INSTRUCTOR: Ganesh Janakiraman, Room KMC 8-71
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COURSE DESCRIPTION AND OBJECTIVES

This course provides a general introduction to operations management. Operations management is the management of business processes, that is, the management of the recurring activities of a firm. Along with finance and marketing, Operations is one of the three primary functions of a firm. At the risk of being simplistic, one may say that marketing induces the demand for products (goods and services), finance provides the capital, and operations produces the product. More generally, Operations spans the entire organization.

This course aims to (1) familiarize you with the problems and issues confronting operations managers, and (2) to provide you with the language, concepts, insights and tools to deal with these issues in order to gain a competitive advantage through operations. This course should be of particular interest to people aspiring for a career in designing and managing business processes, either directly (e.g., V.P. of Operations) or indirectly (e.g., management consulting).

The course should also be of interest to people who manage interfaces between operations and other business functions such as finance, marketing, managerial
accounting and human resources. Finally, a working knowledge of operations, which typically employs the greatest number of employees and requires the largest investment in assets, is indispensable for general managers and entrepreneurs.

In this course, we will see how different business strategies require different business processes, and vice versa, how different operational capabilities allow and support different strategies to gain competitive advantage. A process view of operations will be used to analyze different key operational dimensions such as capacity management, flow (cycle) time management, supply chain and logistics management, quality management and project management.

**ABOUT THE INSTRUCTOR**

Ganesh Janakiraman is an Assistant Professor of Operations Management at the Stern School of Business. He teaches the core class in Operations in the Langone MBA program. His research interests are in Inventory Management and Supply Chain Management.

Ganesh holds a B.Tech. degree in Mechanical Engineering from the Indian Institute of Technology, Madras, and, M.S. and Ph.D. degrees in Operations Research from Cornell University.
GRADING

Each student’s grade will be based on the following items and weights:

- Short Papers (Homework)  20%
- Class Participation   15%
- Midterm Exam          30%
- Final Exam             35%

**Homework:**

There are nine homework assignments. **Only assignments that say SUBMIT in parentheses need to be submitted.** These assignments can be done individually or in groups of up to three students. Assignments submitted by groups of four or more students will not be accepted for credit. In the same spirit, groups should not collaborate with each other for the purpose of doing the assignments.

The assignments serve two purposes: some of them are meant to enable you to apply the concepts and tools learnt in the course and others are meant to help you prepare for class. Those assignments which are due before the relevant materials are covered in class are intended only to encourage you to think analytically about the case before you come to class. All such preparatory assignments are very short (typically requiring an answer in half a page or less) and should take very little time in addition to the time you would spend on reading the case.

All assignments will receive light grading. Specifically, the grader will determine whether an assignment represents a good faith effort to complete the work, and if so, the assignment receives full credit. Assignment submissions should reflect an honest attempt at a solution to each question. The accuracy of the responses will be judged to the extent that concepts have been covered in class before the assignment due date.

Submissions should be up to **two pages in length (unless specified otherwise)** and should be submitted at the beginning of the class in which they are due. Keep a copy for your reference during class. Show all the work if your response requires a calculation.

Electronic submissions are not acceptable unless permission is obtained from the instructor before the due date.

**We encourage all students to prepare for class in groups even when there is no assignment for submission.**
Class Participation:
The development of speaking and listening skills is considered an important part of your evaluation in this course. Please use the following guidelines to determine your effectiveness in class participation:

- Your comments should contribute meaningfully to learning in case discussions and lectures.
- There are no stupid questions.
- Incomplete points or ‘one word answers’ will not get credit. Well defended and well thought out points will get due credit.
- There are no alternative assignments in lieu of class participation.

HONOR CODE

The Stern Honor Code and Code of Conduct will be adhered to in all matters related to grading. If you have questions regarding any of the grading policies, please clarify with me. If you have questions about the Honor Code, please visit the website http://www.stern.nyu.edu/mba/mjc or contact one of the members of the MBA Judiciary Committee. Some specific clarifications 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.
- You may not refer to case write-ups from other sections of the course or from classes offered in earlier semesters for class preparation or submission of assignments.
- There should not be any collaboration across groups for the purposes of doing assignments meant for submission.

THE FOLLOWING SCHEDULE IS TENTATIVE.
Course Materials

• **Course-text - required**  
  *(Competitive Advantage from Operations: B01.2314: Instructors: Araman, Armony, Caldentey, Chernoff, Gaur, Janakiraman, Moses, Nayyar) (Buy from NYU Bookstore.)*  
  o Includes selected chapters from the textbooks, Chase, Aquilano and Jacobs, *Operations Management for Competitive Advantage* and Stevenson, *Operations Management.*

• **Course-packet – required**  
  *(Competitive Advantage from Operations: Course-packet: B01.2314) (Buy from NYU Bookstore.)*  
  Includes the following Harvard cases/articles:  
  o Competing on Capabilities  
  o Benihana of Tokyo  
  o Donner Company  
  o National Cranberry Cooperative  
  o Blanchard Importing and Distributing Co., Inc.  
  o L.L.Bean, Inc.  
  o Toyota Motor Manufacturing, U.S.A., Inc.

• *The Goal* by Eliyahu Goldratt, 2nd Revised Ed., North River Press, 1992. *(not required but highly recommended)*

• **COMPUTER SOFTWARE (optional): NYU Software Package - HOM 3.0**  
  (Downloading and installing Instructions can be found at the end of the syllabus.)

• In addition to these, some required readings would be posted on the course website.
SESSION DESCRIPTIONS

OPERATIONS AND THE CORPORATE STRATEGY

Note: One or more of the following sessions will also include an introduction to an extremely useful mathematical tool called Linear Programming and its applications.

CLASS 1– SESSIONS 1 AND 2

SESSION 1:  Introduction

Operations as a Source of Competitive Advantage

An introduction to Operations will be given in this session.

Reading:
• It is highly recommended that you begin reading The Goal by E.M. Goldratt.

SESSION 2:  Process Design

Case: BENIHANA OF TOKYO

Reading:
• BENIHANA OF TOKYO (Course-Pack)

Questions for class discussion:
Read, analyze, and be prepared to discuss the Benihana of Tokyo case. Use the following questions as guidelines for your analysis.
1. What are the key elements of the Benihana concept?
2. Describe Benihana as an operating system by identifying all the processes and drawing a process flow diagram. For each process, identify its input, output, and performance characteristics.
3. How does the operating system support the Benihana concept?
4. How does the Benihana cost structure compare to the standard American restaurant? Explain the differences.

Related links:
Benihana commercials: http://www.benihana.com/commercials.asp
CLASS 2– SESSIONS 3 AND 4

SESSION 3: Types of Operating Processes

Readings:
- Chapter 5: “Product Design and Process Selection – Manufacturing” in CAJ.¹ (Course-pack)

Virtual Plant Tours:
In this class, we will study different types of operating processes and discuss their suitability for producing various goods and services. Some of these processes and products are illustrated in about 50 virtual PLANT TOURS accessible from the website http://www.mhhe.com/business/opsci/pom/tours.htm.

Study at least two of the following three tours and answer the questions that follow:

1. Stickley furniture (http://www.stickley.com/): Job shop. Follow both the video tour (12 mins) and the factory tour.


Questions for class discussion:
1. What would you expect to be the key elements of each company’s business strategy?
2. What would you expect to be the key elements of each company’s operations strategy? What is your assessment of the fit between each company’s business strategy and its operations strategy?
3. What are the major differences between the operations of the firms?

Note: The Kristen’s Cookies case discussion might begin in the middle of this section.

¹ CAJ refers everywhere to the book chapters of Chase, Aquilano and Jacobs included in the course-pack.
COMPETITIVE ADVANTAGE: PRODUCTIVITY

SESSION 4: Process Flow Analysis: Bottlenecks

Case: KRISTEN’S COOKIE COMPANY (p.58-59 in the course-pack)

Readings:
- Chapter 4: “Process Analysis” in CAJ. (course-pack)
- Read the note “Analysis of an Operation” (Download)

Questions:
Read, analyze and be prepared to discuss the Kristen's Cookie Company case utilizing the study questions at the end as a guide. Draw a process flow diagram for the operation assuming that each order is a custom order for one dozen cookies.

Assignment 1 (SUBMIT):
- Assume that there is ample demand for Kristen’s cookies and that Kristen does not want to alter the prices for these cookies. What do you think is the best way to “measure” this company? Assume you are entrusted with the responsibility of improving this measure. What logical thought process will you use to think about how to improve this measure? (Both your answers, combined, should be half a page or less.)
CLASS 3– SESSIONS 5 AND 6

SESSION 5: Process Flow Analysis: Set-Up Time and Batching

Case: DONNER COMPANY

Readings:
- Chapter 10: “Strategic Capacity Management” in CAJ. (course-pack)
- DONNER COMPANY (course-pack)

Questions for class discussion:
Read, analyze and be prepared to discuss the Donner Company case. The production process in this company is complex. Try to identify the problems facing the company and the sources of these problems.

Assignment 2A (SUBMIT):
Kristen’s Cookie Case:
Assume that Kristen and her roommate have 300 days left before they graduate. They sell two-dozen cookies for $6.80, the material costs are $1.20 and the packaging costs are $0.20 per two-dozen. Kristen is considering buying a second oven (just like the first one). She accepts orders for cookies in two dozens. (Assume every order is for two-dozen cookies.) If she gets the second oven, answer the following questions:

- What is the bottleneck operation?
- What are the cycle times and capacities for each operation?
- What is the throughput time for an order?
- What is the maximum number of cookies (in dozens) that can be made in one evening?
- What is the value of the new oven assuming no cost of labor?
- What is the utilization of Kristen and her roommate’s time?

Assignment 2B (SUBMIT):
Donner Case:
Answer each of the following questions in 1-3 brief sentences. Quantitative analysis is NOT REQUIRED.

- What criteria would you use to determine whether to use the CNC Router or a Punch press or both for a given order?
- What are the daily operating decisions?
- What do you think is the significance of the average number of boards per order?
SESSION 6: The Effect of Uncertainty - Waiting Lines

Basic concepts and formulas of Queuing will be introduced. This session will conclude with comments on the First City National Bank homework.
SESSION 7: Queuing Theory in Action

Case: FIRST CITY NATIONAL BANK

Readings:
- Read Technical Note 6: “Waiting Line Management” in CAJ. (course-pack)
  NOTE: There is a Typo in the first formula on page 264 (of the course-pack), Model 1, for $L_q$. The denominator should be $\mu (\mu-\lambda)$, not $\lambda (\mu-\lambda)$. At the end of the chapter, in the Formula Review, the formula is shown correctly.

Assignment 3 (SUBMIT):
FIRST CITY NATIONAL BANK CASE: (download from course website)
Read the case and answer the following questions. Assume that the staffing levels can change within a day depending on the time of the day.

- Consider the 11:30-12:00 slot on a normal day. What is the smallest number of tellers to use in the single-line teller arrangement in order to ensure that the average waiting time of a customer is 3 minutes or less? What is the teller utilization now? Repeat the exercise for the 12:00-12:30 slot on a normal day.

- Consider the 11:30-12:00 slot on a normal day. What is the smallest number of tellers to use in the alternative teller arrangement in order to ensure that the average waiting time of a customer is 3 minutes or less? What is the teller utilization now? Repeat the exercise for the 12:00-12:30 slot on a normal day.

- Were you able to meet both the objectives of Mr. Craig (average waiting time < 3 minutes and utilization > 80 %)? – Comment.

- List the assumptions that you have implicitly made in answering these questions. Is there an assumption that is not representative of the actual environment? – Explain.

Hints: For the scenario, in which each teller has a separate line, assume that the arrival rate to each teller is the total arrival rate divided by the number of tellers and consider each teller and his/her customers as forming an M/M/1 system. Use the MMS.xls spreadsheet for all calculations in both scenarios. Be careful with units of time etc.
**Note:** The entire assignment should be two pages or less, including any selected portions of the spreadsheet that you might wish to attach.

**Optional Assignment (DO NOT SUBMIT):** Familiarize yourself with the capabilities of the *Queuing Techniques* module of the HOM software. Explore ways of performing alternate and/or more detailed analysis for the FCNB case.

**SESSION 8: Application of Queuing: NYPD Case Study**  
(Download from course website)

This case describes the problem of allocation of patrol cars to different precincts in the City of New York. We will discuss how queuing analysis can be used to analyze this case.
CLASS 5– SESSIONS 9 AND 10

SESSION 9: Analysis of a Continuous Process

Case: NATIONAL CRANBERRY COOP (course-pack)

The National Cranberry case is a “classic” and has become a point of reference for nearly everyone who has attended business school. A common pitfall in analyzing the case is to become mired in too much detail, so be careful to maintain the big picture while addressing the questions. For the purposes of your analysis, you may assume that the Flow Time of the National Cranberry process (starting after the holding bins) is 1 hour (i.e., it takes 1 hour for a cranberry to flow through the plant).

Click on the website http://www.oceanspray.com/about/virtual.asp to see a web video of cranberry harvesting.

Reading:
• Read Chapter 10: “Strategic Capacity Management” in CAJ. (course-pack)

Questions for class discussion:
1. What are the problems facing receiving plant No.1 (RP1)?
2. Draw a Process Flow Diagram of the cranberry process beginning with Receiving and ending with the Bailey Mills (i.e., ignore Sorting and Shipping at the end of the process).
3. Compute the Capacity in barrels per hour of each process step.
4. Consider a peak harvest day (18,000 barrels of berries unloaded with 70% of them wet harvested). Assume that trucks arrive uniformly over a period of 12 hours. Identify the Bottleneck of the process.
5. When would processing be completed on a peak day?
6. When would the last truck unload and how long would it have waited?

Assignment 4(SUBMIT):
• In half a page or less, explain what changes you would make to improve the situation at RP1? (The answer need NOT be quantitative.)

SESSION 10: Review Session
CLASS 6– SESSIONS 11 AND 12

SESSION 11: MIDTERM EXAM

This is an in-class, open book/notes test. It will include calculations and short answers and responses. The material on the test is based primarily on class lectures and discussions.

COMPETITIVE ADVANTAGE - TIME TO MARKET

SESSION 12: Time Based Competition

The concept of Project Management, Network Diagrams and the Critical Path Method will be introduced.

Readings:
• Read Chapter 3: “Project Management” in CAJ. (course-pack)
CLASS 7– SESSIONS 13 AND 14

SESSION 13:  Project Management

Readings:

- Read the FCN-A, FCN-B and FCN-C cases. (These are all very short cases.) (Download)

The concept of crashing and the Program Evaluation and Review Technique will be introduced.

Assignment 5(SUBMIT):

- Draw the network diagram for the project described in the FCN-(A) case. How early can the project be completed? What are the critical activities?
- As a manager in charge of a large project, how would you design an incentive system for staff responsible for different activities of the project? (less than half a page)

COMPETITIVE ADVANTAGE - QUALITY

SESSION 14: Process Improvement – Introduction to Quality,

Case: Ford-Firestone (Download)

Readings:

- Chapter 7: “Total Quality Management: Focus on Six Sigma” in CAJ.
- Read the first 10 pages of the Ford-Firestone Case

Question for class discussion:

- Be prepared to discuss the Ford-Firestone case and how Quality can be a Competitive Advantage using examples of successful companies.
CLASS 8 - SESSIONS 15 AND 16

SESSION 15: Process Improvement- Statistical Process Control

Statistical Process Control will be introduced in this session.

Readings:
- Technical Note 7: “Process Capability and Statistical Quality Control” in CAJ. (Course-pack)

Assignment 6A (SUBMIT):
Read the Specialty Contractors case and submit your analysis of the exercise including the “optimal crash” with respect to the minimum cost alternative, the crash costs, and penalty costs involved. (Hint: Use the greedy algorithm taught in class even though it is not guaranteed to always find the optimal solution.)

SESSION 16: Toyota Production System

Case: TOYOTA MOTOR MANUFACTURING, USA INC.

Reading
- TOYOTA MOTOR MANUFACTURING (handed out in an earlier class)

Toyota is well known for Just-In-Time (JIT) production, but JIT is only a building block of the larger scheme that it calls the Toyota Production System (TPS). We use the Toyota case in two ways: as a “plant tour” to analyze the Toyota Production System (TPS), and to link the material on process analysis with the material on quality management.

We also discuss a specific problem at the Georgetown, Kentucky plant. On May 1, 1992, Doug Friesen, manager of assembly at this plant is concerned about problems with seat installation and wonders how best to resolve them and to which problem to give the highest priority. With sales approaching plant capacity, it is crucial that Friesen choose the most effective path in light of TPS and the realities of the plant organization.

Questions for class discussion:
What are the principal components of the Toyota Production System? What capabilities must an organization possess in order to implement TPS effectively? As Doug Friesen, what would you do to address the seat problem? What options exist? Where would you focus your attention and solution efforts? What would you recommend and why?

Assignment 6B (SUBMIT):
What are the principal components of the Toyota Production System? (Half a page or less.)
COMPETITIVE ADVANTAGE: MANAGING THE SUPPLY CHAIN

CLASS 9 - SESSIONS 17 AND 18

SECTIONS 17 and 18:

The first session will start with a general discussion on why inventory is held, how inventory should be managed and how supply chain design can be a competitive advantage. It will be followed by a formal lecture on inventory management. Finally, the Xenon Case will be discussed.

Reading:
- Xenon Drives Case (Download)

Assignment 7 (SUBMIT):
- Compute the center line, UCL and LCL of the appropriate control charts based on the following data. Is the process under control?

<table>
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<th>Item Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 Sample Mean or Xbar</th>
<th>Sample Range</th>
</tr>
</thead>
<tbody>
<tr>
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<td>12.6</td>
<td>13.2</td>
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<td>12.7</td>
<td>12.28</td>
</tr>
</tbody>
</table>

- Compute the control limits based on the following data. A manager samples 50 phone calls by customers made the previous week and sees if there are any complaints by customers about how they were answered, etc. Based on past data, one customer per week is not satisfied. Also, last week’s sample revealed that three customers had complaints out of the 50 sampled.
CLASS 10 - SESSIONS 19 AND 20

SESSION 19: Inventory Management under Uncertainty-I

In this class, we will discuss the effect of uncertainty on inventory management. We will study a model, called the newsboy model (or newsvendor model), and see how it is used to plan inventory when demand cannot be forecasted accurately. We will also introduce the concept of safety stock.

Assignment 8 (SUBMIT):
Xenon Drives Case

Assume that all demand is met directly from a single centralized warehouse. For the sake of simplicity, assume that demand at each warehouse is exactly 5000 drives a week with no variability (that is, the standard deviation of demand is zero).

- How often should the central warehouse place orders and in what quantities?
- Xenon is considering investing in new technology that would reduce the set-up and ordering costs from $20,000 to $10,000. How often should the central warehouse place orders and in what quantities now?
- How much does Xenon save every year on ordering and inventory holding costs because of the new technology?

SESSION 20: Inventory Management under Uncertainty-II

Case: L. L. BEAN, INC.: ITEM FORECASTING AND INVENTORY MANAGEMENT (course-pack)

Readings:
- Read “A Note on the Newsvendor Model: Inventory Planning for Short Lifecycle Items” from the course website.
- L.L.Bean Case

Questions:
L. L. Bean has adopted a two stage ordering process for products with “one-shot” commitments (i.e., products that they get to order only once because of long supplier lead times). First, they determine a forecast for an item and then they have a process for converting that forecast into an order quantity.
1. How significant (quantitatively) of a problem is the mismatch between supply and demand for LL Bean?
2. How does LL Bean use past demand data and a specific item forecast to decide how many units of that item to stock? Is this the best they can do?
3. Consider the second part of the process, converting a forecast into an order quantity. What item costs and revenues are relevant to the decision of how many units of that item to stock? What is the relationship between LL Bean’s method and the newsvendor model? How would you improve the forecasting and ordering processes at LL Bean? You may begin by addressing the concerns of Rol Fessenden and Mark Fasold towards the end of the case.
CLASS 11 - SESSIONS 21 AND 22

SESSION 21:  
Inventory in Action: The Beer Game

Assignment 9 (SUBMIT):  
The Excel file, LLBean.xls, on the course webpage contains demand and forecast data for 84 items. Suppose that these are the data that LL Bean will use to plan their next season. Consider an item that retails for $45 and costs LL Bean $25. The liquidation price for this item is estimated to be $15. The sales forecast for this item is 12,000 units. What order quantity should LL Bean choose for this item?

SESSION 22:  
Supply Chain Management

This session will start with a discussion of the Beer Game and will be followed by a lecture on Supply Chain Management.

CLASS 12 - SESSIONS 23 AND 24

SESSION 23:  
Review

SESSION 24:  
Final Exam