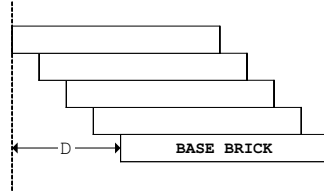
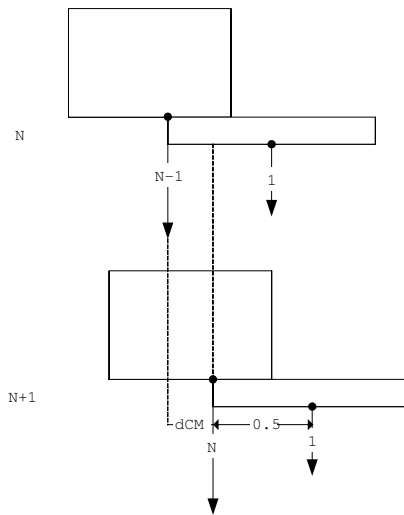


1. PROBLEM



What is the maximum horizontal distance (D) of a single brick, in a tower of bricks compared to the base brick? Each brick is has length of 1 and mass of 1. The tower may consist of any number of bricks, but only one brick at each level.

2. SOLUTION



The maximum distance is gained when the distance is maximized for each brick beginning from the top of the tower. This is achieved when the center of mass (CM) of the sub-tower above each brick is located on the edge of the brick.

The change of center of mass (dCM) when brick N is added to the bottom of the tower can be calculated using a moment equation.

$$(N - 1)dCM(N) = 1\left(\frac{1}{2} - dCM(N)\right)$$

$$dCM(N) = \frac{1}{2N}$$

For first brick the sub-tower above first brick has mass of 0. $dCM(1) = \frac{1}{2}$ represents the change of center of mass for top brick. Maximum D is achieved when number of bricks goes toward infinity.

$$D = \sum_{N=1}^{\infty} dCM(N) = \frac{1}{2} \sum_{N=1}^{\infty} \frac{1}{N}$$

The sum is a harmonic series that diverge. This means that D goes toward infinity when number of bricks goes toward infinity.