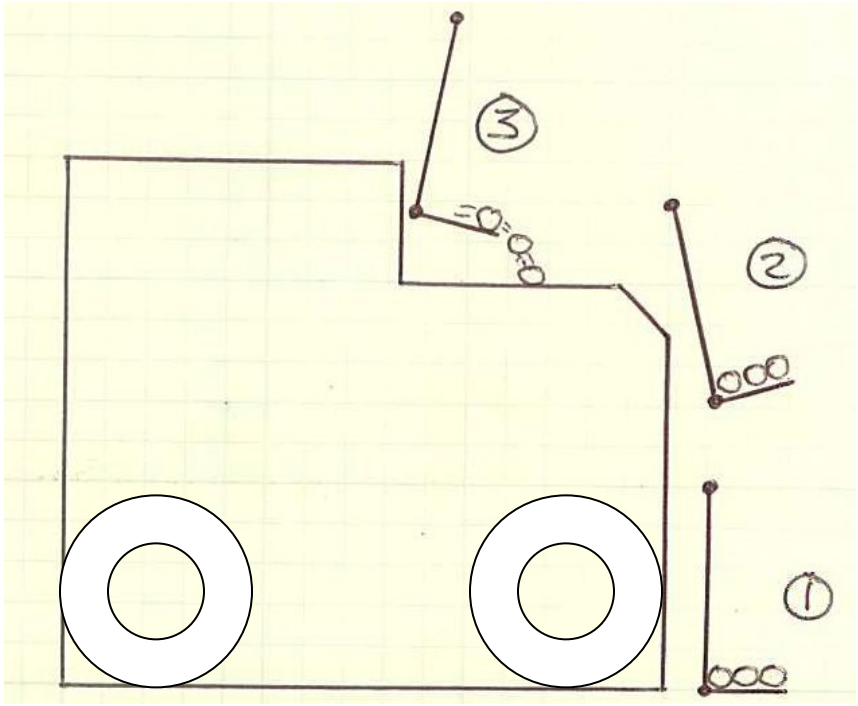
RBE 1001 Homework 11 **Name:** _____

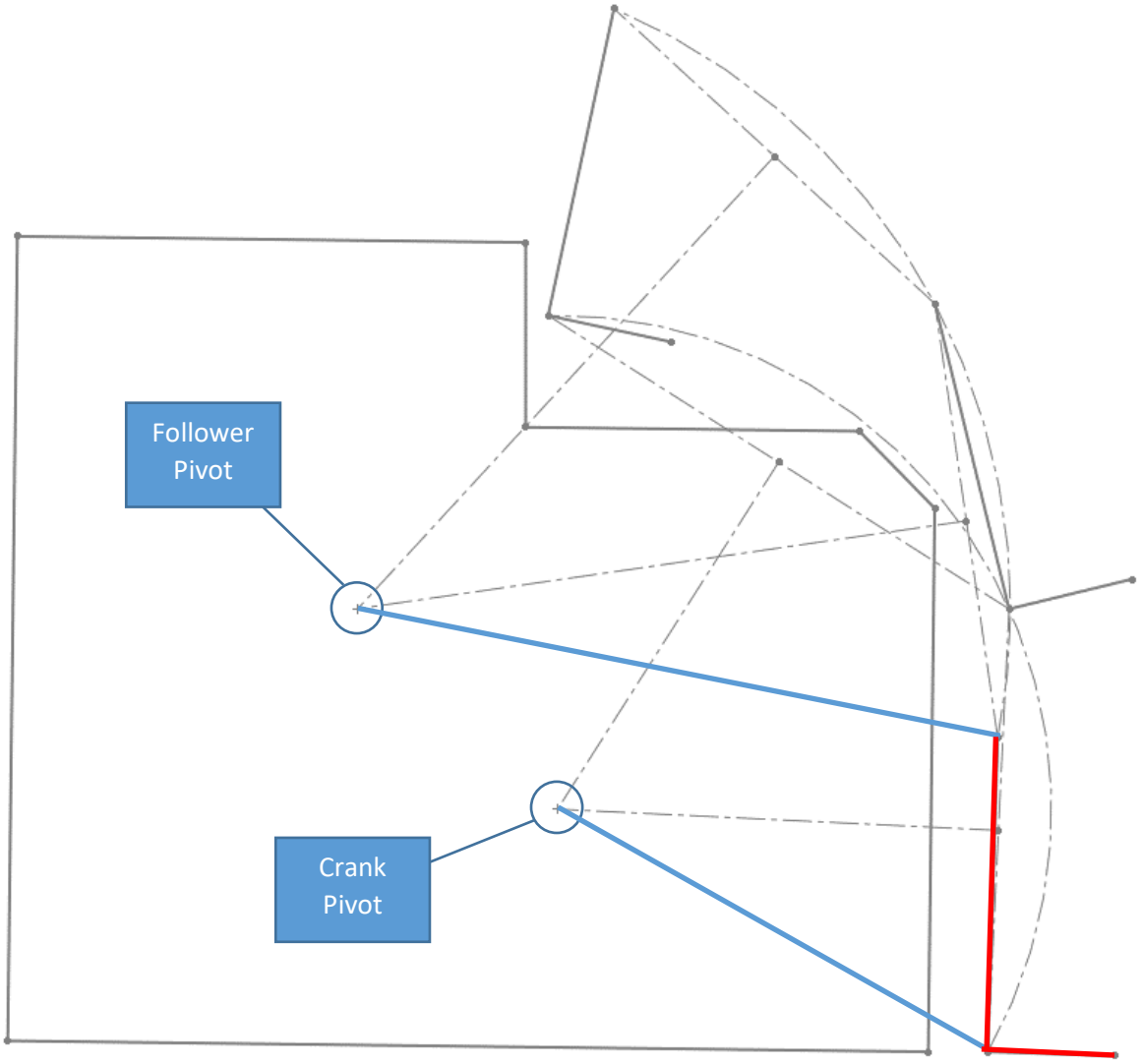
Problem statement:

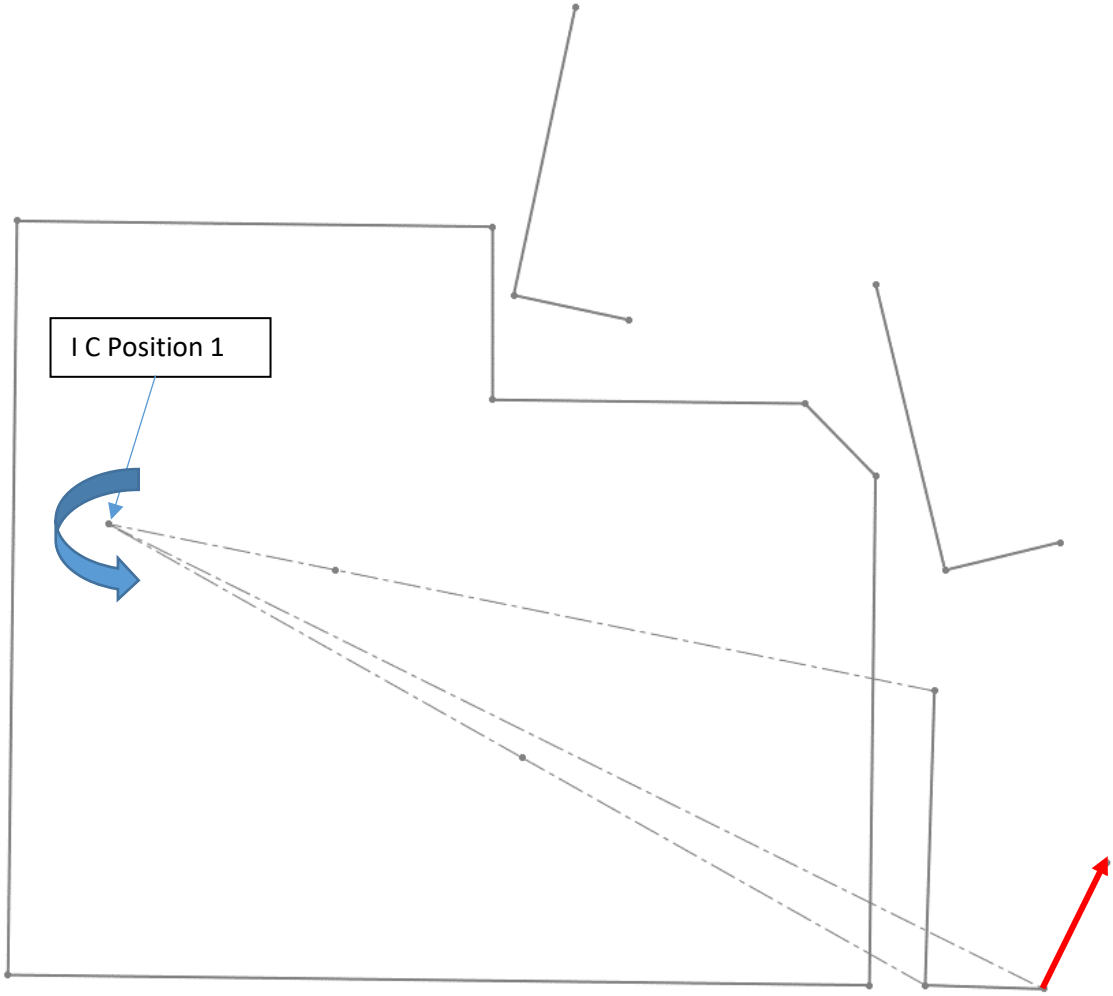
You have a task to scoop up ball bearings with your robot and place them into a container on the robot. With the help of an unspecified loader, the ball bearings are easily loaded onto the "flat" scoop when it is on the floor. Once it leaves the floor, you would like to establish a positive rotation of the scoop such that the balls do not roll out. The scoop also needs to clear the forward top edge of the robot on its way to dumping them into the hopper. A downward angle must then be established to unload the balls. You pick the three locations as shown below to control the position and attitude of the scoop.

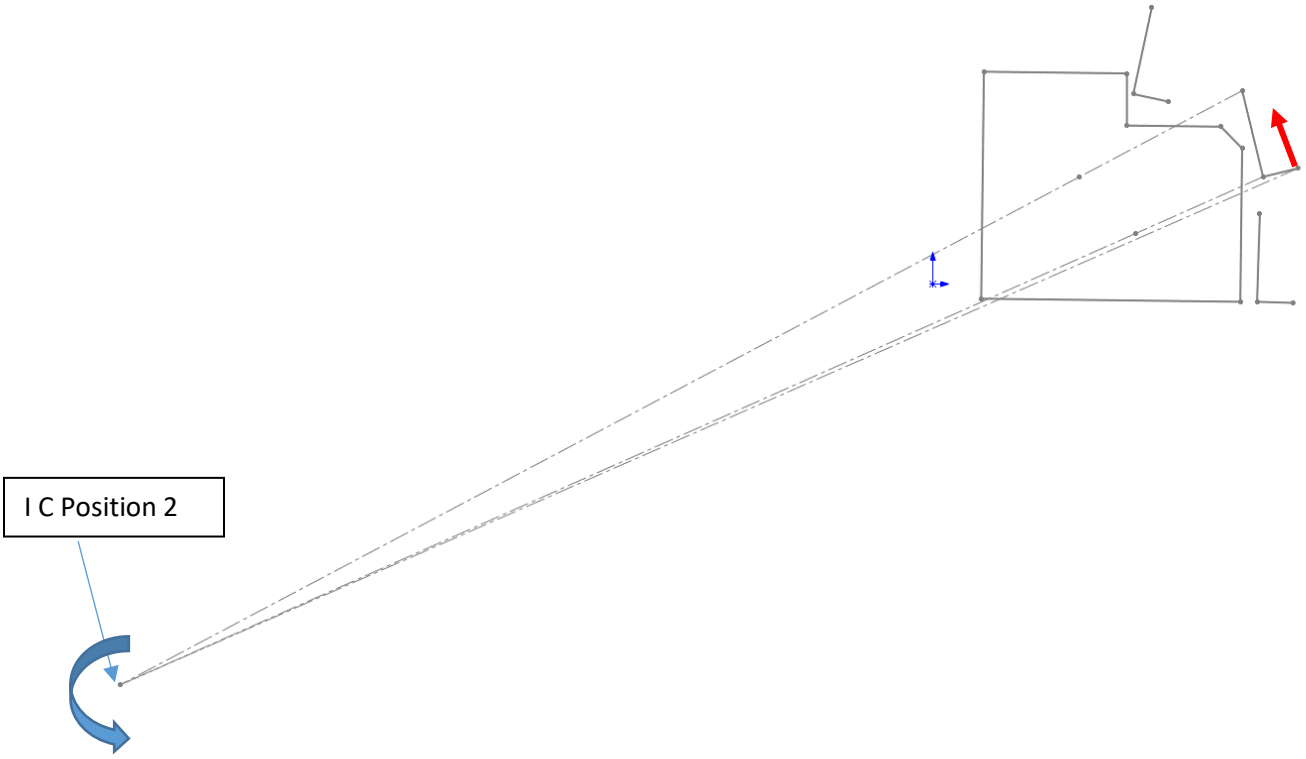


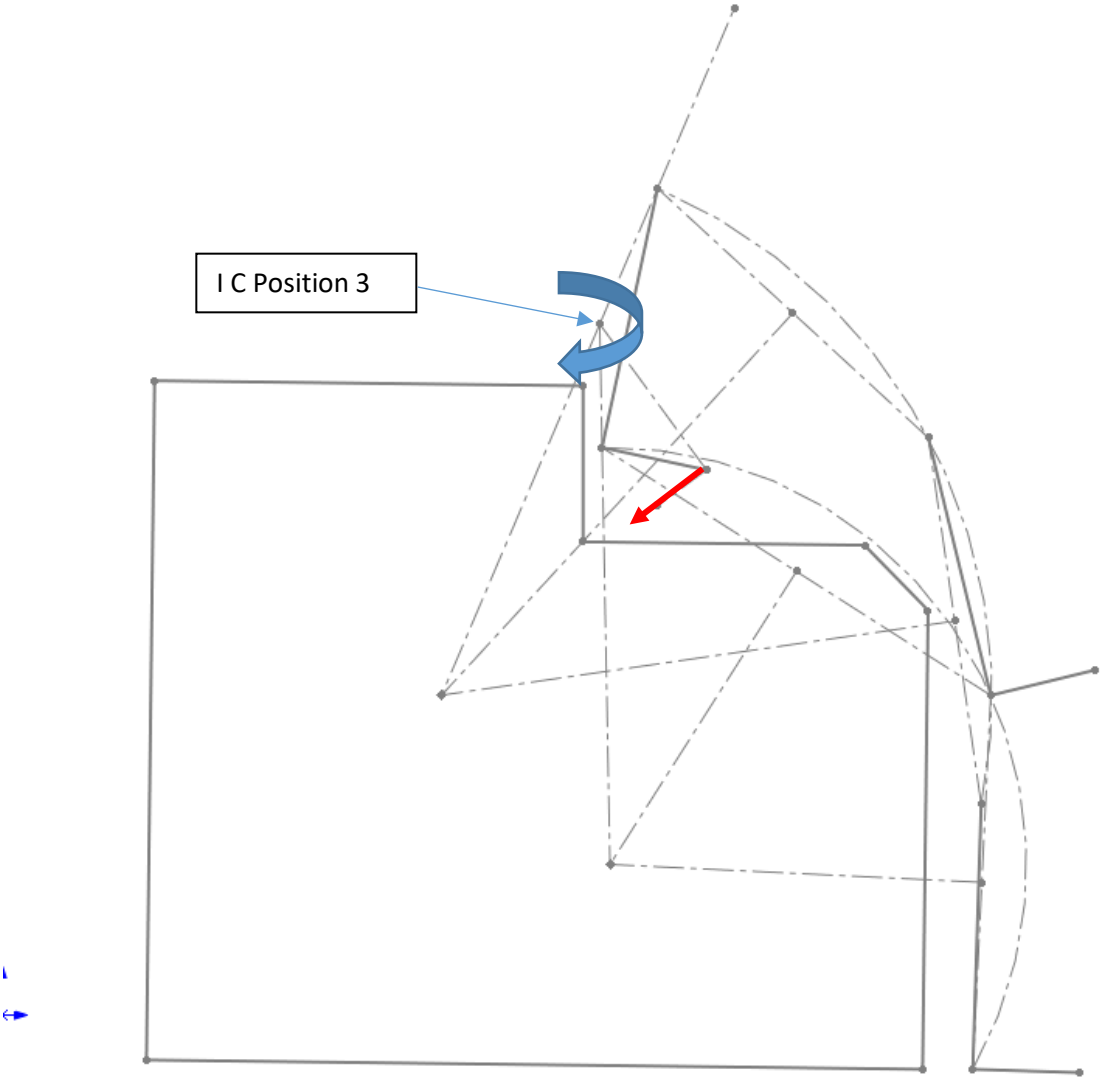
1) **Using SolidWorks** on the above drawing, and leaving any necessary construction lines visible, determine where the chassis pivots for the crank and follower arms must be given the scoop joints as highlighted at the top and bottom corners of the scoop. Show the crank and follower in each of the three numbered positions. The initial SolidWorks sketch is provided on Canvas.
2) Show the **direction of the instantaneous displacement vector** of the rightmost tip of the scoop's lifting surface in each of the three shown positions when the scoop is operating in the direction from position 1 to 3. (Hint, locate the instantaneous centers for each of the positions.)
3) One of the links will be powered via motor-provided torque at a chassis joint. Which link should be powered ensure reliable operation of the linkage? What would happen if the other link were powered instead? The lower link should be the driver because it's the link that goes through a "toggle" just before position 3. If the upper link were driven, it

would actually have to reverse rotation just before position 3, and we still wouldn't be able to control whether or not the lower link will keep rotating counterclockwise.


Follower
Pivot
Crank
Pivot


I C Position 1


I C Position 2


I C Position 3