B01.2314: COMPETITIVE ADVANTAGE FROM OPERATIONS
SPRING 2004
COURSE SYLLABUS

MEETINGS: Section 21  Monday/Wednesday 9:00 – 10:20am  Room 3-55
         Section 24  Tuesday/Thursday 10:30 - 11:50am  Room 3-55
         Section 25  Tuesday/Thursday 1:30 - 2:50pm  Room 3-55

INSTRUCTOR: Vishal Gaur, Room KMC 8-72
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             Website: http://pages.stern.nyu.edu/~vgaur

OFFICE HOURS: Monday – Thursday, 3:30 - 5:30pm, or by appointment

TEACHING ASSISTANTS: Shay Adler (sa731@stern.nyu.edu)
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                      Office Hours: TBA

COURSE WEBSITE: Blackboard (http://sternclasses.nyu.edu/).
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: COOs are in charge of R&D, design/engineering, production operations, marketing, sales, support and service.

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. Finally, we will connect to recent developments such as lean or world-class manufacturing, just-in-time operations, time-based competition, business re-engineering, and e-Commerce.

ABOUT THE INSTRUCTOR

Vishal Gaur is an Assistant Professor of Operations Management at the Stern School of Business, New York University. He teaches Operations Management (core) for undergraduate and graduate students, and doctoral courses in Supply Chain Management. His main research area is Supply Chain Management with specific focus on inventory management, distribution logistics, demand forecasting, real options, and empirical modeling of supply chain performance. He is a member of the Consortium for Operations Effectiveness in Retailing, a joint initiative of Harvard Business School and the Wharton School with several member retailing firms. His consulting experience includes Ahold Corporation, CompUSA, Inc., Zany Brainy Inc. (now a division of FAO Schwartz), and Kenneth Cole. He is an academic affiliate of 4R Systems, a retail operations software firm.

Prof. Gaur received a Ph.D. in Operations and Information Management from the Wharton School, University of Pennsylvania in 2001, an M.B.A. from the Indian Institute of Management, Ahmedabad, India, and a B. Tech. in Computer Science and Engineering from the Indian Institute of Technology, Delhi, India, in 1993. He has received numerous academic awards and scholarships including honorable mention in the George B. Dantzig Dissertation award presented by INFORMS. Before joining Wharton, Prof. Gaur worked in foreign exchange trading and risk management at Citibank, N.A. in India.
MATERIALS REQUIRED

Buy in bookstore

1. BOOK

2. CASES & READINGS (also called CUSTOM-TEXT in this Syllabus)
   • Includes the following cases:
     o Benihana Of Tokyo
     o Kristen's Cookie Co.
     o Donner Company
     o National Cranberry Coop
     o Blanchard Importing and Distributing Company, Inc.
     o L.L. Bean, Inc.
     o Leadership Online: Barnes & Noble Vs. Amazon.Com (A)

Available on the course website or to be distributed in class

OTHER CASES AND READINGS

Analysis of an Operation
HOM 3.0 Installation and Use Instructions
First City National Bank
FCN Securities Demo (A), (B) and (C)
Network Cases – Allied Distributing, Specialty Contractors and Aerospace Components
South Tree Electronics
Toyota Motor Corporation

COMPUTER SOFTWARE: NYU Software Package - HOM 3.0

The HOM software will be helpful in a few topics of the course, especially sessions 6, 7 and 10 on Waiting Lines and Simulation. The software and instructions for its use are available at the website http://www.stern.nyu.edu/om/software/hom/homdownload.html. You should become familiar with it prior to session 7, so that you can comfortably use it to perform calculations for the First City National Bank case.

The software is available in the computer labs. It may also be downloaded from the website and installed on your personal computer.
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 eight homework assignments. These assignments can be done individually or in groups of up to four students. Assignments submitted by groups of five 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, others are meant to help you prepare for class.

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** and be submitted at the beginning of the session 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 may be cold-calling. If you have not been able to prepare a case, or if you are uncomfortable with being called on in a particular class, please let the instructor know in advance of the class.

• 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.

CLASS HOMEPAGE

I have created the class homepage on Blackboard. It may be accessed from the login page http://sternclasses.nyu.edu. Accessing this website will allow you to download all the files related to the course, including

• Electronic cases and articles

• Spreadsheets

• Powerpoint class notes

• Problem sets

• Related links, such as links to other websites relevant to the class. (Please inform me if you discover any interesting links so that I can make them available to the entire class.)

Please refer to the website for up-to-date class information.
FURTHER READINGS IN OPERATIONS MANAGEMENT


## CLASS SCHEDULE FOR MONDAY/WEDNESDAY (Section 21)

### Pre Midterm

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# CLASS SCHEDULE FOR MONDAY/WEDNESDAY (Section 21)

## Post Midterm

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SESSION DESCRIPTIONS

OPERATIONS AND THE CORPORATE STRATEGY

SESSION 1:

Introduction
Operations as a Source of Competitive Advantage

M 1/26.

Readings:

Questions:
1. What are the operational challenges facing firms today?
2. What is operations strategy? Why should it be well integrated with corporate strategy?
3. Consider the following objectives of the operations of a company: low cost, high quality, quick response, and high flexibility. What, if any, are the contradictions between these objectives? For each objective, can you identify an industry or a product group where that objective is more suitable than its counterparts?

SESSION 2:

Process Design

W 1/28.

Case: BENIHANA OF TOKYO


Questions:
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.
SESSION 3: Types of Operating Processes

M 2/2.

Readings: Read Chapter 5: “Product Design and Process Selection – Manufacturing” in CAJ.¹

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:
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?

¹ CAJ refers everywhere to the book chapters of Chase, Aquilano and Jacobs included in the custom-text.
HOW TO ACHIEVE PRODUCTIVITY: PROCESS ANALYSIS WITH AND WITHOUT UNCERTAINTY

SESSION 4: Process Flow Analysis: Bottlenecks

W 2/4.

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

Readings:
1. Read Chapter 4: “Process Analysis” in CAJ.
2. Read the note “Analysis of an Operation” from the course website.

Questions:
Read, analyze and be prepared to discuss the Kristen's Cookie Company case utilizing the study questions at the end as a guide.

Assignment 1:
Draw a process flow diagram for the operation in Kristen’s Cookie Co. Compute the cycle time, throughput time, and capacity for each step in the operation and for the whole production system assuming that each order is a custom order for one dozen cookies.

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

M 2/9.

Case: DONNER COMPANY

Readings: Read Chapter 10: “Strategic Capacity Management” in CAJ.

Questions:
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 2:
Calculate the capacity in circuit boards per month of the following operations in the Donner case, using the assumption that 60 orders are processed in the month. State all the assumptions made and show all the work:
a) Inspect and Shear
b) Etch and Tin Strip
c) Soldermask
d) Profile
e) Determine a decision rule for when to use the CNC Router or the Punch Press.
SESSION 6:  The Effect of Uncertainty - Waiting Lines

W 2/11.

Readings:
1. Read Technical Note 6: “Waiting Line Management” in CAJ. (See ERRATA on the course webpage.)
2. Read the HOM 3.0 Installation and Use Instructions (http://www.stern.nyu.edu/om/software/hom/homdownload.html). Practice some simple problems using HOM.

Questions:
Solve problems 1, 5, 9, 10 and 17 at the end of TN 6 (p. 278). These problems can be solved by hand using the proper formulas in the chapter, and by using the HOM software.

SESSION 7:  Queuing Theory in Action

W 2/18.

Case:  FIRST CITY NATIONAL BANK

Questions:
Read, analyze, and be prepared to discuss the First City National Bank case. The numerical analysis can be done using HOM 3.0. The following study questions will help:
1. Considering the data supplied for arrival and service times, how would you calculate an average arrival rate and service rate?
2. As Mr. Craig, what characteristics of this queuing system would you be most interested in observing?
3. What is the best number of tellers to use?

Assignment 3:
Calculate the waiting time for a customer (time in the queue before service) for each line configuration, and determine which of the two line configurations you would recommend. Support your result with the appropriate quantitative queuing analysis. Use the HOM 3.0 software for Queuing Theory, and/or use by-hand calculations with formulas from text. You do not need to submit all of the computer output. The relevant results and the answer to the question will suffice.

SESSION 8:  Introduction to Simulation

12
Readings:  Read Technical Note 16: “Simulation” in CAJ.

Questions:
Practice questions relating to Monte-Carlo Techniques at the end of the Technical Note:
Solved Problems 1, 2 on pages 321-322.

SESSION 9:  
Simulation as a Problem Solving Tool
for Operating Systems

W 2/25.

Questions:
1. Simulate 25 arrivals (by hand) using the inter-arrival time distribution and service
time distribution given in the First City National Bank Case, with three tellers, for
each of the two line arrangements. Use the data from the case given in Exhibits 2 and
3. Compute the average waiting time in line and the average time in the system.
Which alternative arrangement of teller lines should Mr. Craig select based on the
simulations?
2. What are the advantages of using simulation to study this operation? What are the
limitations?
3. Perform a simulation (on computer using HOM 3.0) using the actual case data, and
choosing Empirical Distribution for your model parameters for both service and
arrivals. Show results for 5, 6 and 7 tellers.
4. Do you feel that these simulation results (from question #2) are more reliable than the
queuing analysis? Justify your answer.

SESSION 10:  
Learnings from The Goal

M 3/1.

Reading:  You should have finished reading The Goal by this class.

In this session, we will discuss the key insights of the book, and identify potential
weaknesses in its message. The simulation exercise will build on the intuition that you
have gained by reading the book and link it to the topics of Queuing and Simulation that
we have studied in class. We will thus obtain a more formal introduction into Process
Analysis in the presence of variability.
Questions:
1. Do the Assembly Line Simulation Exercise (available on the course website) and answer the questions that follow.
2. How does production control work in Alex’s factory? In other words, given a set of orders to be produced, what is the scheme by which work is released to the factory, and what is the scheme by which work is prioritized at each process step?
3. What steps did Alex take to improve performance (as measured by the goal) in his factory?

SESSION 11: Analysis of a Continuous Process

W 3/3.

Case: NATIONAL CRANBERRY COOP

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](http://www.oceanspray.com/about/virtual.asp) to see a web video of cranberry harvesting.

Reading: Read Chapter 10: “Strategic Capacity Management” in CAJ.

Questions:
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?
7. If you were Hugh Schaeffer, what changes would you make to improve performance of the process? Estimate the magnitude of the costs and benefits of these changes.

Assignment 4:
Calculate the capacity of the plant. Show any necessary calculations.

**SESSION 12:**

Review Session


Review of the entire material to date. The review session will be based on your questions that should be prepared prior to class.

**SESSION 13:**

MIDTERM EXAM

W 3/10.

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.

**SPRING BREAK**
COMPETITIVE ADVANTAGE - TOTAL QUALITY MANAGEMENT

SESSION 14:

Process Improvement – Introduction to Quality

M 3/22.

Case:  TOYOTA MOTOR MANUFACTURING, USA INC.

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:
1. What are the principal components of the Toyota Production System? What capabilities must an organization possess in order to implement TPS effectively?
2. 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?

SESSION 15:

Statistical Process Control


Readings:
1. Read Chapter 7: “Total Quality Management: Focus on Six Sigma” in CAJ.
2. Read Technical Note 7: “Process Capability and Statistical Quality Control” in CAJ.
SESSION 16: Quality – Where are the Defects?

M 3/29.

Case: SOUTH TREE ELECTRONICS

Questions:
Read, analyze and be prepared to discuss the quality control issues in the South Tree Electronics exercise. In analyzing South Tree's quality control problems, use the following study questions as guidelines:

a) Indicate on a process diagram, all current inspection points and note the accumulated cost and yield of each operation and test in the process.

b) How many circuits must you start with to achieve the desired output level?

c) How much does a good S-39 circuit cost?

d) How much does a good S-39 circuit cost?

Assignment 5:
At what yield rate would you be indifferent between continuing and discontinuing the first inspection in the process? Show all the work and identify any assumptions used.

COMPETITIVE ADVANTAGE - TIME TO MARKET

SESSION 17: Time Based Competition


Caselets/Exercises: Two Project Management Exercises available on the course webpage: FCN Securities Demo (A) and Allied Distributing.

Readings: Read Chapter 3: “Project Management” in CAJ.

Questions:
Draw the networks for the projects described in the FCN/Securities Demo (A) exercise, and the Allied Distributing exercise.
SESSION 18:  

M 4/5.

**Caselets/Exercises:** Four Project Management Exercises available on the course webpage: FCN Securities Demo (B), (C), Specialty Contractors, Aerospace Components.

**Questions:**
Read, analyze and be prepared to discuss these project management network caselets.

**Assignment 6:**
Submit your analysis of the Specialty Contractors, Inc. exercise including the “optimal crash” with respect to the minimum cost alternative, the crash costs, and penalty costs involved.

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INVENTORY MANAGEMENT: MAKING SUPPLY MEET DEMAND

SESSION 19:  

W 4/7.

**Case:** BLANCHARD IMPORTING AND DISTRIBUTING COMPANY, INC.

**Readings:**  
Read Chapter 12: “Forecasting” in CAJ.

**Questions:**
Use the following questions to analyze Blanchard's demand data:
1. Is forecasting an important issue for Blanchard? Why or why not?
2. How do they currently forecast demand? Do any problems result from their forecasting technique?
3. What factors would you consider in selecting a forecasting method? Considering the demand patterns for the Blanchard products, what forecasting technique(s) would you recommend?
4. Should the same technique be used for each product or for each bottle size?
SESSION 20: 

The Role and Cost Economics of Inventory

M 4/12.

Case: BLANCHARD IMPORTING AND DISTRIBUTING COMPANY, INC.

Readings: Read Chapter 14: “Inventory Control” in CAJ.

Questions:
Although the EOQ/ROP (or, more appropriately, ELS) system may not be appropriate for Blanchard because of the inapplicability of the basic theoretical assumptions, it is instructive to consider the operational feasibility of an EOQ/ROP system. Select Blanchard Vodka in quarts as an example product, and calculate the ELS for this product. What would be the inventory policy that would result from this calculation?

Assignment 7:
To perform an EOQ or ELS calculation, you must first determine which costs should be included. List each of the costs which comprise the Unit Cost (C) and Set-up Cost (S) for Blanchard, and indicate whether or not each of the costs should be included in the calculation for EOQ(or ELS) for vodka in quarts. Include a brief reason for each answer (one or two sentences). List in setup costs: blending setup, size changeover, label changeover and order processing costs. List in unit costs: materials beverage, materials packaging, bottling labor, fixed overhead, variable overhead, state tax, federal distilled spirits tax, federal rectification tax and customs duty. It is not necessary to actually calculate the EOQ/ELS numbers here. Hint: First determine some criteria for whether or not to include each of the costs.

SESSION 21: 

Inventory Management under Uncertainty - I

W 4/14.

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.
SESSION 22:  

Inventory Management under Uncertainty - II

M 4/19.

Case:  
L. L. BEAN, INC.: ITEM FORECASTING AND INVENTORY MANAGEMENT

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

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?
4. 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.

Assignment 8:
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 23: 

Inventory in Action: The Beer Game

W 4/21.

Be on time!

SESSION 24: 

Use of Information in the Supply Chain

M 4/26.

Readings:
1. Read Chapter 9: “Supply Chain Strategy” in CAJ.

SESSION 25: 

E-Commerce: Internet Distribution

W 4/28.

Case: LEADERSHIP ONLINE: BARNES & NOBLE VS. AMAZON.COM

Readings: Read “Managerial Briefing: Electronic Commerce and E-Ops” in CAJ (p. 331).

Questions:
Internet retailing requires less inventory and retail space than brick-and-mortar retailing. But internet retailing introduces additional costs. From an operational perspective, we shall compare these two models.
1. From a consumer’s perspective, what are the pros and cons of purchasing books with Amazon relative to BN’s superstores?
2. In terms of operations, what advantages and disadvantages does Amazon have over BN’s superstores?
3. Compare costs at BN with Amazon for 1996. Do Amazon’s operational advantages outweigh its disadvantages? How does the situation change based on the forecast for 2000 in the case?
4. Suppose BN decided to better integrate its internet and physical channels. What would be the advantages of better integration? What would be the operational challenges to achieve that integration?

SESSION 26: 

Summary and Review Session
M 5/3.

FINAL EXAM       Wednesday, May 5, 1:30pm – 3:30pm.
Suggested Milestones for reading THE GOAL

Required Reading: You only have to read through page 264 of the book.

THE GOAL is an international bestseller (more than 2 million copies sold) and has become a common point of reference for those involved in Operations Management. (For example, one commonly hears the phrase “Where’s Herbie?” when addressing a capacity issue.) The book illustrates the concepts of Process Analysis that we will study more formally in sessions 3-10 of this course. Following is a list of milestones that you should reach in the book by the time of these sessions.

<table>
<thead>
<tr>
<th>Session</th>
<th>Book chapters to be read before this session</th>
<th>Theme/Guidelines</th>
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<tr>
<td>4</td>
<td>1-4</td>
<td>Introduction to the problems faced by Alex’s factory.</td>
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<td></td>
<td>5-8</td>
<td>Defining the goals of Alex’s factory</td>
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<td>5</td>
<td>9-12</td>
<td>Is Alex’s plant being managed by the goals?</td>
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<td>6</td>
<td>13-16</td>
<td>Learning on the hike</td>
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<td>7</td>
<td>17-20</td>
<td>Diagnosis: Where is Herbie in the factory?</td>
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<td>8</td>
<td>21-24</td>
<td>Learning from the new production schedule</td>
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<td>9</td>
<td>25-28</td>
<td>Further improvements. Understanding how bottlenecks differ from non-bottlenecks.</td>
</tr>
<tr>
<td>10</td>
<td>29-31</td>
<td>Effect of batch size on throughput and inventory; Summary of key points.</td>
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</table>

Note: Please be critical in your reading of the book. What concepts expressed in the book are generalizable, and what concepts are specific to the scenario in Alex’s factory?
There are two typos on p.264 in Technical Note 6 in CAJ:

1. In the formula for $L_q$ in Model 1 (in Exhibit TN 6.10), 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.

2. In the formulas for Model 3 in Exhibit TN 6.10, $\rho$ is defined as $\lambda / \mu$. This is incorrect. Since Model 3 is a multi-channel model, the system utilization for Model 3 is defined as $\rho = \lambda / S \mu$, where $S$ is the number of servers.

The formula for $P_w$ for Model 3 is also incorrect. The correct formula is

\[ P_w = L_q \left( \frac{1}{\rho} - 1 \right) \]

Or, alternatively,

\[ P_w = L_q \left( S \mu / \lambda - 1 \right) \]