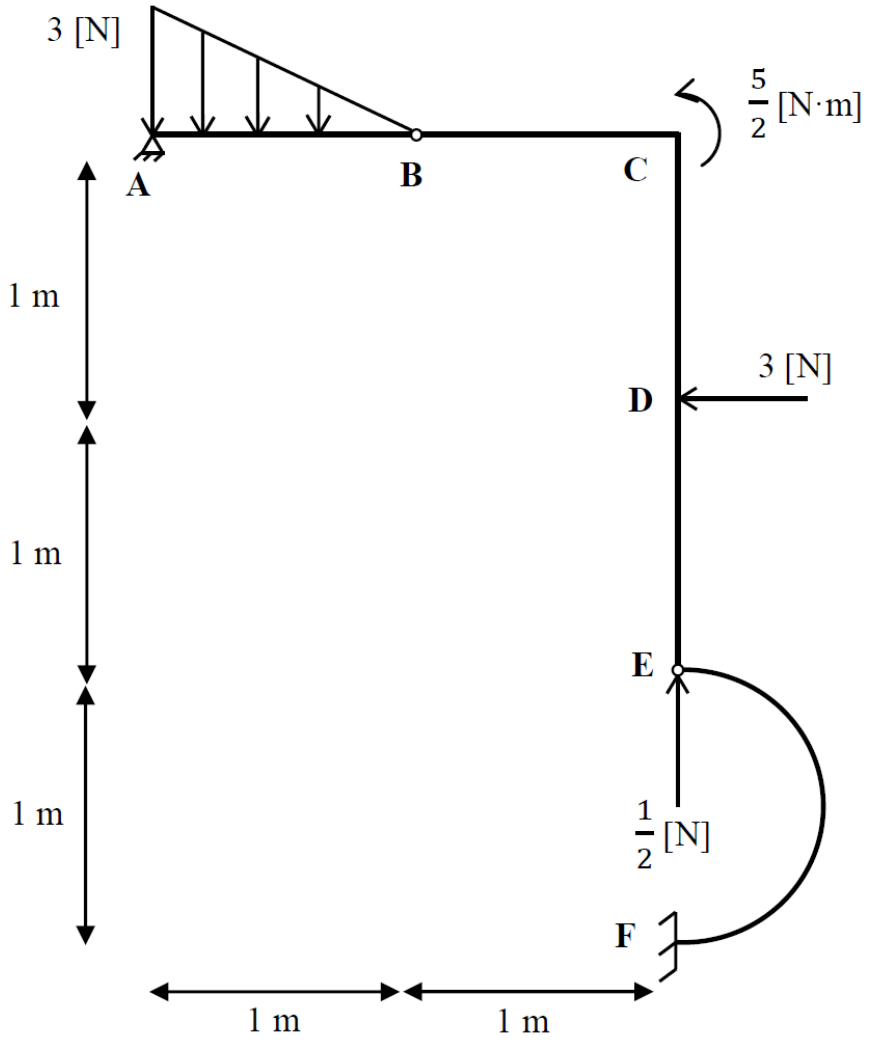
Determine the global degree of static indeterminacy (DSI) . If possible, calculate the reaction forces at the supports of the next structure. Determine its force laws and bending moments laws. Draw its corresponding diagrams.



1) Degree of static indeterminacy

$\text{EDSI} = 5 - 3 = 2$

$\text{IDOF} = 3(4 - 1) = 9$

$\text{IL} = 2[2(2 - 1)] + 3(2 - 1) = 7$

$\text{IDSI} = 7 - 9 = -2$

$\text{DSI} = \text{EDSI} + \text{IDSI} = 2 - 2 = 0$

Therefore, the structure is completely linked and the reactions are statically determined. Now, we are going to use the equations of equilibrium to solve it.

2) Reaction forces

$$\sum M_B = 0 \rightarrow V_A - \frac{1}{2}.3.1.\frac{2}{3} = 0 \rightarrow \mathbf{V_A = 1\ N}$$

$$\sum F_y = 0 \rightarrow V_A + V_F + \frac{1}{2} = \frac{3}{2} \rightarrow \mathbf{V_F = 0\ N}$$

$$\sum M_E = 0 \rightarrow 2.V_A + 2.H_A - \frac{1}{2}.3.1.\frac{5}{3} - \frac{5}{2} - 3.1 = 0 \rightarrow \mathbf{H_A = 3\ N}$$

$$\sum F_x = 0 \rightarrow \mathbf{H_F = 0\ N}$$

$$\sum M_E = 0 \rightarrow \mathbf{M_F = 0\ N} \rightarrow \text{Then it is not neccesary to analyze the arch!!}$$

3) Force laws diagrams

Stretch AB

$$\mathbf{N_{AB} = -3\ N}$$

$$q(x) = q_0\left(1 - \frac{x}{L}\right) = 3(1 - x)$$

$$V_T(x) = \int_0^x q_0\left(1 - \frac{\xi}{L}\right)d\xi = \left[q_0\left(\xi - \frac{\xi^2}{2L}\right)\right]_0^x = 3\left(x - \frac{x^2}{2}\right)$$

$$\mathbf{V_{AB}} = 1 - 3\left(x - \frac{x^2}{2}\right) = \frac{\mathbf{3}x^2}{\mathbf{2}} - \mathbf{3}x + \mathbf{1\ N}$$

$$M_T(x) = \int_0^x q_0\left(\xi - \frac{\xi^2}{2L}\right)d\xi = \left[q_0\left(\frac{\xi^2}{2} - \frac{\xi^3}{6L}\right)\right]_0^x = 3\left(\frac{x^2}{2} - \frac{x^3}{6}\right)$$

$$\mathbf{M_{AB}} = x - 3\left(\frac{x^2}{2} - \frac{x^3}{6}\right) = \frac{\boldsymbol{x^3}}{\mathbf{2}} - \frac{\mathbf{3}x^2}{\mathbf{2}} + \mathbf{x}\ \mathbf{N.m}$$

$$M_{max} \rightarrow \frac{dM(x)}{dx} = V(x) = 0 \rightarrow x = 0{,}47\ m \rightarrow \mathbf{M_{max} = 0{,}192\ N.m}$$

Stretch BC

$$\mathbf{N_{BC} = -3\ N}$$

$$\mathbf{V_{BC}} = -\frac{3}{2} + 1 = -\frac{\mathbf{1}}{\mathbf{2}}\ \mathbf{N}$$

$$\mathbf{M_{BC}} = -x - \frac{3}{2}\left(x - \frac{1}{3}\right) = -\frac{\mathbf{x}}{\mathbf{2}} + \frac{\mathbf{1}}{\mathbf{2}}\ \mathbf{N.m}$$

Stretch CD

$\mathbf{N_{CD} = -0,5\ N}$

$\mathbf{V_{CD} = 3\ N}$

$\mathbf{V_{CD} = 3y - 3\ N.m}$

Stretch ED

$\mathbf{N_{ED} = -0,5\ N}$

$\mathbf{V_{ED} = 0\ N;\ M_{ED} = 0\ N.m}$

4) Force laws diagrams