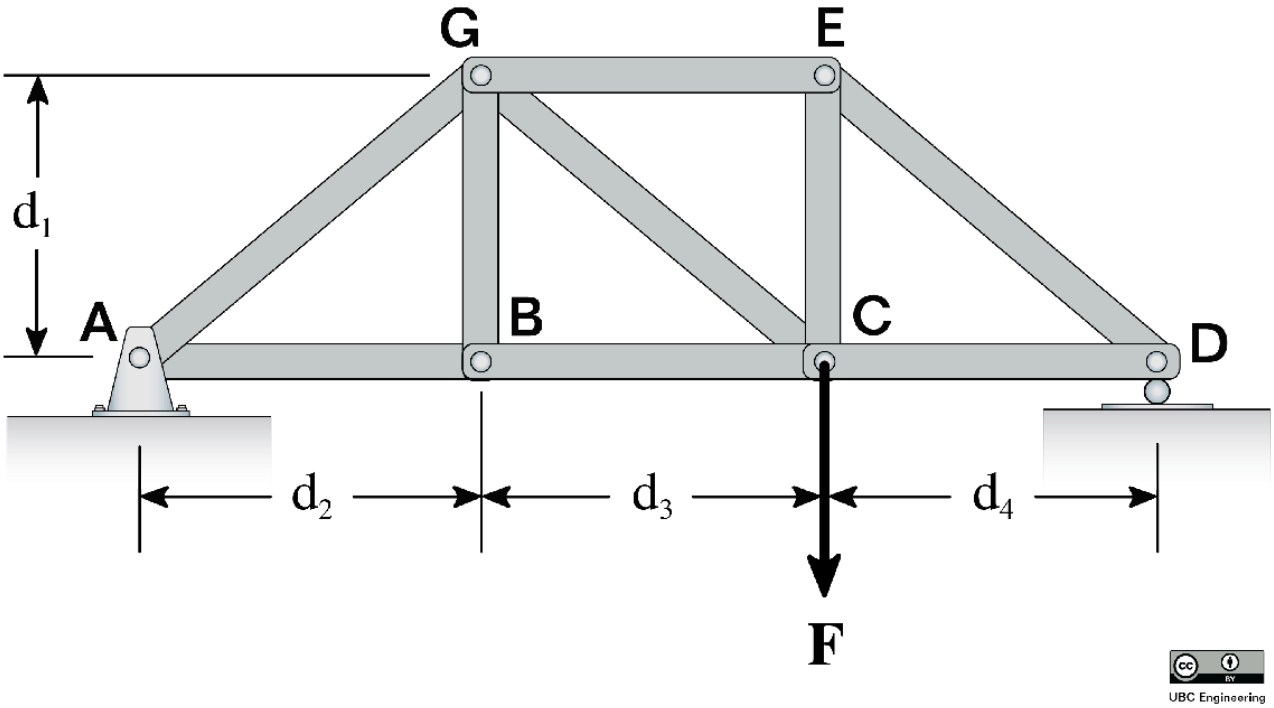

A force F is exerted onto joint C. If the truss is supported by a pin on A and a roller on D, find the zero-force members in the truss as well as the forces in each member. Determine if the members are in compression or tension. Assume all joints are pin connected.

Analyzing the truss as a rigid body, $\Sigma F_x = 0 \rightarrow A_x = 0 \rightarrow N_A = A_y$

$$\Sigma M_A = 0 \rightarrow (d_2 + d_3 + d_4) \cdot N_D - (d_2 + d_3) \cdot F = 0 \rightarrow N_D = \frac{d_2 + d_3}{d_2 + d_3 + d_4} F$$

$$\Sigma M_D = 0 \rightarrow d_4 \cdot F - (d_2 + d_3 + d_4) \cdot N_A = 0 \rightarrow N_A = \frac{d_4}{d_2 + d_3 + d_4} F$$

Assuming tensile forces are positive,

$$+\uparrow \Sigma A_y = 0 \rightarrow N_A + \frac{d_1}{\sqrt{{d_1}^2 + {d_2}^2}} F_{AG} = 0 \rightarrow F_{AG} = -\frac{\sqrt{{d_1}^2 + {d_2}^2}}{d_1} N_A$$

$$+\rightarrow \Sigma A_x = 0 \rightarrow F_{AB} + \frac{d_2}{\sqrt{{d_1}^2 + {d_2}^2}} F_{AG} = 0 \rightarrow F_{AB} = \frac{d_2}{d_1} N_A$$

$$+\rightarrow B_x = 0 \rightarrow F_{BC} - F_{AB} = 0 \rightarrow F_{BC} = F_{AB}$$

$+\uparrow B_y = 0 \rightarrow F_{BG} = 0$ (Zero-force member)

$$+\uparrow \Sigma D_y = 0 \rightarrow N_D + \frac{d_1}{\sqrt{{d_1}^2 + {d_4}^2}} F_{DE} = 0 \rightarrow F_{DE} = -\frac{\sqrt{{d_1}^2 + {d_4}^2}}{d_1} N_D$$

$$+\rightarrow \Sigma D_x = 0 \rightarrow -F_{CD} - \frac{d_4}{\sqrt{{d_1}^2 + {d_4}^2}} F_{DE} = 0 \rightarrow F_{CD} = \frac{d_4}{d_1} N_D$$

$$+\uparrow \Sigma E_y = 0 \rightarrow -F_{CE} - \frac{d_1}{\sqrt{{d_1}^2 + {d_4}^2}} F_{DE} = 0 \rightarrow F_{CE} = N_D$$

$$+\uparrow \Sigma C_y = 0 \rightarrow F_{CE} - F + \frac{d_1}{\sqrt{{d_1}^2 + {d_3}^2}} F_{CG} = 0 \rightarrow F_{CG} = \frac{\sqrt{{d_1}^2 + {d_3}^2}}{d_1} \cdot (F - F_{CE}) \rightarrow F_{CG} = \frac{\sqrt{{d_1}^2 + {d_3}^2}}{d_1} \cdot N_A$$

$$+\rightarrow \Sigma E_x = 0 \rightarrow \frac{d_4}{\sqrt{{d_1}^2 + {d_4}^2}} F_{DE} - F_{EG} = 0 \rightarrow F_{EG} = -F_{CD}$$