

ENGRI 1101 Syllabus

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Office: Rhodes 294
Office hours: Wednesdays, 4-5:30pm and most Sundays, 2-4pm Rhodes, Room TBD

TA's: See Canvas site
TA Office hours: TBD.

Lectures: Tuesday and Thursday 10:10-11:00am, room TBD
Recitations: Wednesday 7:30pm-9:25, Thursday 12:20-2:15, Thursday 2:30-4:25,
Friday 11:15-1:10, all Rhodes 453
Caveat: This syllabus is subject to change at any point.

1 Course Overview

Operations research is *the application of scientific and mathematical methods to the study and analysis of problems involving complex systems*¹. To unpack that definition, this course will introduce several areas of operations research. These include: network models, the shortest path problem, inventory problems, linear programming, integer programming, gerrymandering, and regression techniques that underlie machine learning. For these areas, our process will be: identify the problem, create a mathematical formulation for the problem, develop/run algorithms to solve the problem, and understand if and when we've found the best possible solution. Along the way, we'll see tools to study the structure of social media networks, plan fastest travel routes in map apps, reverse engineer recipes from nutrition labels, test for racial gerrymandering, and find optimal solutions to a huge class of real-world problems!

2 Course Logistics

Prerequisites: You should be comfortable with high-school level math, including algebra.

Course website (Canvas): The Canvas site will contain all the information for this course including this syllabus, office hours, homework assignments, and your grades. If you are not automatically enrolled at the start of the semester, contact me as soon as possible.

Textbook, Handouts, and Practice Problems: There will be no required textbook for this course. Handouts that supplement lectures will regularly be posted on canvas and/or provided in class. Focus problems and answers will be posted to provide supplemental practice. The course calendar will point to focus problems and references associated with each topic.

Cornell students have access to digital copies of a trove of textbooks through the Cornell Library. Many of these books can be used as secondary references for much of the material in this class:

- *Operations Research*, by S.R. Yadav and A.K. Malik, Oxford University Press.
- *Operations Research: A Model-Based Approach*, by H.A. Eiselt and Carl-Louis Sandblom, Springer Texts in Business and Economics.

¹Definition from Informs, the institute for operations research and the management sciences. Available at <https://www.informs.org/Explore/Operations-Research-Analytics>.

- *Introduction to Algorithms*, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, The MIT Press.

These books **are not required** and may differ from the presentation, scope, and difficulty of this class. However, they are free, and might provide a useful or interesting secondary treatment!

Dining Discussion Program: This class was selected for the First-Year Dining Discussion Program sponsored by Faculty Living-Learning Programs. They've generously provided a set of free weekly meals to promote instructor-student interactions outside of class. More details will be provided in class, but there will be abundant opportunities to share meals with the instructor, TAs, and guests to discuss Operations Research more casually and to chat about how Cornell/the course are going.

3 Academic integrity

This is a college course, and you are expected to maintain the highest level of academic integrity. My default assumption is that any work you submit is entirely your own. Any violation will be dealt with according to the Cornell academic integrity code: <http://cuinfo.cornell.edu/Academic/AIC.html>. All course materials are copyrighted by me, and the academic integrity code prohibits any use/upload to the website Coursehero (or similar), as well as copying or sharing homework solutions.

This is also a class where we'll explore tons of interesting problems! For many of these problems, you may find it useful to brainstorm solutions with classmates or to work in groups. That type of collaboration is encouraged, but **every homework must be written up independently without referring to any group work**. For example, if a group works out a problem together on a whiteboard, each student should go home and write the homework up as if from scratch; no group member should copy directly from the whiteboard.

4 Assessment

Course grade will be based on homework sets, participation, recitation exercises, three exams, and a mini-project:

Homework	25%
Recitation Attendance, Lab Completion, and Lab Participation	10%
Lecture Participation	5%
Prelim 1	15*%
Prelim 2	15*%
Final Exam (comprehensive)	25*%
Mini-Project	5%
<hr/> Total	<hr/> 100%

Each student's lowest homework assignment grade will be dropped, providing it is at least 50%.

***Final Override Policy:** if your final exam score is greater than either (or both) prelim scores, then that prelim (or both prelims) will only be worth 7.5%, with your final exam being worth an extra 7.5% (or 15%). In the spirit of this class, the policy involves a little math and optimization, but *this policy can only help your score!* For example, suppose Alice gets a 100 on the first prelim, a 90 on the second prelim, and a 95 on the final. In this case, her final score supersedes her second prelim score, but not her first. Her first prelim will be worth 15%, her second will be worth 7.5%, and her final exam will be worth 32.5%. As another example, suppose that Bob gets a 70 on the first prelim, and 75 on the second prelim, and an 85 on the final. His final supersedes both prelims, so his first prelim will be worth 7.5%, his second will be worth 7.5%, and his final exam will be worth 40%. In the event that any exams are curved, this policy will only be applied after grades are curved.

4.1 Homework

Submitting Homework There will be roughly 11 homework assignments. Each assignment will be due on a Friday at 4pm. You should drop your homework into the dropbox on the fourth floor of Rhodes Hall (in 411, across from the elevators) with the label “ENGRI 1101.” Please be sure to write your name, staple your homework, and be neat. You are allowed one late homework for a real emergency. A late homework must be turned by 4pm on the Monday immediately following the Friday the homework is due. For instance, if the homework was due on Friday the 24th, you would need to submit the late homework by Monday the 27th at 4pm.

Partial Credit and Showing Work When writing your homework, be sure to explain your reasoning. Correct and well-written reasoning is more important than a correct numerical answer! Numerical answers without explanation or shown work will be given little-to-no credit even if correct. Graded homework will be picked up in recitation, and solutions will be posted on canvas.

4.2 Recitation Attendance, Lab Completion, and Lab Participation

The recitation sections will be used primarily as computational laboratories that reinforce and complement material covered in lecture. For some labs, there will be a short homework exercise to be completed before coming to the lab (a “pre-lab”) and turned in at the start of the lab. Attendance in lab is mandatory and for reasons of space, you must attend the recitation section you signed up for.

4.3 Lecture Participation

I will not pressure students to ask or answer questions in-class. The majority of participation points will be awarded for contributing to a productive learning environment for the entire class: attending lecture, showing up on time, and not using electronic devices during class. If you must miss a lecture, please email me in advance so that you don’t miss any important announcements or information. Remaining participation points are awarded for demonstrating engagement with the material. This engagement can be demonstrated by asking or answering questions in-class, but can also come from asking questions outside of class, attending office or TA hours, participating in on-line discussions via canvas, etc.

4.4 Exams

The first prelim will take place October 17th 7:30-9:00pm, the second prelim November 19th 7:30-9:00pm, and the final exam date is December 9th 2:00-4:30pm. (fun fact: scheduling exams to minimize conflicts is a classic application of the material in this course!). You must alert me of any conflicts two weeks before each exam, and exceptions will be made only in very serious situations. The final exam will be cumulative with an emphasis on the later material. **Note that the first prelim is on the second day after fall break.**

4.5 Mini-Project

There will be a mini-project (approximately the length of 1.5 homeworks) which will involve applying the techniques from class to real-world data.

4.6 Regrades

All regrade requests should be submitted in writing to the homework dropbox within one week of when the work was returned. Please give full justification for why you think you deserve more credit. If you submit a regrade request, the entire assignment is subject to regrade which can cause your grade to either increase or decrease.

5 Caring Community

Cornell is a caring community, where students, faculty, and staff support each other. Details are available at <https://caringcommunity.cornell.edu/>. Sometimes life comes at you, and the policies in

this syllabus are designed to support you in those moments: flexible exam grading, a late and dropped homework, no required purchases, etc. If circumstances require additional support, the Cornell caring community website lists many of the resources available.

6 Academic Accommodations

If you require any academic accommodations in this class, please email me your Student Disability Services (SDS) accommodation letter by September 8th. If you need an immediate accommodation for equal access, please speak with me after class or send an email message to me and/or SDS at sds_cu@cornell.edu.