# IE 300 – Analysis of Data

## Section B, Fall 2019

### Meeting times

| Component | Section | Meeting time | Meeting place |
|---|---|---|---|
| Lecture | BL1 | MWF, 11.00am–11.50am | 103 Talbot Laboratory |
| Labs | BD1 | T 5.00pm–5.50pm | **1416 DCL** |
| | BD2 | R 5.00pm–5.50pm | **1440 DCL** |
| | BD3 | W 12.00pm–12.50pm | **1416 DCL** |
| | BD4 | R 12.00pm–12.50pm | **1440 DCL** |

### Course information

**Credit hours:** 3
**Instructor:** Chrysafis Vogiatzis
**Email:** chrys@illinois.edu
**Course website:** compass2g.illinois.edu
**Office:** 201A Transportation Building
**Office hours:** WR 3.30–4.45pm F 2.00–3.00pm

Office hours are also available by appointment. Online office hours will also be provided before quizzes and exams.

### Teaching assistants

**BD1:** Junchi Yang (junchiy2@illinois.edu)

- Office hours: Tuesday 12.00–1.00pm at TB 205.

**BD2:** Zexing Xu (zexingx2@illinois.edu)

- Office hours: Monday 9.30–10.30am at TB 13.

**BD3:** Xingyu Bai (xingyub3@illinois.edu)

- Office hours: Monday 2.00–3.00pm at TB 04.

**BD4:** Sara Kohtz (skohtz2@illinois.edu)

- Office hours: Monday 3.00–4.00pm at TB 316.

### Course communication

All communication of announcements, assignments, and other materials will be done through the course website on compass2g.illinois.edu. You can also email the instructor and teaching assistants; when doing so, please begin your email subject line with [IE 300]. This helps with class organization and will ensure a faster reply.

## Textbook

**Applied Statistics and Probability for Engineers** by Douglas Montgomery and George Runger, 7th ed. (5th or 6th editions will also work), ISBN-13: 978-1119231943, ISBN-10: 1119231949.

## Course description

This course is intended to be an introduction to and survey of probability models and statistical analysis of data. A student should complete this course with the ability to understand how probability distributions model experiments with uncertain outcomes, and how to analyze these experiments by applying statistical methods to observed outcomes.

## Prerequisites

MATH 241 Calculus III – Required.

## Learning outcomes

Upon completion of the course and all of its topics, students should have the abilities and tools to:

- understand and quantify the role of uncertainty in engineering models and data [1,2,6];
- understand and successfully apply probability concepts in the development of engineering models and the analysis of engineering data [1,2,6];
- identify and use proper discrete and continuous random variables and their distributions [1,2,6];
- formulate and conduct statistical analyses and experiments of observed data to reach statistically sound conclusions [1,2,6];
- perform statistical analyses using proper Python packages and software [1,2,6].

Note: ABET outcomes $1, 2, 6$ that are covered with the course are (for more information, please visit https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2019-2020/#GC3):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

## Exams

There are three exams in the class: two midterm exams and a final exam. The two midterms will be testing the material covered in the first and second parts of the class, respectively. The final exam will be cumulative and will be given (as designated by the University of Illinois) on **Thursday, December 19, 2019 1.30–4.30pm**. The final exam will count towards 30% of the grade of a student.

The two midterm exams will be announced in class at least one week before they are scheduled to take place. Tentatively, you may consider them to take place on or near October 7 (midterm #1)

and on or near November 11 (midterm #2).

Make-up exams will **only** be provided if notified at least three days prior to the exam date. In the case of an emergency, a make-up exam will be provided with the proper and appropriate documentation justifying your absence no later than one week from the date of the exam.

### Quizzes

There will be 6-8 quizzes throughout the course of the semester. All quizzes will be announced one class before the quiz is set to take place. An announcement before every quiz will also be posted on the class website. Information specific to each quiz (open or closed books/notes, calculator availability, topics, format) will be announced as needed before every quiz. The lowest quiz grade of every student will be dropped. No make-up quizzes are going to be given.

### Homework assignments

There will be 8 homework assignments throughout the course of the semester. Homework assignments will be announced and submitted online through the course website. The deadlines will be end of day (11.59pm) unless otherwise posted. You are encouraged to work with other students on an assignment, however copying violates the honor code and is not allowed under any circumstances. If you use outside sources for a homework assignment (other book/textbook, scientific or other publication, website, etc.) please acknowledge it by citing the source. Late homework assignments will be accepted with a penalty of 20% plus an extra penalty of 10% for every day late. As an example, a homework assignment submitted the day after it was due will receive a maximum grade of an 80, whereas a homework assignment submitted two days after it was due will receive a maximum grade of a 70. No homework assignment will be accepted after the fourth day after it was due. For example, if the deadline was on Monday, August 26 (end of day), you are only allowed to submit it by Friday, August 30 (end of day) for a maximum grade of a 50.

### Case studies

Case studies will be studied during the lab sessions throughout the semester. Students should work in groups of 3-4 and submit a written report together for each of the case studies. All students of a group will receive the same grade for a submitted report.

The case studies will often require you to use `Python`. The teaching assistant of your lab and the instructor of the class will both be available to help you get used to coding in `Python`.

When submitting your report, create a compressed folder that contains a text document (your report) and the Python code you wrote. More details on submitting your case study reports will be provided during the semester. Seeing as this is a group assignment, no late submissions will be accepted.

### Re-grade policy

If you believe that an exam, quiz, or homework assignment was graded incorrectly, please reach out to me at the latest one week after the announcement of the result. In your email requesting the re-grade, please add an explanation of where and why a re-grade is desired.

## Attendance

While attendance is not mandatory, it is highly recommended. Students will be responsibly for all of the material taught in the classroom. Important discussions and in-class activities will take place during class.

## General class policies

- Be courteous and kind to others (including me and the teaching assistants!).
- Please silence your cell phones and other electronic devices.
- If you are using a laptop to keep notes during class, please sit towards the back of the classroom.
- Do not arrive late for class. If you arrive after the class has started, please sit towards the back of the classroom.

## Grading policy

A: $[93, 100]$, A-: $[90, 93)$, B+: $[87, 90)$, B: $[83, 87)$, B-: $[80, 83)$, C+: $[77, 80)$, C: $[73, 77)$, C-: $[70, 73)$, D+: $[67, 70)$, D: $[63, 67)$, D-: $[60, 63)$, F: $[0, 60)$.

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|---|---|
| Homework assignments | 10% |
| Midterm exam 1 | 20% |
| Midterm exam 2 | 20% |
| Quizzes | 10% |
| Case studies | 10% |
| Final exam | 30% |
| **Total** | **100%** |

## Class topics

- Basic probability theory (textbook chapters 1 and 2).
  - Basic notation and definitions;
  - Counting rules;
  - Axioms of probability;
  - Conditional probabilities;
  - Independence and law of total probability;
  - Bayes' rule.
- Discrete and continuous random variables (textbook chapters 3 and 4).
  - Definitions;
  - Probability mass functions and cumulative distribution functions;
  - Common discrete and continuous distributions;
  - Expectations and variances.

- Joint probability distributions (textbook chapter 5).
  - Joint probability distributions;
  - Marginal and conditional distributions;
  - Covariance, correlation, and independence;
  - Common joint distributions.
- Basic statistics (textbook chapters 6, 7, and 8).
  - Definitions and examples;
  - Populations and samples;
  - Sample means and variances;
  - Estimation and the central limit theorem;
  - Methods of point and interval estimation;
  - Common confidence intervals;
  - Tolerance and prediction intervals.
- Hypothesis testing (textbook chapters 9 and 10).
  - Formulating hypotheses;
  - Errors;
  - Statistical conclusions and $p$-values;
  - One-sample hypothesis tests;
  - Two-sample hypothesis tests.
- Linear regression (textbook chapter 11).
  - Formulating linear regression models;
  - Least squares for parameter estimation;
  - Confidence intervals;
  - Hypothesis testing on linear regression model parameters.
- Other topics (time permitting, textbook chapters 12 and 13).
  - Multiple linear regression;
  - Analysis of variance.

### Academic integrity

We will follow articles 1-401 through 1-406 of the Student Code (you can find the articles beginning at http://studentcode.illinois.edu/article1/part4/1-401/). This rule defines infractions of academic integrity, which include but are not limited to cheating, fabrication, and plagiarism. You are responsible for following these guidelines. If you have any questions about whether something would be an infraction, consult with the instructor before proceeding.

### Request for special accommodations

To obtain disability-related adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217.333.4603, email disability@illinois.edu, or go to the DRES website (at http://disability.illinois.edu).

### Run > Hide > Fight

Emergencies can happen anywhere and at any time. It is important that we take a minute to prepare for a situation in which our safety or even our lives could depend on our ability to react quickly. When we're faced with almost any kind of emergency – like severe weather or if someone

is trying to hurt you – we have three options: Run, hide or fight. Please consult the provided attachment to the syllabus for more information.

### Updates to the syllabus

The contents of the syllabus and the policies described are subject to change. If that happens, all the changes will be announced and described on the course website.

**Prepared by:** Chrysafis Vogiatzis
**Last updated:** October 15, 2019