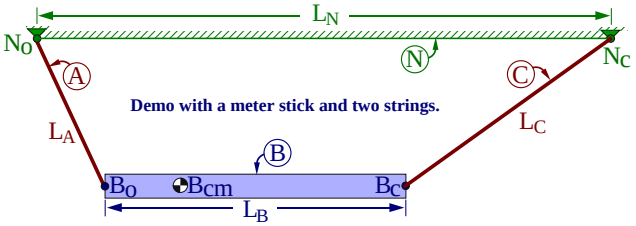
13.14 † Cable length to keep a window-washer's beam stationary and horizontal.

A beam B is attached to the roof of a building N by two relatively light (massless) cables A and C.
Cable A attaches to the roof at point N_o of N and to the beam at point B_o of B.
Cable C attaches to the roof at point N_C of N and to the beam at point B_C of B.
N_o, B_o, B_{cm}, B_C, N_C are all in the same vertical plane. B_{cm} (center of mass of beam/workers) is $\frac{L_B}{4}$ from B_o.

Description	Symbol	Type	Value
Distance between N_o and N_C	L_N	Constant	16 m
Distance between B_o and B_C	L_B	Constant	7 m
Length of cable A	L_A	Constant	7 m
Length of cable C	L_C	Constant	? m



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Determine L_C so the beam stays horizontal.

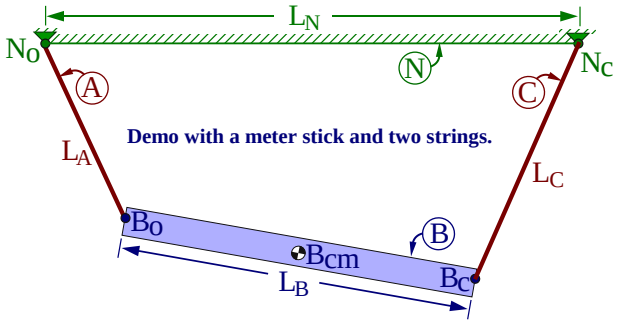
Result: $L_C =$ 9 m

If $L_B = L_N$, intuition/analysis predicts $L_C = L_A$ (vertical cables), independent of B_{cm}'s location between B_o and B_C.

13.15 † Beam location (if you are unable to do this, first try Homeworks 4.13, 13.14).

A uniform beam B is attached to a roof N by two cables (A and C).
Cable A attaches to the roof at point N_o of N and to the beam at point B_o of B.
Cable C attaches to the roof at point N_C of N and to the beam at point B_C of B.
N_o, B_o, B_{cm}, B_C, N_C are all in the same vertical plane.

Description	Symbol	Type	Value
Distance between N_o and N_C	L_N	Constant	6 m
Distance between B_o and B_C	L_B	Constant	4 m
Length of cable A	L_A	Constant	2.7 m
Length of cable C	L_C	Constant	3.7 m



Calculate the distance between N_o and B_{cm} when the beam is stationary in N.

Result (4 significant digits): distance ≈ 4.0955 m

Verify your intuition/analysis predicts vertical cables and a horizontal beam for the special case $L_B = L_N$ and $L_C = L_A$.