

## Sheet 4 Probability of error

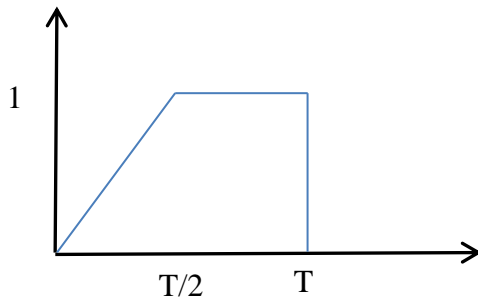
### Problem 1

A binary PCM system uses unipolar RZ signaling to transmit symbols '1' and '0'. The channel noise is modeled as AWGN with zero mean and power spectral density  $N_0/2$ .

Assuming that symbols '1' and '0' have equal transmit probabilities, find an expression for the average error probability at the receiver output using matched filter.

### Problem 2

Repeat problem 1 if the receiver uses a filter with the following impulse response. What is the problem with this filter?



### Problem 3

In a receiver for a Binary Communication System, the inputs to the decision device have the following conditional error probabilities

$$P(e|0') = \frac{\lambda}{N_0} \exp \left[ -\frac{\lambda^2}{2N_0} \right]$$

$$P(e|1') = \frac{1}{\sqrt{2\pi N_0}} \exp \left[ -\frac{(\lambda - A)^2}{2N_0} \right], \quad \lambda > 0 \text{ and } A \gg 0$$

Assuming that the symbols have equal transmission probabilities,

- 1) Find the optimum value of the threshold  $\lambda$  that minimizes the average error probability.
- 2) Find an expression of the average error probability based on the optimum value of  $\lambda$ .