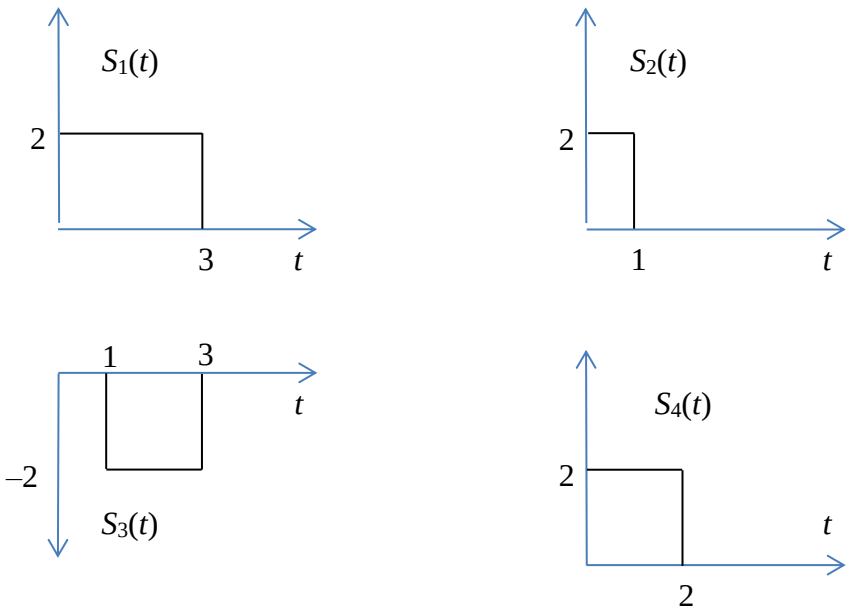
# WIRELESS COMMUNICATIONS I
## Homework assignments 2

- 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. Represent signals (see below) by using orthonormal basis set. Calculate **also** the signal $S_1(t)$ energy and Euclidean distances between the signal $S_1(t)$ and $S_2(t)$ vectors. (*Hint: use the "simplest" signal as a starting point.*)



2. Calculate the energy of FSK-signal. Does it depend on data frequency $m \cdot \Delta f$ ? Draw spectra of individual FSK-signals if $M$ = 2. Start from the following form of the FSK-signal:

$$s_m^{FSK}(t) = A\cos 2\pi(f_c + m \cdot \Delta f)t, \quad 0 \le t \le T,$$

where $A$ is amplitude and $m = \pm 1, \pm 2, \ldots, \pm \frac{M}{2}$, and $f_c >> 1$. It is also known that $\cos^2 u = \frac{1}{2}(1 + \cos 2u)$ and $\sin^2 u = \frac{1}{2}(1 - \cos 2u)$.

3. A voice-band telephone channel has a pass band characteristic in the frequency range 300 Hz < $f$ < 3000 Hz. (*Proakis 9.19*)
   a) Select a symbol rate to achieve 9600 bit/s if you use PSK or PAM modulation
   b) If a square-root raised cosine pulse is used for the transmitter pulse $g(t)$, select the roll-off factor $\beta$. Assume that the channel has an ideal frequency-response characteristic.

4. What is phase locked loop and how it is used in synchronization? Draw also an illustrating figure (figures).

5. What means acquisition and tracking mode in synchronization?