WIRELESS COMMUNICATIONS I
Homework assignments 1

- Homework assignments questions can be found from Moodle.
  - Doing homework assignments is voluntary.
- Every student returns their **own answers to the Return box in Moodle no later than the time indicated in the Moodle Homework Assignments folder.**
- If you answer all the questions (more or less right = **you have tried**), you will get some extra points to raise exam-based grade and, above all, **you will learn MORE** ☺.
  - Maximum 4 extra points will be added to the minor exams total (max 40) points or/and final exam points (max 40).

1. Explain briefly but accurate basic resources of the communication system AND how can you evaluate performance of communication system AND factors, which have effect on the spectrum of digitally, modulated signal.

2. For a multipath fading channel let a scattering function $S_c(\tau,\rho)$ is nonzero over $0 \le \tau \le 0,2$ ms and $-2500 \le \rho \le 2500$ Hz. Assume that the power of the scattering function is approximately uniform over the range where it is nonzero.
   Extra reading: B. Sklar, Rayleigh fading channels in mobile digital communication systems – Part I: Characterization. IEEE Communication Magazine, vol. 35, no. 9, pp. 136–146, September 1997. You can find this article in Moodle (and Part II: Mitigation, too), read them both.

   a) What are the multipath spread and the Doppler spread of the channel? **Explain what the meaning of these spreads are**.

b) Suppose you input to this channel two identical sinusoids. What is the minimum value of Δf for which the channel response to the first sinusoid is approximately independent of the channel response to the second sinusoid?
c) For two sinusoidal inputs to the channel $u_1(t) = \sin 2\pi ft$ and $u_2(t) = \sin 2\pi f(t + \Delta t)$, what is the minimum value of Δt for which the channel response to $u_1(t)$ is approximately independent of the channel response to $u_2(t)$?
d) Will this channel exhibit flat fading or frequency-selective fading for channel with a 2 kHz bandwidth? How about for a channel with a 40 kHz bandwidth?
e) Assume that $BT_s \approx 1$. Is there fast fading, if we use these bandwidths? Explain you answer.

3. Explain briefly but accurate slowly fading channel AND coherence bandwidth and coherence time.