Reading and exercising guide for TSIA202a

The lecture notes offer an overview of the mathematical bases of time series far more complete than what we have time to go through during schedules classes.

Below is a tentative schedule for the lectures, classworks ans labs. In the lectures we refer to the parts of the lecture notes concerned. The exercise numbers correspond to those in the *booklet of exercises*. There are also exercises in the lecture notes but some might appear harder to solve or require notions not detailed during the lectures.

The definitions and results described during the lectures should be sufficient to solve all the exercises of the booklet as well as the exercises of the written exam.

Topic: Random Processes and stationarity

Time slot/TH-1 **Lecture :**Introduction to random processes, stationary and weakly stationary time series. We have an abbreviated version of Chapter 1 and Chapter 2 up to Section 2.2 included. In particular we do not go through all the details of Section 1.2 but try to set the bases and the flavor of it.

Time slot/TH-2 **Classwork (TD), homework :**Exercises 2.1 and 3.1 to 3.3.

Time slot/TH-3 **Lecture :**Spectral measure and spectral density. We go through Section 2.3 but do not finish up Chapter 2 as we overlook Section 2.4 for the moment. Some parts of the proof of Herglotz's theorem (Theorem 2.3.1) will probably be skipped to save time.

Time slot/TH-4 **Classwork (TD), homework :**Exercises 4.1 to 4.4

Topic: Linear filtering and ARMA processes

Time slot/TH-5 **Lecture :**Linear filtering of weakly stationary processes, AR, MA, ARMA processes: definitions, existence and uniqueness. We go through Chapter 3 up to Section 3.3.3 included.

Time slot/TH-6 **Classwork (TD), homework :**Exercises 5.1 to 5.4

Time slot/TH-7 **Lecture :**Linear forecasting, Levinson algorithm. We go through Chapter 4. We skip some details and lose some generality to save time. Essentially we derive the Yule-Walker equations (4.1) and (2.19) and the Levinson algorithm (Algorithm 3).

Time slot/TH-8 **Classwork (TD), homework :**Exercise 5.5

Time slot/TH-9 **Lecture :**Innovation, cas des ARMA, représentations canoniques, caractérisation. We mainly follow Section 3.5 but need some definitions and results picked in Section 2.4 (Definition 2.4.1 and Corollary 2.4.1).

Time slot/TH-10 **Classwork (TD), homework :**Exercises 5.6 and 5.7

Topic: Statistical inference

Time slot/TH-11 **Lecture :**Mean and covariance estimation. We provide a brief account of Sections 2.2.2, 6.2, 6.4 and 6.5 but skip the details on the asymptotic behavior of the estimators. Enough should be said to prepare the ground for the lab.

Time slot/TH-12 **Lab (TP) :**

Time slot/TH-13 **Lab (TP) :**

Time slot/TH-14 **Lab (TP) :**

Time slot/TH-15 **Classwork (TD), homework :**Time to finish what was not yet done.

Time slot/TH-16 **Exam (CC) :**(1 heure 30) Written exam. Lecture notes and personal notes from lectures and classworks are authorized.