Assignment 6, EECS 397/600: DARPA Robotics Challenge
Interactive Markers and Inverse Kinematics
due by 5pm, Tuesday, 14 October

Refer to the documents: "Interacting with Point Cloud Data in Rviz and Invoking Task Commands." This document relies on code examples: example_interactive_marker, example_pointcloud_selector, and example_interactive_ik/example_grab_from_above_v3.

See the document for details on running the code.

The intent of this code is to create a simple, natural and effective user interface to command manipulation. One should be able to select a region of points above a can to induce the robot to approach a grasp pose safely and effectively.

The example code almost works, but there are multiple limitations.

The computeCentroid() function in example_pointcloud_selector.cpp should be smarter. It usually works adequately, but it can give dramatically wrong results if outliers are included in the point selection in Rviz.

The code in example_grab_from_above_v3.cpp has multiple problems. It correctly finds candidate solutions for palm-down grasp frames with origin coincident with the published centroid. However, going to this goal directly will knock objects over. It needs to use a careful approach from above. This was attempted, by trying to find an "approach" solution, offset vertically upwards from the goal solution, and going to the approach before going to the goal. However, although the two hand solutions are identically aligned, but for a pure vertical offset, the joint-space solutions can be radically different, resulting in clumsy joint-space motions going from approach to goal.

Your assignment is to improve on this code.

This has only been attempted in drcsim version 4, which has introduced new bugs. One problem is that the Sandia-hand fingers do not respond to commands. This might be working in drcsim 3. If so, try to achieve picking up a can and setting it back down, without knocking it over, as commanded by point selections in rviz.