Homework 1

Note: Homework should be done individually but discussion is encouraged. If you must use your phone to scan your work, please use a proper digital scanning app to maintain legibility. This particular assignment requires the use of a digital camera. The report shall contain images, psedo-code and output of your algorithms. Homework is out of 10pts.

1. 3-D Reconstruction
   a) (1pts) Using a digital camera and take a stereo image of a single object. Take two pictures from slightly different camera positions. Ideally, the object takes up a large portion of the frame. Manually identify and label visually $n\ (n \gg 8)$ corresponding points in both pictures. You will need to identify the image coordinates of these points as well.
   b) (3pts) Assume world coordinate system is centered at 1st camera pinhole with Z along viewing direction. Use 8-point algorithm to estimate the essential matrix using some of the above corresponding points. Recover rotation matrix and translation matrix. (Show your calculation step)
   c) (2pts) Print a checkerboard image. Take a few images of the checkerboard and then use them to calibrate your camera. Show your camera parameters in the report.
   d) (4pts) Reconstruct the 3-D locations of points and display the 3-D point cloud.