SF2832 - Mathematical systems theory
Plan for exercise sessions, autumn 2017

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This is not a static document - it may be updated through the course

The following is an outline of the exercise sessions, and also contains recommended exercises associated with each exercise session (selected by the teaching assistant). In general, in the beginning of each exercise sessions there will be a recap of the theory part covered in the lectures. Then we will do some exercises on the board.

Exercises in parenthesis is will be done if time permits.

Recommended to recap. during the course
   Linear algebra: especially the concepts image, range, and kernal of a matrix, and how to compute these. Some of this can be found in Beta, chapter 4.1 - 4.5.
   ODEs: how to solve ODEs. Some of this can be found in Beta, chapter 9.

Exercise session 1: Linear algebra recap. and linear dynamical systems
   In class: Some basic exercises on linear algebra, 1.4, 1.5
   Recommended: 1.1, 1.7 (Hint: consider the differential equation for Φ), 1.8, 1.10 and/or 1.11 and/or 1.12 and/or 1.13, 1.9, 1.14, 1b on Homework 1 from 2016

Exercise session 2: Reachability and observability
   In class: 2.1, 2.3, an exercise related to Example 3.2.9, 2.6, two exercises on observability, (2.10)
   Recommended: 2.4, 2.5, (2.11), 2.14

Exercise session 3: Stability and realization theory
   In class: 3.2, basic exercise on BIBO-stability, 3.3 a, 4.6 a & b, (3.6, and another exercise on time-varying systems)
   Recommended: 3.1, 3.3 b

Exercise session 4: Realization theory
   In class: 4.6 c - f, example of Kalman decomposition
   Recommended: Foremost, a couple of the exercises 4.1-4.10.

Exercise session 5: Pole assignment and observers
    In class: 5.1, 5.2, basic exercise on multiple input, exercise on not fully reachable system
    Recommended: 5.4, 5.5, 5.9, (5.12)

Exercise session 6: Linear quadratic control
    In class: 6.1, infinite horizon version of 6.1, example of infinite horizon LQ control, 6.8
    Recommended: 6.3, 6.5, 6.4, 6.6, (6.9), (6.11)

Exercise session 7: Kalman filtering
    In class: Exam 2009-01-12 question 5, exercise on Kalman filter with deterministic input, (7.2), (exercise on Kalman filter with input = feedback of state estimates)
    Recommended: 7.1, 7.7, (exercise given in class on Kalman filter with input = feedback of state estimates)