# Lund University
## Department of Electrical and Information Technology

# Systems and Signals, EITF75
**Task 2 (out of 2)**

Deadline: Complete the task, and hand it in in the course mailbox at the third floor no later than Monday October 21, 08.00.

Observe: To simplify the grading procedure:
- Solve one problem per paper sheet
- Write your name on every paper

Statements must be well motivated by reasoning and/or equations
Points from the tasks will be added to the examination score
Maximum total score (exam + 2 tasks) = 5.0+0.5+0.5=6.0p
Exam Grading: 3 (>2.9p), 4 (>3.9p), 4 (>4.9p)

**1.** Consider the two sequences

$$A(n) = \left[\underbrace{1 \quad 1 \quad 1 \quad 1}_{repeated\ 10^6\ times}\right] \qquad B(n) = \left[\underbrace{1 \quad -1 \quad 1 \quad -1}_{repeated\ 10^6\ times}\right]$$

Compute, using Matlab, the convolution between the two sequences, and plot it in Matlab. Attach your computer program. This problem is not meant to be solved by hand.

**2. At the course webpage, download the associated data file. Type "load task2_2019" in Matlab. You then have a signal r.**

The signal **r** contains an oscillation of the form $\boldsymbol{r} = \cos(2\pi\frac{k_0}{N}n)$, where N=128. It is known that k0 is somewhere in the range $5 \leq k_0 \leq 10$, and not necessarily integer valued. However, the signal **r** is noisy, i.e., $\boldsymbol{r} = \cos\left(2\pi\frac{k_0}{N}n\right) + w(n)$ where w(n) is noise. Perform spectral analysis and find $k_0$. Support your arguments with illustrations/motivations.

**3. 10 out of the below 11 statements regarding a certain system can be simultaneously true. Find the one that must be removed, so that the remaining ones can all be true simulataneously.**

a. If the input is $\exp(\frac{i\pi n}{2})$ , then the output is $\exp(\frac{i\pi n}{4})$
b. The system is LTI
c. The system has 10 zeros, and 2 poles at $0.7\exp(\pm\frac{i\pi}{6})$. There are no further poles, including z=0
d. The frequency response is non-zero for all frequencies
e. The system does not have linear phase
f. If the input signal is causal, the output signal is not
g. The system is BIBO stable
h. For an input with finite duration, the output is of infinite duration.
i. The system can be represented by a difference equation
j. All zeros are inside the unit circle
k. If the input signal is u(n), i.e., a step, the output signal y(n), after long time, obeys a steady-state behavior that cannot be y(n)=0 n>>1