OPERATIONS MANAGEMENT

Spring 2017

(COURSE SYLLABUS COR1-GB.2314.21

STERN SCHOOL OF BUSINESS

This course serves as an introduction to Operations Management. The coverage of the discipline is very selective: We concentrate on a limited number of powerful themes that have emerged recently as the central building blocks of world-class operations. We also present a sample of operations management tools and techniques that have been proved extremely useful over the years. The topics are relevant in the manufacturing as well as in the service sectors. We have 13 sessions in Spring 2017 on Monday afternoons. Class participation is important. If you have to miss any session, please notify the instructor in advance.

MEETINGS:  COR1-GB.2314.21  Monday 1:30 PM – 4:20 PM

ROOM:  KMC M3-55

INSTRUCTOR:  Dr. Michael Pinedo, Room KMC 8-65, (212) 998-0287
mpinedo@stern.nyu.edu

OFFICE HOURS:  Monday 5-7 PM (or by appointment)

OFFICE HOURS:  TBA
COURSE MATERIALS


CASEBOOK (Required): containing two Harvard Cases. This Case Book has to be purchased at the bookstore. (The list below is still tentative and may still change).

- BENIHANA
- NATIONAL CRANBERRY
- L.L. BEAN, INC.

CASEPACKET (Downloadable from NYU Classes): The following list of documents includes NYU, Columbia and Stanford Cases and Readings. This packet is downloadable from NYU classes under Resources/Case Folder.

- ANALYSIS OF OPERATIONS
- KRISTEN’S COOKIES CASE
- PANAMA CANAL
- FCN SECURITIES DEMO (A), (B) AND (C)
- NETWORK CASES
- WAITING LINE MANAGEMENT TABLE
- THE RITZ-CARLTON CASE (Columbia University Case)
- THE FORD-FIRESTONE CASE (NYU Case)
- THE SMITH-THOMPSON INVESTMENT BANK CASE (NYU Case)
- FIRST CITY NATIONAL BANK CASE (NYU Case)
- XENON CASE (NYU Case)
- DELL DIRECT (Stanford Case)
- BLUE SKY AIRLINES (INFORMS Case)

Not all the cases above are going to be discussed in detail in class. For example, the Ford-Firestone Case and the Dell Direct case will not be discussed in class. (You still may want to read them since they are not uninteresting.)


VIDEOS: In the last two pages of this syllabus there are a number of links to youtube videos developed by faculty in our department on seven of the topics that are going to be covered in the course. Each topic has three videos associated with it. You may want to watch the first two videos of each one of the topics. The first one is an *Introduction* in the topic; the second one describes a problem in the particular area, referred to as *Problem Walkthrough*; the third one describes a possible *Assignment* (however, none of the assignments in the videos have to be done for this course).
NYU CLASSES: We will be using NYU Classes a fair amount. Most of the time you will have to go to Resources. In Resources, you may have to go either to Case Folder, Documents for the 6 Modules or to External Links.

COMPUTER SOFTWARE: EXCEL

HOMEWORK

You will be assigned homework at regular intervals. The 4 homework assignments are due on the dates (sessions) where the assignments appear in the syllabus. Their due dates are Sessions ...... Only assignments that are specifically designated as SUBMIT are to be handed-in at the beginning of class (if by any chance you cannot make it to class, email us the homework before the beginning of class). Each homework assignment can be maximum 3 pages of text (1.5 spaced); it may contain one or two extra pages with figures or tables. Make sure to keep a copy of all homework submitted.

Homework will be graded on the scale of (0, 0.5, 1, 1.5 and 2), and will not be accepted late. The assignments have to be prepared individually in order to receive credit. Please write clearly or word process your homework. You are allowed to discuss the general issues concerning the homework with one another. However, the details concerning the homework and the writing up of it, you have to do by yourself (so no two homeworks should be exactly alike).

QUZZES

A quiz might be given in any session. The quiz will relate to facts given in a case and study questions asked in the syllabus.

FINAL EXAM DATE

COR1-GB.2314.21: TBA

GRADING

Class Participation, Attendance, Quizzes 15%
Homework 15%
Mid-Term Examination 30%
Final Examination 40%
(You are allowed to bring to the mid-term and to the final one sheet (just one sheet!) of paper with notes. You may use both sides of the sheet.)
HOW TO PREPARE FOR CLASS DISCUSSIONS

Please read the cases carefully. Use the study questions supplied in the syllabus as a guide. Be prepared to be called-upon to present the facts of the case, or to carry out the analysis indicated by the study questions. Class attendance and participation will be graded on the scale of (0,2), where 1 is for attending without participating, 1.5 is for contributing some to class discussion, and 2 for a substantial contribution to class discussion.

USE OF LAPTOP COMPUTERS IN CLASS

You are only allowed to use laptop computers in class under the following conditions:
- You send me an email in advance notifying me that you will be using a laptop.
- You have to sit in the very last row in class
- Within 10 minutes after the class is over, you have to email me the notes you made on your laptop.

Texting and emailing during class is **not** allowed and will affect your class participation grade negatively.

HONOR CODE

I expect every student to be familiar with the Stern School of Business Honor Code. Some of the ways in which the code applies to this course are discussed below:

- The honor code stipulates that no student will lie, cheat, copy or otherwise behave in an unfair manner to obtain academic advantage over other students.
- As per the honor code, an individual’s name on a report **should be included** only if they have contributed to the analysis. If an individual has not contributed to the analysis in an intellectual manner, it is a violation of the honor code to include his or her name.
- Furthermore, you may not refer to case write-ups from classes offered in earlier semesters.
- The premise of *the honor code* is that ideas should be attributed to their source. Therefore, please acknowledge the main source(s) of data, facts, and ideas (other than from the instructor or textbook) in all your written work and when you make a presentation. If you use material from a source other than the lecturer, the textbooks or the lecture notes, you must attribute the source. For example, say, “I discussed this with the TA.” Or “I obtained this from the following website.”
- You may discuss the homework with your classmates, TA or me. The discussion is limited to “how to solve” type of questions. The actual solution must be done individually. (So two homeworks may not look exactly the same.) Do not be worried of getting the answer incorrect in the homework. Most of the points will be given for using the correct approach.
CLASS SCHEDULE

MODULE 1:  Introduction to Operating Systems - Process Design and Analysis

Jan 30 (Mon)  SESSION 1:  INTRODUCTION – OPERATIONS AS A SOURCE OF COMPETITIVE ADVANTAGE - PROCESS DESIGN AND TYPES OF OPERATING PROCESSES

1. Introduction to Operations Management – Course Introduction and Overview.
2. We will be discussing Operations at UPS. Read the document UPS and Fedex Airhubs, available on NYU Classes under Resources/Documents/Module 1. Watch the video “UPS Operations” available under Resources/External Links. Read also the Economist article “Just in Time Lobsters” also available under Resources/Documents/Module 1.
3. Read the first 12 pages of Analysis of Operations. Available on NYU Classes under Resources/Case Folder
4. Prepare the Benihana Case for class discussion
5. Recommended reading : The Goal by E.M. Goldratt
6. Watch the videos Process Analysis and Capacity (for the links, see the last two pages of this syllabus).

Feb 6 (Mon)  SESSION 2:  PROCESS ANALYSIS – KRISTENS COOKIES CASE

1. Read, analyze and be prepared to discuss the Kristen's Cookie Company case (Resources/Documents/Case Folder) utilizing the six key questions at the end as a guide. In particular prepare the question: What are the cycle time, throughput time or flow time, and capacity of each operation and the whole production system? Use also the Practice Questions for Kristen’s Cookies which you can download from NYU classes (Resources/Case Folder) as a guide for your analysis of the case.
2. Consider the following question: Assume that Kristen and her roommate are working every evening exactly 4 hours (not one minute longer). Assume that all orders that come in are custom made for three dozen cookies:
   a) How many orders can Kristen and her roommate fulfill in one evening?
   b) What is the minimum number of trays that Kristen and her roommate need to ensure a smooth operation
3. Read Operations in Financial Services. (under Resources/documents/Module 1)
Feb 13 (Mon) **SESSION 3: PROCESS IMPROVEMENT – NATIONAL CRANBERRY CASE**

1. Read, analyze, and be prepared to discuss the Panama Canal case (Resources/Case Folder). Read also the *Panama Canal Readings* which is under Resources/Documents/Module 1. There are also many videos on the Panama Canal on Youtube.

2. Prepare the following questions for discussion in class. In the questions below, assume in questions (a) and (b) below that *the canal only operates in one direction* (in reality, the canal works for half a day in one direction and for half a day in the reverse direction and there is a setup time and cost involved in reversing the direction).
   (a) Describe the canal as an operating system and draw a process flow diagram. List the various steps (stages) of the transit process.
   (b) Try to compute the capacity of the Gaillard (Culebra) cut while it is operating in one specific direction. Which (shipping) parameters and which dimensions of the cut determine the capacity of the cut? (To answer this question, look at Example 4 on page 19 of the *Analysis of Operations* document.)
   (c) Suppose that the Culebra Cut has to reverse direction. How much transit capacity is lost due to a reversal?
   (d) Describe all the similarities (and differences) between the Panama Canal case and the Kristens Cookies case.

3. Read the National Cranberry Case

   **Homework 1:**
   a) Draw a process flow diagram for the process fruit operation of RP #1. Assume the arrival rate of wet berries is 600 bbl/hr and the arrival rate of dry berries is 900 bbl/hr (from 7 am till 7 pm). What are the implications for the operations of the plant?
   b) Identify the problems at NCC. How severe are these problems? Answer the following questions:
      - Identify any possible bottleneck(s) in the process and explain how the locations of the bottlenecks depend on the arrival rates of wet and dry berries.
      - Should the fifth dumper have been purchased? Justify your answer (Under which conditions would the purchase of the fifth dumper have been justified?)
   c) NCC is considering selling either one or two dumpers to create more space for trucks waiting to unload. In addition, NCC is considering reserving one dumper for trucks bringing dry berries and have the three (or two) remaining dumpers for the trucks bringing wet berries. Evaluate each one of these alternatives and give your recommendation.

Submit this analysis at the beginning of the class.
MODULE 2: Optimal Resource Allocation

Feb 27 (Mon) SESSION 4: THE BASIC LINEAR PROGRAMMING (LP) PROBLEM: FORMULATIONS AND SOLUTION TECHNIQUES (GRAPHICAL METHOD AND ENUMERATION OF CORNER POINTS)

1. Read Introduction to Linear Programming (available on NYU Classes under Resources/Documents/Module 2.)
2. Prepare in advance for discussion in class: Problems to be formulated as LPs (available on NYU Classes).
3. We will discuss the Graphical Method and the Corner Point Enumeration method in class. We furthermore get into sensitivity analysis and shadow pricing.
4. Solve the five problems in the document LP Basic Problems that is posted on NYU Classes in Module 2.

Mar 6 (Mon) SESSION 5: LINEAR PROGRAMMING (CONTINUED)

1. Solving Linear Programming with Excel
2. The Otto Development Case
3. Homework #2: Solve and submit Problems 1 and 2 of Homework #3 that is posted on NYU Classes (Resources/Assignments).

MODULE 3: Time Based Competition

Mar 20 (Mon) SESSION 6: PROJECT MANAGEMENT – CRITICAL PATH METHOD

1. Read Critical Path Method by Anderson and Hales (available on NYU Classes under Resources/Documents/Module 3)
2. Read FCN/Securities Demo (A) (available in the Case Packet on NYU Classes).
3. Read, analyze and be prepared to discuss the other four project management network cases (exercises) assigned in class: FCN (B), FCN (C) (on NYU Classes), Specialty Contractors, and Aerospace Components (on NYU Classes).
4. Draw the network for Allied Distributing Equipment (on NYU Classes) and determine the Critical Path. Is the Critical Path unique or are there more than one Critical Paths?

Mar 27 (Mon) SESSION 7: Midterm Exam (Covering Modules 1, 2, and 3)
**MODULE 4: Managing Quality as a Strategic Issue**

**Apr 3 (Mon) SESSION 8: QUALITY – DEFINITION AND BASIS FOR COMPETITION**

1. Preview of the next half of the course.
2. Read *Statistical Process Control* by Nelson Fraiman (available on NYU Classes)
3. Read the *Ritz-Carlton Case* (available on NYU Classes)

**Apr 10 (Mon) SESSION 9: QUALITY IMPROVEMENT**

1. Read, analyze and be ready to discuss quality control issues concerning the Ritz-Carlton case.
2. **Homework #3:** Consider the Ritz-Carlton case. The Excel file ritz.xls contains a listing of subset of all defects reported in the DQPR for the Ritz-Carlton Buckhead over a given period. The subset contains all defects for twelve categories of defects that directly impact the customer and are identified as causes for customer dissatisfaction. Analyze this data file and answer the following questions in at most 2 pages due at the start of class:
   (a) What is Ritz-Carlton’s business strategy, e.g. who are their primary customers? Describe the differences between the R-C strategy and that of the Four Seasons.
   (b) How is quality defined at R-C? Does the data in the file ritz.xls indicate any significant quality problems?
   (c) If you were to select a category of defect to address from the DQPR data, which category would you address? Why?
   (d) For whatever defect category you selected, construct a P-chart to help identify days on which some “assignable cause” of added defects arose.
   (e) Using the results of your analysis and any other relevant tools of quality, as well as your common-sense knowledge of hotel operations, generate hypotheses about the possible root causes of the defect category that you selected.
3. Read the Smith-Thompson case (available on NYU Classes).
   (a) Prepare for discussion in class Exercises 1 and 2 of the Smith-Thompson case. Which factor(s) have the largest effect on the total expected losses?
   (b) Watch the videos “Quality” (the links are on the last two pages of this syllabus).
MODULE 5: Inventory Concepts and Models

Apr 17 (Mon)  SESSION 10: INVENTORY / LOGISTICS

1. Read Economic Order Quantity Model by Schwarz (available on NYU Classes)
2. Watch the Video on “Inventory” (for the link, see the last two pages of this syllabus)
3. Read, analyze and be prepared to discuss the Xenon case (on NYU Classes)
4. Consider the Xenon Case.
   a) Consider the case with 4 regional warehouses with nonrandom demand. Compute
      the reorder point for one of the warehouses when the lead time L is 6.5 weeks.
   b) Consider now the case with one centralized warehouse with nonrandom demand.
      Compute the reorder point when the lead time L is 7.5 weeks.
5. Read, analyze and be prepared to discuss the L.L. Bean Inc. case.

Apr 24 (Mon)  SESSION 11: SUPPLY CHAIN MANAGEMENT - REVENUE MANAGEMENT

1. Watch the video “Supply Chain Management” (for link, see the last page of syllabus)
2. Read the Dell Direct Case (available on Blackboard).
3. Read again the L.L. Bean case and also the Blue Sky Airlines Case (available in the case
   packet on NYU Classes)
4. Homework #4: The excel file LLBean.xls (download) contains demand and forecast
   data for 84 items. Suppose that these are the data that L.L. Bean will use to plan their
   next season. Consider an item that retails for $42 and costs LL Bean $26. The
   liquidation price for this item is estimated to be $18. The sales forecast for this item is
   12,000 units. What order quantity should L.L. Bean choose for this item?

May 1 (Mon)  SESSION 12: INVENTORY IN ACTION: THE BEER GAME

   ROOM: Kantor Board Room  (KMC- 11th floor)
May 8 (Mon) **SESSION 13: THE EFFECTS OF UNCERTAINTY - WAITING LINES AND SIMULATION**

1. Read *Queueing Management and Models* (available on NYU Classes under Resources/Documents/Module 6).
2. Watch the videos “Queueing” (for the links, see the last two pages of this syllabus).
3. Read *Intro to Simulation* by J. Banks (available on NYU Classes).
4. Read, analyze, and be prepared to discuss the First City National Bank case (on NYU Classes). The following study questions will help:
   a) Considering the data supplied for arrival and service times, how would you calculate an average arrival rate and service rate?
   b) As Mr. Craig, what characteristics of this queuing system would you be most interested in observing?
   c) What is the best number of tellers to use?
5. Calculate the waiting time for a customer (time spent in the queue before service) and determine which of the two line configurations you would recommend? Support your result with the appropriate quantitative queuing analysis.
6. Consider the First City National Bank case again (on NYU Classes). By hand, simulate 25 arrivals (track them through the bank) using the inter-arrival time distribution and service time distribution given in the case, with three tellers, for each of the two line arrangements. Identify assumptions that are necessary? What are the advantages of using simulation to study this operation? What are the limitations? Which alternative arrangement of teller lines should Mr. Craig select based on the simulations?
7. Consider the following practice question:
   The registration area has just opened at a large convention of building contractors in New York. There are 600 people arriving per hour (exponential interarrival times), and their cost of waiting in queue is valued at $40 per person per hour. The NY Convention Bureau provides servers to register guests. The cost (salary) of a server is $25 per hour. It takes about 1 minute to register an attendee (exponentially distributed). A single waiting line with multiple servers is set up.
   a) What is the minimum number of servers for this system?
   b) What is the optimal number of servers for this system from a cost perspective?
   c) What is the cost for the system, per hour, with the optimum number of servers?
   d) What is the server utilization rate with the minimum number of servers?

**FINAL EXAM DATE:** COR1-GB.2314.21: TBA
Below there are a number of links to youtube videos developed by faculty in our department on seven of the topics that are going to be covered in the course. Each topic has three videos associated with it. You may want to see the first two videos of each one of the topics. The first one is an *Introduction* in the topic. The second one describes a problem in the particular area, referred to as *Problem Walkthrough*. The third one describes a possible *Assignment*.

1- **Process Analysis and Capacity**

   [Watch](https://www.youtube.com/watch?v=kqWozEjl_kw&index=1&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

   [Watch](https://www.youtube.com/watch?v=3A7FW9b-uSw&index=2&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

   [Watch](https://www.youtube.com/watch?v=Gtys0zk4y0w&index=3&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

2- **Quality**

   [Watch](https://www.youtube.com/watch?v=3HBx_N7_tz0&index=18&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

   [Watch](https://www.youtube.com/watch?v=UU1i9EJerKI&index=17&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

   [Watch](https://www.youtube.com/watch?v=cbRRH2yFpbQ&index=16&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

3- **Inventory**

   [Watch](https://www.youtube.com/watch?v=kGPr9oeN0MQ&index=10&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

   [Watch](https://www.youtube.com/watch?v=JCt1IVSjsuM&index=11&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)

   [Watch](https://www.youtube.com/watch?v=plOzdfXsXc&index=12&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A)
4- Supply Chain Management

https://www.youtube.com/watch?v=Gf-d5ml0zs&index=9&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=I3daWQOaHc8&index=8&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=4RwT_VF4KKE&index=7&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

5- Revenue Management

https://www.youtube.com/watch?v=yutHhJgSC-4&index=13&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=4SfMx3pVMgo&index=15&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=YokEJc5yO-4&index=14&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

6- Queueing

https://www.youtube.com/watch?v=EXimUhimeTw&index=4&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=ptFIL2UaKkA&index=5&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=7xv6F_wbCNk&index=6&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

7- Simulation

https://www.youtube.com/watch?v=jNEE7ywKODM&index=19&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=2oT9cuf3CZ8&index=20&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ4A

https://www.youtube.com/watch?v=CVh-8cvZiz4&index=21&list=PLue8TeHAyWZEwHr6D1fcC-zrdxM9DiQ