Exercise Sensor Networks

Lecture 3: Error recovery and energy efficient MAC

Exercise 3.1: Cyclic Redundancy Check

Divide the message 10111010011 by the generator polynomial 10011 as done in the lecture. Write down the whole message as if it was transmitted to a receiver.

Exercise 3.2: CRC polynomials

Write a function in Java or C which does the division above. The messages and the generator polynomials should be the input of the function (you can use strings of the kind “01001” but real bit operations are even more appreciated). The boolean result should denote if the message was divisible without a rest or not.

Exercise 3.3: CRC polynomials

(a) Find an easy to identify case in which a given polynomial will fail for a given error.

(b) How long does a generator polynomial have to be at least in order to detect every possible bit error if the message has n bits?

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Exercise 3.4: Poisson-distribution

An audience consists of 10 listeners. Every listener produces an arrive rate of 0.1 phonemes (basic atoms which build spoken language) per time unit. The speaker (in front of the audience) is able to talk at a rate of 2 phonemes per time unit. Each time the speaker encounters 3 or more phonemes the particular time unit is lost and he has to repeat himself. How high is the data rate that can be achieved in this scenario?

Exercise 3.5: Energy efficiency of pure Alloha

A sensor node consumes the following amount of energy:

Basic consumption	: 8 mA
additional consumption for sending	: 20 mA
additional consumption for receiving	: 6 mA

A node must meet a particular energy constraint that requires it not to consume more than 18 mA. How high can the transmission rate per node be chosen in order not to violate the constraint?

Exercise 3.6: Genie Aided Aloha

Genie-aided Aloha was an estimate for the energy efficiency of the Aloha protocol. Is GAA better than pure Aloha in every case and if not when and why?