



Center International Programs & Sustainability Studies

Course name: Introduction to Statistical Reasoning & Data Analysis

Course code: STAT 1151

Total contact hours: 48

Pre-requisites: Algebra

COURSE DESCRIPTION

In our news-saturated era, brimming with information and unfiltered data, understanding what is relevant and what is not, and more importantly, discerning what has a scientific basis and is evidence-based, becomes one of the most important skills that any professional must acquire during their higher education. This course serves as an introduction to fundamental concepts and the logical foundation of statistical reasoning. It equips students with practical skills at an introductory level, enabling them to select, generate, and accurately interpret various descriptive and inferential methods. Furthermore, this course fosters an understanding of the wide-ranging applications of statistics and its significance. No prior statistical knowledge is required. This course aims to teach students how to develop the proper mental stepwise process to collect, inspect, characterize and examine data from a scientific point of view, based predominantly on statistics. You will learn to unpack and analyze information by presenting and discussing your own results in round tables and presentations.

COURSE PRE-REQUISITES

Basic math and Algebra.

AUDIENCE

This course is structured for any international student attending the Study Abroad Program at an LCI Education university campus with or without knowledge on statistics or scientific data analysis. However, courses are not exclusive to foreigners so local degree-seeking students may enroll in this course.

This is a theoretical-practical course and explores/responds to the following inquiry according to the professional/disciplinary profile:

How to collect, organize, unpack and analyze data for inspection, characterization, exploration, and the derivation of conclusions through the appropriate statistical reasoning?

In order to respond this question, we will study the following generative topics:

- Statistical reasoning
- Data basics.
- Sampling principles and strategies.
- Numerical data.
- Categorical data.
- Probability.
- Random variables.
- Types of distributions.
- Point estimates.
- Sampling variability.
- Confidence intervals.
- Chi-square.

- Paired data.
- Correlation.
- Least-squares method.
- Analysis of Variance
- Linear regression.

Along the course, the following **skills** will be fostered:

- Pattern description.
- Understanding of sampling and experimentation.
- Applying, accepting or rejecting hypotheses.

Among the **values** and **attitudes** that will be promoted among students are the following:

- Teamwork and leadership.
- Systemic thinking.
- Logical and communicative intelligence.
- Problem solving.
- Learning how to learn.
- Learning to apply theoretical concepts to real-life scenarios.
- Thinking outside the box.

COMPETENCIES, CRITERIA AND EVIDENCE

The competencies for the Veritas University are reflexive and integral actions that respond to the professional profile and to the problems of the context, with suitability and ethical commitment, integrating the know-how, and the knowledge to know in a perspective of improvement.

Below are both the disciplinary and general competencies, linked to their criteria and evidence of performance for this course.

Competencies	Key competencies	Learning Assessments
Specific		
Applies the theoretical-practical foundations of data analysis and statistics to address problems in various areas of basic sciences, according to modern research standards.	<ul style="list-style-type: none"> ○ Comprehends the basic concepts and procedures of data analysis. 	<ul style="list-style-type: none"> ○ Oral presentations. ○ Mind maps. ○ Discussions.
	<ul style="list-style-type: none"> ○ Applies techniques and methods of research considering current tools. 	<ul style="list-style-type: none"> ○ Reports. ○ Research. ○ Presentation of results.
	<ul style="list-style-type: none"> ○ Utilizes data concepts and techniques to solve research questions. 	<ul style="list-style-type: none"> ○ Case studies. ○ Discussions. ○ Presentations.
General/Core		
Integrates knowledge, skills and attitudes to learn continuously and through one's life pursuing an efficient development in the knowledge-based society.	<ul style="list-style-type: none"> ○ Learning to learn. 	<ul style="list-style-type: none"> ○ Report. ○ Research. ○ Discussions. ○ Case studies.
Integrates the necessary knowledge, skills and attitudes to learn interpersonal communication techniques.	<ul style="list-style-type: none"> ○ Relates well to others ○ Manage and solve conflicts. ○ Negotiates reliably and empathetically ○ Speaks responsibly ○ Listens attentively. 	<ul style="list-style-type: none"> ○ Round table. ○ Reports. ○ Presentation of results. ○ Research.
Builds the necessary knowledge, skills and	<ul style="list-style-type: none"> ○ Communicates thoughts of the discipline orally, 	<ul style="list-style-type: none"> ○ Presentations. ○ Mindmaps.

attitudes to learn how to communicate orally and in written form in the different disciplines that make up the curriculum.	graphically, and in written form.	
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CONTENT

Unit I. Data basic concepts.

- Data Analysis and Statistics
- Variance.
- Standard deviations.
- Mean.
- Quartile.
- Variables.
- Random variables.
- Relationships between variables.
- Populations.
- Data acquisition techniques.

Unit II. Data interpretation techniques.

- Types of plots (histograms, bar plots, whiskers and boxes, pie chart, mosaic plots, mapped data, tree diagrams).
- Contingency tables.
- Row and column proportions.
- Venn diagrams.

Unit III. Probability.

- Mutually exclusive events.
- Probability distribution.
- Complements.
- Independence.
- Conditional probability.
- Marginal and joint probabilities.
- Linear combination of random variables.
- Variability.
- Continuous distributions.

Unit IV. Types of distributions.

- Normal distributions.
- Geometric distribution.
- Binomial distribution.
- Negative binomial distribution.
- Poisson distribution.

Unit V. Interference.

- Categorical data.
- Numerical data.
- Chi-square.
- Two-way tables.
- Single and double proportions.
- Paired data.
- One-sample means with the t-distribution.
- One way ANOVA

Unit VI. Regressions.

- Linear regression.
- Multiple regression.

METHODOLOGY

The professor will instruct the course through guided master classes where concepts from all units will be explained and demonstrated. Real-life examples will be used to understand all concepts better and provide a tool for students to mimic in other activities. Case studies and reports will be the main ways of evaluating abilities. The class will consist of a masterclass that will cover the concepts, techniques and methods of the day, followed by a practical hands-on case study in which students will solve the exercises supervised by the professor. At the end of each class, the students will host a round table in which they will show and discuss their results and the relevance of the knowledge gained with the exercises performed. During selected classes, the results will be presented as graded oral presentations, round tables and written reports. At the beginning of the course, students will be offered sets of data and projects that they can pick and analyze during the course. Finally, at the end of the course during the last week the students will show the results of the statistical and data analysis of their selected data in a final assignment.

EDUCATIONAL RESOURCES

In order to guarantee a good development of the course, therefore, to guarantee learning, the following resources are available: an updated bibliographic database, multimedia equipment that students can use for their individual presentations, whiteboards and other school equipment for weekly sessions, and readings provided by the educator. All of these complement the suggested projects and provide the students with higher possibilities of knowledge ownership. Most of the lessons will take place in the classroom.

During independent work periods students will be able to attend the institution. A campus library, study rooms, and computer labs are available for the students' independent work time. Free Wi-Fi connection for students, educators, and staff is provided on campus, which gives students the possibility to work not only in the library or computer labs, but also around campus.

LEARNING EVALUATION

Evaluation compiles and evaluates evidence by taking into account feedback providing pre-established criteria. The course evaluation must be aligned with the competencies and the teaching methodology. There is a rubric for each evaluation resource, and the details will be provided in **CANVAS LMS**. Even though the rubric grants a grade, it is also a quantitative and qualitative description of the students' performance. The rubrics include the core and discipline key competences.

ASSIGNMENTS	PERCENTAGE VALUE
Oral presentations to present the results of the case studies (3 in total)	30 %
Round tables (3 in total)	20 %
Written reports (3 in total)	30 %
Final assignment (1 in total)	20 %
Total	100%

LEARNING STRATEGIES AND RUBRICS

1. Oral presentations:

This work aims to challenge the student in a public-speaking setting.

There will be three oral presentations throughout the course, which will be used to present the results of 3 separate case studies. The conclusion of each unit will assign each case study so that the case studies will be regarding specific topics for each unit. This method intends to showcase real-life scenarios where students must apply statistical-related concepts.

These presentations will comprehend 30 % of the course, split equally across the three assignments for this specific evaluation.

2. Round tables:

These activities promote oral expression by creating a space to discuss topics, contrary to the more direct approach of oral presentations. However, the discussions will be centered around the group/individual presentations and will look to expand the conversation. Students will debate about specific points moderated by the professor: how useful statistical tools were for solving the case study, other resources that could have been useful, and further technical questions related to each unit. These round tables will comprehend 20 % of the course, split equally across the three assignments for this evaluation.

3. Written reports:

In addition to the evaluations described in points 1 and 2, written reports will be requested to examine in a detailed way the methodologies applied by the students to solve the case studies. A specific structure will be required to assure quality. These reports will comprehend 30 % of the course, split equally across the three assignments for this particular evaluation.

4. Final assignment:

This assignment is designed to recapitulate and synthesize the contents of the course. The structure will be the same as for the written reports. Given that the assignment will be a written report, the same rubric will be applied. It must include an updated mind map of the entire course and a description of the mind map with detailed information about each point highlighted. The value of this assignment will be 20 %.

ATTENDANCE

Regarding classes:

1. Students are only allowed a two (2) **non-consecutive (back-to-back) class absences**. A student shall fail the course if more than two absences are registered by the professor. Administration does not control attendance.
2. Three **late arrivals** to class (arrival after the first 15 minutes) are treated as one absence. Attending class 30 minutes late without an official justification will also count as an absence.
3. In the case of an **absence from any assignment evaluated in class** (presentations, evaluations, field trips, etc.) a student will be given a grade of zero unless an official document is presented within **one week** of the absence.
4. If a student presents an official document to excuse the absence, the missed assignment is to be presented on that same day.

CODE OF CONDUCT

Professors have the right to expel a student from the classroom should he / she/ they:

1. Be disruptive in the classroom.
2. Behave in a disrespectful way.

3. Be under the influence of alcohol.
4. Be under the influence of any illegal drug.
5. Shows hygiene or odor problems that may disturb other students.

ELECTRONIC DEVICES

The use of cell phones, smartphones, or other mobile communication devices is disruptive and is therefore prohibited during class. **Please turn all devices OFF and put them away** when class begins. Devices may be used only when the professor assigns a specific activity and allows the use of devices for internet search or recording. Those who fail to comply with the rule must leave the classroom for the remainder of the class period. Using devices while the professor or other peers are lecturing, or presenting is perceived as a lack of interest and disrespectful.

STUDY ABROAD PROGRAM POLICIES

The student must comply with the provisions of the Study Abroad Program Policies available on the Canvas platform.

BIBLIOGRAPHY

1. Illowsky, B., & Dean, S. (2018). Introductory statistics. *OpenStax College, Texas*.
2. Dalgaard, P. (2008). Introductory statistics with R. Springer Publication.
3. Daniel, W. W., & Cross, C. L. (2018). *Biostatistics: a foundation for analysis in the health sciences*. Wiley.
4. Nageswara, R. (2007). Statistics for agriculture sciences. BS Publication.

CHRONOGRAM

Week	Contents	Learning strategies
Week 1	<ul style="list-style-type: none"> ○ Example case study ○ Variance (Unit I) ○ Standard deviation (Unit I) ○ Mean (Unit I) ○ Quartile (Unit I) 	<ul style="list-style-type: none"> ○ Guided exercises in class
	<ul style="list-style-type: none"> ○ Variables (Unit I) ○ Random variables (Unit I) ○ Relationships between variables (Unit I) ○ Introduction to R 	
Week 2	<ul style="list-style-type: none"> ○ Populations (Unit I) ○ Data acquisition techniques (Unit I) 	<ul style="list-style-type: none"> ○ Guided exercises in class
	<ul style="list-style-type: none"> ○ Types of plots (Unit II) 	
Week 3	<ul style="list-style-type: none"> ○ Contingency tables (Unit II) ○ Row and column proportions (Unit II) ○ Venn diagrams (Unit II) 	<ul style="list-style-type: none"> ○ Assignment of case study I (Units I and II)
	<ul style="list-style-type: none"> ○ Mutually exclusive events (Unit III) 	
	<ul style="list-style-type: none"> ○ Probability distribution (Unit III) ○ Complements (Unit III) 	<ul style="list-style-type: none"> ○ None

Week 4	<ul style="list-style-type: none"> ○ Units I and II 	<ul style="list-style-type: none"> ○ Oral presentation I (Units I and II) ○ Written report I ○ Round table I
Week 5	<ul style="list-style-type: none"> ○ Units I and II 	<ul style="list-style-type: none"> ○ Oral presentation I (Units I and II) ○ Written report I ○ Round table I
	<ul style="list-style-type: none"> ○ Independence (Unit III) ○ Conditional probability (Unit III) 	<ul style="list-style-type: none"> ○ None
Week 6	<ul style="list-style-type: none"> ○ Marginal and joint probabilities (Unit III) ○ Linear combination of random variables (Unit III) 	<ul style="list-style-type: none"> ○ None
	<ul style="list-style-type: none"> ○ Variability (Unit III) ○ Continuous distribution (Unit III) 	
Week 7	<ul style="list-style-type: none"> ○ Normal distributions (Unit IV) ○ Geometric distributions (Unit IV) ○ Binomial distributions (Unit IV) 	<ul style="list-style-type: none"> ○ Assignment of case study II (Units III and IV)
	<ul style="list-style-type: none"> ○ Negative binomial distribution (Unit IV) ○ Poisson distribution (Unit IV) 	<ul style="list-style-type: none"> ○ None

Week 8	<ul style="list-style-type: none"> ○ Categorical data (Unit V) ○ Numerical data (Unit V) 	<ul style="list-style-type: none"> ○ Guided exercises in class
	<ul style="list-style-type: none"> ○ Chi-square (Unit V) ○ Two-way tables (Unit V) 	
Week 9	<ul style="list-style-type: none"> ○ Units III and IV 	<ul style="list-style-type: none"> ○ Oral presentation II ○ Written report II ○ Round table II
	<ul style="list-style-type: none"> ○ Units III and IV 	
Week 10	<ul style="list-style-type: none"> ○ Single and double proportions (Unit V) ○ Paired data (Unit V) 	<ul style="list-style-type: none"> ○ Guided exercises in class
	<ul style="list-style-type: none"> ○ One-sample means with the t-distribution (Unit V) ○ One Way Anova 	
Week 11	<ul style="list-style-type: none"> ○ Linear regression (Unit VI) ○ Multiple regression (Unit VI) ○ 	<ul style="list-style-type: none"> ○ Assignment of final assessment
	<ul style="list-style-type: none"> ○ Regression examples (Unit VI) 	

Week 12	○ Entire unit V	○ Oral presentation III ○ Written report III ○ Round table III
	○ Entire unit V	○ Oral presentation III ○ Written report III ○ Round table III ○ Final assignment

Please note that this chronogram is tentative and subject to change.