1. (15%)

    (a) What is global histogram equalization?

    (b) What is local histogram equalization?

    (c) What is the main difference between local and global histogram equalization?

2. (40%)

    Please design algorithms to achieve the following requirements respectively. Please describe each algorithm step by step clearly as well as the mathematical expressions and structuring elements if there is any. No credits will be given if sufficient details are not provided appropriately.
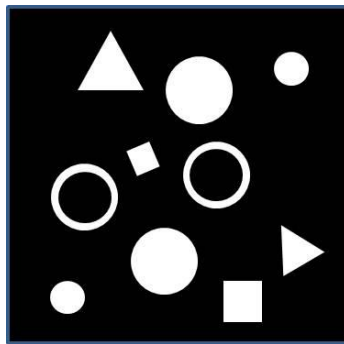

Figure 1

    (a) Count the total number of objects.

    (b) Extract object boundaries.

    (c) Count the number of circles.

    (d) Count the number of triangles.

    (e) Count the number of rings.

3. (30%)

    (a) What is ideal low-pass filter in frequency domain? Why does it may result in ringing artifacts in the output image?

    (b) Explain what the image degradation model is and how to use inverse filter to do image restoration.

    (c) Please describe the instability problem where the inverse filter may encounter and provide one solution.

4. (15%)

    (a) For k-means algorithm, what criterions state a good classification?

    (b) What is the purpose of "Non-maximal suppression" step in Canny edge detector?

    (c) Explain why aliasing may occur while sampling an image and how to avoid it.