Seminar 4 - Decision criteria

DEDP

1. Consider the detection of a signal with two possible levels, 0 (hypothesis H_0) or 6 (hypothesis H_1). The signal is affected by noise with triangular distribution $[-5, 5]$. The receiver takes one sample $r = 3.5$.
   a. Find the decision for the sample $r = 3.5$ considering the following criteria:
      - Maximum Likelihood criterion.
      - Minimum probability of error criterion, if $P(H_0) = \frac{3}{4}$ and $P(H_1) = \frac{1}{4}$.
      - Minimum risk criterion, if $P(H_0) = \frac{3}{4}$ and $P(H_1) = \frac{1}{4}$ and the costs are:
        - $C_{00} = 0$
        - $C_{11} = 0$
        - $C_{01} = 5$
        - $C_{10} = 2$
   b. What is the probability of false alarm, $P(D_1 \cap H_0)$, for the third criterion above?

2. An information source provides two messages with probabilities $p(a_0) = \frac{2}{3}$ and $p(a_1) = \frac{1}{3}$. The messages are encoded as constant signals with values -5 (a_0) and 5 (a_1). The signals are affected by noise with triangular distribution $[-10, 10]$. The receiver takes one sample r. Decision is done by comparing r with a threshold value T.
   a. Find the threshold value T according to the Neymar-Pearson criterion, considering $P_{fa} \leq 10^{-2}$
   b. What is the probability of correct detection, $P(D_1 \cap H_1)$?