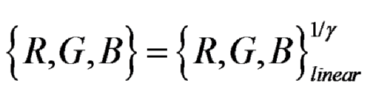
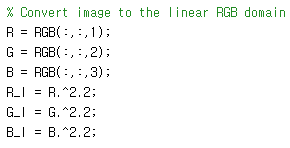
**Homework 5: Color Image Processing**

# Gray-world method

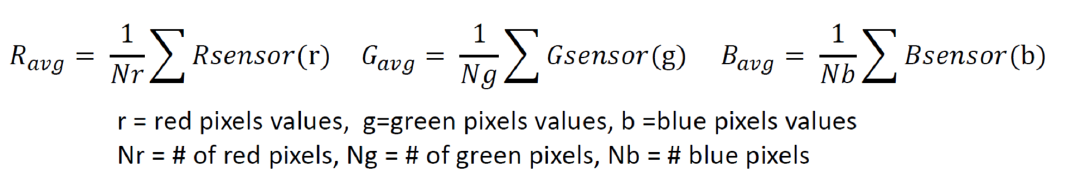
## Background and Matlab code

Convert the image to the linear RGB domain assuming a display ϒ of 2.2 with the following equation

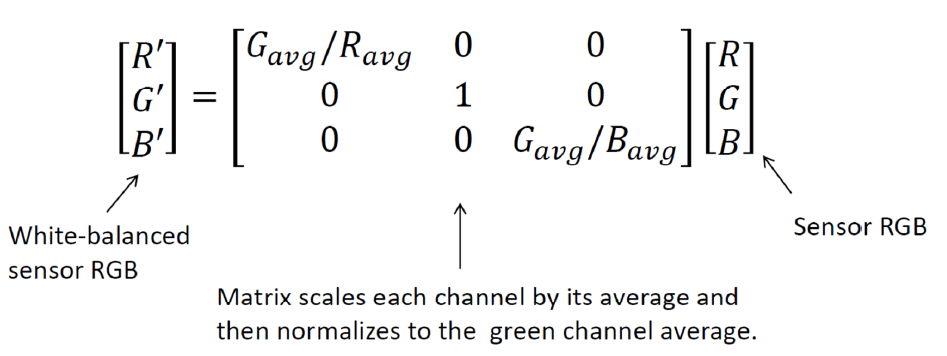


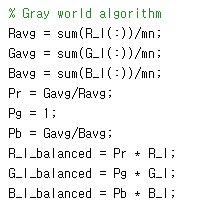


Estimate the average response

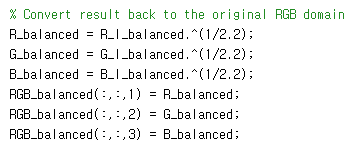


Base on averages, white balance can be express as a matrix as:

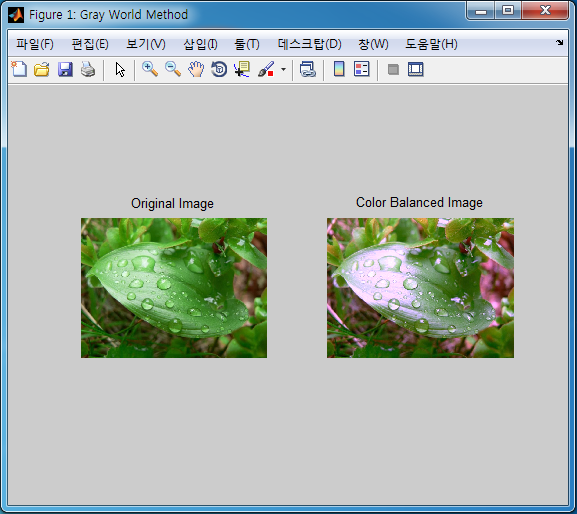


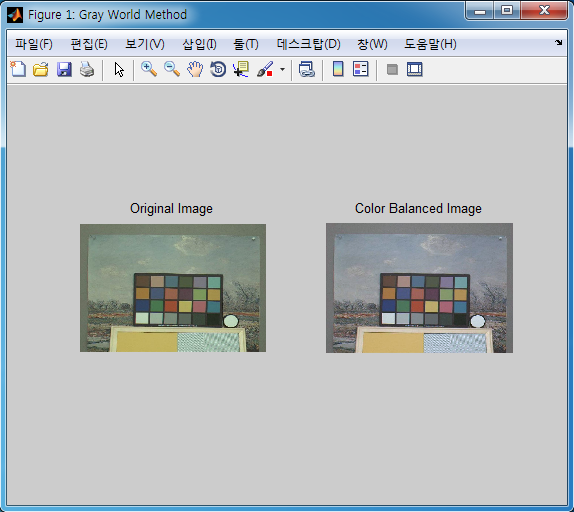


Finally, convert the linear RGB image to the original RGB domain



## Result

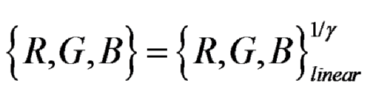


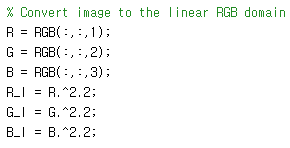


# White patch method

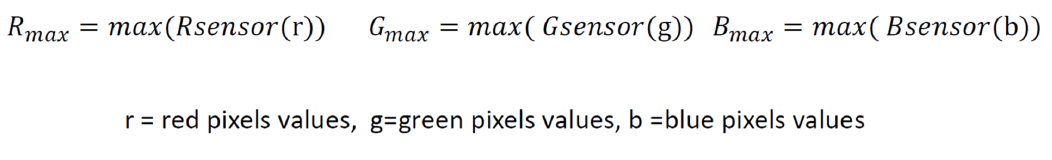
## Background and Matlab code

Convert the image to the linear RGB domain assuming a display ϒ of 2.2 with the following equation

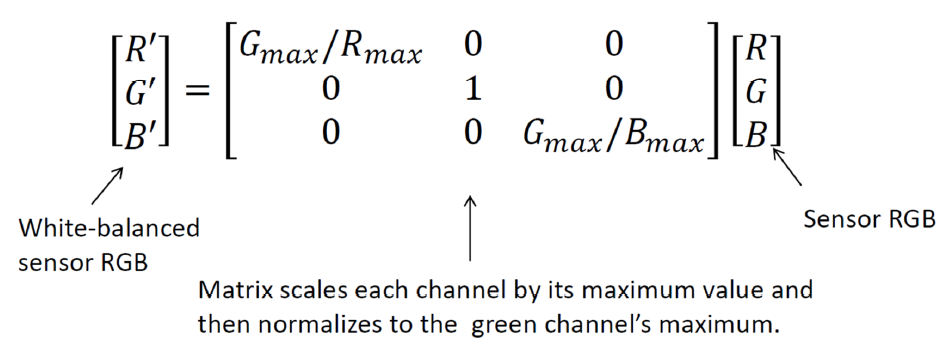


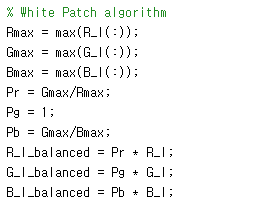


Obtain maximum intensity value for each color channel:

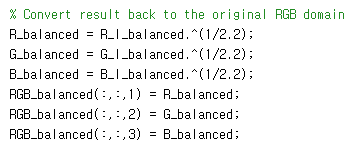


Based on RGB max, white balance can be expressed as a matrix as:

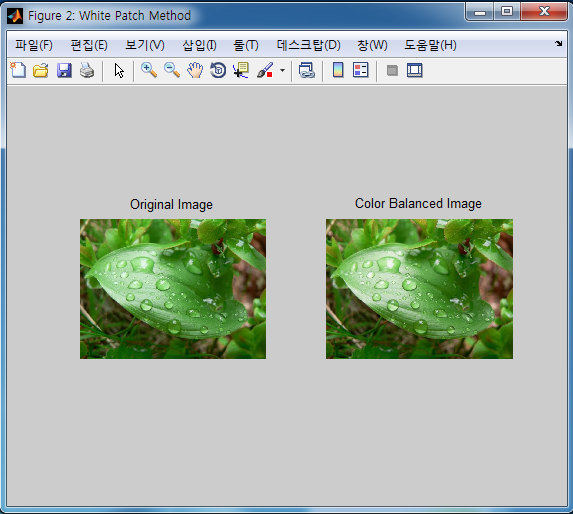


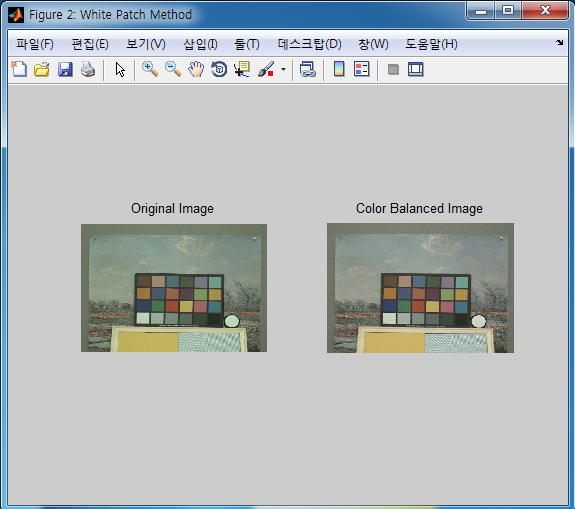


Finally, convert the linear RGB image to the original RGB domain



## Results

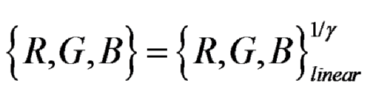


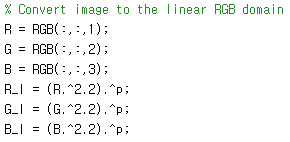


# Shades-of-gray method

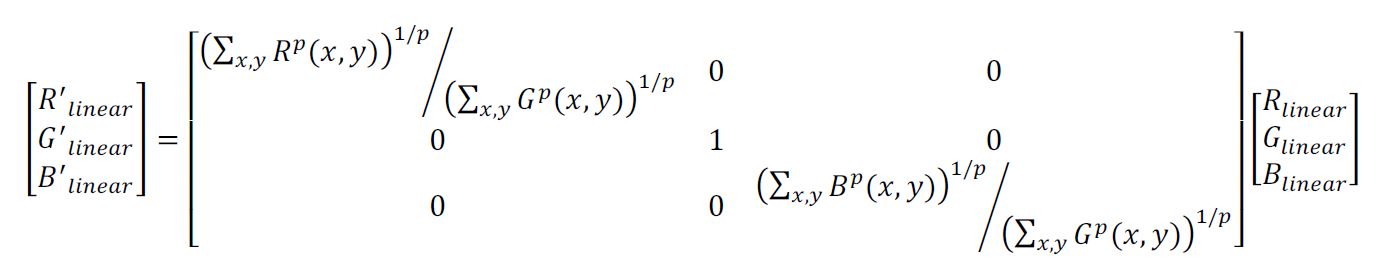
## Background and Matlab code

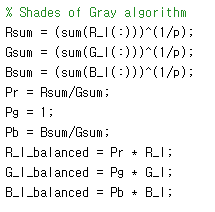
Convert the image to the linear RGB domain assuming a display ϒ of 2.2 with the following equation



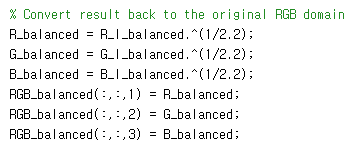


Transformation equation is as follow:

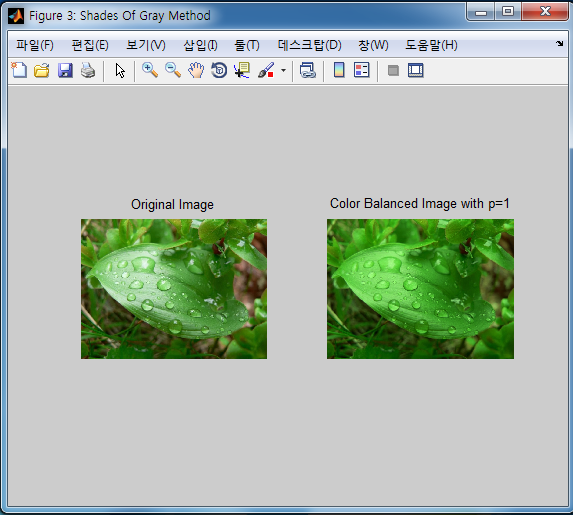


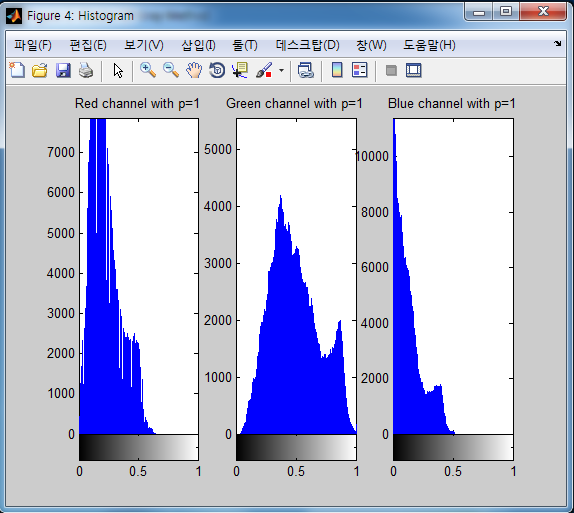


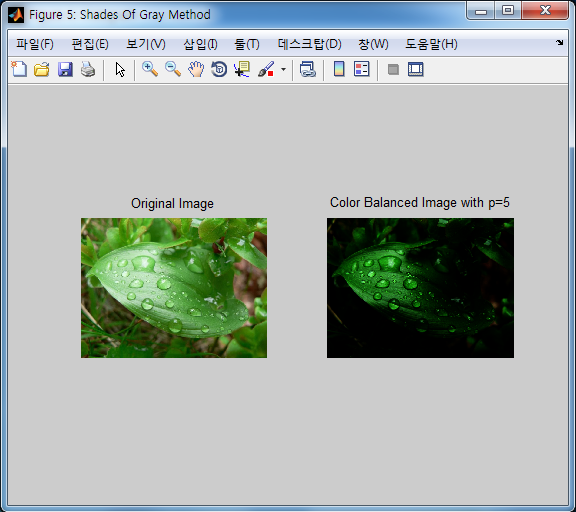
Finally, convert the linear RGB image to the original RGB domain

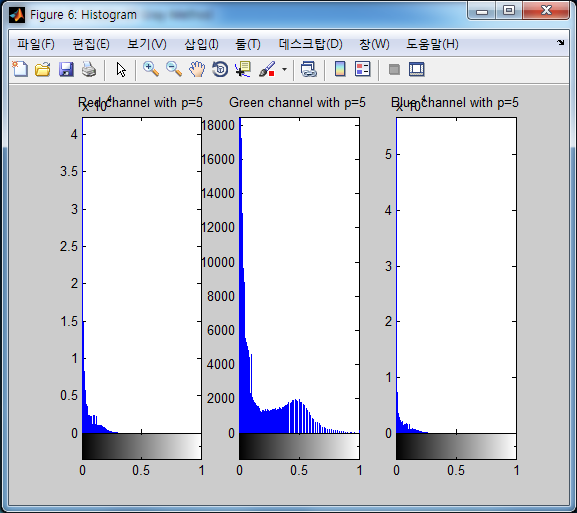


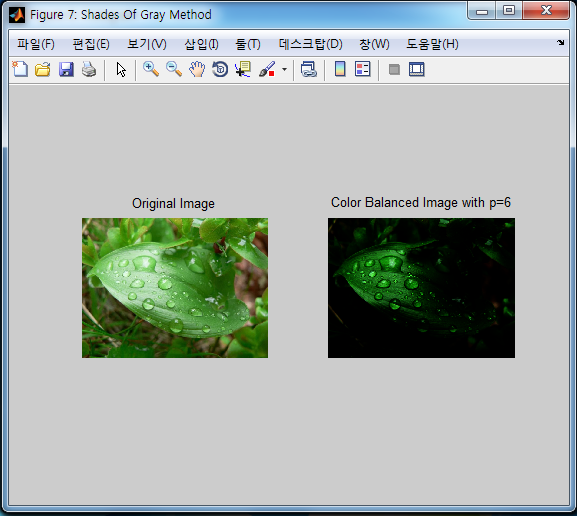
## Results

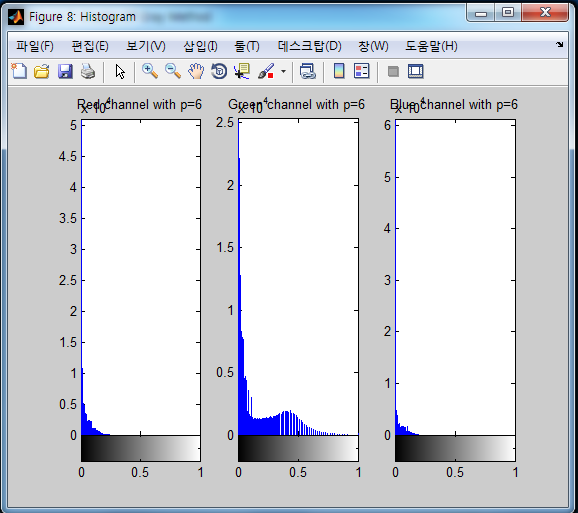


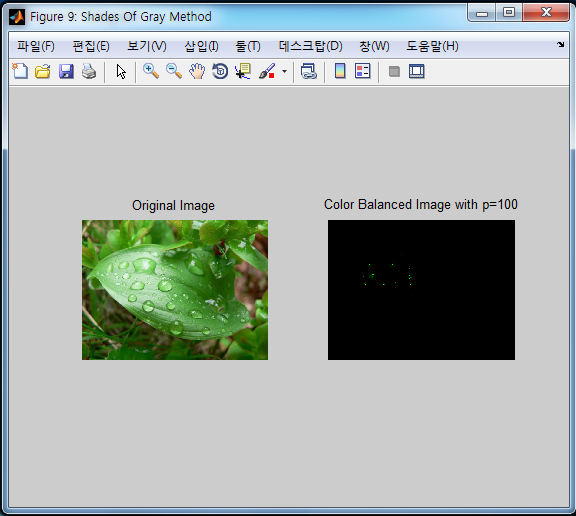


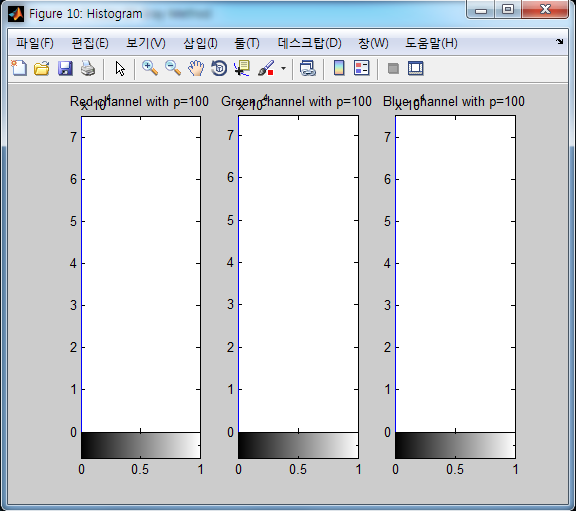


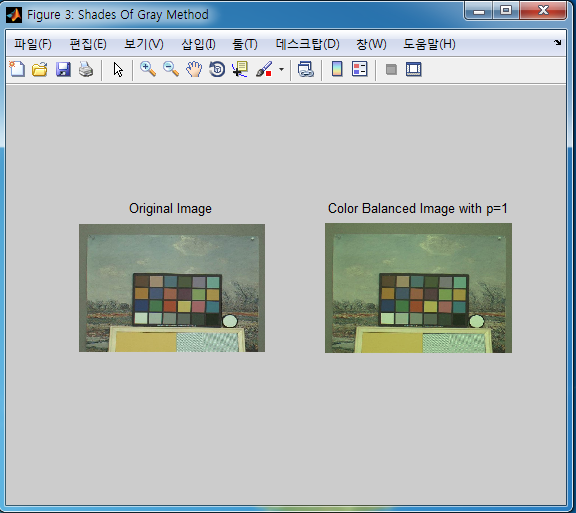


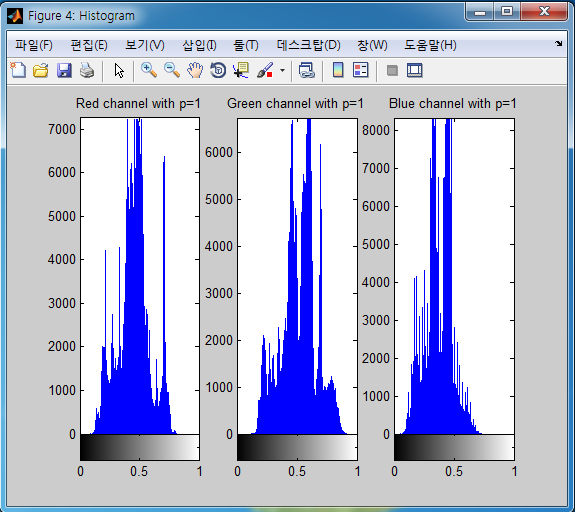


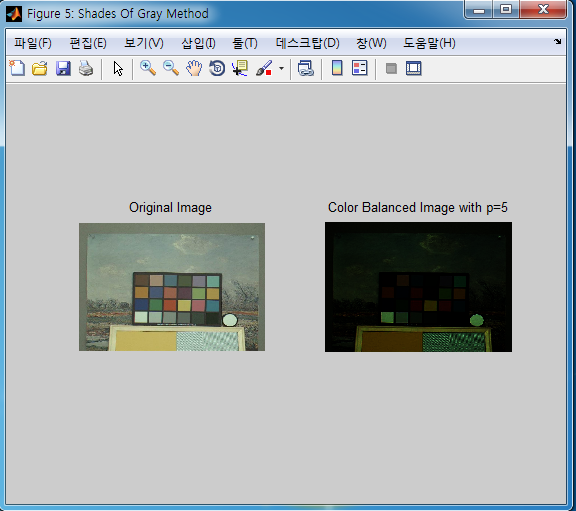


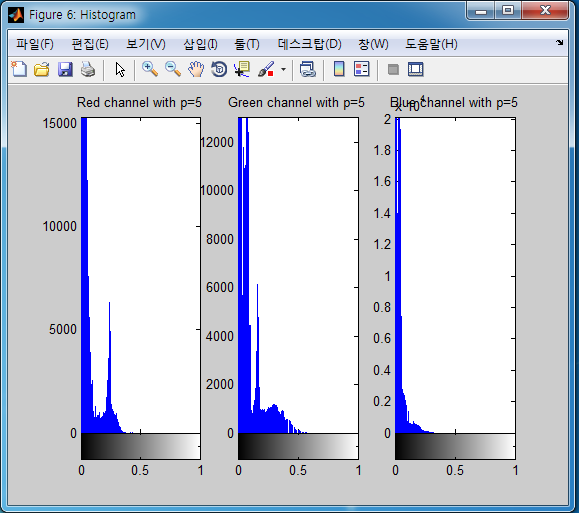


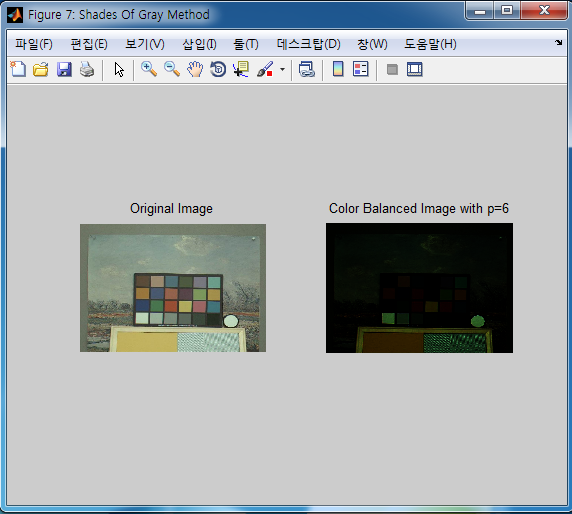


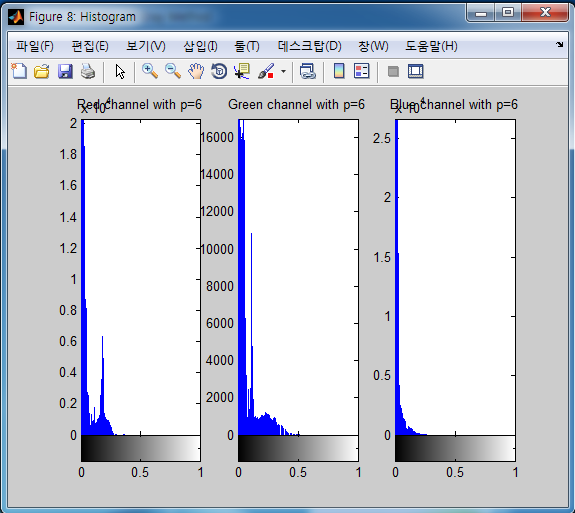


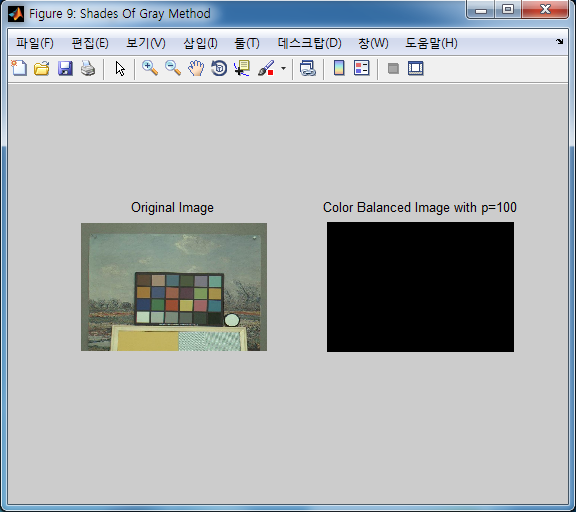


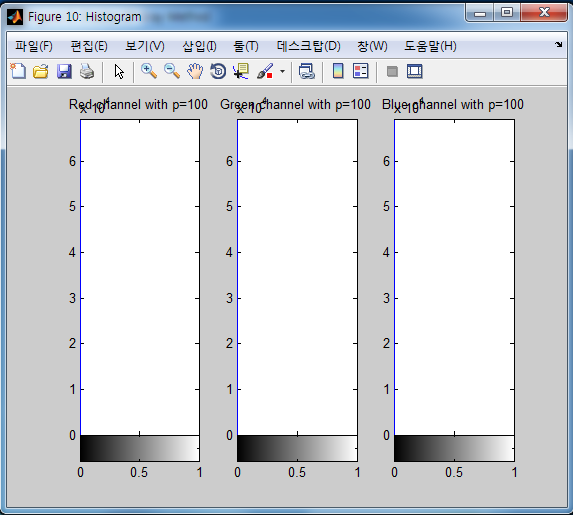












**From above results, we can see that when p value increases, the histogram of each channel shifts to the darker side, that is why the color balanced images become darker.**