clear;

%Problem Number 1

tower = imread( 'white-tower', 'png' );

imshow( tower )

%k-means segmentation

k = 10

clusters = random\_centers( tower, k );

%Change the image into an array of RGBPoints

W = size(tower, 2);

H = size(tower, 1);

points(H, W) = RGBPoint( tower(H,W,1), tower(H,W,2), tower(H,W,3) );

for y = 1:H

for x = 1:W

points(y, x) = RGBPoint( tower(y,x,1), tower(y,x,2), tower(y,x,3) );

end

end

%Clean up the environment

clear tower;

%Begin the while loop

iterate = true;

while( iterate )

%Find out which cluster each point is in and add that point to the working

%average of that cluster

cluster\_amount = zeros(k, 1);

cluster\_average = zeros(k, 3);

for y = 1:H

for x = 1:W

points(y, x) = points(y, x).find\_cluster( clusters );

c = points(y, x).getcluster();

cluster\_average(c, 1) = (cluster\_average(c, 1) \* cluster\_amount(c) + points(y,x).getr()) / (cluster\_amount(c) + 1);

cluster\_average(c, 2) = (cluster\_average(c, 2) \* cluster\_amount(c) + points(y,x).getg()) / (cluster\_amount(c) + 1);

cluster\_average(c, 3) = (cluster\_average(c, 3) \* cluster\_amount(c) + points(y,x).getb()) / (cluster\_amount(c) + 1);

cluster\_amount( c ) = cluster\_amount(c) + 1;

end

end

%Create usable points out of the averages of each cluster

new\_clusters(k) = RGBPoint();

for i = 1:k

new\_clusters(i) = RGBPoint( round( cluster\_average(i, 1)), round( cluster\_average(i, 2)), round( cluster\_average(i, 3)) );

end

thresh = 150; %If RGB-Distance between two points are below this threshold, we consider them the same point.

[iterate, distance\_array] = same\_clusters( clusters, new\_clusters, thresh );

iterate = ~iterate;

disp( "Distances between SSD of old clusters averages and new ones" );

disp( distance\_array );

clusters = new\_clusters;

end %End of while loop

clear distance\_array cluster\_amount cluster\_average i iterate new\_clusters thresh

disp( "These are the resulting clusters of the k-means algorithm." )

for i = 1:k

clusters(i).show()

end

image = zeros( H, W, 3, 'uint8');

for y = 1:H

for x = 1:W

c = points(y, x).getcluster();

image(y, x, 1) = uint8(clusters(c).getr());

image(y, x, 2) = uint8(clusters(c).getg());

image(y, x, 3) = uint8(clusters(c).getb());

end

end

imshow( image );

clear k clusters points c clusters H i image k points W x y