3. An image contains 40 fishes of type ω_1 and 60 fishes of type ω_2. You need to identify the type of each fish in the image. An image segmentation algorithm is used to separate each fish and compute its size. The two probability density functions (PDFs) of the size x of the two types of fishes, $p(x|\omega_1)$ and $p(x|\omega_2)$, are shown in Figure 3 on page 3, where 2 straight lines can be observed.

Note: Question No. 3 continues on page 3.

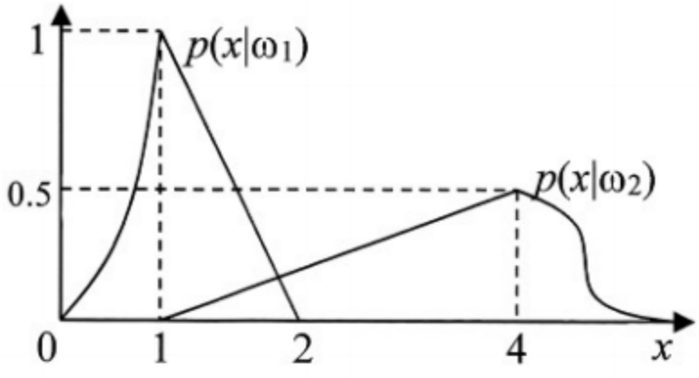

Figure 3

(a) Using optimal thresholding to determine the type of a fish with $x = 1.5$, which minimizes the probability of wrong decision, and calculate the error rate.

(12 Marks)

(b) Generate a decision rule to determine the type of fish based on x, which minimizes the probability of wrong decision, and evaluate the error rate of your method.

(13 Marks)