2023 F=ma Exam: Problem 14

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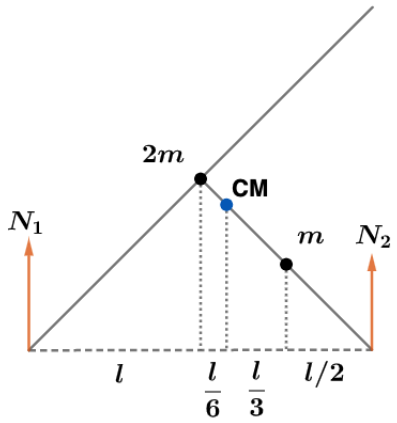

We first find the horizontal location of the CM for this object. We can replace the two rods connected in a line with a point mass $2m$ at their center. We can replace the third rod with a point mass m located at its center.

Let l be the length of the horizontal projection of a rod. Then the horizontal distance between $2m$ and m is $l/2$. The CM is a third of the way from $2m$ to m so

$$x_{\text{CM}} = \frac{1}{3}\left(\frac{l}{2}\right) = \frac{l}{6}$$

to the right of $2m$.

Choosing the CM as the axis of rotation, we can balance torques from the normal forces,

$$N_1\left(\frac{7l}{6}\right) = N_2\left(\frac{5l}{6}\right)$$

$$\frac{N_2}{N_1} = \frac{7}{5}$$

The fraction of the weight on the left leg is given by

$$f = \frac{N_1}{W} = \frac{N_1}{N_1 + N_2} = \frac{1}{1 + \frac{7}{5}} = \frac{5}{12}$$

so the answer is $\boxed{\text{E}}$.