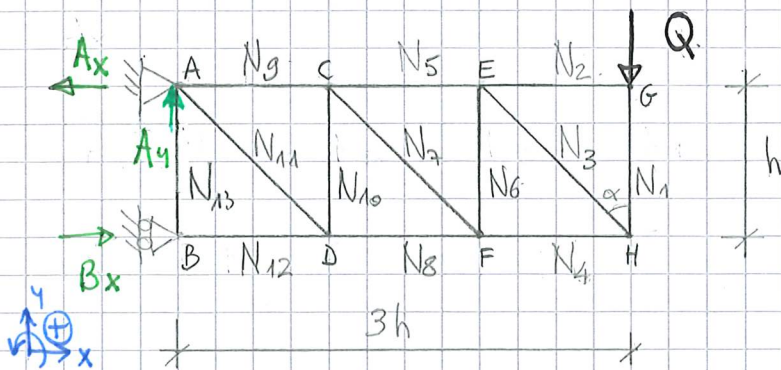


Exercice 9



$$\alpha = 45^\circ : \sin 45^\circ = \cos 45^\circ = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$$

Réactions d'appui

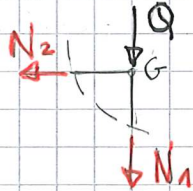
$$\sum F_x = 0 : -A_x + B_x = 0 \Rightarrow A_x = B_x$$

$$\sum F_y = 0 : A_y - Q = 0 \Rightarrow A_y = Q$$

$$\sum M_A = 0 : B_x \cdot h - Q \cdot 3h = 0 \Rightarrow B_x = 3Q \text{ et } A_x = 3Q$$

Efforts intérieurs

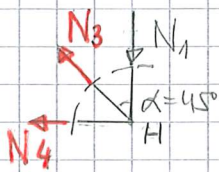
noeud G



$$\sum F_x = 0 : -N_2 = 0$$

$$\sum F_y = 0 : -N_1 - Q = 0 \Rightarrow N_1 = -Q$$

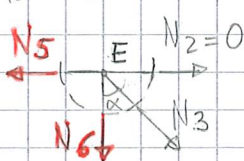
noeud H



$$\sum F_y = 0 : N_3 \cos \alpha - N_1 = 0 \Rightarrow N_3 = \frac{N_1}{\cos \alpha} = \frac{Q}{\cos 45^\circ} = \sqrt{2}Q$$

$$\sum F_x = 0 : -N_4 - N_3 \sin 45^\circ = 0 \Rightarrow N_4 = -N_3 \sin 45^\circ = \frac{-Q \sin 45^\circ}{\cos 45^\circ} = -Q$$

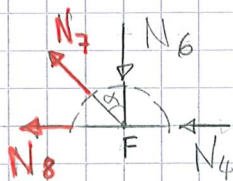
noeud E



$$\sum F_x = 0 : -N_5 + N_3 \sin 45^\circ = 0 \Rightarrow N_5 = N_3 \sin 45^\circ = \frac{Q \sin 45^\circ}{\cos 45^\circ} = Q$$

$$\sum F_y = 0 : -N_6 - N_3 \cos 45^\circ = 0 \Rightarrow N_6 = -N_3 \cos 45^\circ = \frac{-Q \cos 45^\circ}{\cos 45^\circ} = -Q$$

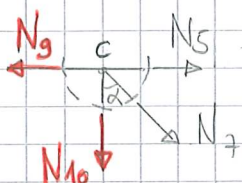
noeud F



$$\sum F_y = 0: N_7 \cdot \cos 45^\circ - N_6 = 0 \Rightarrow N_7 = \frac{N_6}{\cos 45^\circ} = \frac{Q}{\cos 45^\circ} = \sqrt{2}Q$$

$$\sum F_x = 0: -N_8 - N_4 - N_7 \sin 45^\circ = 0 \Rightarrow N_8 = -N_4 - N_7 \sin 45^\circ = -Q - \frac{Q}{\cos 45^\circ} \cdot \sin 45^\circ = -2Q$$

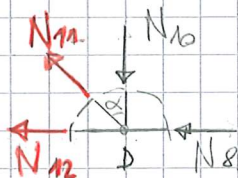
noeud C



$$\sum F_x = 0: -N_9 + N_5 + N_7 \sin 45^\circ = 0 \Rightarrow N_9 = N_5 + N_7 \sin 45^\circ = Q + \frac{Q}{\cos 45^\circ} \sin 45^\circ = 2Q$$

$$\sum F_y = 0: -N_{10} - N_7 \cos 45^\circ = 0 \Rightarrow N_{10} = -N_7 \cos 45^\circ = -\frac{Q}{\cos 45^\circ} = -Q$$

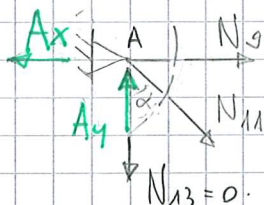
noeud D



$$\sum F_y = 0: N_{11} \cdot \cos 45^\circ - N_{10} = 0 \Rightarrow N_{11} = \frac{N_{10}}{\cos 45^\circ} = \frac{Q}{\cos 45^\circ} = \sqrt{2}Q$$

$$\sum F_x = 0: -N_{12} - N_8 - N_{11} \sin 45^\circ = 0 \Rightarrow N_{12} = -N_8 - N_{11} \sin 45^\circ = -2Q - \frac{Q}{\cos 45^\circ} \sin 45^\circ = -3Q$$

noeud A

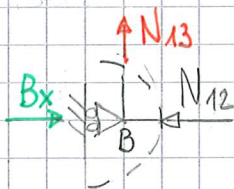


Vérification

$$\sum F_x = -A_x + N_9 + N_{11} \sin 45^\circ = -3Q + 2Q + \frac{Q}{\cos 45^\circ} \sin 45^\circ = 0 \quad \checkmark$$

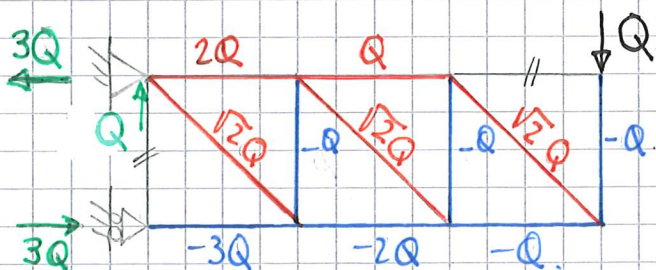
$$\sum F_y = A_y - N_{11} \cos 45^\circ = Q - \frac{Q}{\cos 45^\circ} \cos 45^\circ = 0 \quad \checkmark$$

noeud B

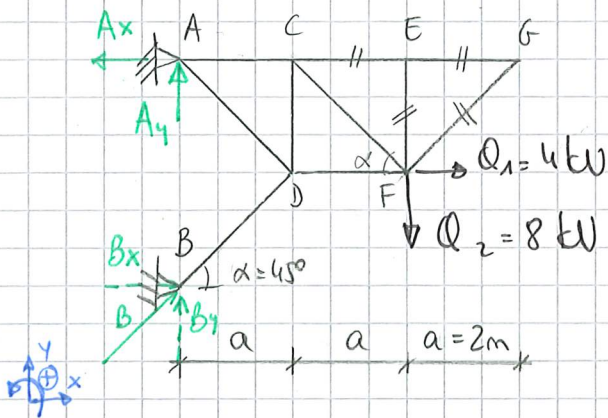


$$\sum F_x = B_x - N_{12} = 3Q - 3Q = 0 \quad \checkmark \quad \text{Vérification.}$$

$$\sum F_y = 0 \Rightarrow N_{13} = 0$$



Exercice 10



B est parallèle à la barre BD.
incliné à $45^\circ \Rightarrow B_x = B_y = B \sin 45^\circ$

Barres à effort nul : CE, EG, EF, FG

Réactions d'appui

$$\sum M_A = 0 : B_x \cdot 2a + Q_1 \cdot a - Q_2 \cdot 2a = 0 \Rightarrow B_x = \frac{2Q_2 - Q_1}{2} = \frac{2 \cdot 8 - 4}{2} = 6 \text{ kN}$$

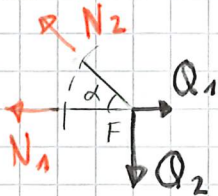
$$\sum F_x = 0 : B_x - A_x + Q_1 = 0 \Rightarrow A_x = B_x + Q_1 = 6 + 4 = 10 \text{ kN}$$

$$\sum F_y = 0 : B_y + A_y - Q_2 = 0 \Rightarrow A_y = Q_2 - B_y = 8 - 6 = 2 \text{ kN}$$

$$\text{avec } B_y = B_x = 6 \text{ kN car } \alpha = 45^\circ \quad \text{et } B = \frac{B_x}{\cos 45^\circ} = \frac{6}{\cos 45^\circ} = 8,49 \text{ kN}$$

Efforts intérieurs

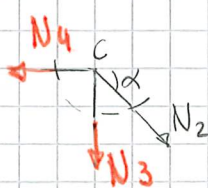
noeud F



$$\sum F_y = 0 : N_2 \sin \alpha - Q_2 = 0 \Rightarrow N_2 = \frac{Q_2}{\sin \alpha} = \frac{8}{\sin 45^\circ} = 11,31 \text{ kN}$$

$$\sum F_x = 0 : -N_1 - N_2 \cos \alpha + Q_1 = 0 \Rightarrow N_1 = -N_2 \cos \alpha + Q_1 = -11,31 \cos 45^\circ + 4 = -4 \text{ kN}$$

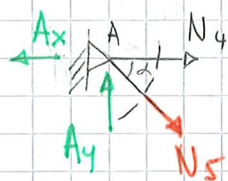
noeud C



$$\sum F_y = 0 : -N_3 - N_2 \sin \alpha = 0 \Rightarrow N_3 = -N_2 \sin \alpha = -11,31 \sin 45^\circ = -8 \text{ kN}$$

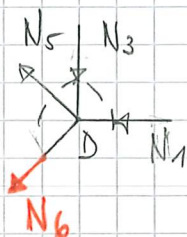
$$\sum F_x = 0 : -N_4 + N_2 \cos \alpha = 0 \Rightarrow N_4 = N_2 \cos \alpha = 11,31 \cos 45^\circ = 8 \text{ kN}$$

nœud A



$$\sum F_y = 0: -N_5 \cdot \sin \alpha + A_y = 0 \Rightarrow N_5 = \frac{A_y}{\sin \alpha} = \frac{2}{\sin 45^\circ} = 2,83 \text{ kN}$$

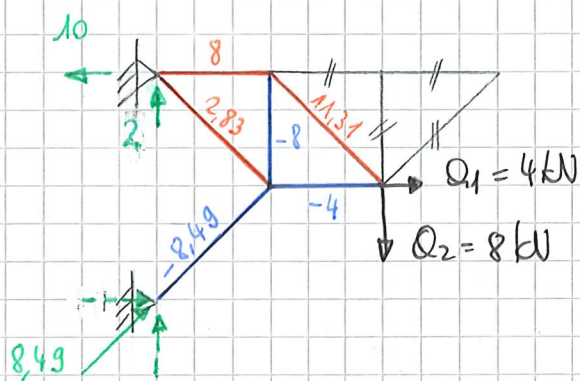
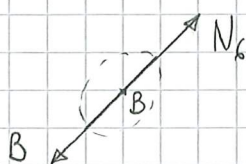
nœud D



$$\sum F_x = 0: -N_5 \cos \alpha - N_6 \cos \alpha + N_1 = 0 \Rightarrow N_6 = \frac{-N_1}{\cos \alpha} = N_5 = \frac{-4}{\cos 45^\circ} = -8,49 \text{ kN}$$

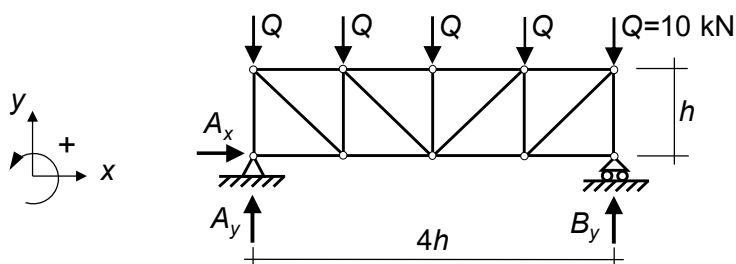
nœud B:

$$\text{Vérification: } N_6 = -8,49 \text{ kN} = B \quad \checkmark$$



forces en kN

Exercice 11

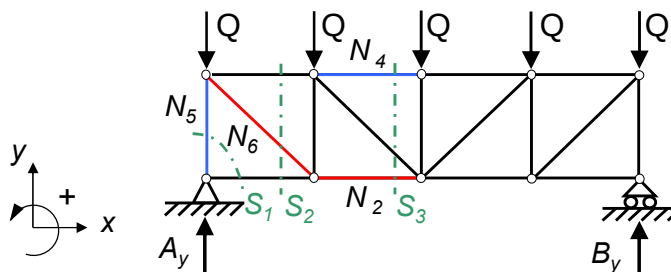


A_x, A_y, B_y : réactions d'appuis
 $N_1 - N_{17}$: efforts normaux dans les barres

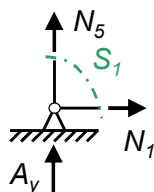
Réactions d'appuis

$$\begin{cases} \sum F_x = 0 : & \Rightarrow A_x = 0 \text{ kN} \\ \sum F_y = 0 : A_y - 5Q + B_y = 0 & \Rightarrow A_y = 5Q - B_y = 5Q - \frac{5Q}{2} = \frac{5Q}{2} = \frac{5 \cdot 10}{2} = 25 \text{ kN} \\ \sum M_A = 0 : B_y \cdot 4h - Q \cdot 4h - Q \cdot 3h - Q \cdot 2h - Q \cdot h = 0 & \Rightarrow B_y = \frac{10Q}{4} = \frac{10 \cdot 10}{4} = 25 \text{ kN} \end{cases}$$

Barres les plus sollicitées :

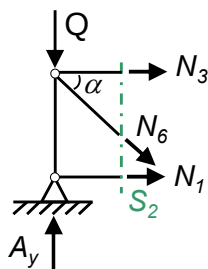


Coupe S_1 :



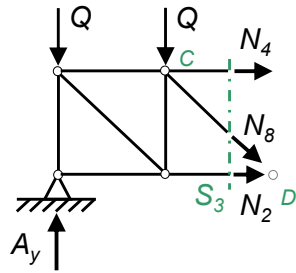
$$\begin{aligned} \sum F_y = 0 : A_y + N_5 &= 0 \\ \Rightarrow N_5 &= -A_y = -25 \text{ kN} \end{aligned}$$

Coupe S_2 :



$$\begin{aligned} \sum F_y = 0 : A_y - Q - N_6 \cdot \sin \alpha &= 0 \\ \Rightarrow N_6 &= \frac{A_y - Q}{\sin \alpha} = \frac{25 - 10}{\sin 45^\circ} = 21.2 \text{ kN} \end{aligned}$$

Coupe S_3 :



$$\sum M_C = 0 : -A_y \cdot h + Q \cdot h + N_2 \cdot h = 0$$

$$\Rightarrow N_2 = A_y - Q = 25 - 10 = 15 \text{ kN}$$

$$\sum M_D = 0 : -A_y \cdot 2h + Q \cdot 2h + Q \cdot h - N_4 \cdot h = 0$$

$$\Rightarrow N_4 = -2A_y + 2Q + Q = -2 \cdot 25 + 3 \cdot 10 = -20 \text{ kN}$$

Efforts déterminants :

