Course Description

OPIM 224: Analytics for Service Operations
(Fall 2017)
(Revised April 18, 2017)

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Teaching Assistant:
TBD
Email:
Office Hours:

Class Room and Schedule
TBD  Monday 3pm – 6:00pm

Course Overview
The service sector represents the largest segment of most industrial economies. In the U.S., for example, it accounts for approximately 70% of GDP and over 80% of employment. In addition to this "pure" service sector, the competitiveness of many manufacturing firms increasingly is based on their service processes and capabilities. Indeed consumers today care little about the distinction between manufacturing and service. Rather, they simply want their specific needs to be fulfilled through a combination of physical goods, intangible services and information, provided not only at the moment of placing a demand, but also throughout the life-cycle of product acquisition, use and disposal. This has blurred the traditional distinction between 'manufacturing' and 'service' firms. Today's firms must provide what the customer needs, and frequently that is a bundle of services and physical goods that generate value.

While operational excellence is critical for success in most industries today, this is particularly true for the production and delivery of services. For example, industries such as banking, transportation, health care, and communications all face intensified competition and rising customer expectations based on the performance of their operations. At the same time, the rapid evolution of information technology and the internet has enabled firms to operate in a fashion – and to offer a level of service – that has not been previously possible.

Elements common to most services make the management of their operations complex, however. In particular, services are intangible, not storable or transportable, and often highly variable. Frequently their delivery involves distributed operations with a significant amount of customer contact. All of these factors make service operations end up looking quite a bit different than manufacturing operations, and thus the task of achieving excellence in them requires particular strategies and analysis methods.
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Therefore, the understanding and effective management of service operations requires specialized analytical tools and a customer-centric focus. This course covers a mix of topics with an emphasis on quantitative methods, application of analytics and strategic frameworks. The class will introduce simple models and basic concepts that support analysis of tradeoffs in a variety of common service processes.

Students also will have the opportunity to apply the ideas and analytical models developed in the course to a particular service industry. They will do so by conducting a guided, application group project which includes opportunities for in-depth analysis of a particular service process and field work.

The course will cover the following service operations topics:

- The design of a service strategy
- Capacity management for services
- Service quality management
- Service delivery processes
- Revenue management
- Lean for services
- After-sales service product support
- Servicization of products and product-service systems

In class, we will apply analytic tools and methods developed for each of these topics to cases and problems derived from service industries such as:

- Financial Services and Banking
- Health Care
- Transportation and Logistics
- Entertainment
- Restaurants
- Consulting
- Hospitality/Hotel
- Gaming
- Sports
- Education

We will also discuss how the material covered in the course is relevant to customer focused, service delivery aspects pervasive in product related industries such as:

- Telecommunications
- Manufacturing Equipment
- Internet Retailing
- Semiconductor
- Auto
- Aerospace and Defense
- Consumer Electronics
- High Technology/IT
- Power Systems
- Energy/Oil & Gas

Prerequisites and Related Courses

To take this course, you should have a good understanding of elementary probability and statistics as well as some exposure to linear programming and computer simulation, (all at the level of OIDD 101 or an equivalent course).

- Your background in probability and statistics should include an understanding of random variables, measures of central tendency and variation and the use of sample data to estimate distribution parameters.
- Your background in linear programming should include an understanding of the algebraic formulation and spreadsheet implementation of linear programs (LPs as well as shadow (dual) prices). We will review the use of the Solver in Excel that solves such problems.
Your understanding of simulation should include an understanding of the basic principles of Monte Carlo Simulation. We will introduce some basic simulation modeling tools that are available in Excel. We will also be using several prepared simulation models to support analysis of specific cases.

- We will introduce several basic Queueing models and use quantitative tools to analyze performance tradeoffs and decisions for these models.
- A heuristic solution algorithm applied to a complex optimization problem will be introduced and applied to a problem of after-sales service support.

Students without these specific prerequisites, but with a good quantitative or systems background can take the course, but may have to do some extra reading to cover these topics. You will learn to apply these tools in Structured, Active Learning class sessions.

We will be using several tools and models that you may have seen in other courses, i.e. in OIDD 220 or OIDD 321. Our focus in this course is on the application of such tools to realistic service related business cases.

**Group Project**
At the start of the course, you should form teams of 3-4 people. The group will be responsible for developing a suitable project with the participation of a service organization, conduct the project and submit a final report due at the end of the semester. Each group also will be responsible for several assignments to report on project progress. Groups are encouraged to share their results with the sponsoring organization.

**Case Reports**
At the start of the course, you should set up a group that you will work with for both the project and for the three group case assignments. Reports for the group cases will be due 2 days after the active learning session where we analyze the case and demonstrate use of any relevant tools. There are three additional cases that we will discuss in class, and which do not require a written report. Your participation in the discussion of these cases, however, will count towards your participation grade. There also will be an in-class midterm test that will focus on the some of the analytic tools covered in the course. You are encouraged to discuss all of the cases and assignments in your groups.

**Course Requirements and Grading**
Course grades will be based on individual class participation (15%), 3 group assignments (15%), the in-class midterm test (20%) and the group project (50%).

**Class Participation**
Please be prepared for every class. Because much of the course revolves around case discussion, your input is essential. While you should prepare for classes in your case groups, each and every person should be prepared to talk about the questions to be discussed in class.

**Honor Code**
As noted above some of the cases and the project are partner and group efforts. You can discuss cases, class materials and all of the assignments with your group and other members of the class. Any case write-ups answers from prior/other related classes cannot be used in the course. You will also be asked to rate all members of your group with respect to their contribution effort to the final project.
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Classroom Expectations – Concert Rules
Classes will start and end on time. Sit according to the seating chart and please display your name tents. Late entry or reentry to a class session is allowed only under exceptional circumstances. All phones, laptops and other electronic devices should be turned off except for the active learning sessions where you are required to bring your laptop and use it in class.

Project Progress and Reporting
There are a number of milestones associated with the group project report. These include topic idea generation and topic selection, a progress report presentation, a final presentation and the final report.

Course Materials
All required course materials are available at the Study.Net link in the course Canvas site. Additional materials and all handouts will be posted on the course Canvas site at:
https://canvas.upenn.edu/courses/xxxx

For those who would like to have a text, I recommend the following book for reference:

Deliverables Schedule

<table>
<thead>
<tr>
<th>Class #</th>
<th>Assignment</th>
<th>Deliverable</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-B</td>
<td>The Indigo Story</td>
<td>Prepare for Discussion</td>
<td>9/11</td>
</tr>
<tr>
<td>2-B</td>
<td>Benihana simulation</td>
<td>Active Learning Session</td>
<td>9/18</td>
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<tr>
<td>---</td>
<td>Benihana simulation</td>
<td>Group Case Report</td>
<td>9/20</td>
</tr>
<tr>
<td>3-B</td>
<td>Shouldice Hospital</td>
<td>Active Learning Session</td>
<td>9/25</td>
</tr>
<tr>
<td>4-A</td>
<td>Project Topic List</td>
<td>Group Report</td>
<td>10/02</td>
</tr>
<tr>
<td>4-B</td>
<td>Potelco (A)</td>
<td>Active Learning Session</td>
<td>10/02</td>
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<tr>
<td>5-B</td>
<td>Potelco (B)</td>
<td>Active Learning Session</td>
<td>10/09</td>
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<td>Potelco (B)</td>
<td>Group Case Report</td>
<td>10/11</td>
</tr>
<tr>
<td>6-B</td>
<td>Pal’s Sudden Service</td>
<td>Prepare for Discussion</td>
<td>10/16</td>
</tr>
<tr>
<td>7-A</td>
<td>In-Class Midterm Test</td>
<td>Individual Test</td>
<td>10/23</td>
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<tr>
<td>9-A</td>
<td>Harrah’s Entertainment</td>
<td>Active Learning Session</td>
<td>11/06</td>
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<tr>
<td>10-A</td>
<td>Project Plan Presentation</td>
<td>Group Report</td>
<td>11/13</td>
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<tr>
<td>11-A</td>
<td>Service Inventory</td>
<td>Active Learning Session</td>
<td>11/20</td>
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<tr>
<td>---</td>
<td>Service Inventory</td>
<td>Group Case Report</td>
<td>11/22</td>
</tr>
<tr>
<td>12</td>
<td>Project Progress Update</td>
<td>Group Report</td>
<td>11/27</td>
</tr>
<tr>
<td>13-A</td>
<td>Azagna: Lighting Up Africa</td>
<td>Prepare for Discussion</td>
<td>12/04</td>
</tr>
<tr>
<td>14</td>
<td>Project Presentation</td>
<td>Group Report</td>
<td>12/11</td>
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<tr>
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<td>Project Report</td>
<td>Group Report</td>
<td>TBD</td>
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</table>

Case write-ups and assignments must be turned in to Canvas before the start of class in which it is due.
Term Project

The lecture and active learning portion of the course introduces several analytical models and strategy frameworks that are useful for the management of service operations. The in-class examples, cases and problems allow you to see how these tools can be applied in various service settings.

By design, all of the classroom material is somewhat sanitized, however. That is, the hard work of acquiring data, cleaning it, and massaging it into a form that is useful for analysis has already been done for you. The use of such “clean” data allows you to focus on internalizing the key concepts without becoming unnecessarily distracted by data anomalies.

The final project provides an important complement to the classroom experience, allowing you to apply course concepts and tools on a problem of special interest to you. The project is a guided application, in which I assist your group through a significant course of self-study. Specific benefits of the guided study include a chance to think through how best to collect and clean the data, as well as how to apply the models used in class, especially if none of them exactly fits the project situation.

Since we all are actively involved as consumers of services, it should be straightforward to select a particular service provider or a service industry that your group is interested in and is familiar with. There is a wide variety of topics that each group can choose from to pursue for the final project. Some important considerations when selecting a project topic is that you gain access to the site, have cooperation and involvement of management and have access to data. The following types of project work out best.

**Service Improvement – a mini-consulting project.** It involves use of the methodologies introduced in class to analyze a real life service operations system, diagnose its problems, identify opportunities for improvement and quantify potential costs, benefits, risks and service impacts.

**New Service Business Plan.** This is an opportunity for entrepreneurs to identify a service need that can be met through enhanced service operations processes. Your group will be required to develop a mini-business plan and support the analysis through use of the tools introduced in the course. You are encouraged to consider opportunities that are based on emerging technologies and strategies related to services (internet, mobile communication, social networking, 3-D printing, internet of things, servicization etc.).

To the extent that the above types of projects do not work out for your group – or to the extent that you have a burning passion to study a particular industry, you also might consider the following option:

**Industry / Company Service Profile.** You will be required to complete a report that describes the key operational and strategic challenges in the selected service industry, and how various firms are managing these challenges. Alternatively the report could focus on a single firm, describing its service concept, competitive position, underlying service strategy, the main characteristics of its operations, key operational choices it has made, operational policies, etc.
## Course Description

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>To Read Before Class / Agenda</th>
<th>Due</th>
</tr>
</thead>
</table>
| 2-A   | Mon 9/18 | Monte Carlo simulation | • Overview of Simulation modeling  
• Airplane boarding simulation  
• Introduction to Benihana case  
D. Iancu, “Monte Carlo Simulation in Excel” “How to Register for Benihana Simulation as a Student”  
Link to simulation: [https://cb.hbsp.harvard.edu/cbmp/access/33742429](https://cb.hbsp.harvard.edu/cbmp/access/33742429) | |
Simulation analysis of Benihana case | AL* |
| 3-A   | Mon 9/25 | Quantitative Methods Review - Linear Programming | • Review of Linear Program modeling  
D. Iancu, “Constructing a Linear Model” (video) | |
| 4-A   | Mon 10/02 | Capacity mgmt: Queuing models - Introduction | M. Rieders, “Basic Queuing Models”  
| 4-B   | Mon 10/02 | Capacity mgmt: Queuing models - Little’s law & performance metrics Parameter estimation | Application of Analytical Models  
N. Agrawal, “Analysis of Call Center Performance at Patelco Credit Union”, Santa Clara University, (A) Case, 2011 | AL |
| 5-B   | Mon 10/09 | Capacity mgmt: call center case | N. Agrawal, Application of Analytical Models –Patelco, Santa Clara University (B) Case 2011 | AL* |
| 7-A   | Mon 10/23 | In-Class Midterm Test | | |
| 7-B   | Mon 10/23 | Revenue Management - Introduction | Revenue Management Game | |
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<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Reading/Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-A</td>
<td>Mon 11/13</td>
<td>Project Plan Presentations</td>
<td></td>
</tr>
<tr>
<td>11-A</td>
<td>Mon 11/20</td>
<td>Optimal Inventory Management – Assignment</td>
<td>Optimal Inventory Management – Group Assignment</td>
</tr>
<tr>
<td>12</td>
<td>Mon 11/27</td>
<td>Project Progress Report</td>
<td>Project Progress Report</td>
</tr>
<tr>
<td>14</td>
<td>Mon 12/11</td>
<td>Project presentations</td>
<td>Project Presentations</td>
</tr>
<tr>
<td></td>
<td>TBD</td>
<td>Final Report Due</td>
<td>P5</td>
</tr>
</tbody>
</table>

**Assignments / Deliverables:**

- **Active Learning Session** = AL (no hand-in required); AL* (group case report required)
- **Case discussion** (no hand-in required) = CD
- **Project Topic List** = P1 (2-3 choices with brief description of each)
- **Project plan proposals progress report** = P2 (2 page description of your project)
- **Project progress update** = P3 (1 page report describing progress, changes in direction)
- **Project presentations (power point)** = P4
- **Project final report** = P5