The University of Pennsylvania
The Wharton School
Operations and Information Management Department

Spring 2010

Errata: The final exam date is now Mar 4, 2010

OPIM 631: Operations Management: Quality and Productivity

I. Faculty Contact Information and Office Hours*

Cohorts	Faculty
A, B, C	Professor: Nicolas Reinecke Office: To be announced E-mail: To be announced Office hour: To be announced
D, E, F	Professor: Pranab Majumder Office: To be announced E-mail: To be announced Office hour: To be announced
G, H, I	Professor: Christian Terwiesch Office: JMHH 548 E-mail: terwiesch@wharton.upenn.edu Office hour: Mon 3:00 – 4:30
J, K, L	Professor: Richard Lai Office: JMHH 551 E-mail: lairk@wharton.upenn.edu Office hour: Mon 3:00 – 4:30
TAs and their office hours	To be announced during first week of course Location: JMHH 607 Phone: 215-573-7771
Final Exam	~~Wed, March 3~~, Thu, Mar 4, 2010, 6pm-8pm

* Additional office hours available by appointment.

II. Course Description

Matching supply with demand is an enormous challenge for firms: excess supply is too costly, inadequate supply irritates customers. In the course, we will explore how firms can better organize their operations so that they more effectively align their supply with the demand for their products and services. Throughout the course, we illustrate mathematical analysis applied to real operational challenges – we seek rigor and relevance. Our aim is to provide both tactical knowledge and high-level insights needed by general managers and management consultants. We will demonstrate that companies can use (and have used) the principles from this course to significantly enhance their competitiveness.

In OPIM 631, the emphasis is on the design of business processes to maximize supply and to achieve world-class quality. The first part of the course details different kinds of business processes and explains how to measure key process parameters like capacity and lead time. The second part of the course focuses on process improvement and examines classic ideas in quality management as well as recent ideas about restructuring processes to optimize output for a given set of limited resources.

III. Course Policy

This syllabus provides details on course policy and the schedule for OPIM 631. Students should read this material carefully at the start of the course.

IV. Grading

Each student's final numerical score for each course is based on the following items and weights:
- homework assignments (10%),
- class participation (30%),
- final exam (60%)

A student's grade is based on the ranking of the student's final numerical score for that course among the student's cluster (i.e., the three cohorts taught by the same professor). The faculty award grades approximately based on the following distribution: 15% A and A+, 20% A-, 30% B+, 20% B, 10% B-, 5% C+ or lower. A failing grade is awarded when performance is particularly poor (for example, fewer than 30% of final exam questions answered correctly).

Homework assignments:
- There are three homework assignments for the course.
- Assignments are due by 4:00 p.m. on the assignment's due date. We prefer that you turn in assignments during your assigned class session, but if this is not possible, then an assignment should be returned to your professor's mailbox in the OPIM suite (500 JMHH).
- Electronic submissions are not accepted.
- Each student must turn in his or her own assignment. We encourage students to attempt to complete the assignments on their own. However, to promote learning, students are allowed to discuss each assignment with other students in their cohort.
- Partial credit is not given. Credit is also not given unless all work is shown.

Class participation:
- Half of this score is based on peer-voting by students. The voting mechanism and instruction are in webcafe. Voting, while not mandatory, counts as class participation (you should at least vote for yourself).
- The other half of this score is based on evaluation by faculty.

Final exam:
- There is a final exam based on the contents of the course: analytical tools, case discussions, lectures, etc.
- The format of the final exam is open book and open notes.

V. Course Text, Readings and Handouts

The following *required* course material is available for purchase at the Penn Bookstore on the corner of 36th and Walnut Streets or from any online retailer. (Do NOT go to Wharton Reprographics.)

- Cachon, G. P. & Terwiesch, C. 2008. Matching supply with demand: An introduction to operations management 2nd Ed. Boston, MA: McGraw Hill.

The cases are available at www.study.net.

Other materials, such as exercises, copies of key overheads, readings and other notes of interest will be distributed in class during the course and/or available for download in webcafe.

Class Sessions

Session #	Date	Topic and Readings	Assignment Due
1	Mon, 1/11	Introduction Text: Chapters 1-2	
2	Wed, 1/13	Process Flow Analysis Case: Toshiba Text: Chapter 3-4	
3	Wed, 1/20	The Operations – Finance Link I Exercise: Paul Downs Furniture Text: Chapter 5: 5.1-5.3	
4	Mon, 1/25	The Operations – Finance Link II Lecture: Airline efficiency Text: Chapter 5: 5.4	#1
5	Wed, 1/27	Batching / Lean exercise Exercise: Electronics Assembly Text: Chapter 6: 6.1-6.3	
6	Mon, 2/1	Lean Operations in Services Case: Capital One	
7	Wed, 2/3	Managing Variability: Waiting Time Problems Text: Chapter 7	#2
8	Mon, 2/15	Managing Variability: Waiting Time Problems Case: Beau Ties	
		DIP Week	
9	Wed, 2/17	Managing Variability: Throughput Losses Text: Chapter 8	
10	Mon, 2/22	Quality Management, Six Sigma Text: Chapter 9: 9.1-9.6	
11	Wed, 2/24	Toyota Production System Case: Toyota Text: Chapter 9.7-9.9	#3
12	Mon, 3/1	Exam Review	
	To be announced	Final Exam 6pm-8pm (Location to be announced)	

OPIM 631: Session Descriptions

Session 631.1 Introduction

Reading: Text, Chapters 1-2

Session 631.2 Process Flow Analysis

The Toshiba case illustrates a classic assembly line operation. We use the case to reinforce several of the key concepts and terms in process flow analysis.

Reading: Text, Chapters 3-4

Case: Toshiba: Ome Works (HBS, 9-696-059)

Case Preparation Questions:

- What are the key elements of Toshiba's business strategy in notebook computers? In what way do Ome's operations support this strategy?
- What is Toshiba doing to achieve high performance on cost, quality and flexibility?
- Assuming the assembly line prototype is implemented as shown in Exhibit 1, calculate the following quantities:
    - Process Capacity
    - The maximum number of computers that can be produced in a 7.5 hour shift.
    - Direct Labor Content per notebook computer (i.e., the amount of time a worker actually works on a computer while it is on the assembly line).
    - Direct Labor Idle Time per notebook computer assembled (i.e., the amount of time workers are idle per computer assembled).
    - Inventory on the assembly line.
    - Flow Time for a notebook computer.

Note that Station 9 is somewhat more complex than the others. Two facts are important: (1) software loading does not require an operator (it's like waiting for your computer to start up) and (2) Station 9 occupies three "spaces" on the line. Because the conveyor belt moves continuously, a given computer therefore spends three times as long in Station 9 as in the other stations. The worker for Station 9 moves as needed among the three computers within Station 9 to perform the tasks requiring an operator.

Session 631.3 The Operations – Finance Link I

We talk about the link between operations management and finance. Two topics will be emphasized. First, we will talk about inventory turns and other aspects of working capital management. Second, we will outline the link between financial performance metrics and operational decisions using the case of a small furniture company.

Reading: Text, Chapter 5: 5.1-5.3

Session 631.4 The Operations – Finance Link II

We discuss how to analyze operations-finance issues using public data, in the context of an airline. We then move from the toolkit to study actual airline data.

Reading: Text, Chapter 5: 5.4

Session 631.5 Batching / Lean exercise

Reading: Text, Chapter 6 (read only Sections 6.1-6.3)

Exercise: Please follow the instructions provided by your professor.

In the first part of the session, we will do a hands-on simulation exercise of a manufacturing environment. In the second part of the session, we discuss the impact of set-up times on capacity and inventory levels.

Session 631.6 Lean Operations in Services

In this class, we apply the ideas and concepts derived in production settings to the service industry.

Case: Loan Processing at Capital One (Wharton)

Case Preparation:

- Read the book chapter "Lean Operations and Toyota" that is posted on web-café in the folder "new chapters". This is a chapter that was just completed for the 2nd edition of the textbook. It provides you with a good overview of Lean Operations.
- Try to put the two pieces (book chapter, case) together and address the question "What needs to be done in the consumer loan processing organization to meet the new business needs?"

Session 631.7 Managing Variability: Waiting time problems

This lecture will introduce queuing formulas needed for the next several classes.

Reading: Text, Chapter 7

Session 631.8 Managing Variability: Waiting time problems

The Beau Ties case will allow us to apply the tools of variability management for the analysis of a call center. Check out http://www.beautiesltd.com/ for more details about the company's product line.

When answering the questions, please note the following: (a) use coefficients of variation equal to 1 for both arrival and service processes (b) The numbers in Exhibit 5 reflect call volumes for the corresponding time slots cumulated over a period of two months. E.g. the

18 calls in the Monday 7-8 time slot come from eight different Mondays in March and April. Divide the numbers by 8 to get daily volumes!

Case: Beau Ties Limited of Vermont (UVA-OM-0836)

Case Preparation Questions:

- Assuming that Kenerson's has a target of an average wait of less than 1 minute, develop a telephone staffing plan for December 4, 1995 assuming that the distribution of phone calls throughout the day follows the hourly distribution in Exhibit 5.

- How will your December 4, 1995 plan change if the target is an average wait of less than 30 seconds?

- Compare the variable costs of the staffing plans from questions 1 and 2 with the charges from AIDC.

- How should Kenerson evaluate the decision to bring the telephone order-entry system in-house?

For the questions above, we strongly encourage you to build a spreadsheet model in Excel, rather than doing the analysis "by hand".

Session 631.9 Managing Variability: Throughput Losses

Reading: Text, Chapter 8

Session 631.10 Quality Management, Six Sigma

This lecture will introduce the methodology of statistical process control as well as the concept of six sigma.

Reading: Text, Chapter 9 (9.1-9.6)

Session 631.11 Toyota Production System

We use the Toyota to illustrate the Toyota Production System (TPS). We also discuss a specific problem at the Georgetown, Kentucky plant. This session serves to link the material on process analysis with the material on process improvement.

Reading   Text: Chapter 9.7-9.9

Case: Toyota Motor Manufacturing (9-693-019)

Case Preparation Questions:

- How does the andon procedure work and what are its fundamental aspects? How much does it cost to stop the line? What are the benefits of stopping the line?

- What are the underlying causes of the problems facing Doug Friesen?

- How, if at all, does the current routine for handling defective seats deviate from the principles of the Toyota Production System?
- As Doug Friesen, what would you do to address the seat problem? Where would you focus your attention and solution efforts? What options exist? What would you recommend? Why?

Session 631.12 Exam Review

This session concludes and reviews the course material. We will work through a mock-up exam to help you get ready for the final.