

## **Problem Set 9: Momentum and Collision Theory, Rigid Bodies Kinematics**

### ***Design Engineering Challenge: “The Big Dig” 2.007 Contest Ball Pyramid breaking Concepts***

You have decided to deploy a prong that springs into position, and this prong (like on a unicorn!) is propelled forward by your car so the prong pierces the ball stack so the balls on that side of the stack roll off to your side of the table.

1. Sketch concepts for deploying the prong. Should the prong be retractable, and what is the “cost” for this function?
2. What are the physics of each concept? Is there a concept where the deploying itself can help to pierce the stack?
3. If the prong is deployed and the car then zooms forward so the prong impacts the stack, how fast must the car be going in order to fully pierce the stack?
4. Can you devise a simple experiment to verify your calculations, or to do a quick test before you even start the calculations (and spend the time on them?)