# ESTIMATION AND DETECTION THEORY

## HOMEWORK # 5:

Please work out the **five** (5) problems stated below – HVP refers to the text: H. Vincent Poor, *An Introduction to Signal Detection and Estimation* (Second Edition), Springer Texts in Electrical Engineering Springer, New York (NY), 2010. With this in mind, Exercise **II.2** (HVP) refers to Exercise 2 for Chapter II of HVP. Exercises are located at the end of each chapter.

**Show** work and **explain** reasoning.

**1.**

Solve Exercise **II.13** (HVP).

**2.**

Solve Exercise **II.14** (HVP).

**3.**

Solve Exercise **II.19** (HVP).

**4.**

Solve Exercise **II.20** (HVP).

**5.**

An $\mathbb{R}$-valued rv $Y$ is said to be uniformly distributed over the finite interval $(a, b)$ (with $a < b$), written $Y \sim \mathrm{U}(a, b)$, if its probability distribution function admits the density $f : \mathbb{R} \to \mathbb{R}_+$ (with respect to Lebesgue measure) given by

$$f(y) = \begin{cases} \frac{1}{b-a} & \text{if } a \leq x \leq y \\ 0 & \text{otherwise.} \end{cases}$$

Consider the ternary simple hypothesis problem

$$H_m : \ Y \sim \mathrm{U}(a_m, b_m), \quad m = 0, 1, 2$$

where $a_0 = -1$, $b_0 = -1$, $a_1 = 0$, $b_1 = 2$, $a_2 = -2$ and $b_2 = 0$. Assume uniform prior, i.e., $p_0 = p_1 = p_2 = \frac{1}{3}$.

**5.a** Find the test that minimizes the probability of error.

**5.b** What is the minimum probability of error?