McDaniel College Budapest

STA 2215 – Elementary Statistics for Social Science

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Availability
After class or by appointment.

Prerequisite
Students must take the mathematics placement exam. Apart from this, students are highly encouraged to revise the following topics before the beginning of the semester.

- basic algebra, fractions, percentages
- ratio and proportions
- calculus - basic functions: polynomials, **exponential function**, logarithmic function, drawing graphs of the these functions

Course Description
This course introduces important statistical principles and techniques with the aim of providing a strong background for applying statistical analysis in business and social science research. While introducing the mathematical foundations of statistics, the lectures and class activities will aim to engage students with varying degrees of confidence in mathematics to apply newly learned concepts to real world examples and data. The course focuses on building strong foundations for the study of more advanced statistical topics in the future.

The course is structured into three parts.

- Part 1: Descriptive statistics. This part of the course deals with summarizing large data in a concise, coherent manner. Various scales of measurement and measures of location and variability are used to summarize different aspects of the data.
- Part 2: Probability. Basic understanding of probability is fundamental to and the underlying foundation of statistical inference. This part of the course includes basic probability, conditional probability, random variables, expected value, variance, and discrete and continuous probability distributions.
- Part 3: Statistical inference. Knowledge of probabilistic distributions is applied to analyze statistical variables (population mean, variance etc.) to infer, with a precise degree of confidence, the intervals for these variables, and to further state the probability of certain hypothesis about these variables. These ideas are further evolved in Goodness of Fit and Simple Linear regression.

Course objectives

- Choosing appropriate descriptive statistical method, and to summarize given data in concise and intelligible manner. This also involves using a software like Google sheets or Excel to present the data in a clear manner.
- Building a strong foundation in basic probability theory.
- Applying statistical inference methods to sample problems from business or social science research.
- Acquiring skills for communicating and presenting data analysis in a clear and comprehensive way.

Learning outcomes

- Students will gain an understanding of different ways to summarize and present data, on paper and using Google sheets or Excel. Students will learn both graphical methods (like charts, histograms etc,) and numerical methods (mean, quartiles etc) for this.
- Students will achieve a certain level of comfort with basic probability, counting, and its application to problems from business and social sciences. They will also learn probability distributions and their use in modeling real life situations.
- Students will gain an understanding of various methods of statistical inference that will be a foundation to advanced classes in statistics. They will also learn how to use probability to understand the reason behind these methods. This understanding will help them to discern how to apply methods of statistical inference instead of rote learning of application of formulas.

Required texts & materials

- Anderson, Sweeney, Williams. *Statistics for Business and Economics*. (11^{th} edition)

Assignments & grading

Homework	– 25%
Quizes	– 20%
Midterm	– 25%
Final exam	– 30%

Final letter grades will be based on the McDaniel College scale in the Guidance Bulletin.

Course Policies

Class Attendance is mandatory. After a student's third unexcused absence, all additional unexcused absences result in an automatic drop in the student's final grade, one letter grade per absence.

Class participation: Students will be expected to be actively engaged during class and will be frequently asked to apply the concepts learned through in-class exercises. Participation includes solving practice exercises, answering questions that will be raised during the lectures, and asking questions when a concept is unclear.

Homework policies: Weekly homework will be assigned. It is due before the first class of the following week. Late submissions are not accepted. Some assignments will require the use of Excel/ Google sheets or an equivalent software. All submissions must be made via Blackboard. Work must be shown, grading is based on completeness and clarity of presentation. Students are encouraged to discuss the problems with each other or with the teacher during office hours or via email, but the final submission must be the student's individual work.

Quizzes and Exams: There will be four quizzes during the semester, one midterm and a final.

Honor code
Students are expected to adhere to the McDaniel College academic honor code. Any violation will result in a zero on the related assignment or exam or other appropriate measures.

Dates

- Week 1-6: Chapters 1-6
- Week 7: **Review and midterm exam**
- Week 8-15: Chapters 7-12, 14
- Week 15: **Final review**

Topics

- **Basic statistics** [Chapter 1-3]
- Types of data
- Scales of measurement: nominal, ordinal, interval, ratio
- Population vs. sample
- Frequency distribution and relative frequency
- Graphs, charts, histograms
- Cross-tabulations

- Measuring location: mean, median, and mode
- Measuring variability: range, variance, standard deviation, skewness
- Measuring association between two variables: covariance and correlation coefficient

- **Probability** [Chapter 4.1-4, 5.1-5, 6.1-3]

- Counting rules for combinations and permutations
- Assigning probabilities
- Tree diagrams and Venn diagrams
- Complement, union, intersection, mutually exclusive events
- Conditional probability and independent events
- Discrete and continuous random variables
- Expected value and variance
- Discrete probability distributions
- Continuous probability distributions

- **Statistical inference** [Chapter 7.1-5; 8.1-3; 9.1-4; 10.1-3; 11.1-2; 12.1-3]

- Simple random sample compared to other types of sampling
- Properties of sampling distributions
- Central limit theorem
- Margins of error and confidence intervals
- Calculating interval estimates for population mean
- Determining the sample size for a given margin of error
- Hypothesis testing
- Differences between two population means
- Tests of goodness of fit and independence

- **Simple linear regression** [Chapter 14]

- Independent and dependent variables
- Regression model and equation
- Least squared method
- Sums of squares
- Coefficient of determination
- Assumptions about error terms
- Residual plots
- Autocorrelation
- Outliers and influential observations