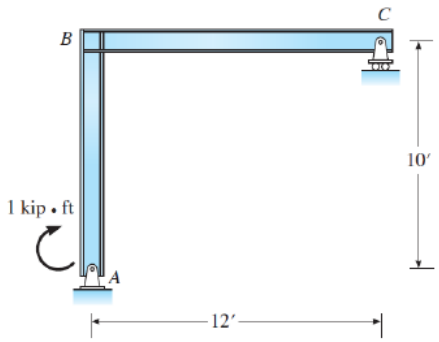
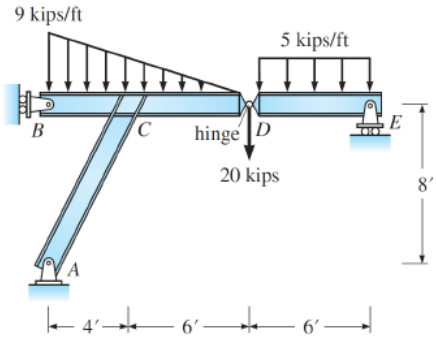
Problem 1. Determine the reactions of the following structures. All dimensions are measured from the centerline of members.



(a)



(b)

P1 (a) $\Sigma M_A = 0$

$1 - C_y \cdot 12' = 0$

$\Rightarrow C_y = \frac{1}{12} = 0.083 \text{ kips} \uparrow$

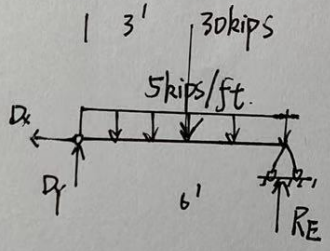
$\Sigma F_A = 0$

$C_y - A_y = 0$

$\Rightarrow A_y = 0.083 \text{ kips} \downarrow$

$\Sigma F_x = 0 \Rightarrow A_x = 0$

(b) Freebody Diagram Right of Hinge D



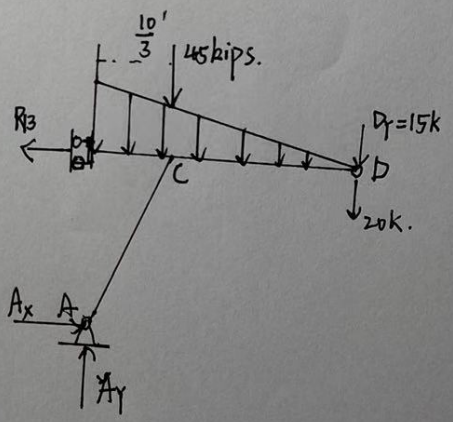
$\Sigma M_D = 0 \quad 30^k(3') - R_E \cdot 6' = 0$

$R_E = 15 \text{ kips} \uparrow$

$\Sigma F_y = 0; \quad D_y - 30^k + R_E - 15^k = 0$

$D_y = 15 \text{ kips} \uparrow$

Freebody Diagram Left of Hinge D



$\Sigma M_A = 0 \quad -R_B 8' + 45^k(\frac{10'}{3}) + 35^k(10') = 0$

$R_B = 62.5 \text{ kips} \leftarrow$

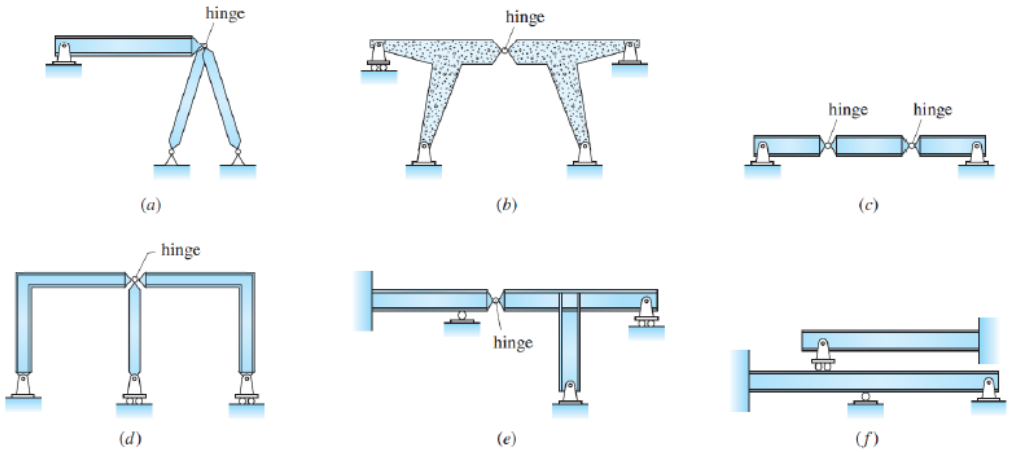
$\Sigma F_x = 0 \quad A_x - R_B = 0$

$A_x = 62.5 \text{ kips} \rightarrow$

$\Sigma F_y = 0 \quad A_y - 45^k - 15^k - 20^k = 0$

$A_y = 80 \text{ kips} \uparrow$

Problem 2. Classify the structures below. Indicate if stable or unstable. If unstable, indicate the reason. If the structure is stable, indicate if determinate or indeterminate. If indeterminate, specify the degree.



(a) Indeterminate 1^o

(b) Indeterminate 3^o

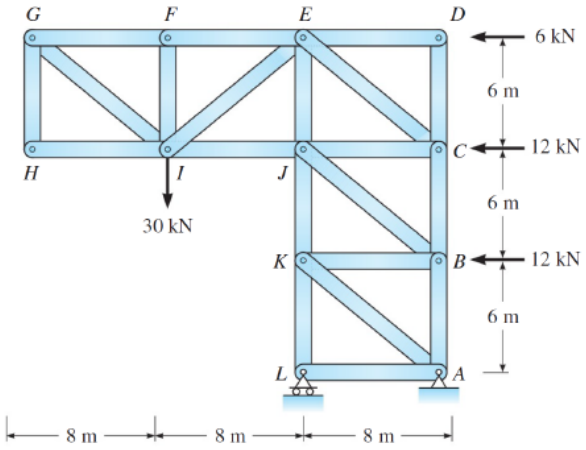
(c) Unstable $D = r + b - 2n = 3 + 4 - 2 \times 4 = -1 < 0$

(d) Indeterminate 2^o

(e) Indeterminate 3^o

(f) Indeterminate 4^o

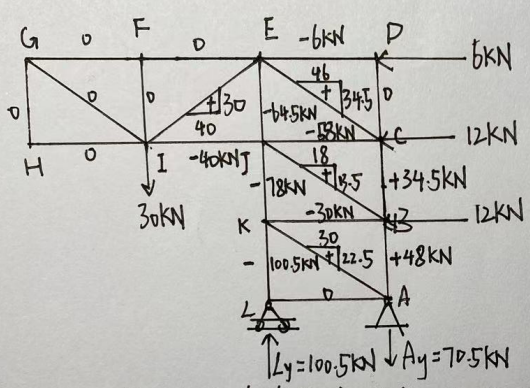
Problem 3. Using the method of joints, determine the force in all truss bars. Indicate tension or compression.



P3.

\+ tension

− compression



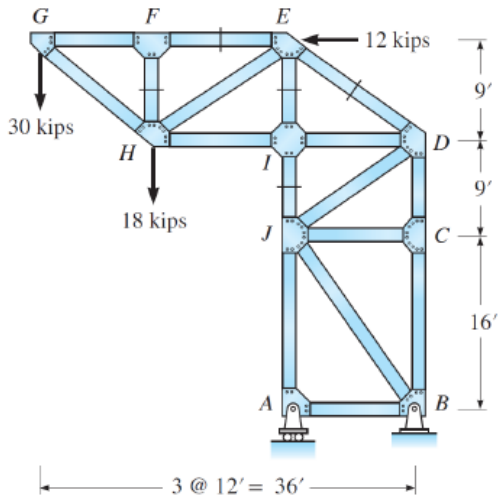
$\Sigma M_L = 0 \quad -30\cdot(8m) - 6\cdot(18m) - 12\cdot(12m) - 12\cdot(6m) + A_y(8m) = 0$

$A_y = 70.5\,kN\downarrow$

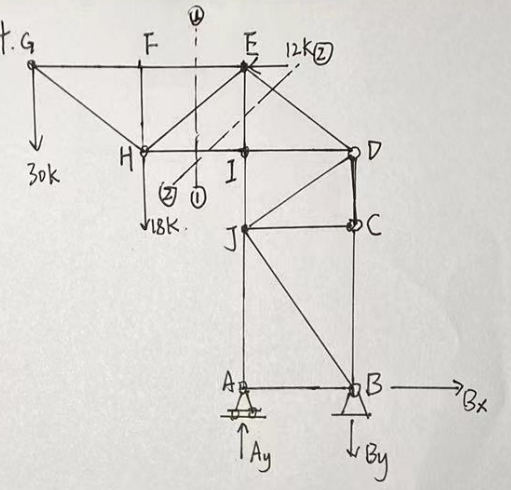
$\Sigma F_y = 0 \quad -30 - 70.5 + L_y = 0$

$L_y = 100.5\,kN\uparrow$

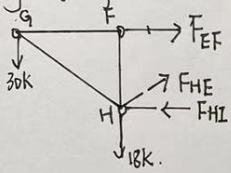
Problem 4. Using the method of sections, determine the forces in the bars EF, EI, ED, FH, and IJ.



P4.



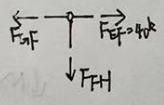
Freebody Left of Section ① to Compute Force in Bar EF:



$\Sigma M_H = 0 \quad F_{EF}(9') - 30^k(12') = 0$

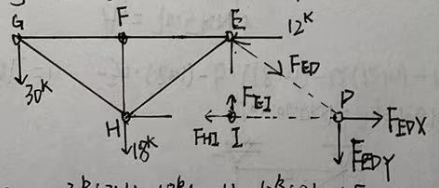
$F_{EF} = 40^k$ tension

Freebody Joint F:



$\Sigma F_y = 0 \quad F_{FH} = 0$

Freebody Left of Section ② to Compute Forces in Bars EI&ED:



$\Sigma M_D = 0 \quad -30^k(36') - 18^k(24') - 12^k(9') + F_{EI}(12') = 0$

$F_{EI} = 135^k$ compression

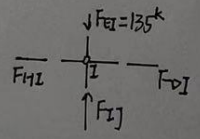
$\Sigma M_I = 0 \quad -30^k(24') - 18^k(12') - 12^k(9') + F_{EDY}(12') = 0$

$F_{EDY} = 87^k \downarrow$

$\frac{F_{EDX}}{4} = \frac{87^k}{3}, \quad F_{EDX} = 116^k$

Thus $F_{ED} = 145^k$ tension

Freebody Joint I:



$\Sigma F_y = 0 \quad -F_{EI} + F_{IJ} = 0$

$F_{IJ} = 135^k$ compression