



Title: Probability

Delivery-mode: Campus-based

Credit rating: 3 ECTS

Learning: In-class learning: 12 hours; Out-of-class learning: 63 hours

Methods of instruction: flipped classroom; live group activity sessions; case study; discussion; teamwork; self-directness learning.

International and Ethics, Responsibility, Sustainability (ERS) focus:

| | | |
|---------------|-------------------------------------|--|
| International | <input type="checkbox"/> | Stand-alone course |
| | <input checked="" type="checkbox"/> | Part of core and/or elective (e.g., topics or themes, discussion of externalities) |
| | <input checked="" type="checkbox"/> | Relevant materials (e.g., case study, data, compulsory reading) |
| | <input type="checkbox"/> | International group project(s) |
| ERS | <input type="checkbox"/> | Stand-alone course |
| | <input checked="" type="checkbox"/> | Part of core and/or elective (e.g., <u>SDG topics</u> , <u>ESG topics</u> , discussion of externalities) |
| | <input checked="" type="checkbox"/> | Relevant materials (e.g., case study, data, compulsory reading) |
| | <input type="checkbox"/> | SDG/ESG group project(s) |

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Teacher: Bénédicte Langella (benedicte.langella@tsm-education.fr)

Teaching assistant: Maurizio Dandrea (maurizio.dandrea@tse-fr.eu)

Brief teacher bio: Mathematics Agregation, teacher at INSA Toulouse, degrees in fundamental mathematics, theoretical mechanics, and English.

Class etiquette

We value the voice of every student in the course. Our diversity as a class (in language, identity, social class, race, colour, national origin, sexual orientation, gender orientation, religion creed, ancestry, cultural background, age, or disability) is an asset to our learning experience. As a result, we will design inclusive lessons and assignments that provide you with the opportunity to speak and be heard, explore your own understanding, and encounter each other.

Success in management depends critically on teamwork. Therefore, we invite and expect every student to engage in constructive discourse, to contribute creatively, to bring their perspective, and to be accepting of others' opinion as part of their learning process.

Degrading, abusing, harassing, silencing, or dismissing others in the process is not acceptable behaviour. It is also bad management attitudes and behaviours. We are committed to providing an enriching learning environment for every student.

Presentation and Intended Learning Outcomes

A) Course overview

Even if you are an experienced manager and your instinct tells you that a business decision is the right one, relying on instinct alone to make decisions can be hazardous. A series of events can result in multiple outcomes, because there are too many data involved. In order to predict which decision will lead to a determined outcome, one has to compute all these data and choose which indicator will be relevant, and that's where statistics and probability step in.

B) Knowledge, understanding and cognitive objectives

By the end of the course, learners will be able to:

- Understand and manipulate the basic tools in descriptive statistics
- Choose the right graphic to represent data and know how to interpret it
- Know how to compute probabilities, with discrete and continuous random variables
- Know how to solve basic equations and simultaneous equations
- Know how to compute and when to use the different moments, and what they represent
- Know how to choose a relevant sample, test an hypothesis, and determine a confidence interval
- Choose the right mathematical tools to model a situation and answer a specific question or solve a case study

C) Skills and attitudes

By the end of the course, learners will be able to:

- Structure their arguments following a rigorous logical pattern
- Communicate their approach and conclusions in an accurate and concise way
- Be able to collaborate efficiently and respectfully with one's peers and instructors during the live sessions, and in order to produce the errors analysis report which will be part of the formative assessment.

D) Digital skills

By the end of the course, learners will be able to:

- Choose the right digital tool (software or online service) to model the data (typically sequences and/or functions) related to a given problem, and generate a graph or chart representing it.
- Find the most appropriate tool to generate a graph related to the studied data, and be able to interpret it
- Choose an appropriate environment to collaborate with one's classmates in order to complete the formative assessment

Link to the programme

The course is positioned at the very beginning of the first year of the BSc. The technical knowledge acquired in this course will help students to work their analytical thinking, scientific rigour and teamwork skills and abilities.

Course outline

This course consists of seven sessions.

| | Date | Session | Topic | Stuff due |
|-----------|------|-------------|---|-----------|
| Session 1 | | Online prep | Basic tools in descriptive statistics. Different types of graphic representations . | |
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| Session 2 | | Online prep | Discrete probability distributions: probability tree diagram, conditional probability. Bernoulli distribution, binomial distribution. | |
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| Session 3 | | Online prep | Different types of moments of discrete random variables. | |
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| Session 4 | | Online prep | Continuous variables and probability, probability density function, expected value and moments. | |
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| Session 5 | | Online prep | Normal distribution. | |
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| | | | Group projects | |
| | | | Discussions with the teacher assistant | |
| Session 6 | | Online prep | Relevant sample, test of an hypothesis, confidence intervals | |
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| Session 7 | | Online prep | Applications, summary of the course. | |

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|--|--|------|---|--|
| | | Live | Formative assessment, group work: errors analysis, discussion, questions. | |
| | | | Final assessment | |
| | | | | |

Prerequisite: none

Readings

- Essential Mathematics for Economic Analysis, *Knut Sydsaeter, Peter Hammond, Arne Strom, Andrés Carvajal*; Pearson editions - 5th or 6th edition (in French: "Mathématiques pour l'économie")

Further readings

- Maths for economics, *Geoff Renshaw*; Oxford University Press
- Getting it wrong - How faulty monetary statistics undermine the Fed, the financial system, and the economy, *William A. Barnett*; The MIT Press

Formative Assessment (55%)

- Class contribution (5%)
- Peer-evaluation and peer-feedback (10%)
- Online prep work on TSM Academy (20%)
- Group projects and/or presentations team project (20%)

Deadline: Friday, October 22nd

The formative assessment will be an error analysis report. Groups of 4 to 5 students will be formed, and each student should analyse a sample of the other ones' errors in the previous exercises done in and out of class. The students will have to answer the following questions:

- What is the error?
- Why did this student commit it ? Which notion did he/she mistake for another, for example ?

Assessment criteria

1. Efficiency of the collaboration between students in the group
2. Diversity of the choice of errors analysed
3. Relevance of the analysis of the causes of these errors
4. Intelligibility of the explanations given

Summative Assessment (45%)

Two-day open-resource exam.

A statistics and probability problem will be given to each group, and will be solved by the group. The written solution will be handed back to the teachers, but the final exam will be an individual oral exam, where each student

Deadline: à définir ensemble.

Assessment criteria

1. Quality of the written solution
2. Soundness of the student's knowledge developed during the oral exam
3. Quality of the student's argumentation

Syllabus Disclaimer

The information provided on this syllabus is tentative and may be modified. Modifications to the syllabus will be announced during class.