1. (25 points) The motion of the backhoe bucket shown is controlled by the hydraulic cylinders \( AD, CD, \) and \( EF \). As a result of an attempt to dislodge a portion of a slab, a 2-kip force \( P \) is exerted on the bucket teeth at \( J \). Knowing that \( \theta = 45^\circ \), determine the force exerted by cylinder \( EF \).
2. (25 points) A stadium roof truss is loaded as shown. Determine the force in members $AE$, $EF$, and $FJ$. 

![Diagram of a stadium roof truss with loadings and forces indicated.]
3. (30 points) For the stop bracket shown, locate the $x$ coordinate of the center of gravity. The bracket is made entirely of the same material.
4. (20 points) Draw the free-body diagrams for the following situations.

5. Bonus Question: (20 points, No partial credit will be awarded) Solve problem (d). Hint: use $M_{EA} = \lambda_{EA} \cdot \lambda_{F} = 0$.

(a)

Member $ABC$ is supported by a pin and bracket at $B$ and by an inextensible cord attached at $A$ and $C$ and passing over a frictionless pulley at $D$. The tension may be assumed to be the same in portions $AD$ and $CD$ of the cord. For the loading shown and neglecting the size of the pulley, determine the tension in the cord and the reaction at $B$.

(b)

The bent rod $ABEF$ is supported by bearings at $C$ and $D$ and by wire $AH$. Knowing that portion $AB$ of the rod is 250 mm long, determine the tension in the wire $AH$ and the reactions at $C$ and $D$. Assume that the bearing at $D$ does not exert any axial thrust.

(c)

A 250 $\times$ 400-mm plate of mass 12 kg and a 300-mm-diameter pulley are welded to axle $AC$ which is supported by bearings at $A$ and $B$. For $\beta = 30^\circ$, determine the tension in the cable and the reactions at $A$ and $B$. Assume that the bearing at $B$

(d)

The bent rod $ABDE$ is supported by ball-and-socket joints at $A$ and $E$ and by the cable $DF$. If a 60-lb load is applied at $C$ as shown, determine the tension in the cable.
does not exert any axial thrust.