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Exercise for the lecture
Algorithms for Radio Networks
Winter 2013/14

Sheet 1

EXERCISE 1:

1. A digital system operates at a rate of 56 kbps. What is the the baud rate if a signal uses an encoding with 128 symbols?

2. What is the channel capacity (according to Shannon) for a radio channel which has a 300 Hz bandwidth and a signal-to-noise ratio (SNR) of 3 dB?

EXERCISE 2:
Assume a radio transmitter sending with a power of 50 Watt at a carrier frequency of 900 MHz via free space propagation. Assume that the transmitter and receiver antennas have a gain of 1.

1. Reformulate the Friis transmission equation using logarithmic terms (i.e. units of dBm and dBW)

2. Compute the received power in dBm in the distance of 100m (according to the Friis equation).

3. What is the receiving power at 10 km distance, i.e. $P_r(10 \text{ km})$?

EXERCISE 3:

1. Calculate the Fourier coefficients of the function $\cos(x + \pi/8)$.
   Hint: use the addition theorem.

2. Given n sampling points of a periodic function. i.e. $f(0), f(\frac{1}{n}2\pi), f(\frac{2}{n}2\pi), \ldots, f(\frac{n-1}{n}2\pi)$. How can you approximate with these values the Fourier coefficients?

3. Calculate the Fourier coefficients a_k, b_k for $k = 0, \ldots, 5$ of the periodic function $f(x) = \sin(\frac{3}{2}x)$ $0 \leq x < 2\pi$.

4. What modulation ist used by *GSM*?

5. What modulation does *IEEE 802.11g* use! Which symbol rate and which data rate is possible?