DIP Assignment 1 Results

Q1. The bin center values and corresponding frequencies for 32 bins found from both custom function *custom_plot()* and matplotlib's *hist()* function are as follows:

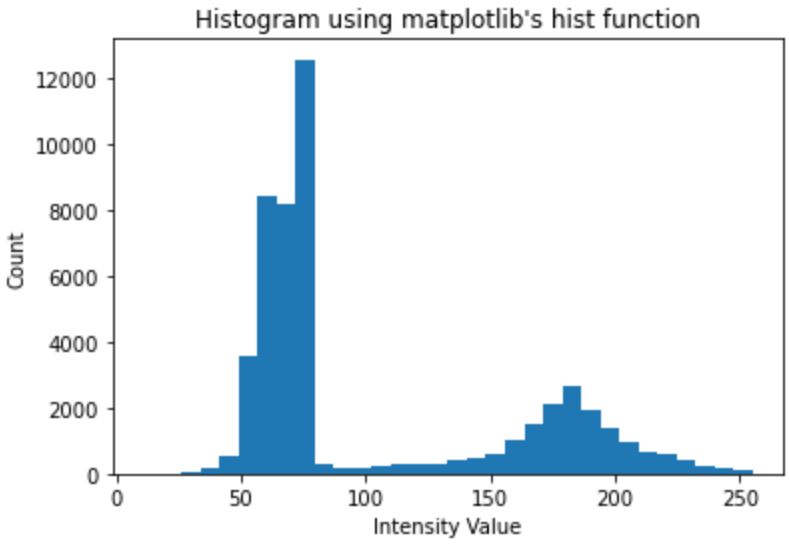
Using Custom Function:

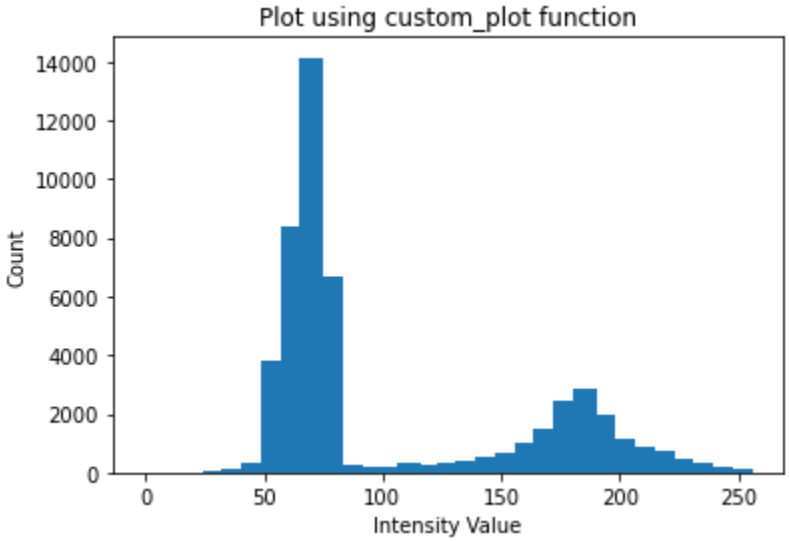
Bin Center	Frequency
4.11	0.0
12.34	1.0
20.56	8.0
28.79	52.0
37.02	150.0
45.24	318.0
53.47	3824.0
61.69	8411.0
69.92	14137.0
78.15	6682.0
86.37	230.0
94.60	168.0
102.82	200.0
111.05	307.0
119.27	281.0
127.50	332.0
135.73	375.0
143.95	506.0
152.18	645.0
160.40	988.0
168.63	1513.0
176.85	2475.0
185.08	2887.0
193.31	1997.0
201.53	1143.0
209.76	841.0
217.98	725.0
226.21	471.0
234.44	307.0
242.66	200.0
250.89	133.0

Using Library Functions:

Bin Center	Frequency
14.81	2.0
22.44	18.0
30.06	64.0
37.69	149.0
45.31	536.0
52.94	3584.0
60.56	8411.0
68.19	8146.0
75.81	12542.0
83.44	309.0
91.06	157.0
98.69	171.0
106.31	252.0
113.94	262.0
121.56	293.0
129.19	292.0
136.81	393.0
144.44	472.0
152.06	574.0
159.69	988.0
167.31	1513.0
174.94	2130.0
182.56	2637.0
190.19	1952.0
197.81	1370.0
205.44	951.0
213.06	645.0
220.69	571.0
228.31	419.0
235.94	223.0
243.56	184.0
251.19	134.0

The histogram plotted using *hist()* and for comparison bar graph plotted using *custom_plot()* function for 32 bins are as follows:





Q2. The results of Otsu's binarization implementation using three different functions are as follows. The 3 different functions are:

1. *otsu_library()* - Uses threshold_otsu() function from skimage library
2. *max_between_classv()* - Calculates the threshold by maximizing the between-class variance
3. *min_within_classv()* - Calculates the threshold by minimizing the within-class variance

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Threshold found by maximizing beetween class variance:  126
Time required using max_between_classv function: 0.0440 secs

Threshold found by minimizing within class variance:  126
Time required using min_within_classv function: 0.0494 secs

Threshold found with skimage's threshold_otsu function:  125
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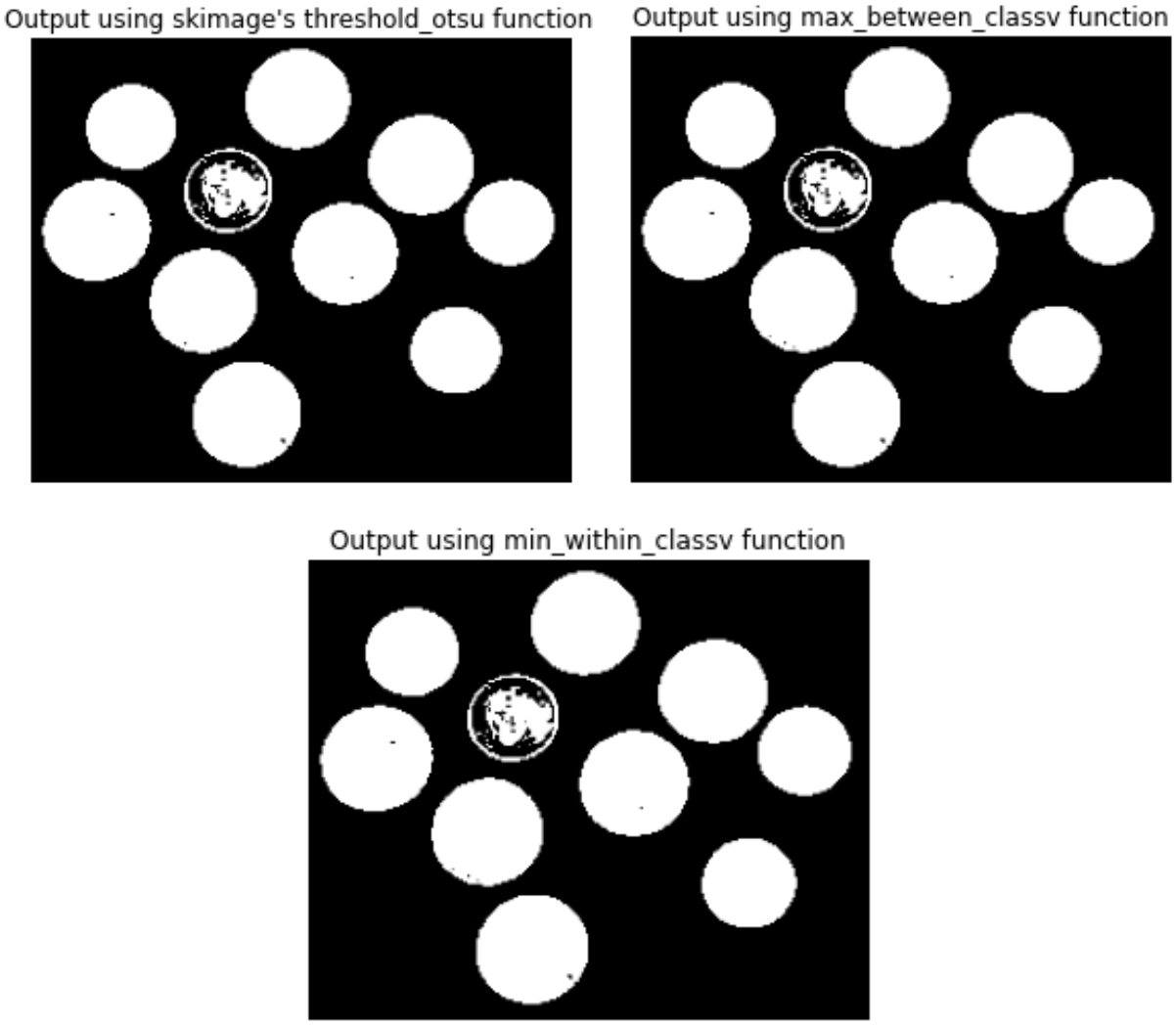
As we can see from above, the threshold calculated by maximizing between-class variance and the one calculated by minimizing within-class variance are both the same and took almost same time. Also, both the thresholds match with the one calculated using a library function.

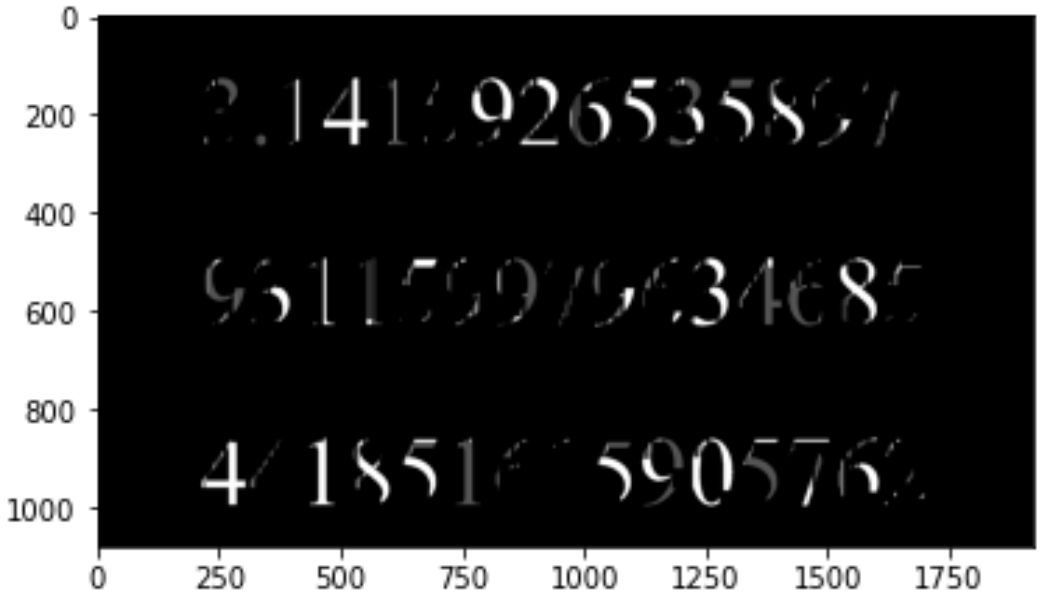
Below are the binary images plotted using corresponding threshold values:



Q3. The text in red color superimposed on the GrassBackground:

Q4. NOTE: This answer is incomplete

The plot of region index found from binary image of PiNumbers.png:



Number of digits in the image obtained from function connected_components() = 3

Q5. The cleaned image got after denoising NoisyImage.png: