

IE 5551
Spring 2019

Production Planning and Inventory Control

Course objectives: This course will provide you with an introduction to methods for managing production, inventory, and distribution systems. Topics covered include demand modeling and forecasting, inventory management, supply chain coordination, revenue management, production planning, and management of manufacturing operations. The objective of the course is to familiarize you with quantitative models that can be used to make decisions in each of these areas. Special emphasis will be given to the link between operational issues and strategic objectives regarding cost, responsiveness, flexibility, product variety, and customer differentiation, among others. We will also discuss the implications of various emerging technologies, business practices, and government regulations.

Meeting Time/Location: We are meeting Tuesdays and Thursdays from 1:25 pm to 3:20 pm at Mechanical Engineering Building room 102.

Prerequisites: Introductory courses in probability and statistics and optimization, including linear programming, is required. Knowledge of Matlab (or Microsoft Excel) is assumed.

Instructor: Behrooz Pourghannad; behrooz@umn.edu

Texts: *Factory Physics* by Wallace Hopp and Mark Spearman, Irwin/McGraw-Hill, Third Edition, 2011 (selected chapters), *The Goal* by Eliyahu M. Goldratt and Jeff Cox, North River Press, Second Edition, 1992. The texts will be supplemented with handouts and assorted papers from recent literature and other textbooks.

Website: Lecture notes, homework, and homework solutions will be posted online.

Office hours: Tuesday 9:30 am - 11:00 am at Shepherd Lab 493 or by appointment.

Homework: Homework will be assigned regularly and will be due a week from the assignment date (unless instructed otherwise). Homework solutions will be posted on the course Canvas site. In addition, each student will be assigned a paper for in-class presentation and critique. All assignments are due the day of the corresponding presentation.

Exams: Two exams, one in class (tentatively scheduled for week 8; the last session before spring break) and one during finals week.

Paper presentations: Each week, we will have a paper (or a book) assigned for reading and presentation in class. The papers and the two books have been carefully selected to supplement lectures, to illustrate important ideas, emergent concepts, or to document industry practices. Each student needs to sign up for one of the papers listed below. Papers are available for download via the Moodle site. For your assigned paper, you will be responsible to prepare a professional looking 10 to 15 minute presentation. There will be an additional 10 to 15 minutes for questions and class discussion. In addition to summarizing the main ideas in the paper (assume everyone has read it), your role as a presenter is to provide a critical assessment, describing both the usefulness of the concepts described and their limitations. More importantly, your role is to engage and lead the class in a lively discussion. For this purpose, your last slide should consist of a list of open-ended questions to ask from the rest of the class. In preparing your presentation, feel free to provide additional background or perspective (this may require additional research on your part) or to draw on your own experience. You may liven up your presentation by using other media, such as videos, live demos, physical prototypes, or by carrying out a game.

Everyone in the class is expected to participate in the discussion following each presentation. Each student should come to class having read the paper and prepared to contribute to the discussion with questions and comments.

Course Projects: You may work in groups of 2 (you may also work by yourself). Topic and scope of the project is flexible. Three types of projects are possible (1) problem solving, (2) data analysis, (3) case studies, and (4) reviews. In a “problem-solving” project, you would address a production and inventory control problem (either specific to a particular setting or generic) and provide a solution in the form, for example, of a mathematical model, a computer model, or via statistical analysis of actual data. In a “data analysis” project, you would identify a rich data set and you will mine this data set to identify interesting relationships and useful insights. In a “case study” project, you would consider a specific firm and document its operations, managerial practices, or its use of certain technologies. In a “review project”, you would provide an in-depth survey of practices in an industry, the usage of a certain technology or a management principle in practice, or a review of academic research on a particular topic.

Every year, there is a theme selected for the projects. Students are encouraged, but **not** required, to choose project topics consistent with the theme. This year’s theme is “*Business Model Innovation*.”

A two-page proposal is due by the end of the fifth week. The proposal should describe the topic, preliminary work carried out so far, and assignment of project duties among team members. Project presentations will be scheduled during the last week of classes. Project presentations will be 10 minutes in length followed by 5 minutes of questions and discussion. Written reports will be due on the last day of classes. The final report must be typed. You are encouraged to schedule individual meetings with me throughout the semester to discuss progress on your project.

Grading: Final grades will be assigned based on the following breakdown: Exam 1: 25%, Exam 2: 25%, HWK: 20%, group project: 20% (5% oral presentation; 15% written report), paper

presentation 5%, paper summaries 5%; class participation and attendance: 5%. Late assignments will not be accepted.

Class Participation and class attendance: Students are expected to attend all lectures and to actively participate in class discussions. Please inform the instructor beforehand if you are going to be absent or late to a class. Unexcused absences will negatively impact your grade.

Re-grades: You may submit an assignment or an exam for a re-grade within two weeks of its return date. Re-grade requests are not accepted after this time limit. The requests must be accompanied by a written explanation of why you feel the original grading was inaccurate.

Scholastic Dishonesty: You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. Student Conduct Code is available at

http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Schedule of lecture topics: The following is a tentative schedule of lecture topics.

Week 1	Introduction to Production Planning and Inventory Control
Week 2	Inventory Control – Deterministic Demand
Week 3	Inventory Control – Stochastic Demand
Week 4	Inventory Control – Stochastic Demand
Week 5	Inventory Control – Stochastic Demand
Week 6	Inventory Control – Time Varying Demand
Week 7	Inventory Control – Multiple Echelons
Week 8	Supply Chain Coordination and contracting
Week 9	Behavioral Issues in Supply Chain Management
Week 10	Revenue Management
Week 11	Demand Modeling and Forecasting
Week 12	Managing Manufacturing Operations
Week 13	Selected Topics
Week 14	Selected Topics
Week 15	Project Presentations

For your record here is University of Minnesota's 2019 Spring academic calendar

January 21 Monday	MLK holiday
January 22 Tuesday	Classes begin
March 18-22 Mon.-Fri.	Spring Break
May 6 Monday	Last day of instruction
May 7-8, 12 Tues.-Wed., Sun.	Study days
May 9-11, 13-15 Thurs.-Sat., Mon.-Wed.	Final examinations
May 15 Wednesday	End of the term

Additional Resources

Other recommended textbooks: The following texts offer additional discussion of material related to our course.

Introductory

- *Fundamentals of Supply Chain Theory* by Larry Snyder and Max Shen, John Wiley, 2011
- *Principles of Inventory Management* by John Muckstadt and Amr Sapra, Springer 2009
- *Designing and Managing the Supply Chain* by David Simchi-Levi, Philip Kaminski and Edith Simchi-Levi, McGraw-Hill, Third Edition, 2007
- *Matching Supply with Demand: An Introduction to Operations Management* by Gerard Cachon and Christian Terwiesch, McGraw Hill, 2009
- *Decision Systems for Inventory Management and Production Planning* by Edward Silver, David Pyke, and J. Peterson, Third Edition, John Wiley, 1997
- *Production and Operations Analysis* by Steve Nahmias, Fifth Edition, Irwin, 2007
- *Supply Chain Management* by Sunil Chopra and Peter Meindl, Prentice Hall, Ninth Edition, 2015
- *Operations Strategy* by Jan Van Mieghem and Gad Allon, Dynamic Ideas, 2015
- *Factory Physics for Managers: How Leaders Improve Performance in a Post-Lean Six Sigma World* by Edouard S. Pound, Jeffrey Bell and Mark Spearman, McGraw-Hill, 2014
- *Operations Rules* by David Simchi-Levi, MIT Press, 2010.
- *The New Science of Retailing: How Analytics are Transforming the Supply Chain and Improving Performance* by M. L. Fisher and A. Raman, Harvard Business Press, 2010.

Advanced

- *Foundation of Inventory Theory* by Paul Zipkin, McGraw-Hill, 2000
- *Stochastic Inventory Theory* by Evan Porteus, Stanford University Press, 2002
- *Stochastic Models of Manufacturing Systems* by John Buzacott and George Shanthikumar, Prentice-Hall, 1993

- *Inventory Control* by Sven Axsater, Kluwer, Second Edition, 2006
- *The Theory and Practice of Revenue Management* by Kalyan Talluri and Garrett van Ryzin, Springer, 2005.

Related magazines and journals: The following are selected journals and magazines that publish articles in the areas of production, inventory and supply chain management

- Harvard Business Review
- Supply Chain Management Review
- APICS Magazine
- Sloan Management Review
- Interfaces
- Manufacturing and Service Operations Management
- Management Science
- Operations Research
- Production and Operations Management
- IIE Transactions
- Naval Research Logistics
- European Journal of Operational Research

Related Blogs: The following are blogs focused on topical issues in supply chain management and to supply chain management in news.

- The Operations Room, <https://operationsroom.wordpress.com>
- RenaissanceInnovator.com, <http://renaissanceinnovator.com>
- Global Supply Chain Musings, <https://aviyer2010.wordpress.com>
- Global Supply Chain Blogs, <http://blogs.anderson.ucla.edu/global-supply-chain/>
- Jay and Bary's OM Blog, <https://heizerrenderom.wordpress.com>
- SupplyChain@MIT, <http://supplychainmit.com>

Useful Web sites: The following websites are rich in content related to the topics of our course and contain links to other relevant websites.

- www.factory-physics.com
- www.scmr.com
- <http://cscmp.org>
- <http://www.scdigest.com>
- <http://www.supplychainasia.org>
- www.apics.org
- www.poms.org
- www.informs.org

Students with Disabilities: The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact the instructor early in the semester to review how the accommodations will be applied in the course.

Appendix I: Additional information regarding Course Projects

There is no length requirement on the project report, but typical reports tend to range from 20 to 25 pages **double-spaced**. A report may include the following.

- 1) A **title** page that includes your project's title and names of your project team members.
- 2) An **introduction** that describes at a high-level what the project is about, the motivation for choosing the project (why the topic/problem addressed is important); a summary of your approach and a summary of your main findings.
- 3) If relevant, a brief **review of literature or existing practices** (e.g., what is known about the problem; how are things currently done in practice; are there published results that are relevant)
- 4) A detailed description of the **problem/ review topic/ data set/ the subject of the case study**.
- 5) A detailed **description of your approach** (how did you tackle the problem/data analysis/ literature review/ case study; how did you collect data/information; what data did you end up using ; what analysis did you carry out; is there a model that you used; is there an algorithm that you implemented; did you do any computations; etc.)
- 6) A summary of **your results, findings, and recommendations**.
- 7) A **brief conclusion** that summarizes the problem, the approach, and the findings.
- 8) If needed; **an appendix** that includes data you collected; code you developed; and any other supplementary material you would like to include.
- 9) **List of references**, data sources, websites consulted, and other sources of information.
- 10) A **description of how the work was allocated among team members** and who did what.

Note that, depending on the type of project, some sections may be emphasized more than others.

Projects will be graded based on the following criteria:

- Quality and depth of the analysis.
- Quality and importance of results/observations/recommendations provided.
- Overall effort relative to the number of team members.
- Overall quality relative to other projects.
- Overall quality of the writing and organization of the report.

A component of each student's project grade will be based on a confidential peer review feedback from members of her/his project team. An indication that a student has not adequately contributed to the project may result in a failing grade on the project.