Seminar 10

DEDP

1. Consider detecting a signal $s_1(t) = 3\sin(2\pi f_1 t)$ that can be present (hypothesis H_1) or not ($s_0(t) = 0$, hypothesis H_0). The signal is affected by AWGN $\mathcal{N}(0, \sigma^2 = 1)$. The receiver takes 2 samples.
   a. What are the best sample times t_1 and t_2 to maximize detection performance?
   b. The receiver takes 2 samples with values $\{1.1, 4.4\}$, at sample times $t_1 = \frac{0.125}{f_1}$ and $t_2 = \frac{0.625}{f_1}$. What is decision according to Maximum Likelihood criterion?
   c. What if we take the decision with Minimum Probability of Error criterion, assuming $P(H_0) = 2/3$ and $P(H_1) = 1/3$?
   d. What is the decision according to Minimum Risk Criterion, assuming $P(H_0) = 2/3$ and $P(H_1) = 1/3$, and $C_{00} = 0$, $C_{10} = 10$, $C_{01} = 20$, $C_{11} = 5$?
   e. What if the receiver takes an extra third sample at time $t_3 = \frac{0.5}{f_1}$. Will the detection be improved? f, What is the minimum value of $P(H_0)$ such that Minimum Risk Criterion results in decision D_1?

2. Se transmite unul dintre semnale $s_0(t)$ sau $s_1(t)$, iar la recepție se recepționează $r(t)$. Semnalele sunt reprezentate mai jos. Știind că semnalele transmise sunt afectate de zgomot alb cu distribuție Gaussiană $\mathcal{N}(0, \sigma^2 = 2)$, să se găsească decizia luată de receptor conform criteriului plauzibilității maxime:
   a. with continous observation
   b. based on 3 samples taken at moments $t_1 = 0.5$, $t_2 = 1.5$ and $t_2 = 3.5$