COURSE TITLE

BASIC STATISTICS AND PROBABILITY

1.1. Course code number

18872

1.2. Content area

Instrumental

1.3. Course type

Basic

1.4. Degree level

Undergraduate

1.5. Level year

Second

1.6. Semester

First (Fall semester)

1.7. Number of credits

6 ECTS credits

1.8. Prerequisites

Good background in High School Algebra

1.9. Minimum attendance requirement

Attendance is compulsory

1.10. Instructor

Prof. Patricio Cifuentes

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Office hours:

1.11. Course objectives

The main aim of this course is to introduce the student to the basic statistical concepts that will permit a first approach to the descriptive and the inferential statistical tools, giving enough background to interpret the basic Statistics results found in scientific papers. The course is completed with a short introduction to the elementary concepts in Probability, essential to give a scientific foundation to Mathematical Statistics. These general objectives may be summarized in the following four points:

1. Introduction to the basic Statistical tools to analyze data proceeding from a variety of sources.
2. Introduction to the basics of Probability.
3. Ability to read and understand statistical texts from several scientific areas.
4. Use of basic computing statistical tools.

1.12 Course contents

- DESCRIPTIVE STATISTICS: Graphical and numerical representation of quantitative data. Paired data: covariance, regression line, correlation coefficient.
- PROBABILITY MODELS AND SAMPLING: Discrete random variables. Bernoulli trials. Binomial distribution. Continuous random variables. Uniform distribution. Normal distribution. Sampling. Estimators. Distributions related to the normal distribution: Chi square, Student's t, F.
- POINT ESTIMATION: The concept of a point estimator. Properties. Criteria to determine good point estimators.
- CONFIDENCE INTERVALS: Constructing confidence intervals. Confidence intervals for proportions. Confidence intervals for means in normal populations. Paired data. Approximate intervals from large samples. Minimum sample size.
- HYPOTHESIS TESTING: Setting of the problem. Null and alternative hypothesis. Type I and Type errors. Significance level and rejection set. Tests for ratios. Tests for mean in normal populations. Paired data.

Relationship between confidence intervals and hypothesis testing. What is the p-value? Non-parametric tests: goodness of fit.

1.13 References

Textbook

- MCCLAVE, JAMES T. and SINCICH, TERRY. *Statistics* (12th international ed.) Pearson Education International. ISBN 13: 978-0-321-80728-1.

Other texts

- MOORE, DAVID S. *The Basic Practice of Statistics*. W. H. Freeman, (several editions).
- MILTON, J. SUSAN and ARNOLD, JESSE C. *Introduction to Probability & Statistics.* McGraw-Hill, (several editions).

2 Teaching methodology

The course will meet 4 hours per week. The material of the course will be covered during two of these four hours. The other two hours will be dedicated to discussing and solving exercises, using specialized computer software, and doing exams and quizzes.
Homework will be due on weeks 3, 7, and 12. Homework can be worked out in groups but should be turned in individually.

3 Student workload

Students are supposed to dedicate 6 hours per week to personal study and work.

4 Evaluation procedures

During the semester, two quizzes and a midterm will be given. The final grade will determined as follows: the final exam will count 40%, the midterm will count 30%, and each quiz will count 15%.

5 Course calendar

Week 1: Sep 10th Intro; overview; Statistics, what is it? Types of data.
Week 2: Sep 17th Data description, summaries. Diagrams, plots, numbers.
Week 3: Sep 24th *Quiz 1.* Intro to Probability, elementary problems.
Week 4: Oct 1st (Organic Chemistry Lab)
Week 5: Oct 8st A more formal approach to probability.
Week 6: Oct 15th Random variables. Discrete random variables.
Week 7: Oct 22th Bernoulli trials, binomial distribution.

Week 8: Oct 29th Review session. *Midterm*.
Week 9: Nov 5th Continuous random variables. Uniform and normal distributions.
Week 10: Nov 12th Sampling and the Central Limit Theorem.
Week 11: Nov 19th Point and interval estimation. Means and Proportions.
Week 12: Nov 26th *Quiz 2.* Hypothesis testing.
Week 13: Dec 3rd Hypothesis testing for the mean, known variance.
Week 14: Dec 10th Hypothesis testing for mean and variance.
Week 15: Dec 17th Two-sample inferences, equal variances.
Week 15: Dec 17th *Final exam.*