

DSO 570 – The Analytics Edge: Data, Models, and Effective Decisions (for MSBA Students)



Syllabus – Fall 2021 – 3.0 Units
Professor: Peng Shi
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Course Times: Section 16291: Tuesday/Thursday 9:30am-10:50am JFF-414
Section 16293: Tuesday/Thursday 11:00am-12:20pm JKP-110

Office Hours: Fridays 8:55am-10:55am (via Zoom). You can reserve a 20 minute slot for the upcoming Friday using this link: <https://calendly.com/pengshi/dso570-recurrent>

Course Description

This course equips students to be practitioners of *prescriptive analytics*, which is the science of decision making using rigorous mathematical tools of simulation and optimization. Students will create simulation models using Python, as well as formulate linear optimization models that can be scaled up to solve real-world problems. Application areas include business strategy, inventory management, revenue management, resource allocation, matching, scheduling, and portfolio optimization.

Learning Objectives

Upon successful completion of this course, students will be able to:

1. **Create** Python code to automate a given task.
2. **Formulate** linear optimization models to inform a business decision.

Prerequisites:

Students must have access to a computer with reasonably fast Internet access. Moreover, the latest Anaconda distribution for Python 3.X should be installed, available at <https://docs.anaconda.com/anaconda/install/>. Using Anaconda to install Python, rather than using another method such as pip, will minimize technical difficulties later on.

See the videos posted on Blackboard under the “Getting Started” module for detailed installation instructions, as well as a video explanation of this syllabus.

Classroom Policy:

In order to accommodate students who are unable to attend class in person due to possible illnesses, visa difficulties, or travel restrictions, all course contents are simultaneously delivered via the following two means, and one can participate via either of the two means in any given week:

1. **Online:** To maximize the learning experience of students who are unable to participate in person during a given week, all lecture content will be available via a series of short videos posted on Blackboard, which are released at the same time as the in-person lecture. There is an exercise after each video to give you immediate practice. Breaking up the lecture into short videos is intended to make difficult material easier to digest, and completing the exercises are crucial to effective learning. After submitting each exercise, you will be able to view a video explaining the solution. While you can watch the lecture and complete the exercises at a time convenient for you, you must complete all of the exercises by 1pm Pacific Time the day after the scheduled session time, so that if I notice any issues with your submission I can email you prompt feedback.
2. **In-person:** These are the regular lectures in the classroom, which cover the same content as the video lectures on Blackboard. Students are expected to complete the same set of exercises as the online participants, and time will be allotted during class time to start those exercises. If you do not finish in class, you must complete the exercises on your own time and submit them by 1pm Pacific Time the day after the class session. Except for the videos explaining the solutions to certain exercises, students attending in person are not required to watch the video lectures intended

for online participants. However, those videos are available to all students and may still be useful when reviewing course material.

Students who are experiencing illness should not attend class in person, but should participate online until all symptoms are gone for at least 24 hours without the use of medications. This course is designed so that students are never penalized for having to miss class due to possible illness, which makes the classroom safer for everyone.

Communication Policy:

During the semester, I am committed to respond to your email as soon as I can. The maximum response time would be by the next business day that the email is received, based on Los Angeles time. (For example, for an email received on Monday, I will respond by Tuesday at the latest. For an email received on Friday, Saturday, or Sunday, I will respond by Monday at the latest.) Note that these are maximum response times, and often times I will respond much sooner.

Supplementary Resources:

The content of the course is self-contained and are posted on Blackboard. However, students requiring extra help may find it helpful to review the following textbooks as well as the exercises therein:

- Chapters 1-9 of “Python for Everybody” by Charles R. Severance, available at <https://www.py4e.com/book.php>. (Both the PDF and HTML versions are free.)
- Chapters 5, 7-9 of “Data, Model, and Decisions: The Fundamentals of Management Science.” By Dimitris Bertsimas and Robert M. Freund, Dynamic Ideas, 2004. (ISBN-13: 978-0975914601 and ISBN-10: 097591460X) Available at the USC bookstore, on Amazon, or through the publisher.

Grading:

Grading will be based on adding up the number of points obtained in each of the following assessments, weighted according to the proportion given in the third column below. A final letter grade will be assigned based on both your total number of points and how it compares to other students in the course. The target average GPA for this course is 3.5.

Assessment	Description	Weight
Session Exercises	These are mini-exercises that follow each asynchronous video, and are to be completed by both the asynchronous online participants and the synchronous in-person participants. Time will be allotted during class time to start the exercises, and all exercises are due by 1pm Pacific time on the following day, so that I have time to give you feedback if needed. The exercises are graded based on timely completion and effort, rather than by correctness. You are not required to completely solve all exercises, but to demonstrate effort when you cannot solve a question, you should at least write something, either a partial solution or a description of your thinking process. No credit will be given if your submission is largely blank.	18%
Problem Sets	In most weeks, there is a problem set due by Thursday 6pm (Pacific Time). There are 10 problem sets, each worth 3% of course grade, and these are different from the session exercises above. Unlike the session exercises, the problem sets will be graded based on correctness.	30%
Midterm Exam	This exam is open-notes, open-computer, and is administered on Blackboard during a regular session time. The exam is 80 minutes and worth 24% of final course grade. It covers material from the first	24%

	half of the course. While students can consult notes and online resource, they cannot collaborate with one another, cannot ask anyone for help and cannot share answers with others.	
Final Exam	As with the midterm, the final exam is open-notes, open-computer, and is administered on Blackboard during the scheduled time for the final exam (see https://classes.usc.edu/term-20213/finals/ for the schedule). The exam is 100 minutes and worth 28% of final course grade. While students can consult notes and online resource, they cannot collaborate with one another, cannot ask anyone for help and cannot share answers with others.	28%
Total		100%

Exam Rescheduling:

If you have a medical or family emergency, I can work with you to create a makeup exam to be completed at another date. **For all other reasons of missing the exam, including travels for non-emergencies, interviews, or forgetfulness about exam date, the student will not be allowed to reschedule and will receive a zero for the exam.**

Assignment Submission Policy:

All session exercises, problem sets, and exams must be submitted via Blackboard before the time it is due. If your Internet or Blackboard breaks down, then you should email the submission to the instructor as soon as you regain web access, along with a screenshot verifying the latest date of modification of the attached file. **Unless you can document that you completed the assignment before the deadline or have a documented medical or family emergency, no late submissions will be considered for grading.** This policy is strict and the Blackboard system will not accept submissions after the given timestamp. The purpose of this policy is so that the instructor can release the solutions to problem sets and exams immediately after they are due while the problems are still fresh in students' minds, and to train students to be assiduous in completing tasks on-time, which is an important part of professionalism.

Requests for Re-Grading:

If you feel that an error has occurred in the grading of any assignment, you may, within one week of the date the assignment is returned to you, write me an email in which you request that I re-grade the assignment. Attach the original assignment to the email and explain fully and carefully why you think the assignment should be re-graded. Be aware that the re-evaluation process can result in three types of grade adjustments: positive, none, or negative.

Students with Disabilities

USC is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. If you have a disability which may impact your performance, attendance, or grades in this course and require accommodations, you must first register with the Office of Student Accessibility Services (OSAS, <https://osas.usc.edu/>). OSAS provides certification for students with disabilities and helps arrange the relevant accommodations. Any student requesting academic accommodations based on a disability is required to register with OSAS each semester. A letter of verification for approved accommodations can be obtained from OSAS. OSAS is located in GFS (Grace Ford Salvatori Hall) 120 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for OSAS is (213) 740-0776. Email: OSASFrontDesk@usc.edu

Academic Conduct:

Students are expected to make themselves aware of and abide by the University community's standards of behavior as articulated in the [Student Conduct Code](#). Plagiarism – presenting someone else's ideas as

your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

IMPORTANT: No communication between students is tolerated during an exam, and students cannot discuss exam questions with other students during the day of the exam. Any suspicion of plagiarism or cheating will be reported and investigated. Students are encouraged to report any suspicious behavior of peers; the identity of the student who reports cheating will be held confidential. **Any documented act of plagiarism or cheating will result at a minimum in a failing grade of “F” for all responsible parties and accomplices, and depending on the result of the investigation, may also result in higher penalties such as suspension or expulsion.** In order to uphold the academic integrity of the university, such disciplinary actions will be executed without mercy on the first violation. By USC policy, any student who is investigated for cheating will not be allowed by the system to drop the course.

The Importance of Course Evaluations:

This course is continuously improved, based on feedback from students and instructor observations. Please participate in the mid-term and end-of-term course evaluations online. Your feedback would be much appreciated and I will read each evaluation carefully and use it to improve the course for the future.

ADDITIONAL INFORMATION

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call – studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call – suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) – (213) 740-9355(WELL), press “0” after hours – 24/7 on call – studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Campus Support & Intervention (CSI) – (213) 740-0411 – <https://campussupport.usc.edu/>
A team of professionals here to assist students, faculty, and staff in navigating complex issues. Whether you are here seeking support for yourself or someone else, we are available to help you problem solve, understand options, and connect with resources. Please note that we are not an emergency resource and are not available 24/7.

Office of Equity and Diversity (OED) – (213) 740-5086 | *Title IX* – (213) 821-8298
equity.usc.edu, titleix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws

and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

Office of Student Accessibility Services - (213) 740-0776 <https://osas.usc.edu>. OSASFrontDesk@usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy – (213) 821-4710 – uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC – (213) 740-2101 – diversity.usc.edu
Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Grade Disputes

All grades assigned by faculty members are final. Students have the right to seek explanation, guidance, counsel and reasons for the assignment of a grade. Faculty may initiate a change in grade if there is an error in the calculation of a grade. Students may appeal a grade according to university policy as set forth in *SCampus*. A faculty member may not change a disputed grade outside the formal appeals process. In response to a disputed academic evaluation by an instructor, a student is entitled to two levels of appeal after review by the instructor: first to the chairperson of the department and then to the appropriate dean of the school. The full university policy can be found in *SCampus* under University Governance / Academic Policies at <https://policy.usc.edu/scampus-part-c/>.

COURSE CALENDAR

Week	Session	Date	Topic	Due Thursday by 6pm Pacific Time
1	1	8/24	Introduction to Python programming	Pre-course survey
	2	8/26		
2	3	8/31	Data structures and loops	Problem set 1
	4	9/2		
3	5	9/7	Algorithmic thinking I	Problem set 2
	6	9/9		
4	7	9/14	Algorithmic thinking II	Problem set 3
	8	9/16		
5	9	9/21	Simulation modeling	Problem set 4
	10	9/23		
6	11	9/28	Coding practice	Problem set 5
	12	9/30		
		10/5	Midterm exam	
7	13	10/7	Introduction to optimization	
	14	10/12		
Fall break				
8	15	10/19	Concrete formulation I	
	16	10/21		
9	17	10/26	Concrete formulation II	Problem set 6
	18	10/28		
10	19	11/2	Using the Gurobi solver	Problem set 7
	20	11/4		
11	21	11/9	Abstract formulation	Problem set 8
	22	11/11		
12	23	11/16	Reusable software	Problem set 9
	24	11/18		
	25	11/23		
Thanksgiving break				
13	26	11/30	Problem solving practice	Problem set 10
	27	12/2		
	Finals Week		Final exam Section 16291: Thu, Dec. 9 11am-1pm Section 16293: Tue, Dec. 14 8am-10am	

Notes:

- All session exercises must be submitted by 1pm Pacific Time the day after the session to receive credit. These exercises are graded based on timely completion only.
- In each week, you should budget **at least 9 hours** to complete the lectures, the session exercises, and the problem sets. (This includes the time spent in class.) This level of minimum workload is mandated by USC policy: <https://arr.usc.edu/services/classroomscheduling/contacthours.html> (To achieve mastery, it is possible that the actual time spent may be more. **Please reach out to me for extra help if you are struggling to complete the course material in a reasonable amount of time, and I will do all I can to help you learn more efficiently.**)
- The final exam times are scheduled by the university and cannot be changed. See the current semester's schedules at: <https://classes.usc.edu/term-20213/finals/>.