STATISTICS, PROBABILITY AND DISCRETE MATHEMATICS

BACHELOR IN MANAGEMENT INFORMATION SYSTEMS
Professor: RAFIF SROUR DAHER
E-mail: rsrour@faculty.ie.edu

Academic year: 17-18
Degree course: FIRST
Semester: 2º
Category: BASIC
Number of credits: 6.0
Language: English

PREREQUISITES
Working knowledge of Mathematics.

SUBJECT DESCRIPTION
This course is designed for first year information and system management students. It encompasses three topics: Statistics, Probability, and Discrete Mathematics. Statistics is the science of data. It uses mathematical tools to collect, organize, process, and summarize data. Using probability rules, statistics make estimates and draw inferences that will shape decision-making in uncertain environments.

Students following this course will study a particular set of mathematical facts such as basic and discrete structures, functions, and combinatorial analysis. This will teach them how to apply logic and mathematical reasoning to problem-solving in real-life situations.

In addition, they will learn how to describe, organize, and interpret data; how to test hypotheses and claims; and how to make informed decisions.

OBJECTIVES AND SKILLS
The main objective of this course is to demonstrate through exercises and assignments that the techniques developed throughout the course are not an end unto themselves but tools that can be used to assist IT managers in becoming more effective decision-makers.

At the end of the course, students should be able to:
- Master the concepts of single and multi-variable functions;
- Understand basic structures mainly sets, sequences, sums, and matrices;
- Learn basic counting rules namely permutations and combinations;
- Perform matrix operations and use them to solve systems of linear equations;
- Describe data by means of graphs or numbers, and understand in which context each of these descriptive tools is useful;
- Understand patterns of randomness that can affect business activities and relate them to known probability distributions;
- Understand the differences between population and sample distributions;
- Read the most common distribution tables;
- Derive confidence intervals for a parameter;
- Make inferences by understanding the concept of null and alternative hypotheses and interpret outputs of hypothesis testing;
- Test for differences between populations;
- Use statistical methods for decision-making in a business and IT contexts.

Additionally, the course will focus on the acquisition or reinforcement of generic skills:
- The ability to summarize and present information in a meaningful way;
- The ability to build an abstract model to address any real-life problem;
- The ability to quickly identify the tools that need to be used in business situations.

METHODOLOGY

Three types of lectures are delivered throughout this course: Theoretical, practical, and review. The former type focus on delivering the basic concepts underlying mathematical and statistical theories and will include many examples (test your understanding, worked examples, and challenging problems). During the practical sessions; Excel (among others) will be used to answer specific questions presented in the context of case-studies. In the review sessions; the theoretical part will be revised using Kahoot (https://getkahoot.com/); a free online learning platform that combines technology and new teaching methodologies (“flipping the classroom”) to facilitate the learning process and makes it an enjoyable and fun experience.

Prior to all sessions, students should read assigned textbook sections. Reading the textbook in advance will allow them to get the most out of each lecture. When reading the textbook sections prior to each lecture, students must look at the examples but not necessarily solve them.

On weekly basis, a brief quiz covering previously taught material will be given. These quizzes are meant to test the students overall understanding of the material and will help the professor assess the overall performance and evolution of the class. Marks obtained on these quizzes will be included in the final grade. Quizzes will be done online via Campus Online. Instructions will be given a-priori.

Technology and Us!!!

In this course, it is all about technology. For this reason, whenever possible, technological tools will be used. Areas of applications include:

I. Quizzes, which will be done online via Campus Online, during the class lecture hours.

II. Kahoot (https://getkahoot.com/); a free online learning platform that will be used in the revision sessions, as one type of “flipping the classroom” teaching methodology.

Bringing your laptop is mandatory to all sessions, although its use (or not) will be decided by the professor.

<table>
<thead>
<tr>
<th>Teaching methodology</th>
<th>Weighting</th>
<th>Estimated time a student should dedicate to prepare for and participate in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>33.34 %</td>
<td>50 hours</td>
</tr>
<tr>
<td>Discussions</td>
<td>6.67 %</td>
<td>10 hours</td>
</tr>
<tr>
<td>Exercises</td>
<td>16.67 %</td>
<td>25 hours</td>
</tr>
<tr>
<td>Group work</td>
<td>16.67 %</td>
<td>25 hours</td>
</tr>
<tr>
<td>Other individual studying</td>
<td>26.67 %</td>
<td>40 hours</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0 %</td>
<td>150 hours</td>
</tr>
</tbody>
</table>
SESSION 1

PART ONE: DISCRETE MATHEMATICS
Sessions 1 – 10 & Practice Sets I & II
UNIT 1: INTRODUCTION
Topics: Introduction and presentation of the course syllabus and objectives.

SESSONS 2 - 4

UNIT 2: BASIC STRUCTURES
Topics: Definition of Sets. Sets operations and properties.
Recommended Reading: “Discrete Mathematics and its Applications”
Chapter 2: Sections 2.1, 2.2, & 2.5

SESSONS 5 - 7

Topics: Sequences and Summations.
Recommended Reading: “Discrete Mathematics and its Applications”
Chapter 2: Sections 2.3 & 2.4

SESSONS 8 - 10

Recommended Reading: Handouts

SESSONS 11 - 12

UNIT 3: COUNTING
Topics: The basics of counting. The Pigeonhole principle.
Recommended Reading: “Discrete Mathematics and its Applications”
Chapter 6: Sections 6.1 & 6.2

SESSONS 13 - 14

Topics: Permutations and Combinations.
Recommended Reading: “Discrete Mathematics and its Applications”
Chapter 6: Sections 6.3 & 6.5

SESSION 15

REVIEW I: UNITS 2–3.
Requirements: Submit Assignment I.

SESSONS 16 - 17
PART TWO: DESCRIPTIVE STATISTICS
Sessions 16-25 & Practice Set III

UNIT 4: EXPLORING DATA
Topics: Basic statistical concepts. Variables and levels of measurement.
Recommended Reading: “Statistics for Business and Economics”:
Chapter 1: Sections 1.1 – 1.2
Requirements: Submit Section 1 of your group project (Title, objectives, population of interest, type of sampling and sample size, and proposed information gathering strategy).

SESSIONS 18 - 19
UNIT 5: GRAPHICAL AND NUMERICAL PRESENTATION OF DATA
Topics: Organizing data into tables and charts. Frequency distribution tables. Using graphs to summarize data (histograms, time-series plots, etc.). Data presentation errors.
Recommended Reading: “Statistics for Business and Economics”
Chapter 1: Sections 1.3 – 1.5

SESSIONS 20 - 21
Recommended Reading: “Statistics for Business and Economics”
Chapter 2: Sections 2.1 – 2.4

SESSIONS 22 - 24
Practice I: Excel, Plotly, and Gapminder: Case Study.
REVIEW II: UNITS 4 & 5.

SESSION 25
Exam I [45 min]: Material covered Units 2 through 5 (inclusive).

SESSION 26
PART THREE: PROBABILITY
Sessions 26 – 40 & Practice Set IV
UNIT 6: PROBABILITY
Recommended Reading: “Statistics for Business and Economics”
Chapter 3: Sections 3.1 – 3.3

SESSIONS 27 - 29
**Recommended Reading:** “Statistics for Business and Economics”
Chapter 3: Sections 3.4 & 3.5

**SESSION 30**

**REVIEW III: UNIT 6.**

**SESSIONS 31 - 32**

**UNIT 7: RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS.**

**Topics:** Random Variable: Definitions. Discrete random variables: probability functions and properties (expected value and variance). Jointly Distributed Discrete Random Variables.

**Recommended Reading:** “Statistics for Business and Economics”
Chapter 4: Sections 4.1 & 4.2

**Requirements:** Submit Section 3 of your group work (Descriptive Statistics & Discrete Mathematics).

**SESSIONS 33 - 34**

**Topics:** Discrete probability distributions: Binomial, Hypergeometric, and Poisson distributions. Applications.

**Recommended Reading:** “Statistics for Business and Economics”
Chapter 4: Sections 4.4 – 4.7

**SESSIONS 35 - 36**

**Topics:** Continuous random variables: Definition and properties. The normal distribution. Others continuous distributions.

**Recommended Reading:** “Statistics for Business and Economics”
Chapter 5: Sections 5.1 – 5.3, & 5.5

**SESSION 37**

**REVIEW IV: UNIT 7**

**SESSIONS 38 - 39**

**UNIT 8: DISTRIBUTIONS OF SAMPLE STATISTICS**


**Recommended Reading:** “Statistics for Business and Economics”
Chapter 6: Sections 6.1 – 6.4

**Requirements:** Submit Section 4 of your group work (Probability).

**SESSION 40**

**REVIEW V: UNITS 6 – 8.**
SESSION 41
Exam II [60 min]: Material covered Units 6 through 8 (inclusive).

SESSION 42
PART FOUR: INFERENCE
Sessions 42 – 50 & Practice Sets V & VI
UNIT 9: ESTIMATION: POINT AND INTERVAL ESTIMATION (Problem Set V)
Topics: General theory. Types of estimators. Point estimation.
Recommended Reading: “Statistics for Business and Economics”
Chapter 7: Sections 7.1

SESSIONS 43 - 44
Topics: Confidence Interval estimation for the mean and proportion of a normally distributed single population. Finite versus infinite populations. Sample size determination.
Recommended Reading: “Statistics for Business and Economics”
Chapter 7: Sections 7.2 – 7.8

SESSIONS 45 - 46
UNIT 10: HYPOTHESIS TESTING (Problem Set VI)
Recommended Reading: “Statistics for Business and Economics”
Chapter 9: Sections 9.1 – 9.6

SESSION 47
Topics: Hypothesis testing for two populations: Tests of differences between two population means (Independent and paired samples). Tests of difference between two population proportions.
Recommended Reading
- Chapter 10: Sections 10.1 – 10.3 & 10.5.

SESSION 48
PRESENTATION
Requirements: Submit the final report INCLUDING Section 5 of your group work (Inferential statistics).

SESSION 49
GENERAL REVIEW

SESSION 50
FINAL EXAM
BIBLIOGRAPHY

COMPULSORY Buy your books here
Title: Statistics for Business and Economics
Authors: Newbold, Paul, Carlson, William L., & Thorne, Betty.
ISBN / ISSN: 978-0-13-274565-9
Medium: PRINT ELECTRONIC

Title: Discrete Mathematics and its Applications
Authors: Rosen, Kenneth H.
ISBN / ISSN: 978-0-07-131501-2
Medium: PRINT ELECTRONIC

Additional documents, including lecture slides, exercise sets, etc… will be posted on Campus Online throughout the semester.

EVALUATION CRITERIA

Your final grade in the course will be based on both individual and group work of different characteristics that will be weighted in the following way:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Percentage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Participation</td>
<td>10 %</td>
<td></td>
</tr>
<tr>
<td>Workgroups &amp; Presentation</td>
<td>20 %</td>
<td></td>
</tr>
<tr>
<td>Quizzes</td>
<td>10 %</td>
<td></td>
</tr>
<tr>
<td>Partial Exams I &amp; II</td>
<td>30 %</td>
<td>15% each</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30 %</td>
<td></td>
</tr>
</tbody>
</table>

Also, the final grade in this course will take into account the evaluation of Math 0.1.

A. Class participation and discussion

Class participation will be evaluated based on the following criteria:

- Quality (not quantity) of your participation in class discussion: The most important dimension of participation concerns what it is that you are saying. A high quality comment reveals depth of insight, rigorous use of case evidence, consistency of argument, and realism. Frequency refers to the attainment of a threshold quantity of contributions that is sufficient for making a reliable assessment of comment quality. The logic is simple: if contributions are too few, one cannot reliably assess the quality of your remarks. However, once threshold quantity has been achieved, simply increasing the number of times you talk does not automatically improve your evaluation. Beyond the threshold, it is the quality of your comments that must improve. In particular, one must be especially careful that in claiming more than a fair share of “airtime”, quality is not sacrificed for quantity. Finally, your attempts at participation should not be such that the instructor has to “go looking for you”. You should be attempting to get into the debate on a regular basis.

You might want to avoid being classified as one of the following types of students:
· Repeaters, i.e., students that, consciously or unconsciously, make comments that are really just repeats/rephrasing of what has already been said (by other students, or you). This wastes time and adds nothing to learning.
· Ramblers, i.e., students that take a lot of time to say simple things or they may tell long personal/professional stories, or they roam into topics that are not relevant, or simply make low-quality comments just to participate. They waste valuable time and prevent other students from being able to participate.
· Students that have been distracted (by Facebook, etc.) or who have stopped paying attention and then, later on, when they realized they have missed a term or concept, they ask you about it.

B. Group report and presentation

Group project is an integral part of this course. It consists in the identification of a real-world problem, the formulation of appropriate hypotheses, the collection and statistical analysis of data, and the presentation and interpretation of obtained results.

Throughout the semester, each group will be asked to submit 5 sections as briefly described in Section 4 of this syllabus. These sections will be corrected by the professor and returned to the group. A final report and presentation are due at the end of the course.

At the end of the semester, you must submit the full report including all sections. The final version should include edited versions of the previously submitted sections following the recommendations of your professor. In addition, each group will be asked to prepare a short video (3-4 min) that will be uploaded on youtube.

Information (description, specifics, etc.) related to each section as well as the final report (format, content, etc.), presentation (time, format, content, etc.) and video are detailed in "Statistics Project: Description & Instructions" file, which is already available on Campus Online/Documents.

C. Quizzes

At the beginning of some sessions, you will be given a short online-quiz based on previously covered material. These quizzes will help you assess your overall understanding of the subject being studied and identify any caveat in your learning. NO MAKE UP FOR QUIZZES IS ALLOWED.

D. Partial and Final exams

There will be two partial exams and one final. For these exams, you must bring your own calculator (phones, tablets, laptops and other electronic devices are not allowed). You are also allowed to bring up one sided sheet of paper in each partial (two sheets in the final exam) with any formula and/or example that you think could be helpful.

In order to pass the course, you need a minimum grade of 3.5 in the final exam. If your grade in the final exam does not reach the threshold value of 3.5, you will fail the course, even in the case in which your weighted average (computed using the table above) exceeds 5.0.

PROFESSOR BIO

Professor: RAFIF SROUR DAHER
E-mail: rsrour@faculty.ie.edu

PROFESSIONAL EXPERIENCE

Sep 2014-Present  Associate Professor-IE University (Madrid, Spain)
· Preparing and delivering courses in Statistics and Mathematics.
· Final project advisor: Leading a team of 10 students and helping them define a project idea, collect and analyze adequate data, and make appropriate decisions.
· Mentoring: In charge of coaching and assisting students in making effective decisions when tailoring their studies, selecting internships, and/or exchange destination.
Jan 2010-Jan 2011  Market Consultant-Perspectiv Project Management (Madrid, Spain)
Mar 2007-Nov 2007  Training Consultant-Chamber of Commerce, Industry and Agriculture in collaboration with the Order of Engineers (Lebanon)
Dec 2006-Mar 2007  Technology Implementation Consultant-American University of Beirut (Lebanon)
Sep 2005-Dec 2005  Technical Advisor-Rehabilitation of Lebanese Administration UNPD (Lebanon)
Aug 2004-Aug 2005  Visiting Professor-West Virginia University (West Virginia, USA)
Jan 2001-Apr 2004  Academic Researcher-West Virginia University (WV, USA)
Feb 1999-Dec 2000  Departmental Researcher-American University of Beirut (Lebanon)
Sep 1998-Aug 2000  Supervising Engineer-United Nation Development Program (Lebanon)
Sep 1998-Feb 1999  Graduate Research Assistant-American University of Beirut (Lebanon)

EDUCATION
2000 – 2004  PhD in Quantitative Methods in Environmental Sciences  West Virginia University, (USA)
1998 – 2000  MS in Soil Science  American University of Beirut (Lebanon)
1994 – 1998  BE in Agricultural Engineer  American University of Beirut (Lebanon)
1994 – 1998  BS in Agriculture  American University of Beirut (Lebanon)

OTHER INFORMATION
Office Hours: Before or After class: Appointment required.
Contact: rsrour@faculty.ie.edu

CODE OF CONDUCT IN CLASS

1. **Be on time:** Students arriving more than 5 minutes late will be marked as “Absent”.
   Only students that notify in advance in writing that they will be late for a specific session may be granted an exception (at the discretion of the professor).

2. **If applicable, bring your name card and strictly follow the seating chart.** It helps faculty members and fellow students learn your names.

3. **Do not leave the room during the lecture:** Students are not allowed to leave the room during lectures. If a student leaves the room during lectures, he/she will not be allowed to re-enter and, therefore, will be marked as “Absent”.
   Only students that notify that they have a special reason to leave the session early will be granted an exception (at the discretion of the professor).

4. **Do not engage in side conversation.** As a sign of respect toward the person presenting the lecture (the teacher as well as fellow students), side conversations are not allowed. If you have a question, raise your hand and ask it. If you do not want to ask it during the lecture, feel free to approach your teacher after class.
   If a student is disrupting the flow of the lecture, he/she will be asked to leave the classroom and, consequently, will be marked as “Absent”.
5. **Use your laptop for course-related purposes only.** The use of laptops during lectures must be authorized by the professor. The use of Social Media or accessing any type of content not related to the lecture is penalized. The student will be asked to leave the room and, consequently, will be marked as “Absent”.

6. **No cellular phones:** IE University implements a “Phone-free Classroom” policy and, therefore, the use of phones, tablets, etc. is forbidden inside the classroom. Failing to abide by this rule entails expulsion from the room and will be counted as one absence.

7. **Escalation policy: 1/3/5.** Items 4, 5, and 6 above entail expulsion from the classroom and the consequent marking of the student as “Absent.” IE University implements an “escalation policy”: The first time a student is asked to leave the room for disciplinary reasons (as per items 4, 5, and 6 above), the student will incur one absence, the second time it will count as three absences, and from the third time onward, any expulsion from the classroom due to disciplinary issues will entail 5 absences.