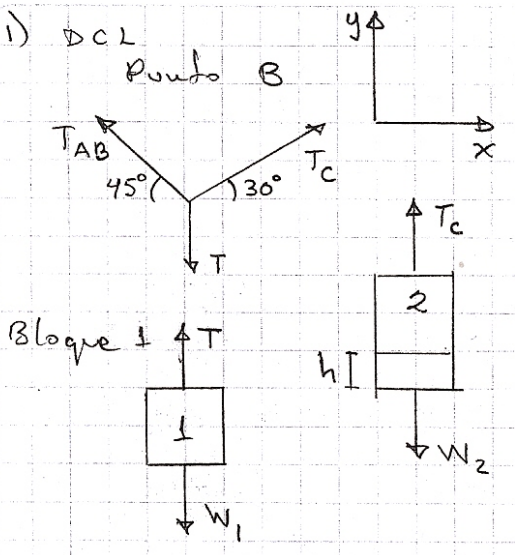
Solución: Primer Examen Final Consolidado 2013-2
Estática Vespertino

1) DCL



Bloque 1 $T = W_1$

Punto B

$\Sigma F_x = \frac{\sqrt{3}}{2} T_C - \frac{1}{\sqrt{2}} T_{AB} = 0 \rightarrow T_C = \sqrt{\frac{2}{3}}\, T_{AB}$

$\Sigma F_y = \frac{1}{2} T_C + \frac{1}{\sqrt{2}} T_{AB} - T = 0$

$\Rightarrow T = \left[\frac{1}{\sqrt{6}} + \frac{1}{\sqrt{2}}\right] T_{AB}$

$T = 8922.84\ N$

$W_1 = 8922.84\ N$

$T_{AB} = 8000$

$T_C = 6531.97\ N$

Bloque 2 $W_2 = T_C$ y además $W_2 = 9810\, V_{olumen} = 9810(2h)$

$\Rightarrow h = 0.333\ m$

2) $\vec{R} = 4\hat{i} + (m-4)\hat{j} + 5\hat{k}$ resultante

Con respecto al origen

$\vec{M}_A = 5\hat{k} \times (2\hat{i} - 4\hat{j}) = 20\hat{i} + 10\hat{j}\ N\cdot m$ $\quad \vec{M}_B = -5\hat{j} \times (2\hat{i} + 4\hat{k}) = -20\hat{i} + 10\hat{k}\ N\cdot m$

$\vec{M}_C = 5\hat{i} \times (m\hat{j} + 6\hat{k}) = -30\hat{j} + 5m\hat{k}\ N\cdot m$ $\quad \vec{M}_D = (4\hat{i} - 3\hat{k}) \times (-5\hat{k}) = 20\hat{j}\ N\cdot m$

$\vec{M}_E = (3\hat{i} + 4\hat{j}) \times (2\hat{i} - 1.5\hat{j}) = -12.5\hat{k}\ N\cdot m$ $\quad \vec{M}_G = (-3\hat{i} - 4\hat{j}) \times (-2\hat{i} + 1.5\hat{k}) = -12.5\hat{k}\ N\cdot m$

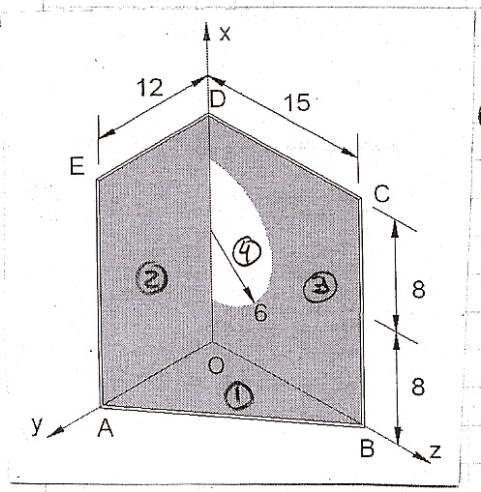
$\vec{M}_O = \vec{M}_A + \vec{M}_B + \vec{M}_C + \vec{M}_D + \vec{M}_E + \vec{M}_G \Rightarrow \vec{M}_O = (5m - 15)\hat{k}\ N\cdot m$

Se debe cumplir $\vec{R} \cdot \vec{M}_O = 0 \Rightarrow 25m - 75 = 0 \Rightarrow m = 3$

así $\vec{M}_O = \vec{0}$, por lo cual, se concluye que el sistema S_1 se reduce a una fuerza cuya línea de acción pasa por el origen

Se puede resolver considerando solamente el volumen

	$\bar{x}_i$ [in]	$\bar{y}_i$ [in]	$\bar{z}_i$ [in]	W_i [lb]	$\bar{x}_i W_i$ [lb·in]	$\bar{y}_i W_i$ [lb·in]	$\bar{z}_i W_i$ [lb·in]
①	0	4	5	5.63	0	22.50	28.13
②	8	6	0	12	96	72	0
③	8	0	7.5	15	120	0	112.50
④	8	0	2.55	3.53	28.27	0	9



$W_T = W_1 + W_2 + W_3 - W_4 = 29.09$ lb

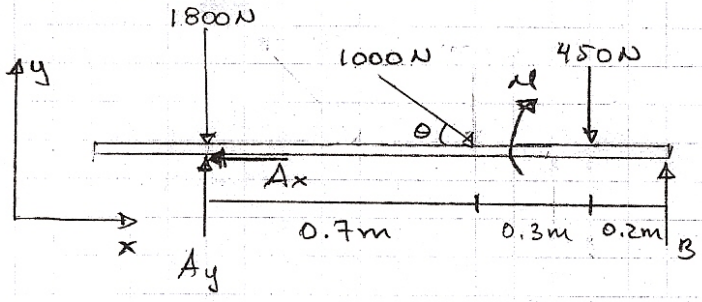
$\Sigma \bar{x}_i W_i = x_1 W_1 + x_2 W_2 + x_3 W_3 - x_4 W_4 = 187.73$ lb·in

$\Sigma \bar{y}_i W_i = y_1 W_1 + y_2 W_2 + y_3 W_3 - y_4 W_4 = 94.50$ lb·in

$\Sigma \bar{z}_i W_i = z_1 W_1 + z_2 W_2 + z_3 W_3 - z_4 W_4 = 131.63$ lb·in

$\bar{x} = 6.45$ in , $\bar{y} = 3.25$ in , $\bar{z} = 4.52$ in

4)



$M = 2300$ N ; $\cos\theta = \frac{3}{5}$; $\operatorname{sen}\theta = \frac{4}{5}$

$\Sigma F_x = 1000\left(\frac{3}{5}\right) - A_x = 0 \rightarrow A_x = 600$ N

$\Sigma F_y = A_y + B - 1800 - 450 - 1000\left(\frac{4}{5}\right) = 0$

$A_y + B = 3050$

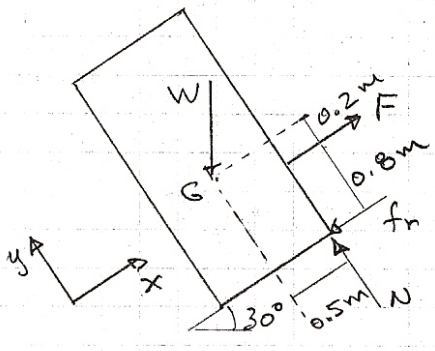
$\Sigma M_A = -0.7(1000)\left(\frac{4}{5}\right) - 1(450) + 1.2B - 2300 = 0 \Rightarrow$

$B = 2758.33$ N

$A_y = 291.66$ N

$A = 667.13$ N

5)



Deslizamiento

$\Sigma F_x = F - f_r - W \operatorname{sen} 30° = 0$

$\Sigma F_y = N - W\cos 30° = 0$ $\quad N = \frac{\sqrt{3}}{2} W$

de $f_r = \mu_s N = \frac{\sqrt{3}}{2} \mu_s N$

sust. en $\Sigma F_x \rightarrow F = \frac{1}{2}(\sqrt{3}\,\mu_s + 1) W$