THRESHOLDING

Problem 5

In what situations do you think the following thresholding schemes a-c would perform well: (3p)

a) Fixed thresholding.
b) The Triangle algorithm, where a line is constructed between the maximum of the histogram at brightness b_{max} and the lowest value b_{min} in the image. The distance **d** between the line and the histogram h[b] is computed for all values of b from $b = b_{min}$ to $b = b_{max}$. The brightness value b_o where the distance between $h[b_o]$ and the line is maximal is the threshold value.
c) Adaptive thresholding or gradient-based procedures were thresholding is related to image gradient values.

Assume that the distribution of pixel values in an image can be modeled by a weighted sum of two Gaussians, i.e. $p(x) = P_1p_1(x) + P_2p_2(x)$, where p_1 and p_2 refers to the background and object, respectively.

d) What are the weights P_1 and P_2? (1p)
e) What are the parameters of p_1 and p_2? (1p)

Make a simple sketch of p(x) indicating the underlying distributions p_1 and p_2. Use this sketch to answer the following:

f) Where at p_1 and p_2 can you find the optimal (in terms of minimal number of misclassified pixels) threshold value T? (1p)
g) Define the entities sensitivity and specificity (2p)
h) Why do we sometimes prefer to increase or decrease sensitivity and specificity and so deviate from the optimally determined threshold value? (2p)