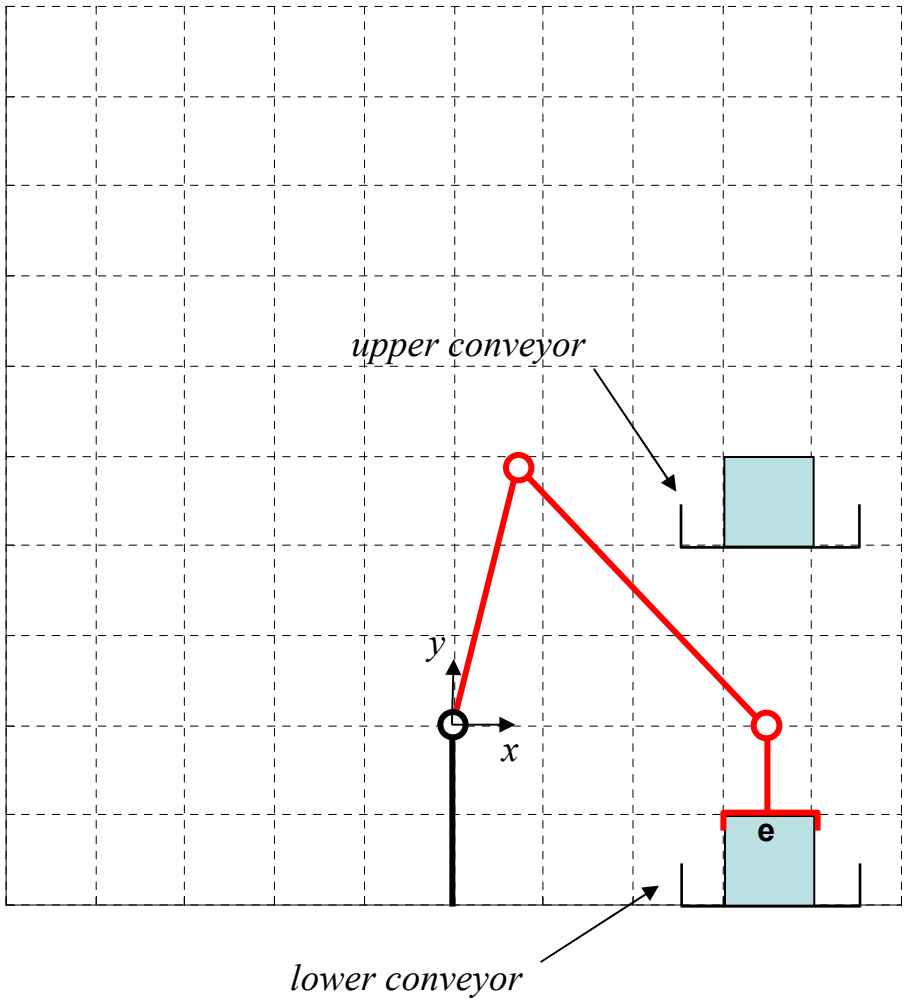
AE/BME/CS/ECE/ME 7785 HW01 (Lipkin) Due: Friday 16 Sept 2011

The figure shows a RRR arm picking up containers filled with fluid from a lower conveyer belt and moving them to an upper conveyor belt. To avoid spilling, the containers must remain vertical. The robot end-effector moves on a series of straight line paths at 1unit/sec to make the transfers. The lengths of the moving links are 3, 4, and 1 units and the coordinate origin is at the first joint. The conveyor dimensions are 2 by ½ units and the thickness of the sides and bottom are negligible.

Submit via T-Square



1. Reverse displacement analysis. Design a piecewise continuous trajectory for the robot. Ensure you pick enough data points to have a relatively smooth trajectory. There must be no interference of the robot or container with either conveyor. Plot the joint angles vs time on three separate plots. Be sure to use the same angle conventions as in the notes. This data could be used to *control* the joint motors. Hand in the joint plots.

2. Forward displacement analysis. Use the joint angles to determine the locations of joints 2 and 3 and point e along the paths. Draw the robot links as a series of straight lines to *simulate* it moving on the path. (Feel free to embellish the drawing, like adding joints, etc. though it is not necessary). Hand in plots of the robot along the path.

3. Joint control. The robot controller has died and it must be controlled manually using a button box which can only control one joint at a time and you want to minimize the number of moves to save time. Also the containers are empty so the orientation along the path isn't important. Solve the problem any way you can. Hand in plots of the robot along the path. (Hint: begin at the goal and work backwards to the start.)

Submit via T-Square as a single pdf file.

Bonus: Animate 2. and 3. Submit separate animation files.