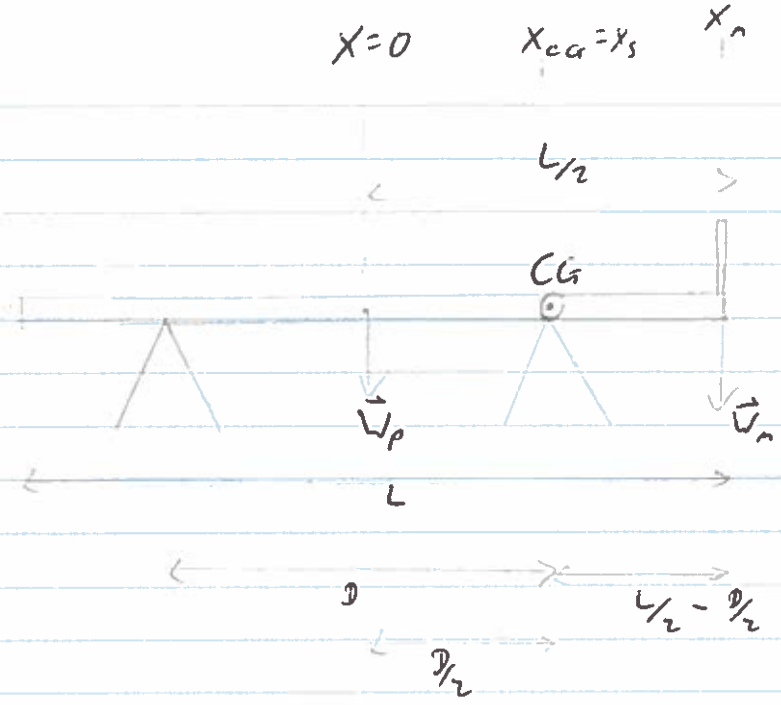
Ex 11.1
p 348



For system to just balance, CG of system must be over right hand support, X_s

$$X_{cg} = X_s$$

$$\frac{M_p(0) + m_n\left(\frac{L}{2}\right)}{M_p + m_n} = \frac{D}{2}$$

$$\frac{m_n}{M_p + m_n}\ \frac{L}{2} = \frac{D}{2}$$

$$\frac{M_p + m_n}{m_n} = \frac{L}{D}$$

$$\frac{M_p}{m_n} + 1 = \frac{L}{D}$$

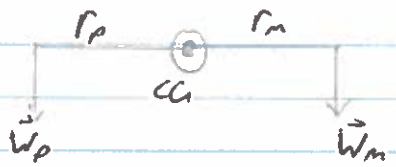
$$\frac{M_p}{m_n} = \frac{L - D}{D}$$

$$M_m = M_p \frac{D}{L-D}$$

$$= (90\,kg)\frac{(1.5\,m)}{(6.0\,m - 1.5\,m)}$$

$$M_m = 30\,kg.$$

Or use torques around right-hand support / CG



~~Stability~~ Rot. equil: $\Sigma\tau = 0 = \tau_p + \tau_m$

Torques: $\tau_p = +r_p M_p g$
$\tau_m = -r_m M_m g$

$\therefore \quad r_p M_p g - r_m M_m g = 0$

$$M_m = M_p \frac{r_p}{r_m}$$

$r_m = L/2 - D/2$
$r_p = D/2$

$$\therefore M_m = M_p \frac{D}{L-D}$$ as before.