

PROBABILITY AND STATISTICS

QEM 1 and IMMAEF

PREVISIONAL SYLLABUS

Number of Credits: **7 ECTS Credits**. 30 hours of courses and 42 hours of TDs (tutorials), during 12 weeks.

Prerequisites: Logic & Sets, Multivariable Calculus, Computation of sums with summation notation (change of index) and computation of integrals (primitives, change of variables, integration by parts).

Attendance is mandatory (20% of the mark)

The following documents may help the students that have some lacks in the preceding topics. They will be considered as prerequisites for this course:

[SET THEORY](#)

[COMBINATORIAL ANALYSIS](#)

[COMPUTATION OF SUMS](#)

[COMPUTATION OF INTEGRALS](#)

[SOME EXERCICES TO TRAIN](#)

Website of the course:

<https://sites.google.com/view/chorro-christophe/qem-2025-2026>

Teacher: Christophe Chorro

Contact: christophe.chorro@univ-paris1.fr

For further information please contact directly the teacher

Course 1: Probability/ independence (online)

Axioms of probability, consequences of sigma-additivity, independence of sets

TD1: Exercises taken from the summer list

Course 2: Conditional probability/ law of total probabilities/ Bayes formula (online)

TD2: Exercises taken from the summer list

Course 3: Random variables/Independence (16/09)

Examples of random variables, definition, distribution of a random variable, independence

TD 3: ,6, 7, 8 list 3

Course 4: Discrete random variables I (online)

Distribution function, classical distribution (Bernoulli, Binomial, Geometric, Poisson) **TD 4:** 13, 16, 18 list 3

Course 5: Discrete random variables II (23/09)

Functions and independence of discrete random variables, expectation

TD5 : 1, 3, 6 list 4

Course 6: Discrete random variables III (25/09)

Variance/covariance, joint distribution

TD 6: 8, 10, 12 list 4

Course 7: Continuous Random variables I (30/10)

Density function, classical distributions (Uniform, Exponential, Gaussian)

TD 7: selected exercises from the two first lists

Course 8: Continuous Random variables II (2/10)

Functions and independence of continuous random variables, joint distribution

TD 8 2,3, 4 List 5

Course 9: Continuous Random variables III (7/10)

Functions of jointly continuous random variables, expectation, variance

TD 9 5, 6 List 5

Course 10: Continuous Random variables IV /Moment generating function (9/10)

Definition of MGF, computation for classical distributions (Gaussian, Gamma, Poisson)

TD 10 2, 6, 7 list 6

Course 11: Moment generating function (14/10)

Sums of independent random variables revisited, the case of pairs (links with independence)

TD 11 3, 5 list 6

End of the program for the midterm

Course 12: Conditional expectation I (16/10)

Conditional distribution in the discrete and the jointly continuous case, definition of conditional expectation, intuitive interpretation as best approximation,

TD 12: 2, 3, 4 List 7

Course 13: Conditional expectation II (21)

Conditional variance, R^2 , optimal linear predictors

TD13: 5, 6, 7 List 7

Course 14: Random vectors (online)

Vector of expectations, variance-covariance matrix,

TD 14: 8, 9 List 7

WEEK 8: HOLLIDAYS

HOMEWORK TO DO

Course 15: Gaussian vectors I (4/11)

definition of Gaussian vectors, associated mgf

TD 14: MIDTERM EXAM (40% of the mark)

Course 16: Gaussian vectors II (6/11)

Linear transforms, density function, conditional density function

TD 16: Selected exercises from list 6 and 7

For the statistical part, I have kept 3 lists of exercises authored by Joan Lull from Barcelona in 2015/2016

Course 17: Sampling I (13/11)

See slides

TD 17: 2 List A

Course 18: Sampling II (18/11)

See slides

TD 18: 1, 3, 4 List A

Course 19: Estimation I (20/11)

See slides

TD 19: 1, 2 List B

Course 20: Estimation II (25/11)

See slides

TD 20: 4, 9 List B

Course 21 : Test I (26/11, yes a Wednesday)

See slides

TD 21: 1 List C

Course 22: Test II (27/11)

See slides

TD 22: 4, 5 List C

Course and TD 23: (2/12) [Selected exercises](#)

Course and TD 24: (3/12, yes a Wednesday) [Selected exercises](#)

Course and TD 25: (4/12) [Selected exercises](#)

December 12 FINAL EXAM (2H) (40 % of the mark)

- REFERENCES

All the slides of the course are available on my website:

<https://sites.google.com/view/chorro-christophe/qem-2025-2026>

From sessions 1 to 16 some books:

Mathematical Statistics and Data Analysis by John Rice (Chapter 1, 2, 3, 4, 6)

Mood et al, Introduction to the Theory of Statistics (Chapter 1 to 5)

For the students that wants to go deeper in probability theory:

Jacob, Protter, [Probability essentials](#) (Mainly from Chapter 1 to Chapter 16 with Chapter 23)