

# Probability

Spring Semester 2011

Prof. Dr. Stefan M. Moser



## Syllabus

<http://moser.cm.nctu.edu.tw/nctu/prob/>

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### 1 Website

There is a website which is always kept up-to-date:

<http://moser.cm.nctu.edu.tw/nctu/prob/>

You will find there all necessary information and current announcements about this course. All handouts and exercises that are handed out during classes will also be available for download on this page. Note that while the website is available worldwide, the documents can only be downloaded from within the National Chiao Tung University (NCTU) and the National Tsing Hua University (NTHU).

### 2 Course Objective

This course is an introduction to probability. Its goal is to give the students a profound knowledge about probability theory and some of its important applications. We will cover the following subjects:

- Sample Space and Probability
  - probabilistic models and conditional probability
  - total probability and Bayes' Rule
  - independence
- Discrete Random Variables (RV)
  - probability mass function (PMF)
  - transforming RVs
  - expectations
  - joint PMF
  - conditioning and independence
- General Random Variables
  - probability density function (PDF) and cumulative distribution function (CDF)
  - joint PDF
  - Gaussian RVs
  - conditioning

- transforming RVs
- sum of random number of independent RVs
- least squares estimation
- Stochastic Processes
  - Bernoulli process
  - Poisson process
  - Markov chains
- Limit Theorems
  - Markov and Chebyshev inequalities
  - weak and strong law of large numbers
  - convergence
  - ergodicity
  - central limit theorem

For more detail see the above mentioned homepage.

We believe that this course is essential for any engineer and we very much hope that a student who finishes the course will feel comfortable with the theory and can apply it.

### 3 Prerequisites

The following lectures/topics are recommended:

- basic math from high-school

### 4 Instructor

Prof. Stefan M. Moser  
 Engineering Building IV, Office 727  
 phone: 03-571 21 21 ext. 54548  
 e-mail: stefan.moser@ieee.org

### 5 Time and Place

There will be two lectures per week:

- Tuesday, 9:00–9:50 (B), Engineering Building IV, Room B26 (EDB26)
- Wednesday, 10:10–12:00 (CD), Engineering Building IV, Room B26 (EDB26)

The course starts on Tuesday, 22 February 2011, and finishes on Wednesday, 22 June 2011. For a more detailed program see the above mentioned website.

### 6 Office Hours

NCTU requests that every teacher offers two hours per week where students may come to ask questions. The exact time will be announced once it is decided.

However, we would like to encourage you to show up in the teacher's or teaching assistant's office at any time in case you have questions about the class or related subjects. Moreover, we are always available during and after classes.

## 7 Textbook

The course will mainly be based on

- Dimitri P. Bertsekas, John N. Tsitsiklis: *Introduction to Probability*, Athena Scientific, Massachusetts, 2002 (first edition) or 2008 (second edition).

For certain topics there might be some additional handouts.

## 8 Exercises

Every week, an exercise will be distributed in class. This exercise will consist of several problems that need to be solved at home and handed in during the class of the following week. A model solution will be handed out afterwards.

We believe the exercises to be extremely important and crucial to the understanding of the course. They also serve as a preparation for the mid-term and final exams and we therefore highly recommend to solve them. **To pass the course you need to hand in at least 10 exercises.**

## 9 Exams

There will be one mid-term and one final exam. Both exams are going to last three hours and be open-book. Details about the covered material will be published in due time.

## 10 Grading

The grade will be an average of

- the homework and class participation (15%),
- the midterm exam (35%), and
- the final exam (50%).

The grade of the homework will not be based on the correctness of the answers, but rather on the effort the student shows in trying to solve them. Moreover, I will try to reward students who participate actively in the course. This course is worth 3 credits.

## 11 Special Remarks

The lecture will be held in English.