Problem 1:
Consider a two-category classification problem where
• $\Omega = \{\omega_1, \omega_2\}$
• $P(x | \omega_1) = \mathcal{N}(2, 1)$ (Normal distribution with $\mu = 2$, $\sigma^2 = 1$)
• $P(x | \omega_2) = \mathcal{N}(3, 0.5)$
• $\omega_1$ and $\omega_2$ are equally probable
• $\lambda_{11} = 0, \lambda_{12} = 2, \lambda_{21} = 1, \lambda_{22} = 0$

Find the optimal decision regions given the following loss functions:
   a) $\lambda_{ij} = 0, \lambda_{ij} = 2, \lambda_{ij} = 1, \lambda_{ij} = 0$
   b) $\lambda_{ij} = 1, \lambda_{ij} = 2, \lambda_{ij} = 3, \lambda_{ij} = 4$

where $\lambda_{ij}$ is the loss incurred by classifying a sample that belongs to class $\omega_j$ as class $\omega_i$.

What are the optimal decision regions?

Please give exact solutions, as well as numeric approximations if appropriate.

Problem 2:
Pattern Classification text, chapter 2, problem 12.

Problem 3:
Pattern Classification text, chapter 2, problem 13.

Problem 4 (required only for 6000 level):
Pattern Classification text, chapter 2, problem 14, parts a, b, and c.

Problem 5 (required only for 6000 level):
Pattern Classification text, chapter 2, problem 23, parts a, b, c, and d. For (c), please write an expression for $x_w$ in terms of $x_0$; for (d), use the value of $x_0$ given in (a).

Problem 6:
Pattern Classification text, chapter 2, problem 27.