IE 441: INFORMATION & KNOWLEDGE ENGINEERING SYSTEMS

Fall 2025

Instructor: SangWoo Park, Assistant Professor in Mechanical & Industrial Engineering
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Lecture: WF 10 AM – 11:20 AM, GITC 2305
Class website: Canvas
Office hours: Monday 10:30 AM – 12PM, Fenster 266
TA: Valeriia Bulanova (email: vb529@njit.edu)
TA office hours: Thursday 1-2PM, Mechanical Engineering Center, Lab 333B

1 Course Objectives

Companies have more data than ever before, requiring new skills in information technology and big data analytics. While the usage, storage, and categorization of incoming data can be automatized, well-trained individuals must convert data into information and perform analytical and quantitative tools to interpret data and make decisions for the future.

The objective of this course is to teach data analytical tools and statistical/optimization skills using Microsoft Excel and hands-on activities to solve engineering problems and to convert real-world large data sets into useful information for decision making. Recent advancements in Excel spreadsheets provide powerful features in data analytics and quantitative modeling. Mastering spreadsheet not only offers tremendous career opportunities for students, but it also enables engineers and managers to formulate and solve complex problems on their computers to aid in decision making.

We will focus on the use of Microsoft Excel useful in data analysis and modeling. The goal is to develop analytical skills to interpret data, make better decisions, and have excellent Excel-use skills. Topics include writing formulas and functions using Excel, descriptive statistics, data visualization, descriptive data mining, linear regression, forecasting, problem formulation, optimization models, spreadsheet models, simulation using Excel.

In addition to Excel, we will have the opportunity to learn how to use R for statistical analyses and SQL for managing databases.

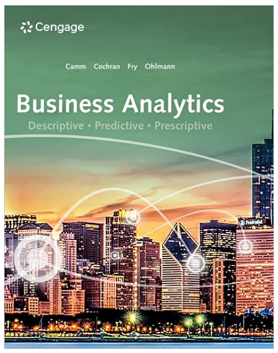
Student Learning Outcomes:

- Explore datasets using MS Excel.
- Import, clean, store, sort, and filter data using Excel.
- Build data model, transform raw data, and deliver interactive data visualization.
- Be able to apply basic, intermediate, and advanced formulas and Excel features for data analysis.
- Be able to visualize data using Conditional Formatting.
- Create charts and PivotTables to visualize quantitative data.
- Descriptive Statistics: Numerical Measures: Mean, Median, Mode, Standard Deviation, Correlation, and more.
- Descriptive Statistics: Data Visualization: Charts, Tables, and Dashboards.
- Predictive Statistics: Simple Linear Regression, Multiple Linear Regression

- Predictive Statistics: Time Series Analysis and Forecasting.
- Prescriptive Statistics: Linear Programming Models.
- Prescriptive Statistics: Monte-Carlo Simulation using Excel.
- Understand regression methods and their implication on managerial issues.
- Formulate real-life engineering problems as optimization models.
- Learn spreadsheet optimization using model formulation and Excel Solver functions.
- Perform sensitivity analysis to determine the magnitude of change of a model's optimal solution as the data change.
- Predictive Statistics: Data Mining Techniques (if time allows)
- Performing part of the above tasks using R.
- Database management using SQL.

2 Required Textbook and Materials

a. Textbook. Business Analytics (4th edition), Camm, Cochran, Fry, Ohlman, Anderson **(Required)**



b. Microsoft Excel. Microsoft Excel with the Solver Add-in software. If you are an Apple Mac user, please make sure that your laptop can run the advanced data analysis functions in Excel. Mac users have often encountered problems and the solutions to those may be found in the following link:

`https://answers.microsoft.com/en-us/msoffice/forum/all/solver-wont-add-in-excel-on-macbook/ad8bb4d0-5440-4af0-a2d7-be74198ad702`.

All exams will be computerized and be performed on your own PCs while the instructor proctors and records the exams. Using an optimization Solver under Office for Mac 2016 or higher can generate errors in models. If you run into issues, you can try downgrading to an earlier version of Office (2011).

3 Grade Determination

Your grade will be determined on the basis of your performance on the activities identified below. One midterm exam and a final exam will be given. Students are expected to complete eight assignments (the majority of which will require Excel Solver) to get a passing grade from the course. No make-ups for exams will be given. If an individual misses a lecture and fails to participate in the in-class exercises, up to one bonus assignment will be given to make up for that. Additional quizzes or other assignments may be given to everyone in class with or without notice in advance at the instructor's discretion.

a) Point distribution

When preparing your assignments and solutions for the exam, pay attention to the content, cleanliness, and organization of the document. They all contribute to your grade. You will be required to upload digital files of your Excel spreadsheet showing your work. Semester grades will be based on

the four main scores:

Component	Percentage
Midterm Exam	20%
Final Exam	30%
Assignments (8)	35%
Participation	15%
Total	100%

* Note that final grades will be calculated using the grading scheme above, and so the Total grade column shown in Canvas, which is automatically calculated, does not reflect your final grade. Do not use the percentage grades you see in canvas to calculate your overall grade.

b) Grading policy

Letter grades will be assigned based on the following criteria as a percentage of total points:

Percent	Grade
92.0% or above	A
85.0 - 91.9 %	B+
80.0 - 84.9 %	B
70.0 - 79.9 %	C+
65.0 - 69.9 %	C
60.0 - 64.9 %	D
Lower than 60.0 %	F

c) Exams

One midterm exam and a final exam will be given. Both exams will be computer-based. The midterm exam will be held on Friday, October 17, 2024. The final exam will be held on the final exam week, on the day determined by the school. All exams are closed-book and closed-notes. The exams include a set of problems/questions that are based on the graded problem sets and in-class problems we have covered (e.g., Excel-based problems). The final exam will be cumulative. Both midterm and final exams will be proctored, where you will be required to upload your Excel spreadsheet showing your work. Exam time and dates are set; they will not be changed. Please make all your arrangements based on the exam dates. No make-up exams will be given, so missing an exam will result in a zero grade for the exam. However, **well-documented** special circumstances (e.g., severe illness or injury, death of a close family member) could be considered to provide a make-up exam with the instructor's prior approval.

d) Homework Policy

There will be software assignments where MS EXCEL will be used to solve problems discussed in class. All assignments must be submitted via the Canvas "Assignments" tab by the deadline. Deadlines are based on Eastern Standard Time; if you are in a different time zone, please adjust your submittal times accordingly.

A single excel file should be submitted through Canvas. The answers should be presented in different sheets of the excel file. Each sheet should be appropriately named by the problem and corresponding part name. You should attempt to solve the questions yourself. If you are stuck, you can discuss problems with me or your classmates. However, you should provide your own solutions and excel file. Plagiarism, i.e., copying somebody else's work will not be tolerated.

Lateness Policy. I encourage you to submit all homework by the due date specified. Late homework will be accepted for up to three days past the due date, but the late penalty will be as follows (note even half-an-hour lateness of the due date will be considered as a day late):

Days Late	Late Penalty
1	10%
2	20%
3	30%

e) Attendance

Participation includes the following: regular attendance, timely arrival (at least 5 minutes before the class time to set up the computer), and participation in in-class problem-solving. Regular attendance and participation in class are critical to learning the class material and will be, therefore, a part of your overall grade.

Class participation will account for 15% of the grades. Absences and tardiness may lower your grade.

In-class problem-solving. An essential part of the attendance grade will be determined based on the submissions of your work during in-class problem-solving sessions. I expect you to work on class exercise problems and submit your work by the end of the class through Canvas under the Assignments tab. I often give a chance for students to interact with each other, discuss solution strategies, and learn from each other during in-class group working/problem-solving sessions.

4 Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

`http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf`.

On the Use of AI: *This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.*

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

More on Cheating:

1. Cheating will result in the student receiving a zero grade for the assignment and may result in a failing grade for the class.
2. Turning in an item you did not create is cheating.
3. Copying another person's digital item or work is cheating.
4. Allowing (intended or not intended) someone else to copy your work or the digital item is considered cheating and will result in a failing grade for the assignment.
5. You must do your own work, and do not exchange your work with another student.
6. Having someone complete a homework assignment for you is cheating.

5 Students with Disabilities

If you have a disability or a particular need for which you are or may be requesting accommodations, please contact both the Office of Accessibility Resources and Services (OARS) and me as early as possible in the semester. The official website is `https://www.njit.edu/accessibility/`. You must submit appropriate

documentation to the instructor before accommodations can be granted. OARS will review your concerns and determine, with you, what accommodations are necessary and appropriate for you. All information and documentation of your disability is confidential and will not be released by OARS without your written permission.

6 Class Schedule

Please see the **Tentative Class Schedule**:

Class Date	**Topics**
Week 1	Introduction and Syllabus, Chapter 2 (Descriptive Statistics)
Week 2	Chapter 3 (Data Visualization)
Week 3	Chapter 7 (Linear Regression)
Week 4	Chapter 5 (Descriptive Data Mining)
Week 5	Chapter 8 (Times Series Analysis and Forecasting)
Week 6	Chapter 11 (Monte Carlo Simulations) - part 1
Week 7	Midterm review (10/16), Midterm exam (10/18)
Week 8	Chapter 11 (Monte Carlo Simulations) - part 2
Week 9	Chapter 12 (Linear Optimization Models)
Week 10	Chapter 13 (Integer Linear Optimization Models)
Week 11	Chapter 14 (Nonlinear Optimization Models)
Week 12	Introduction to R
Week 13	Thanksgiving
Week 14	TBD
Week 15	Final Exam Review
Week 16 (Final week)	Final exam