Probability (1st year
Preparatory cycle Department)

LESSON PLAN: Probability I

“Carried out as part of the PEDANTIC 2024-" training

Amel AZZI

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I. Course Information

Preparatory cycle Department

Public cible : 1st year

Intitulé du cours : Probability I

Credit:03 Coefficient:02

Duration : 15 Weeks

Days : Sunday: 08h30-10h00Room: Amphi 1 (course)

Room : (Roome A and B)

Professor

Cours, TD : Dr. Abdelrahman KESSIRA

Tutorial (TD) : Dr Amel AZZI

Contact : par mail au amel.azzi@nhsm.edu.dz and abderrahim.kessira@nhsm.edu.dz

Availability :
At the office (Room : Co :04) : Sunday, Monday, 11h00 -12h00

Answer on the forum: any question relating to the course must be posted on the dedicated forum so that you can all benefit from my answer, I undertake to answer the questions posted within 48 hours.

By mail : I undertake to respond by email within 48 hours of receipt of the message, except in the event of unforeseen circumstances, I draw your attention to the fact that the preferred communication channel is the forum, email is reserved for "emergencies" (in the event of a problem accessing the platform) and it must be used with discernment.

II. Course presentation

Course Presentation: Introduction to Probability Theory

Welcome to the captivating world of probability theory! This foundational branch of mathematics is at the heart of understanding uncertainty and making well-informed decisions. Throughout this course, designed specifically for first-year university students, we will embark on an exciting journey to explore the core principles of probability theory and uncover its diverse applications across various disciplines.

As we navigate through this semester, our primary objective is to equip you with a solid understanding of the fundamental concepts that underpin probability theory. From experiments to sample spaces and events, we will lay the groundwork necessary for you to comprehend the intricate fabric of probability.

Building upon this foundation, we will delve into the rich landscape of probability laws and axioms, empowering you with the tools needed to navigate probabilistic scenarios with confidence and precision. Through interactive lectures and engaging discussions, you will gain a deep appreciation for the elegant rules that govern uncertainty.

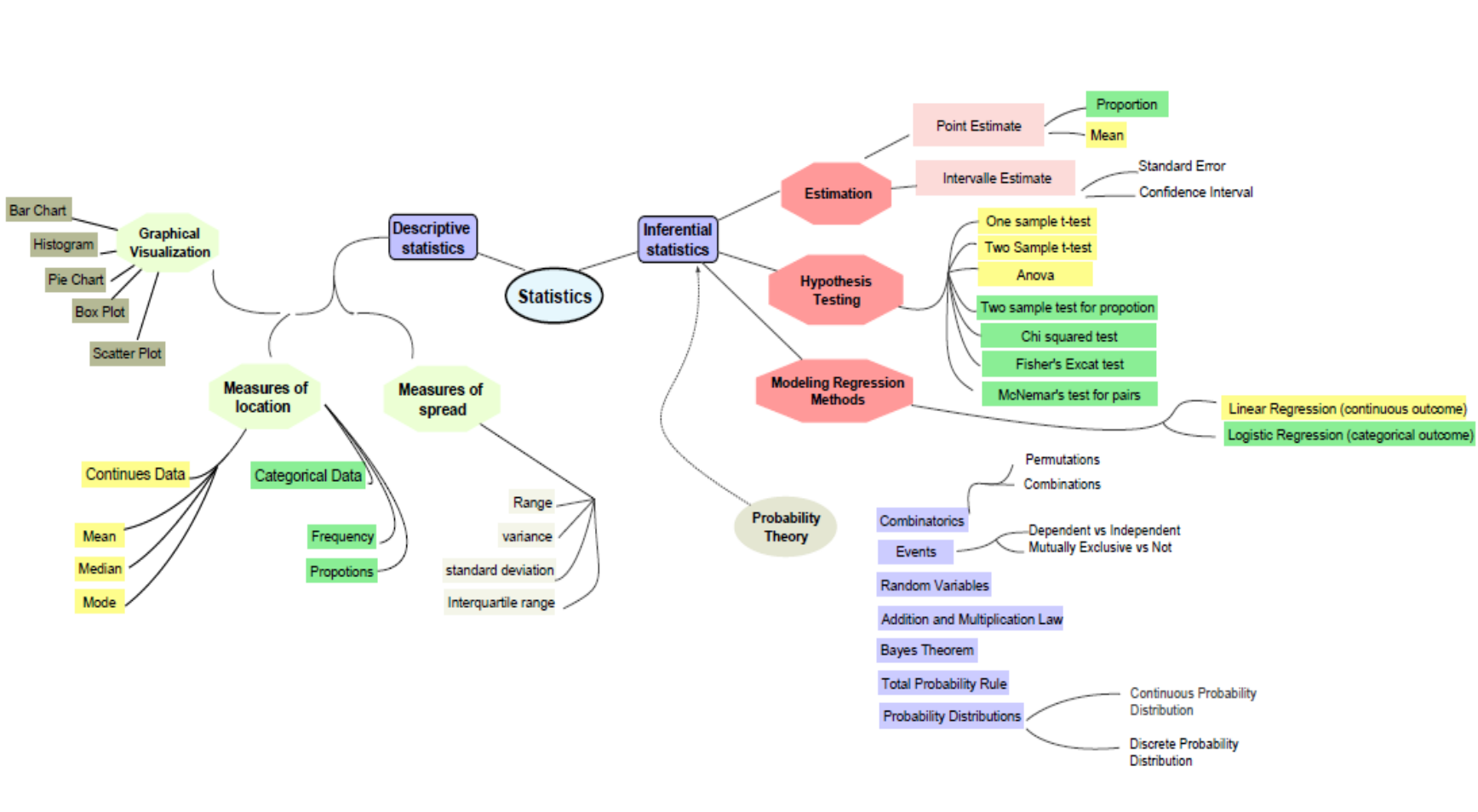
Next, we will journey into the realm of probability distributions, where you will encounter a diverse array of discrete and continuous distributions. From the intuitive simplicity of the Bernoulli distribution to the elegance of the normal distribution, you will learn to analyze distributions, calculate expectations, and quantify variability.

Throughout our exploration, we will emphasize the practical relevance of probability theory, showcasing its applications in real-world scenarios. Whether it's analyzing risk in finance, modeling natural phenomena in biology, or optimizing processes in engineering, probability theory serves as a powerful tool for understanding and predicting outcomes.

By the end of this course, you will emerge with a newfound appreciation for the beauty and utility of probability theory. Armed with a robust understanding of its principles and applications, you will be well-prepared to tackle complex problems and make informed decisions in your academic and professional pursuits. Get ready to embark on an exhilarating journey into the realm of probability theory!

The study of probability aims to equip students with a foundational understanding of randomness and uncertainty, essential for both theoretical knowledge and practical applications. The primary goals include grasping fundamental concepts such as probability distributions, expected value, and variance, and understanding the core principles of probability laws, including the addition and multiplication rules, Bayes' theorem, and the law of total probability. Students learn to model real-world phenomena using probabilistic tools, enabling them to quantify and express uncertainty in various contexts. This foundation supports informed decision-making and risk assessment, vital skills in fields ranging from science and engineering to economics and social sciences. By mastering these basics, students are prepared for more advanced studies in probability and statistics, fostering critical thinking and analytical skills necessary for their academic and professional development.

concept map


Statistics
Descriptive statistics
Inferential statistics
Graphical Visualization
Bar Chart
Histogram
Pie Chart
Box Plot
Scatter Plot
Measures of location
Measures of spread
Continues Data
Categorical Data
Mean
Median
Mode
Frequency
Propotions
Range
variance
standard deviation
Interquartile range
Estimation
Point Estimate
Proportion
Mean
Intervalle Estimate
Standard Error
Confidence Interval
Hypothesis Testing
One sample t-test
Two Sample t-test
Anova
Two sample test for propotion
Chi squared test
Fisher's Excat test
McNemar's test for pairs
Modeling Regression Methods
Linear Regression (continuous outcome)
Logistic Regression (categorical outcome)
Probability Theory
Combinatorics
Permutations
Combinations
Events
Dependent vs Independent
Mutually Exclusive vs Not
Random Variables
Addition and Multiplication Law
Bayes Theorem
Total Probability Rule
Probability Distributions
Continuous Probability Distribution
Discrete Probability Distribution

Content

The course is divided into three learning units All the learning units are described here, the detailed course plan and tutorial is available by accessing the online course then clicking on the classroom and the platform.

a. Introduction

The objectives of Probability ((1 st year (Preparatory cycle Department)) are manifold and depend on the context in which it is used. However, here are some general objectives of Probability: summarize the likelihood of all possible outcomes, Solving daily mathematical problems, Knowing where we can use it in practice, Having solid basics to usual law….

b. The specifics of the module

The probability module teaches foundational concepts like sample spaces, events, and probability laws. It covers various distributions, including discrete and continuous ones, along with expectations, conditional probability, and Bayes' theorem. Applications in diverse fields demonstrate real-world relevance.

III. Preconditions (Les prérequis)

These preconditions provide the foundational framework for understanding and applying probability theory.

1. Experiment: A process that can produce a set of outcomes.

2. Sample Space: The set of all possible outcomes of an experiment, denoted by \(S \).

3. Event: A subset of the sample space, representing a collection of outcomes of interest.

4. Probability Measure: A function that assigns a numerical value between 0 and 1 to each event, representing the likelihood of that event occurring.

IV. Learning goals

These following learning goals help students develop a strong foundation in probability theory and its applications, preparing them for further study or application in various fields

1. Understanding Basic Concepts: Students should grasp fundamental concepts like sample spaces, events, and probability measures.

2. Applying Probability Laws: Students should be able to apply probability laws and axioms, such as the addition rule, multiplication rule, and complement rule.

3. Analyzing Discrete and Continuous Distributions: Students should be able to analyze and work with discrete probability distributions (e.g., binomial, Poisson) and continuous probability distributions (e.g., uniform, normal).

4. Calculating Expectation and Variance: Students should understand how to calculate the expected value (mean) and variance of random variables, and apply properties of these measures.

5. Using Conditional Probability and Independence: Students should be able to compute conditional probabilities and identify independent events, applying these concepts to various scenarios.

6. Applying Bayes' Theorem: Students should understand Bayes' theorem and its applications in real-world problems, including Bayesian inference and decision making.

7. Analyzing Joint and Marginal Distributions: Students should be able to analyze joint probability distributions, conditional distributions, and marginal distributions for multiple random variables.

8. Understanding Limit Theorems: Students should comprehend important limit theorems such as the law of large numbers and the central limit theorem, and understand their implications.

9. Applying Probability in Real-world Contexts: Students should be able to apply probability theory to practical problems in fields such as engineering, finance, biology, and physics.

10. Developing Problem-solving Skills: Students should develop problem-solving skills by solving a variety of probability problems, both theoretical and applied.

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V. Learning evaluation methods

The final evaluation is done through:

c. **A final table exam :**which covers everything you have seen in this course during the semester, during this exam, which counts for 50% of the final grade .

a. **Continuous and regular evaluation:** with the remaining 50%, it allows you to earn points throughout the semester, this continuous evaluation is carried out in different forms,You have :

- ✓ To solve problems similar or close to the problems dealt with during the tutorials, questions.
- ✓ To answer summary questions (via multiple choice questions)
- ✓ To answer reflection questions. (you will be trained to answer this type of question by the questions asked during the tutorials, courses and during the quizzes that will be offered to you online)

Teaching-learning activities

By incorporating a variety of teaching activities, instructors can cater to different learning styles and create a dynamic learning environment that fosters engagement and comprehension of probability concepts.

- Lecture Presentations: Traditional lectures can introduce new concepts, provide explanations, and offer examples to illustrate key ideas.

- Interactive Discussions: Foster discussions to encourage student participation and critical thinking. Use thought-provoking questions to stimulate discussion on challenging topics.

- Problem-solving Sessions: Provide students with practice problems and guide them through the process of solving them. Encourage students to work collaboratively in groups to solve problems.

- Hands-on Activities: Incorporate hands-on activities, such as experiments or simulations, to demonstrate probability concepts in action. For example, flipping coins or rolling dice to understand basic probability rules.

- Case Studies: Present real-world scenarios where probability theory is applied. Analyze case studies together as a class to understand how probability concepts are used in various fields.

- Interactive Online Resources: Utilize interactive online resources, such as simulations or interactive tutorials, to reinforce concepts and engage students outside of the classroom.

- Group Projects: Assign group projects where students can apply probability theory to analyze data or solve practical problems. This encourages teamwork and application of learned concepts.

- Guest Speakers: Invite guest speakers, such as professionals who use probability in their careers, to share their experiences and provide real-world insights.

- Quizzes and Assessments: Administer quizzes and assessments to gauge student understanding and track progress. Provide constructive feedback to help students improve.

- Practical Applications: Integrate practical applications of probability theory into assignments and assessments to demonstrate the relevance of the concepts learned in class.

Operating methods

The course is organized in:

- Theoretical sessions to provide you with all the knowledge needed to deal with practical problems.

- In tutorial sessions (TD), present after each learning unit (chapter), so that you can mobilize knowledge in solving the exercises and problems proposed.

Help Resources

Resources are made available to you on the platform:

- ✓ Courses of each chapter
- ✓ Some Book of Probability (link+PDF)
- ✓ Work sheet problem with solutions
- ✓ Proposed exercises with solutions.