Perform one of the following analyses for the design of a contest device. Describe the assumptions you make, and briefly justify them. For example, you might assume a certain weight (mass) and coefficient of friction with the arena. It is usually best to make conservative assumptions, i.e., assume that the friction coefficient and Velcro tension forces are less, and the Velcro peel force greater than is likely, so that your device will perform better (or at least no worse) than shown by your analysis.

1. Analyze at what speed and with what force your device (or a device that you might consider building) can move up the Velcro wall. How well does this device function on the horizontal surface? A steady-state analysis is acceptable, but including the acceleration of the mass(es) would be better. What transmission ratio and wheel size (effective wheel radius) did you choose? Why? What can be done to improve performance on the two distinct surfaces?

2. Analyze a method for throwing the spherical SI towards the Velcro wall. Consider the power and energy available by the source that you choose to analyze (e.g., 12 volt motor or 2 rubberbands). How far and how high can this method throw the SI? What might you do to improve the accuracy of this method? Will the SI stick to the Wall? What can you do to improve the probability of sticking?

3. Analyze a vertical “scissors-jack” mechanism that is designed to achieve a particular final height. Determine the deployment height as a function of time using a lead screw drive. What transmission ratio and lead-screw pitch did you choose? Why? How would you optimize your choice? What is the affect of adding additional stages? What is the affect of changing the link lengths? In your analysis use a material density that is appropriate to your material choice and assume that the height goal remains unchanged.