

**MMDA**  
**APPLIED PROBABILITY AND STATISTICS**

SYLLABUS (DRAFT)

1. TEACHER

**Quentin Paris** | Assistant Professor  
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Email: [qparis@hse.ru](mailto:qparis@hse.ru)  
Teaching material: <http://www.qparis-math.com/teaching>

2. CONTENT OF THE COURSE

The course presents an introduction to measure theory, advanced probability theory and statistics, emphasizing their natural connections. The level of the material ranges from a solid undergraduate to a graduate level. The course aims at providing a solid theoretical foundation of modern probability theory along with an overview of a selected number of topics in applied probability and statistics.

***Part 1 - Measure theory***

Measure and probability spaces; Measurable functions and random variables; Integration with respect to a positive measure and applications; Independence and conditioning; Limit theorems in probability; Introduction to discrete time stochastic processes.

***Part 2 - Applied probability***

Basic algorithms for random variable generation/simulation; Some applications of martingales and Markov chains; Basic concentration inequalities; Introduction to optimal transport theory and Wasserstein (Kantorovich) spaces.

***Part 3 - Statistics***

Chosen topics in parameter estimation, confidence regions and hypothesis testing.

3. EVALUATION PROCESS

The final evaluation grade  $g$  for the course will be computed based on:

$h$ : a home assignment grade,

$m$ : a mid-term exam grade,

$f$ : a final test grade,

according to the formula

$$g = \frac{6h + 2m + 2f}{10}.$$

- *Home assignment*

Students will have 4 home assignments. The HA's can be performed individually or in groups of 2 people (maximum). The HA's should be handed over in time (indicated by the teacher), can be hand-written or typed, with name and surname of participants. Reports are expected to be very well presented. The home assignment grade  $h$  will be the average grade of all the HA's.

- *Final and mid-term exam*

The final/mid-term exams will consist in a 3 hours written tests that students will perform individually, at the same time and under the supervision of the teacher. During this test, only a single hand-written A4 sheet of paper (front and back) will be allowed for the students to collect lecture material and results. All other documents or electronic devices will be strictly forbidden. The students are expected to work in total silence and to provide manuscript answers in the order of the given questions, on ruled paper with their name and surname.

#### 4. POLICY

- If the final evaluation grade  $g$  (described above) does not meet the minimal requirements, a final oral make-up test will be given to the concerned students as a chance to validate the course. In case of success at the make-up test, the students will only be given the minimal grade authorizing to validate the course.
- Absence at the final exam should be justified by exceptional medical reasons. In such a situation, official medical certificates are expected to be handed-out as soon as possible. Only for those students able to justify officially their absence, an additional final make-up test will be prepared. Students unable to justify their absence will unfortunately be given the grade 0 to the test.
- Home assignments will be given in advance with a large preparation time. As a result, they are expected to be handed out on time and no additional delay will be allowed. Students unable to hand-out their work in time will be given the grade 0 to the related assignment.