Exercise Lesson 10

Problems from the compendium:

3.9, 3.19, 3.22, Example 3.7 on page 135

Example 3.19 on page 168, 4.1, 4.6, 4.25

Other problems:

10.1 Consider a 2-ray multi-path channel with impulse response

$$h(t) = \sum_{i=1}^{2} \alpha_i \, \delta(t - \tau_i) \ , \quad \text{where } \alpha_1 = 1, \alpha_2 = 0.5, \tau_1 = 0\,\mu\text{s}, \tau_2 = 1\,\mu\text{s} \ .$$

A binary PAM signal with triangular pulse $g_{tri}(t)$ of amplitude A and duration $T = 2\,\mu$s is transmitted over this channel.

(a) Determine the largest bit rate R_b for which no overlap of signal alternatives will occur after the channel.

(b) Draw the signal $z_1(t)$ at the output of the channel for the input $s_1(t) = A\, g_{tri}(t)$.

(c) Your task is to implement an ML receiver for the given system by means of a matched filter. Determine the impulse response $v(t)$ of the matched filter.

10.2 Consider transmission with a rectangular pulse $g(t) = g_{rec}(t)$ of duration $T = 1\,\mu s$ and a multipath channel with $h(t) = \delta(t) + 0.5 \cdot \delta(t - 2T)$.

(a) Assume that $s_1(t) = +1 \cdot g(t)$ is transmitted and that $N(t) = 0$ (no noise). Draw the signal $z_1(t)$ at the output of the channel.

(b) Let the impulse response of the receiver filter $v(t)$ be matched to the pulse, i.e., $v(t) = g(T - t)$. Draw the signal $z_1(t) * v(t)$ at the output of the receiver filter.