

Quantitative Models for Decision Makers

MASY1-GC 1210 | 101 | Spring 2024 | 01/23/2024 - 04/30/2024 | 3 Credit

Modality: In-person

Course Site URL: <https://brightspace.nyu.edu/>

General Course Information

Name/Title: David Fogarty, Adjunct Professor, He/Him/His

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Class Meeting Schedule: 01/23/2024 - 04/30/2024 | Tuesdays | 06:20pm - 08:55pm

Class Location: Bldg: MIDC Room 1023

Office Hours: Th 5:00-8:00pm EST, (NYU Zoom, Phone), or by appointment. All sessions arranged via email.

Description

This course prepares students to analyze operational and strategic business situations and select appropriate and optimal courses of action. Using quantitative tools, students learn to analyze the firm's operation, employ sound critical decision making to initiate appropriate action and move the organization to creative problem solving. This course provides students with the tools and techniques required to manage these processes efficiently and make decisions effectively.

Prerequisites

N/A

Learning Outcomes

At the conclusion of this course, students will be able to:

- Apply appropriate mathematical concepts and computational methods in economics, operations research, logistics, and business planning
- Design, business case solutions using probability theory, numerical computations, and quantitative methods
- Apply skills and knowledge of advanced analytical methods and tools to facilitate decision making
- Analyze business problems using linear programming and network flow management for decision making

Communication Methods

You are expected to check your NYU email and/or [NYU Brightspace notifications](#) daily for announcements concerning assignments, class changes or cancellations, and other important information. Credit students must use their NYU email to communicate. Non-degree students do not have NYU email addresses. Brightspace course-mail supports student privacy and FERPA guidelines. I intend to reply to all questions or comments within 24 hours using NYU email and or messages function within Brightspace for all communications w/ students. Student information or grade questions should only be communicated via NYU Email, per FERPA guidelines.

Structure | Method | Modality

There are 14 session topics in this course. The session topics are each covering an important quantitative model(s) for business and how they are implemented and used in practice.

Active learning experiences, individual and group projects are key components of the course. Assignments, papers, and exams will be based on course materials (e.g., readings, videos), lectures, and class discussions. Course sessions will be conducted in classroom and students will be able to access all course materials from the course site in [NYU Brightspace](#).

Expectations

Learning Environment

You play an important role in creating and sustaining an intellectually rigorous and inclusive classroom culture. Respectful engagement, diverse thinking, and our lived experiences are central to this course, and enrich our learning community.

Participation

You are integral to the learning experience in this class. Be prepared to actively contribute to class activities, group discussions, and work outside of class. Participation means contributing to the discussion versus simply speaking in class or offering a random comment in the Brightspace discussion forum; it also means actively listening and building on the questions and discussion points of your classmates. As graduate students, you are expected to conduct yourselves in a professional manner and engage and collaborate with your classmates.

Assignments and Deadlines

Students are required to complete (on their own) homework assignments following each chapter covered in the text, group case problems which will be periodically assigned, and a final exam.

Assignments and readings must be executed and are due on the dates indicated at the time of assignment. Missed assignments will lower the student's grade based on the percentage of the grade allocable to it. Late assignments are permitted only with advance notice to, and permission from, the instructor. Assignments will be graded for content and clarity.

See outline for assignment due dates.

Course Technology Use

This class is to be held in-person. However, in the event of a change due the pandemic all class sessions would require the use of Zoom. Establishing an environment of mutual respect and exchange in the classroom requires a commitment to presence in discussions and full attention to the course materials presented in class. All class sessions require use of technology (e.g., laptop, tablet, or smartphone for learning purposes).

However, in the interest of ensuring that attention stays focused on your classmates and class discussions, use of laptops, cellphones, and other electronic devices is not permitted during

the session unless required for a class activity. We will utilize multiple technologies to achieve the course goals. I expect you to use technology in ways that enhance the learning environment for all students.

Feedback and Viewing Grades

I will provide timely meaningful feedback on all your work via our course site in NYU Brightspace. You can access your grades on the course site Gradebook.

Attendance

Students are expected to attend all on-line class sessions. Excused absences are granted in cases of documented serious illness, family emergency, religious observance, or civic obligation. In the case of religious observance or civic obligation, this should be reported in advance. Unexcused absences from sessions may have a negative impact on a student's final grade. Students are responsible for assignments given during any absence.

If for some reason (excused absence) you will not be in class, you must notify the instructor prior to the scheduled session if you will not be attending and the reason.

Each unexcused absence or being late may result in a student's grade being lowered by a fraction of a grade. A student who has three unexcused absences may earn a Fail grade.

Refer to the [SPS Policies and Procedures page](#) for additional information about attendance.

Textbooks and Course Materials

Required: An Introduction to Management Science: Quantitative Approaches to Decision Making, 16th Edition; Published: 2023; Anderson, Sweeney, Williams, Camm, Cochran, Fry, Ohlmann. CENGAGE Learning. Relevant chapters to be assigned during the term.

Published Year: ISBN: 978-1-337-40652-9 / ISBN-10: 0357715462

Other readings will be provided in relevant weeks and occasional additional short readings may be provided during the term.

Course Requirement:

Students are required to bring computers to class. We will be using MS Excel for our models. Students can purchase these items through the NYU Bookstore:

Grading | Assessment

Class Participation	10%
Individual Homework	60%
Group Assignment	30%
Total	100%

Homework assignments (problems from the textbook) will be given out as we progress through the text. The weight of each homework toward the total Individual Homework Assignment grade will be equal except for weeks 6,12 when the weight for each assignment will be double. All homework assignments are graded, discussed, and returned.

During the course, we will have one Group Assignment. Group Assignment will be picked from two of the business cases in the assigned text. These problems should be from two different chapters. Ninety percent of each Group Assignment grade will be based on whether the group uses the appropriate methodologies and determines the correct answer to the problems. Ten percent of the grade will be assessed on the group's ability to clearly present the problems and solutions.

Each group member will be expected to be responsible for analyzing a specific aspect of the strategic decision-making metrics for the group's assigned cases. This analysis will form the basis for assessing each individual student's contributions towards the group results.

Group Assignment will culminate into a final report-out via PowerPoint to the class on Week 14.

To be individually assessed each team member must present on the topic they are assigned as group leader and individual contributions towards each component of the overall final group project.

- The group work will be assessed based on several dimensions, including the ability of the team to generate a range of ideas, listen respectfully to different perspectives, distribute work fairly, resolve differences, and communicate “effectively”.
- Students will form groups of 4 students per group.
- Students will consider the following for the final report-out:
- Select two case studies relevant to the Chapters covered and present a thorough analysis and give a recommendation from the perspective of a management consulting company. (You should provide a solution from your fictitious company to the target company in the case study).
- Make sure to provide your company profile, business problem being addressed, benefits\disadvantages/challenges and final recommendations.
- A proper understanding of the business, management science concepts and solutions that your company recommends being implemented must be conveyed.
 - The presentation needs to be for a target audience of stakeholders or decision makers that would be interested in the improved model.
 - The presentation is required to be about 20-30 minutes (Including time for Q&A) consisting of at least 15-30 slides covering and pertaining to relevant topics to thoroughly depict the case study to the target audience.
 - Oral presentations will be recorded for Self-Assessment Evaluation and feedback by the student.
 - Peer assessment should not be used in grading.
 - Every presentation requires a corresponding recorded webinar with voice over narration.
 - An oral presentation will also be conducted for each group.

- All contributions and work must be recorded appropriately to be submitted accordingly
- Each member should keep a running report of all contributions, meeting minutes, code, log files, models developed, tasks completed etc.) should also be submitted or posted to corresponding group discussion boards or assignment droboxes.

Class Participation consists of asking questions and engaging in class discussions.

See the [“Grades” section of Academic Policies](#) for the complete grading policy, including the letter grade conversion, and the criteria for a grade of incomplete, taking a course on a pass/fail basis, and withdrawing from a course.

Course Outline

Start/End Dates: 01/23/2024 - 04/30/2024 | Tuesdays

Time: 06:20pm - 08:55pm

No Class Date(s): Tuesday, 03/19/2024

Special Notes: Spring Break 03/18/24 - 03/24/24

Week	Date	Topic to Complete	Topic / Assignment	Topic to Complete	Due Date
1	01/23/24	Chapter 1	Introduction	Homework	01/28
2	01/30/24	Chapter 2	An Introduction to Linear Programming	Homework	02/04
3	02/06/24	Chapter 3	Linear Programming: Sensitivity Analysis and Interpretation of Solution	Homework	02/11
4	02/13/24	Chapter 4	Linear Programming Applications in Marketing, Finance, and Operations Management	Homework	02/18
5	02/20/24	Chapter 6	Distribution and Network Models	Homework	02/25
6	02/27/24	Readings	Intro to Data Science and Data Mining	Homework	03/03
7	03/05/24	Chapter 7 Chapter 11	Integer Linear Programming Queuing Theory / Waiting Line Models	Homework	03/10
8	03/12/24	Chapter 9	Project Scheduling: PERT/CPM	Homework	03/17
N/A	03/19/24		No Class	N/A	
9	03/26/24	Chapter 10	Inventory Models	Homework	03/31

Week	Date	Topic to Complete	Topic / Assignment	Topic to Complete	Due Date
10	04/02/24	Chapter 13	Decision Analysis	Homework	04/07
11	04/09/24	Chapter 15	Time Series Analysis and Forecasting	Homework	04/14
12	04/16/24	Readings	Quality Control	Homework	04/21
13	04/23/24		Guest Speaker	TBA	04/23
14	04/30/24		Group Project Presentations		04/30

Week 1 - 01/23

Chapter 1: Introduction to Quantitative Analysis

In this week, we will have a general knowledge of the uses of Management Science in problem solving and an introduction to some commonly used techniques:

Syllabus Review & Course Overview

Group Creation

Homework: Chapter 1, Problems 6, 8, 10, 11, 13 due 01/28.

Week 2 - 01/30

Chapter 2: An Introduction to Linear Programming

In this week, we will understand the ability to model, analyze, and solve business problems using graphic and algebraic methods of linear programming:

Homework: Chapter 2, Problems 4, 6, 8, 10, 12, due 02/04.

Week 3 - 02/06

Chapter 3: Linear Programming: Sensitivity Analysis and Interpretation of Solution

In this week, we will discuss Linear Programming: Sensitivity Analysis and Interpretation of Solution:

Homework: Chapter 3, Problems 4, 6, 15, due 02/11

Week 4 - 02/13

Chapter 4: Linear Programming Applications in Marketing, Finance, and Operations Management

In this week, we will discuss Linear Programming Applications in Marketing, Finance, and Operations Management.

Homework: Chapter 4, Problems 4, 5, due 02/18.

Week 5 - 02/20

Chapter 6: Distribution and Network Models

In this week, we will learn Distribution and Network Models

Homework: Chapter 6, Problems 2, 5a-b (formulate only), due 02/25

Week 6 - 02/27

In this week we will learn about Data Science and Data Mining. Selected Readings in Data Science and Data Mining:

- Apte C, Bing Liu, Pednault EPD, Smyth P. Business Applications of Data Mining. Communications of the ACM. 2002;45(8):49-53. doi:10.1145/545151.545178
- Bartschat, A., Reischl, M., & Mikut, R. (2019). Data mining tools. WIREs: Data Mining & Knowledge Discovery, 9(4), N.PAG. <https://doi-org.proxy.library.nyu.edu/10.1002/widm.1309>
- Ipin Sugiyarto, Bibit Sudarsono, & Umi Faddillah. (2019). Performance Comparison of Data Mining Algorithm to Predict Approval of Credit Card. Sinkron, 4(1), 149–157. <https://doi-org.proxy.library.nyu.edu/10.33395/sinkron.v4i1.10181>
- Jiraporn Charoenpong, Busayamas Pimpunchat, Somkid Amornsamankul, Wannapong Triampo, & Narin Nuttavut. (2019). A Comparison of Machine Learning Algorithms and their Applications. International Journal of Simulation -- Systems, Science & Technology, 20(4), 1–17. <https://doi-org.proxy.library.nyu.edu/10.5013/IJSSST.a.20.04.08>

Homework: Practice Developing ML Algorithms Using RapidMiner/ <https://rapidminer.com/get-started-educational/> due 03/03

Week 7 - 03/05

Chapter 7: Integer Linear Programming

Chapter 11: Queuing Theory / Waiting Line Models

In this week, we will learn Integer Linear Programming and Queuing Theory / Waiting Line Models

Homework: Chapter 7, Problems 3, 7, due 03/10.

Homework: Chapter 11, Problem 6, due 03/10.

Week 8 - 03/12

Chapter 9: Project Scheduling: PERT/CPM

In this week, we will discuss the ability to utilize analytical tools such as Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) to solve planning and scheduling problems.

Homework: Chapter 9, Problems 4, 6 7, due 03/17.

Spring Break 03/19

There will be no class on 03/19

Week 9 - 03/26

Chapter 10: Inventory Models

In this week, we will discuss Inventory Models.

Homework: Chapter 10, Problems 3, 4 due 03/31.

Week 10 - 04/02

Chapter 13: Decision Analysis

In this week, we will discuss decision analysis, which includes Problem Formulation, Decision Making with and without Probabilities, and Risk Analysis and Sensitivity Analysis.

Homework: Chapter 13, Problems 2, 5, due 04/07

Week 11 - 04/09

Chapter 13: Time Series Analysis and Forecasting

In this week, we will learn Time Series Analysis and Forecasting, where we will learn Quantitative Approaches to Forecasting and Forecast Accuracy.

Homework 6: Chapter 15, Problems 2, 4 due 04/14

Week 12 - 04/16

Selected Readings in Quality Control:

- Fountoulaki, A., Karacapilidis, N., & Manatakis, M. (2011). Augmenting statistical quality control with machine learning techniques: an overview. *International Journal of Business and Systems Research*, 6, 610.
- Freeman, K. P., Cook, J. R., & Hooijberg, E. H. (2021). Introduction to statistical quality control. *JAVMA-JOURNAL OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION*, 258(7), 733–739.
- Montgomery, D., & Woodall, W. (2008). An Overview of Six Sigma. *International Statistical Review / Revue Internationale De Statistique*, 76(3), 329-346. Retrieved August 17, 2021, from <http://www.jstor.org/stable/27919650>
- Thangarajoo, Y., & Smith, A. (2015). Lean Thinking: An Overview. *Industrial Engineering and Management*, 4(2), 1-5. DOI: 10.4172/2169-0316.1000159

Homework: Using the learnings for this week's reading assignments and additional research complete the following:

PHASE 1 - PROCESS IMPROVEMENT

Select a process from an organization you work for or are familiar with. Make sure it's a process you are able to collect data and process statistics.

Create a flowchart of the current state or as-is process using Microsoft Word, PowerPoint, Vizio, or Excel and evaluate how well your process operated (efficiency and effectiveness) of your process using process improvement techniques.

Next ascertain how the process can be improved based on the results of your evaluation and define process metrics and measure the current state process. Use process improvement techniques to improve the process. Create a flow chart of the improved process using Microsoft Word, PowerPoint, Vizio, or Excel.

Use your professional judgment and what you learned this week to ascertain how the future state process will perform according to your metrics.

Phase 2 – Evaluation

Evaluate your process using either lean concepts to find ways to eliminate waste and improve the process and/or SQC or Six Sigma to reduce defects or variances in the process

Then complete the following in Excel:

chart and compute the defined process metrics including process capability and process variation.

Create and display a control chart for the process.

Analyze the control process metrics using Statistical Quality/Process Control (SQC) methods. Decide whether the process could benefit from the use of Six Sigma, Lean, or other tools. (Include all calculation and charts)

Executive Summary

Write a 700-to-850-word executive summary which includes the following:

- A brief description of the process based on the flowchart of processes current state
- Explain the results of your process evaluation and how the weak points can be strengthened. Include a description of the process improvement technique(s) used.
- Provide a brief description of future state process improvements
- Using the metrics chosen to evaluate process current state estimate how you anticipate the future process will perform
- Provide a brief description of your process improvement project to achieve the process future state

A summary of the Process Evaluation (using either Lean or SQC or Six Sigma)

A summary of the evaluation of the control chart and process metrics based on other tools

A description of the SQC project and recommendations.

Cite references (including some peer reviewed) to support your assignment.

Provide a list of references and format your citations according to APA guidelines. Due 04/21.

Week 13 - 04/23

Guest Speaker

Week 14 - 04/30

Group Project Presentation (Oral)

This class will cover the following content:

- Chapter 1: Introduction to Quantitative Analysis
- Chapter 2: An Introduction to Linear Programming
- Chapter 3: Linear Programming: Sensitivity Analysis and Interpretation of Solution
- Chapter 4: Linear Programming Applications in Marketing, Finance, and Operations Management
- Chapter 6: Distribution and Network Models
- Chapter 7: Integer Linear Programming
- Chapter 9: Project Scheduling: PERT/CPM
- Chapter 10: Inventory Models
- Chapter 11 Queuing Theory (Waiting Line)
- Chapter 13: Decision Analysis
- Chapter 15: Time Series Analysis and Forecasting
- Readings: Statistical Quality Control
- Readings: Data Science and Data Mining

If time permits, we may discuss some of these other current topics in Management Science:

- Simulation (including Nonlinear Optimization)
- Multicriteria Decision Modeling
- AI for Management Science
- Cloud Computing and Management Science
- Healthcare Delivery and Operations Research

The course overview:

A general knowledge of the uses of Management Science in problem solving and an introduction to some commonly used techniques. The ability to model, analyze, and solve business problems using graphic and algebraic methods of linear programming.

Skill in achieving an optimal strategy in situations with several decision alternatives or uncertainty, utilizing different methodologies involving probabilities and mathematical models. The ability to recognize and solve different types of network flow problems, using linear programming.

The ability to understand the principles of data science and how to develop data mining models to solve common business problems.

The ability to utilize analytical tools such as Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) to solve planning and scheduling problems.

A fundamental understanding of the applications of Queuing Theory (Waiting Line) and the ability to solve basic queuing problems.

Understanding the fundamental principles and application of statistical quality control
Basics of financial modeling and forecasting. Project presentations.

NOTES:

The syllabus may be modified to better meet the needs of students and to achieve the learning outcomes.

The School of Professional Studies (SPS) and its faculty celebrate and are committed to inclusion, diversity, belonging, equity, and accessibility (IDBEA), and seek to embody the IDBEA values. The School of Professional Studies (SPS), its faculty, staff, and students are committed to creating a mutually respectful and safe environment (*from the [SPS IDBEA Committee](#)*).

New York University School of Professional Studies Policies

1. Policies - You are responsible for reading, understanding, and complying with [University Policies and Guidelines](#), [NYU SPS Policies and Procedures](#), and [Student Affairs and Reporting](#).
2. Learning/Academic Accommodations - New York University is committed to providing equal educational opportunity and participation for students who disclose their dis/ability to the [Moses Center for Student Accessibility](#). If you are interested in applying for academic accommodations, contact the [Moses Center](#) as early as possible in the semester. If you already receive accommodations through the Moses Center, request your accommodation letters through the Moses Center Portal as soon as possible (mosescsa@nyu.edu | 212-998-4980).
3. Health and Wellness - To access the University's extensive health and mental health resources, contact the [NYU Wellness Exchange](#). You can call its private hotline (212-443-9999), available 24 hours a day, seven days a week, to reach out to a professional who can help to address day-to-day challenges as well as other health-related concerns.
4. Student Support Resources - There are a range of resources at SPS and NYU to support your learning and professional growth. For a complete list of resources and services available to SPS students, visit the [NYU SPS Office of Student Affairs site](#).
5. Religious Observance - As a nonsectarian, inclusive institution, NYU policy permits members of any religious group to absent themselves from classes without penalty when required for compliance with their religious obligations. Refer to the [University Calendar Policy on Religious Holidays](#) for the complete policy.
6. Academic Integrity and Plagiarism - You are expected to be honest and ethical in all academic work. Moreover, you are expected to demonstrate how what you have learned incorporates an understanding of the research and expertise of scholars and other appropriate experts; and thus recognizing others' published work or teachings—whether that of authors, lecturers, or one's peers—is a required practice in all academic projects.

Plagiarism involves borrowing or using information from other sources without proper and full credit. You are subject to disciplinary actions for the following offenses which include but are not limited to cheating, plagiarism, forgery or unauthorized use of documents, and false form of identification

[Turnitin](#), an originality detection service in NYU Brightspace, may be used in this course to check your work for plagiarism.

Read more about academic integrity policies at the NYU School of Professional Studies on the [Academic Policies for NYU SPS Students](#) page.

7. Use of Third-Party Tools - During this class, you may be required to use non-NYU apps/platforms/software as a part of course studies, and thus, will be required to agree to the “Terms of Use” (TOU) associated with such apps/platforms/software.

These services may require you to create an account but you can use a pseudonym (which may not identify you to the public community, but which may still identify you by IP address to the company and companies with whom it shares data).

You should carefully read those terms of use regarding the impact on your privacy rights and intellectual property rights. If you have any questions regarding those terms of use or the impact on the class, you are encouraged to ask the instructor prior to the add/drop deadline.