ANALYSIS OF DATA
IE300 – SECTION B, SPRING 2017

COURSE INFORMATION

Meeting Times:

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Section</th>
<th>Meeting Time</th>
<th>Meeting Place</th>
<th>Teaching Assistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>BL1</td>
<td>MWF, 10:00-10:50AM</td>
<td>253 Mechanical Eng Bldg</td>
<td></td>
</tr>
<tr>
<td>Labs (enroll in one)</td>
<td>BD1</td>
<td>Mon, 11:00-11:50AM</td>
<td>L520 DCL</td>
<td>Peter McGlaughlin</td>
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<td></td>
<td>BD2</td>
<td>Tues, 3:00-3:50PM</td>
<td>L520 DCL</td>
<td>Ebrahim Arian</td>
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<td></td>
<td>BD3</td>
<td>Wed, 9:00-9:50AM</td>
<td>L520 DCL</td>
<td>Roshanak Khaleghi</td>
</tr>
<tr>
<td></td>
<td>BD4</td>
<td>Thurs, 3:00-3:50PM</td>
<td>L520 DCL</td>
<td>Ebrahim Arian</td>
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</tbody>
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Credit Hours: 3 hours
Course Website: Located at https://compass2g.illinois.edu/ (access restricted to enrolled students)
Instructor: Douglas M. King, Ph.D. (dmking@illinois.edu)
Office Location: 3 Transportation Building
Office Hours*: Wednesday, 1:00-1:50PM

Teaching Assistants:
Ebrahim Arian (arian2@illinois.edu)        Office Hour*: Tuesday, 11:00-11:50AM, room 25 Transportation
Roshanak Khaleghi (khalegh2@illinois.edu)  Office Hour*: Thursday, 12:00-12:50PM, room 21 Transportation
Peter McGlaughlin (mcglghl2@illinois.edu)  Office Hour*: Monday, 4:00-4:50PM, room 416 Transportation

* - Office hours may also be available by appointment (please arrange by email, providing at least 24-hours advance notice)


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.

Learning Outcomes: Following the completion of this course, students should be able to...
(*) ABET outcomes)
...understand the role of uncertainty in engineering models
...understand and apply critical probability concepts (e.g., independence, expectation, variance)
...identify and analyze discrete and continuous random variables
...formulate and conduct statistical analyses of observed data (e.g., estimators, hypothesis tests)
...create probability models and perform statistical analysis with the Python programming language

Prerequisites: MATH 241 (required)
Course Type: Required

Students with Disabilities: All reasonable accommodations required for students with disabilities will be provided, as ensured by Article 1, Part 1 of the Student Code. Please alert the instructor by the end of the first week of class regarding accommodations, to ensure that accommodations can be made available when needed.

GRADING AND POLICIES

Grades will be based on the following:

- Midterm exams (2) 40% (20% each)
- Final exam 30%
- Homework assignments 15%
- Case studies 10%
- Quizzes/Participation 5%

Quiz/Participation Policies: In-class quizzes will be held to assess understanding of the concepts covered in the course.
- Schedule: Quizzes may be held during lab and/or lecture, and dates may or may not be announced in advance. Students can only take lab quizzes during the lab section in which they are enrolled. Participation credit may also be awarded under other circumstances at the discretion of the instructor.
• **Attendance:** On some occasions, class attendance will count toward participation credit, such that only students who attend the entirety of a particular class period are given such credit. Moreover, extra course-related opportunities or benefits may be provided to students who attend and participate in lecture, at the discretion of the instructor.

• **Absences:** Make-up quizzes are not offered. Any student who is absent from a quiz will receive a grade of zero. To accommodate unavoidable absences that may occur during the semester, each student’s lowest quiz score will be dropped. If you anticipate an extended period of unavoidable absences, please alert the instructor as soon as possible; such cases will be handled on a case-by-case basis.

• **Allowed materials:** Quizzes are closed-book and closed-notes. Calculators are not allowed on quizzes.

**Assignment Policies:**

• **Schedule:** Roughly nine homework assignments will be collected throughout the semester.

• **Submitting Assignments:** Instructions for how to submit homework assignments will be provided. Please follow these instructions carefully! **Late submissions will not be accepted!** To accommodate unanticipated tardiness, each student’s lowest homework score will be dropped.

• **Assignment Groups:** You may submit assignments in groups of up to three students, with the following restrictions:
  
  (a) Groups must submit a group agreement form before the deadline. Details will be available on Compass.
  
  (b) Once a group has been formed, no new members can join that group.
  
  (c) Each group must turn in one assignment; all group members will receive the same grade for the assignment.
  
  (d) If you are a member of a group, you may decide to leave that group, but you cannot join another group (i.e., you must complete all future assignments on your own). You must notify the group members of your current group before leaving.

**Case Study Policies:**

• **Schedule:** Several case studies will be assigned throughout the semester. These case studies will be primarily discussed in lab, and will often require you to write Python code to perform computations or analyze data. Your teaching assistant and the course instructor can help you acclimate to using Python, and will be a great resource if you have questions about coding.

• **Case Study Groups:** You must submit case studies in groups of three to four students. The members of your group must all be enrolled in the same lab section, and (unlike assignment groups) you may form a different group for each case study. All members’ names and NetIDs must be listed on the cover sheet of your report (no names may be added once the report is submitted), and all members of your group will receive the same grade on the case study.

• **Submitting Case Studies:** Your case study solutions should be submitted as a written report (one per group) that contains a clear written description and discussion of your results, along an appendix containing any Python code written to carry out the tasks of the case study. Instructions for how to submit case studies will be provided. Please follow these instructions carefully! **Late submissions will not be accepted!**

**Exam Policies (Midterms and Final):**

• **Schedule:** Exam dates will be announced in class.

• **Absences:** To ensure that student performance is assessed uniformly, make-up exams are only offered in rare circumstances. Missed examinations will receive a grade of zero. Make-up midterm exams will only be offered if required by University policy. However, I understand that extraordinary and unavoidable circumstances may arise that negatively impact midterm exam performance. To accommodate such circumstances, when determining each student’s final course grade, their lowest midterm exam score will replaced by the lowest of (a) their other midterm exam score, (b) their final exam score, (c) the average of all their homework assignment scores, and (d) the average of all their quiz scores. Such replacement will only be applied if it improves the student’s course grade. A student who takes a make-up midterm exam for any reason will not be eligible to replace their lowest midterm exam score in this way. Make-up final examinations are only offered if required by University policy, or a student has made arrangements with their college to receive an “I” (Incomplete) grade in the course. Please notify the instructor as early as possible if you believe you will need to take a make-up exam. Make-up exam arrangements will be made on a case-by-case basis.

• **Allowed materials:** Exams are closed-book and closed-notes. Calculators are not allowed on exams. **Cell phones and other electronic devices should not be brought to exams!**

• **Regrades:** To request that your exam be regraded, you must return your exam to the instructor within one week of when exams were first returned in class. **Do not write on or alter your exam in any way!** On a separate sheet of paper, provide a written explanation of why you believe additional credit should be awarded (and how many points), based on your work as it was completed when you originally took the exam. If you request a regrade, your entire exam will be reviewed and regraded.

**Attendance:** You are expected to attend all course meetings and participate in class discussions. Important course announcements will be made during class; you are responsible for being aware of these announcements. Moreover, extra course-related opportunities or benefits (e.g., participation points) may be provided to students who attend and participate in lecture, at the discretion of the instructor.
Computation Policies (Exams/Quizzes): When answering questions requiring computations on an exam or quiz, you should report your answer using the simplest mathematical expression possible, to the extent that a final numerical answer could be easily obtained with a calculator. For example, you should report the expression \((24 \cdot e^6) / (4 \cdot e^2)\) as \(6 \cdot e^4\).

Academic Integrity: It is expected that your exams and quizzes will contain only your own work, and that your assignments and case studies will contain only the work of your group. Any student who misrepresents their work in an exam or quiz, or group who misrepresents their work on an assignment or case study, will receive a grade of zero on that exam, quiz, assignment, or case study; other sanctions may also be pursued, as allowed by University policy. Any homework assignment, quiz, or exam on which an academic integrity infraction has occurred cannot be dropped or replaced when computing a student’s final course grade.

Cell Phones and Other Devices: Please turn off all cell phones before class. Use of other electronic devices (tablets, laptops, etc.) is allowed for course-related purposes only. The instructor may restrict device usage for the benefit of class participation. Do not bring any electronic devices to exams.

NOTE: The policies contained in this syllabus are subject to change. Any such changes will be posted on Compass, and will often be discuss in class beforehand.

### TENTATIVE LIST OF TOPICS

- **Introduction to Probability**
  - Definition and interpretations
  - Sample spaces and events
  - Counting rules
  - Axioms of probability
  - Conditional probability
  - Independence
  - Law of total probability
  - Bayes’ Theorem

- **Random Variables (Continuous and Discrete)**
  - Definition
  - PMFs, PDFs, and CDFs
  - Expectation, mean, and variance
  - Common discrete distributions
  - Common continuous distributions
  - Joint probability distributions
  - Marginal and conditional distributions
  - Covariance, correlation, and independence
  - Common joint distributions

- **Introduction to Statistics**
  - Definition and examples
  - Samples and populations
  - Sample mean and variance
  - Common statistics
  - Graphical representations of sample data

- **Point and Interval Estimators**
  - Introduction to estimation
  - Central limit theorem
  - Sampling distributions
  - Properties of estimators
  - Methods of point estimation
  - Methods of interval estimation
  - Common confidence intervals
  - Tolerance and prediction intervals

- **Statistical Hypothesis Testing**
  - Formulating statistical hypotheses
  - Types of errors
  - Statistical conclusions and p-values
  - Hypothesis test procedures
  - Common one-sample hypothesis tests
  - Common two-sample hypothesis tests

- **Linear Regression**
  - Formulating linear regression models
  - Parameter estimation (least squares)
  - Confidence intervals on model parameters and single observations
  - Hypothesis tests on model parameters
  - Analysis of residuals

- **Other Statistical Hypothesis Tests (e.g., ANOVA) (time permitting)**