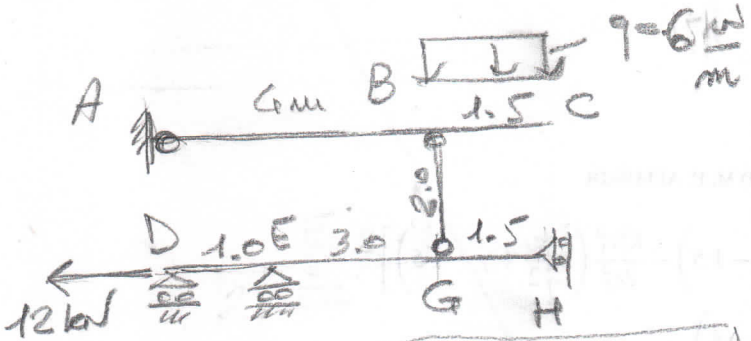
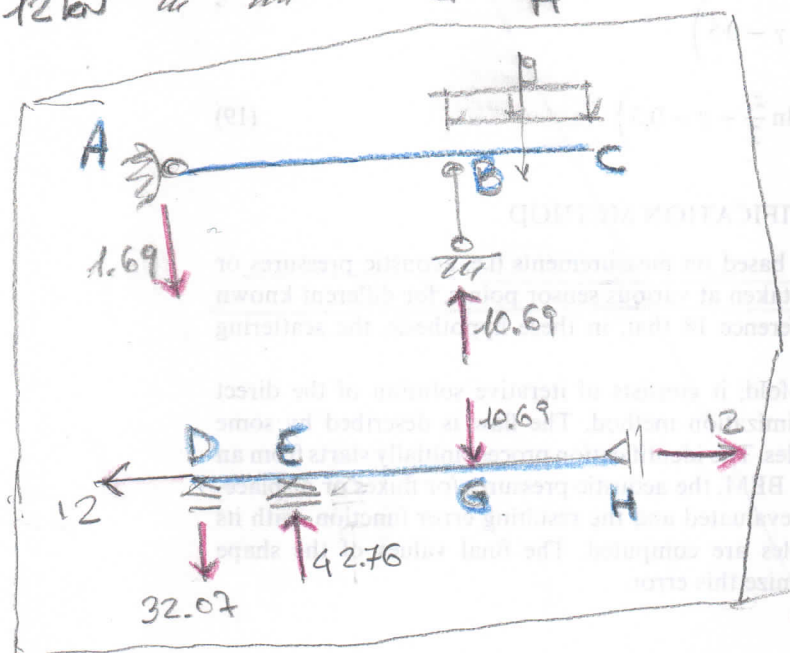
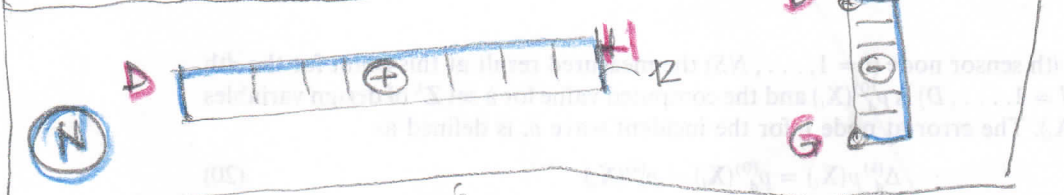
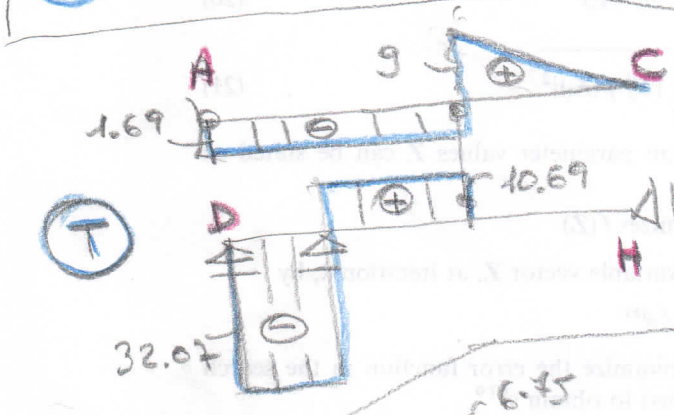
ES. 1

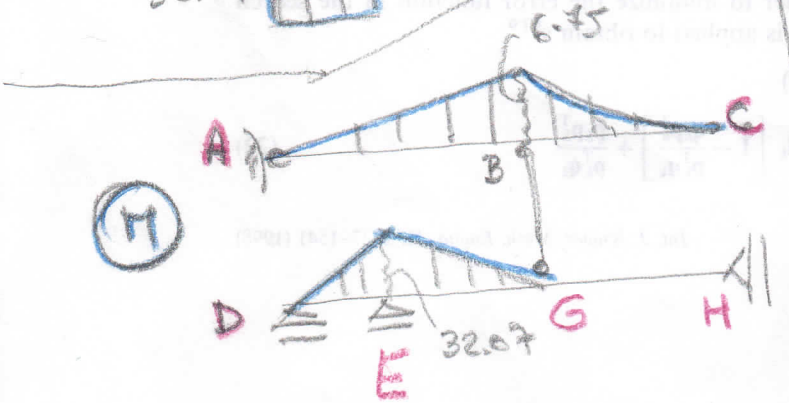




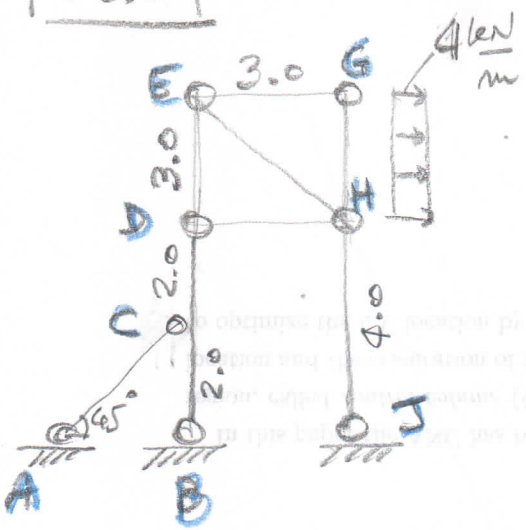


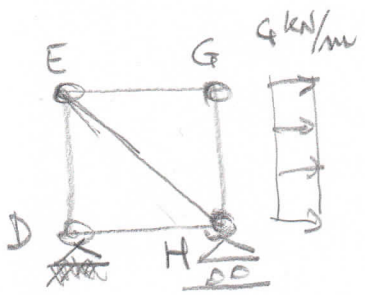


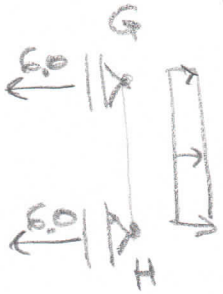
$$\Delta l_{DH} = \frac{12000\,N * 5500\,mm}{210000\,\frac{N}{mm^2} * 100\,mm^2} = 3.1\,mm$$

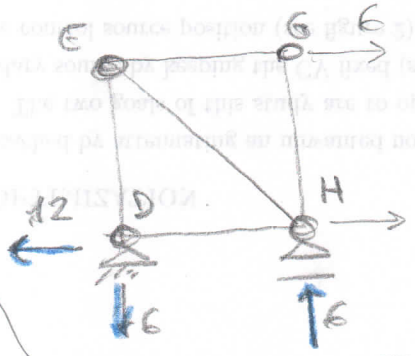


ES.2

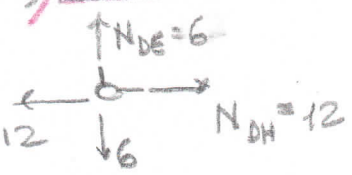




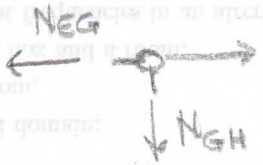




1) Nodo D



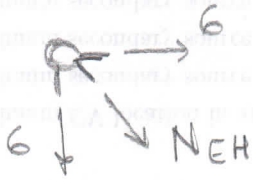
2) Nodo G



$N_{GH} = 0$

$N_{EG} = 6$

3) Nodo E

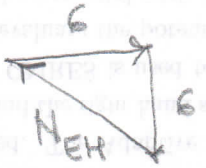


$6 + N_{EH}\frac{\sqrt{2}}{2} = 0$

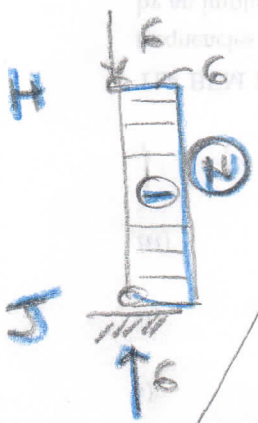
$\Downarrow$

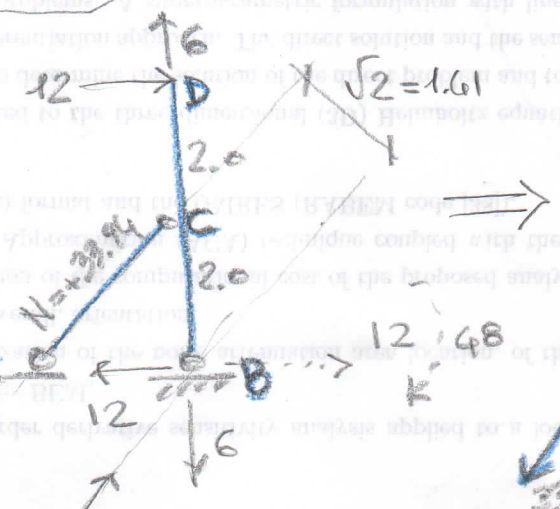
$N_{EH} = -6\sqrt{2}$

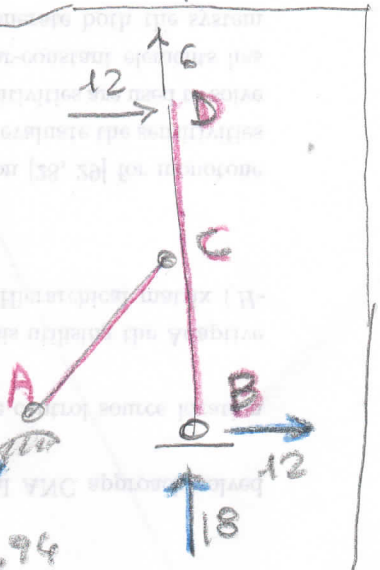
oppure



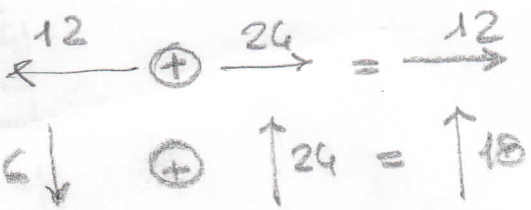
	DE	DH	GH	EG	EH
N	6	12	$\emptyset$	6	$-6\sqrt{2} = -8.49$

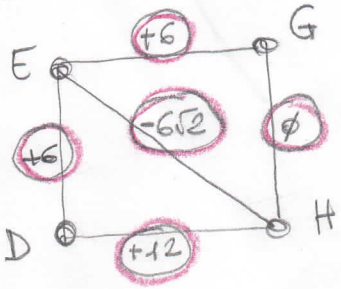


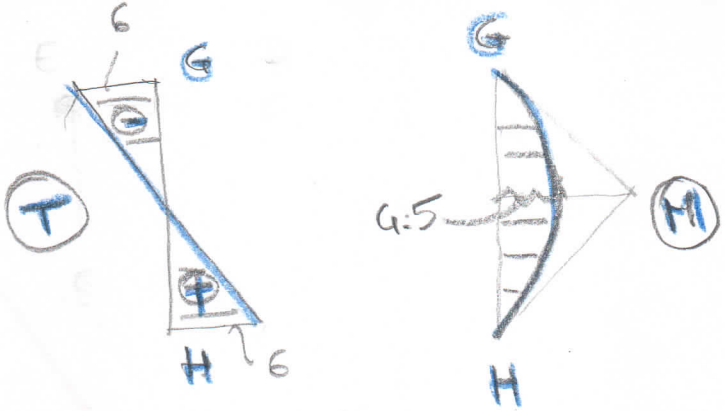




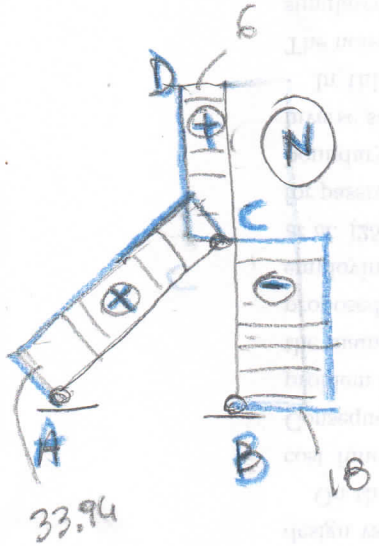
$\frac{48}{\sqrt{2}} = 24\sqrt{2} = 33.94$

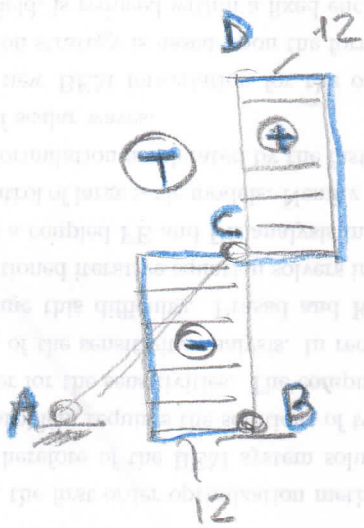


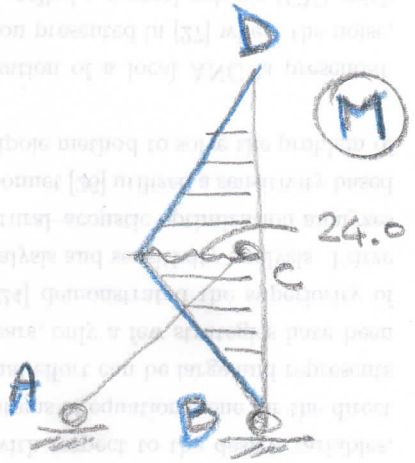



6
G
T
H
6

G
4.5
M
H

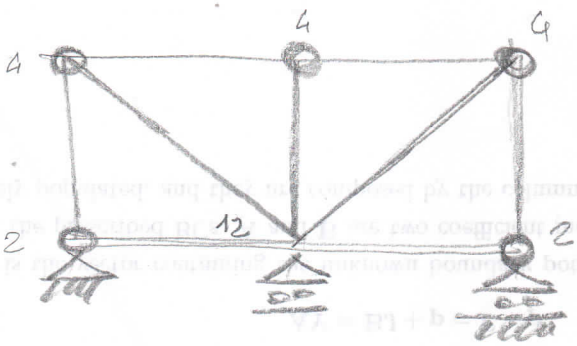

6
D
N
C
A
B
18
33.94


D
12
T
C
A
B
12


D
M
24.0
C
A
B

ES. 3

φ.4



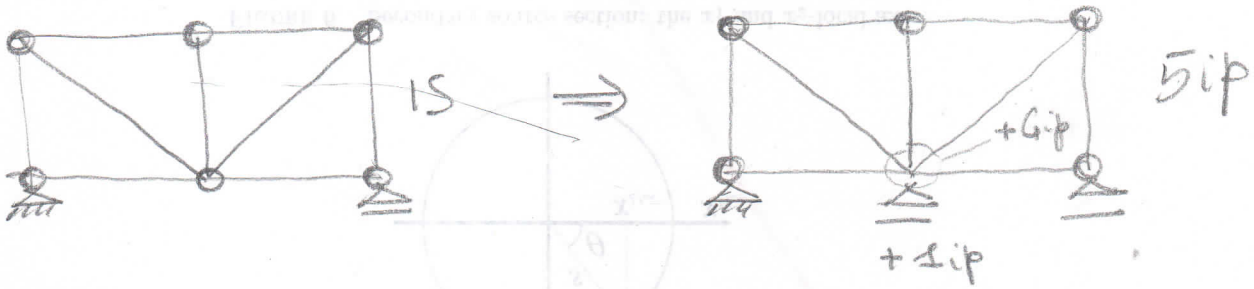
$3t = 3 \times 9 = 27 \quad s = \overset{ext}{4} + \overset{int}{28} \quad 3t - s = 27 - 32 = -5$

5 i.p

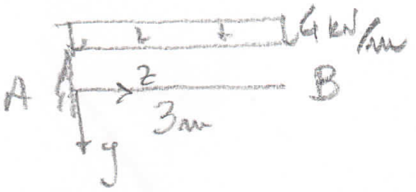
oppure:

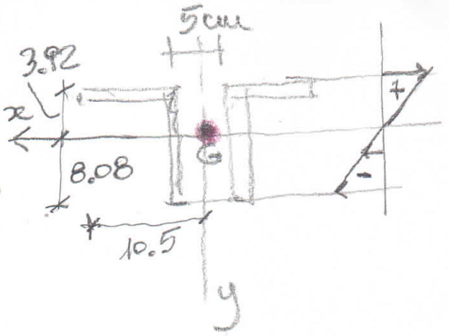
$3t = 3 \times 5 = 15 \quad s = \overset{ext}{4} + \overset{int}{16}$ 5 i.p

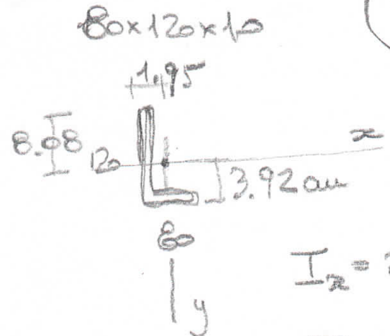
oppure



ES. 4







$I_x = 276\ cm^4$

$I_y = 80.8$

$A = 19.1\ cm^2$

Determinare G delle sezioni

I_x e I_y Diagramma σ_z

$M = M^{AB}_{max} = 4 \times \frac{9}{2} = 18\ kNm$ Valore di σ_z^{max}

Un tipo nocciolo centrale

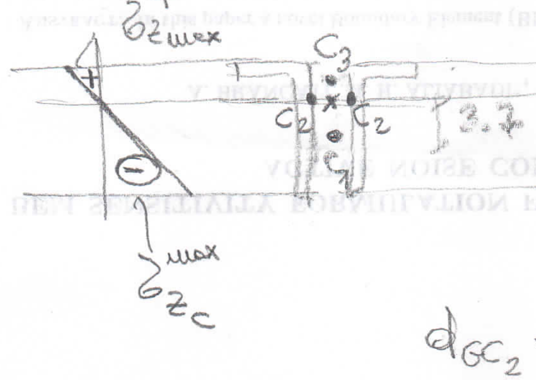
$y_G = 3.92\ cm$ $I_x = 2 \times 276 = 552\ cm^4$

$I_y = 2\left[80.8 + 19.1 \cdot (2.5 + 1.95)^2\right] = 918\ cm^4$

$\sigma^{comp}_{z\,max} = \frac{-18 \cdot 10^6}{552 \times 10^4} \times 80.8 = -263\ N/mm^2$

$\sigma^{+}_{z\,max} = \frac{-18 \cdot 10^6}{552 \times 10^4} \times (-39.2) = +128\ N/mm^2$

$3.92 \cdot d_{GC_1} = \rho_x^2 \quad d_{GC_1} = \frac{552}{2 \cdot 19.1} \frac{1}{3.92} = 3.7\ cm$



$d_{GC_2} = \frac{918}{2 \cdot 19.1} \frac{1}{10.5} = 2.3\ cm$

$d_{GC_3} = \frac{552}{2 \times 19.1} \frac{1}{8.08} = 1.8\ cm$