

## ONS Problem Set 3

Wednesday, November 22, 2017

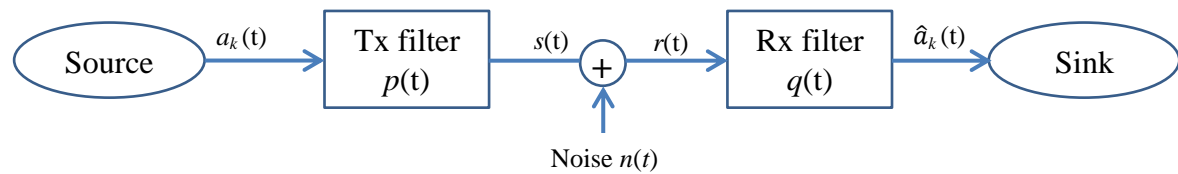
### Problem 1: Bit error ratio (BER)

BER is used as a signal quality metric in transmission systems.

- a) Derive the optimum threshold for the decision threshold for an OOK signal.
- b) Derive a term for the BER of a 4-level pulse amplitude modulation (PAM4) signal.

### Problem 2: Transmitter & Receiver Filters, Matched Filter

- a) Describe a transmission system mathematically using a transmitter filter  $p(t)$  and receiver filter  $q(t)$ . Make use of the following setup.



- b) From the equation derived in part a), calculate the signal-to-noise ratio (SNR) and show that a matched filter maximizes the SNR in a system with AWGN.
- c) Give the units of the time signals and the filter impulse responses.

### Problem 3: Eye diagrams

Which of the following eye diagrams would you identify as having:

- a) Deterministic timing jitter
- b) Random timing jitter
- c) No issue
- d) Shot noise
- e) Bandwidth limitation

