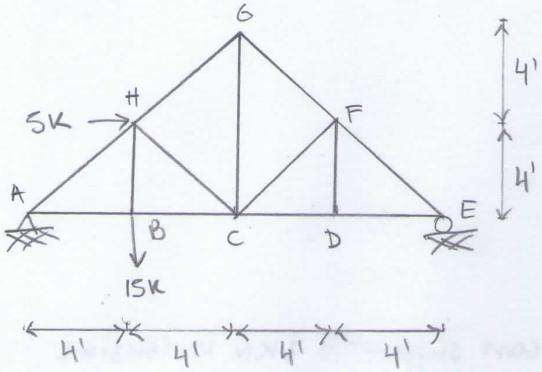
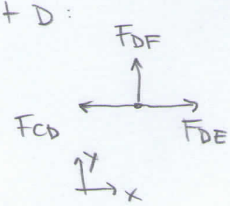
HOMEWORK 2 Solutions

Problem 1:



a) Determine all zero force members

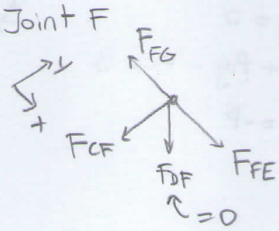
Joint D:



$\Sigma F_y = 0$

$\boxed{F_{DF} = 0}$

Joint F



$\Sigma F_y = 0$

$\boxed{F_{CF} = 0}$

b) Determine forces in members BC, CH, GH. State whether forces are in tension or compression.

Determine support reactions:

$\xrightarrow{+} \Sigma F_x = 0$

$A_x + 5K = 0$

$\boxed{A_x = -5K}$

$+\circlearrowleft \Sigma M_A = 0$

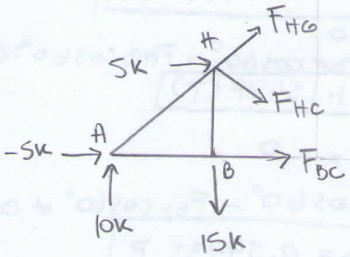
$-15K(4') - 5K(4') + E_y(16') = 0$

$E_y = 5K$

$+\uparrow \Sigma F_y = 0$

$A_y - 15K + E_y = 0$

$A_y = 10K$



Method of sections:

$+\circlearrowleft \Sigma M_H = 0$

$-5K(4') - 10K(4') + F_{BC}(4') = 0$

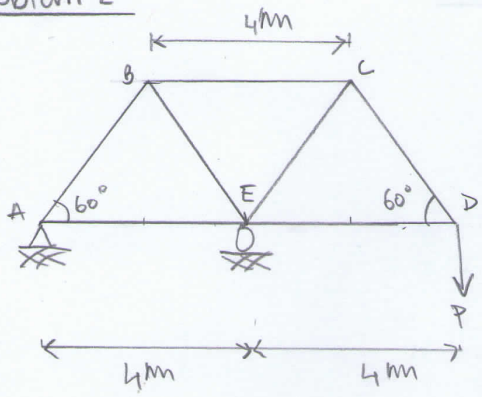
$\boxed{F_{BC} = 15K\ (T)}$

$$\begin{cases} \xrightarrow{+} \Sigma F_x = 0 \\ -5K + 5K + \cancel{F_{BC}}^{15K} + F_{HC}\cos 45^\circ + F_{HG}\cos 45^\circ = 0 \\ +\uparrow \Sigma F_y = 0 \\ 10K - 15K - F_{HC}\sin 45^\circ + F_{HG}\sin 45^\circ = 0 \end{cases}$$

Solve system of equations.

$\boxed{F_{HC} = 14.4K\ (C)}$ $\boxed{F_{HG} = 7.07K\ (C)}$

Problem 2:



If the maximum force that any member can support is 8KN in tension and 6KN in compression, determine the maximum force P that can be supported at D.

Determine support reactions:

$+\circlearrowleft \Sigma M_A = 0$

$E_y(4m) - P(8m) = 0$

$E_y = 2P$

$+\uparrow \Sigma F_y = 0$

$E_y + A_y - P = 0$

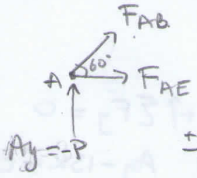
$A_y = -P$

$\xrightarrow{+} \Sigma F_x = 0$

$A_x = 0$

Method of joints:

Joint A:



$+\uparrow \Sigma F_y = 0$

$F_{AB}\sin 60° + (-P) = 0$

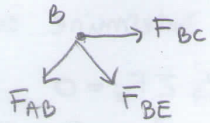
$\boxed{F_{AB} = 1.1547P \ (T)}$

$\xrightarrow{+} \Sigma F_x = 0$

$F_{AE} + F_{AB}\cos 60° = 0$

$\boxed{F_{AE} = -0.57735P \ (C)}$

Joint B:



$+\uparrow \Sigma F_y = 0$

$-F_{AB}\sin 60° - F_{BE}\sin 60° = 0$

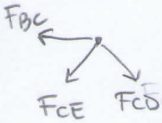
$\boxed{F_{BE} = -1.1547P \ (C)}$

$\xrightarrow{+} \Sigma F_x = 0$

$F_{BC} + F_{BE}\cos 60° - F_{AB}\cos 60° = 0$

$\boxed{F_{BC} = 1.1547P \ (T)}$

Joint C:



$\xrightarrow{+} \Sigma F_x = 0$

$-F_{BC} + F_{CD}\cos 60° - F_{CE}\cos 60° = 0$

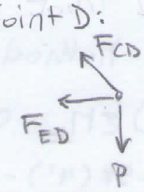
$+\uparrow \Sigma F_y = 0$

$-F_{CE}\sin 60° - F_{CD}\sin 60° = 0$

$\boxed{F_{CE} = 1.1547P \ (T)}$

$\boxed{F_{CD} = 1.1547P \ (T)}$

Joint D:



$\xrightarrow{+} \Sigma F_x = 0$

$-F_{CD}\cos 60° - F_{ED}\cos 60° = 0$

$\boxed{F_{ED} = 0.57735P}$

From the above analysis, the maximum compression and tension in the truss members is 1.1547P.

Compression: $1.1547P = 6KN$

$P = 5.19615 \ KN$

$P \approx 5.2 \ KN$ (governs)

Tension: $1.1547P = 8KN$

$P = 6.9282 \ KN$

In this case, compression controls which requires $\boxed{P = 5.2 \ KN}$