Assignment 3:

Submission Instructions: Please submit a .zip file named <your name>.zip containing 1) report named report.pdf including your answers to all required questions with images and/or plots showing your results, and 2) the python notebook provided, with the cells run and the relevant source code. If you include other source code files for a given exercise, please indicate it in the report.

Problem 1. Separable Convolution (20%)

Separable Convolution refers to breaking down the convolution kernel into lower dimension kernels. Show that convolution with a 2D Gaussian kernel is a spatially separable convolution, i.e. there are two 1D kernels if applied to the image row-wise and column-wise in sequence, it is equivalent to convolving that image with the 2D Gaussian kernel. Is Sobel kernel spatially separable? Why separable convolutions are preferred?

Problem 2. Edge Detection (50%)

Implement Canny Edge Detection algorithm as described in the class. Apply your program to detect edges in image 1. Your program will take as an input a grayscale image, the sigma of the Gaussian filter and the two low and high thresholds. The output of your program is a binary image. Implement gaussian convolution as a separable sequence of horizontal and vertical convolutions.

Problem 3. Corner Detection (30%)

Implement Harris Corner Detection algorithm described in the class. Apply your program to detect corners in image 1.