Computer Controlled Systems
1st midterm test
2017. 10. 19.
theoretical questions (25 points)
(The answers can be given in Hungarian)

1. Define the exponential function e^{At} of a square matrix A using power series. Give an explicit formula to compute e^{At} analytically (not only approximately). (5p)

2. Define the impulse response function h of a SISO linear time invariant (LTI) system. How can we compute h from the matrices (A, B, C) of a state space model? (5p)

3. When do we call an LTI system BIBO stable? What is the necessary and sufficient condition for BIBO stability? (5p)

4. Let $A \in \mathbb{R}^{n \times n}$ be a positive definite symmetric matrix. Can A have complex conjugate eigenvalues? Does there exist an invertible transformation matrix $T \in \mathbb{R}^{n \times n}$, such that $\bar{A} = TAT^{-1}$ is a stability matrix? Justify your answers! (5p)

5. Define the notion of observability of a state space model (A, B, C). Define the unobservable subspace of (A, B, C). Determine the unobservabe subspace of the following second order LTI system:

$$\dot{x}_1 = a_{11}x_1 + a_{12}x_2$$
$$\dot{x}_2 = a_{22}x_2 + b_2 u \qquad\qquad (5p)$$
$$y = c_2 x_2 \qquad\qquad c_2 \neq 0$$