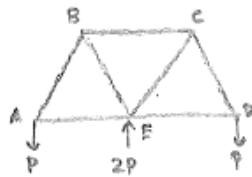


HOMEWORK 2 SOLUTIONS

Problem 1:

$$T_{max} = 8 \text{ k} \quad C_{max} = 5 \text{ k}$$



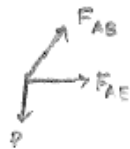
Due to symmetry

$$F_{AB} = F_{ED}$$

$$F_{AE} = F_{DE}$$

$$F_{BE} = F_{CE}$$

Joint A



$$\sum F_x = 0: F_{AB} \cos 60^\circ + F_{AE} = 0$$

$$\sum F_y = 0: F_{AB} \sin 60^\circ - P = 0$$

$$F_{AE} = -\frac{P}{\tan 60^\circ}$$

$$F_{AB} = \frac{P}{\sin 60^\circ}$$

Joint B



$$\sum F_x = 0: -F_{AB} \cos 60^\circ + F_{BE} \cos 60^\circ + F_{BC} = 0$$

$$\sum F_y = 0: -F_{AB} \sin 60^\circ - F_{BE} \sin 60^\circ = 0$$

$$F_{BC} = \frac{2P}{\tan 60^\circ}$$

$$F_{BE} = -\frac{P}{\sin 60^\circ}$$

Solve for smallest P

$$F_{AB} = F_{ED} = \frac{P}{\sin 60^\circ} = 8 \Rightarrow P = 6.93 \text{ k}$$

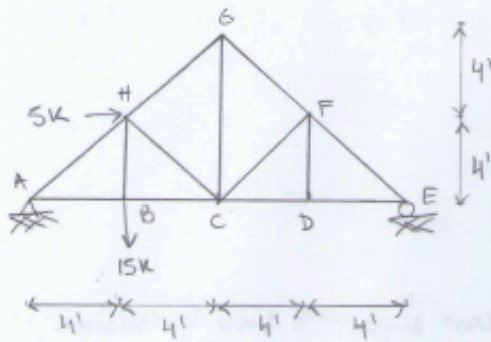
$$F_{AE} = F_{DE} = -\frac{P}{\tan 60^\circ} = -5 \Rightarrow P = 8.66 \text{ k}$$

$$F_{BC} = \frac{2P}{\tan 60^\circ} = 8 \Rightarrow P = 4.33 \text{ k}$$

$$F_{BE} = F_{CE} = -\frac{P}{\sin 60^\circ} = -5 \Rightarrow P = 4.33 \text{ k}$$

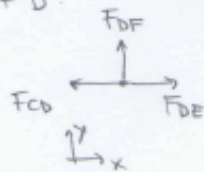
$$\Rightarrow \boxed{P_{max} = 4.33 \text{ k}}$$

Problem 2:



a) Determine all zero force members

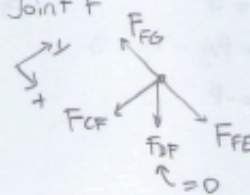
Joint D:



$$\sum F_y = 0$$

$$F_{DF} = 0$$

Joint F:



$$\sum F_y = 0$$

$$F_{FC} = 0$$

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

Determine support reactions:

$$\sum F_x = 0$$

$$A_x + 5k = 0$$

$$A_x = -5k$$

$$\sum M_A = 0$$

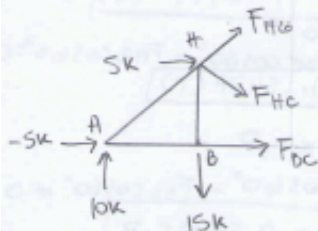
$$-15k(4') - 5k(4') + E_y(16') = 0$$

$$E_y = 5k$$

$$\sum F_y = 0$$

$$A_y - 15k + E_y = 0$$

$$A_y = 10k$$



Method of sections:

$$\sum M_H = 0$$

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

$$F_{BC} = 15k (T)$$

$$\sum F_x = 0$$

$$-5k + 5k + F_{BC} + F_{CH} \cos 45^\circ + F_{HG} \cos 45^\circ = 0$$

$$\sum F_y = 0$$

$$10k - 15k - F_{CH} \sin 45^\circ + F_{HG} \sin 45^\circ = 0$$

Solve system of equations.

$$F_{CH} = 14.4k (C)$$

$$F_{HG} = 7.07k (C)$$

Problem 3:

$\sum F_x = 0: 12 - A_x = 0$
 $A_x = 12 \text{ kips}$

$\sum M_A = 0: D_y(24) - 15(16) - 12(6) = 0$
 $D_y(24) = 312$
 $D_y = 13 \text{ kips}$

$\sum F_y = 0: -15 + 13 + A_y = 0$
 $A_y = 2 \text{ kips}$

FBD of cut

$\tan x = \frac{6}{8}$
 $x = 36.87^\circ$

$\sum F_y = 0: -15 + 13 + F_{FC} \sin(36.87) = 0$
 $F_{FC} = \frac{2}{\sin(36.87)}$
 $F_{FC} = 3.33 \text{ kips (T)}$

$\sum M_F = 0: 13(16) - 15(8) - F_{BC}(6) = 0$
 $-F_{BC} = -\frac{88}{6}$
 $F_{BC} = 14.67 \text{ kips (T)}$

$\sum F_x = 0: -F_{BC} - F_{FC} \cos(36.87) - F_{FG} = 0$
 $-F_{FG} = (14.67) + (3.33) \cos(36.87)$
 $F_{FG} = 17.33 \text{ kips (C)}$