

EE5130: Detection and Estimation Theory

Problem Set 2

1. (Poor II.F.2) Suppose Y is a random variable that, under hypothesis H_0 , has pdf

$$p_0(y) = \begin{cases} \frac{2}{3}(y+1), & 0 \leq y < 1 \\ 0, & \text{otherwise} \end{cases}$$

and under hypothesis H_1 , has pdf

$$p_1(y) = \begin{cases} 1, & 0 \leq y < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find the minimax rule and minimax risk for uniform costs.

2. (Poor II.F.3) Repeat problem 1 for the situation in which p_j is given instead by

$$p_j(y) = \frac{j+1}{2} e^{-(j+1)|y|}, \quad y \in \mathbb{R}, \quad j = 0, 1$$

$$C_{ij} = \begin{cases} 0, & \text{if } i = j \\ 1, & \text{if } i = 1 \text{ and } j = 0 \\ \frac{3}{4}, & \text{if } i = 0 \text{ and } j = 1 \end{cases}$$

3. (Poor II.F.4) Repeat problem 1 for the situation in which p_0 and p_1 are given instead by

$$p_0(y) = \begin{cases} e^{-y}, & y \geq 0 \\ 0, & y < 0 \end{cases}$$

$$p_1(y) = \begin{cases} \sqrt{\frac{2}{\pi}} e^{-\frac{y^2}{2}}, & y \geq 0 \\ 0, & y < 0 \end{cases}$$

4. (Poor II.F.6) Repeat problem 1 for the hypothesis pair

$$H_0 : Y = N - s$$

$$H_1 : Y = N + s$$

where $s > 0$ is a fixed real number and N is a continuous random variable with density

$$p_N(n) = \frac{1}{\pi(1+n^2)}, \quad n \in \mathbb{R}$$