ISOM 4830: Analytics for Service Operations

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Course Description & Objectives

This course focuses on concepts and tools that can generate operational excellence for the production and delivery of services across various industries including health care, ride-hailing, advertising, and content markets. Unlike traditional product markets, a salient feature of these industries is that services are intangible and not storable, and often highly variable, which raises significant challenges in decision making. The goal of this course is to improve the understanding of these challenges and to learn how to overcome the obstacles with data-driven quantitative models. This class will introduce simple predictive and prescriptive methods that are useful in service operations. Students will also have the opportunity to apply these concepts in various service industries via case studies and homework assignments.

Course Material

There is no textbook for this course. All necessary material will be available on the course website http://canvas.ust.hk/. The website provides important download material, including assignments, data files, simulations/games, course slides, as well as additional readings and announcements. So you will have to check the website regularly.

Course Requirements

You cannot master the material for this course without systematic practice. Hence, there will be individual assignments throughout the course. There is an individual assignment for (almost) every week. Each assignment involves a conceptual component and some Excel-based analysis. While you do not have to be a spreadsheet expert, the course is not recommended for students

who are not disposed to "play around" with data, or to dedicate systematic effort outside of class. The grade will count the assessments using the following proportions:

Class participation	20%
Individual assignments (x5)	30%
Final project and presentation	30%
Final exam	20%
Total	**100%**

- *Class participation.* This is a qualitative assessment of your contribution to classroom learning. For each class, you are expected to complete the assigned readings and be prepared to discuss the case questions. You can contribute by asking critical questions and providing constructive suggestions during discussions. The instructor will assess the significance of your contributions and factor them into your grade.

- *Individual assignments.* There are 5 homework assignments that each student will study independently. Follow the instructions and the deadlines once the assignments are posted on canvas. Late submission will not be accepted.

- *Final project and presentation.* You are required to form groups of size 3 or 4 and submit the list to the course assistant by February 26. The group should be relatively comfortable to work with Excel. You are encouraged to sit with your teammates in class. Each group will conduct a project on the topics related to the course.

  The project will be an opportunity for you to get creative and seek out opportunities for service analytics. The theme of the final project will be announced during the course. Within the common theme, choose a context. Your job is to identify opportunities for service analytics in your chosen context. You are expected to construct a model that can be used to assist the improvement. You do NOT need to collect the data and solve the model. However, you are expected to explain how you will go about getting the needed data, how the model will be solved and what pricing strategies you expect to use. You should also explain how the improvement will be implemented and preferably provide an estimate on the expected magnitude of improvement (justified based on some initial data). Basically, you can consider this as a proposal to a company from either a consulting firm or an internal consulting department.

  A one-page proposal is due on March 26 at the beginning of class. Each team will be given time to present its project in the last two weeks of the semester. I will decide on the presentation schedule after I receive the proposals. A copy of the presentation slides and relevant Excel spreadsheets should be submitted before the presentation. However, no detailed written report is needed.

  Your grade for the project will be based on my assessment of the project, your presentation, how you handle the questions raised in the class on your project and also how your teammates evaluate you. The table below should give you an idea on how the project will be evaluated: Also, the table below will be used to evaluate your team members, including yourself. For each category, you will evaluate each team member and give a grade. All responses are confidential. You must hand in this form by the end of class on May 7. Failure to do so will reduce your own total score by 1 point.

	4-5	3-4	2-3	0-2
Problem identification	Well defined and explained; a large amount of original thought; problem with very significant potential improvement	Well defined and explained; some original thought; problem with significant potential improvement	Interesting problem identified, but there is little evidence of original thinking, or unclear potential improvement	It is not clear what the real problem is
Model and data	Appropriate and rigorous model but yet not overly complicated; excellent plan for data collection	Appropriate and rigorous model, but some fine-tuning is required; some good ideas of how data can be collected	Appropriate model, but major adjustment is required; little idea of how data can be collected	Inappropriate model, and/or major errors in the model; no idea on how data can be collected
Implementation planning	Concrete and comprehensive plans; show considerations for all key ideas; specific on how to measure the benefit	Good and realistic plan for data collection and improvement implementation	There are some good points in the plan, but the plan is either too vague or some ideas are unrealistic	No or little clue about what data is needed and how the improvement should be implemented; or plans are unrealistic or illogical
Delivery (presentation)	Excellent use of visuals; very clear and concise flow of ideas; demonstrate and stimulate passion	Good use of visuals; clear flow of ideas; demonstrate interest	Limited and/or not so good use of visuals; ideas presented but focus is lost at times; limited evidence of interest	No use of visuals; hard to follow ideas; lack of enthusiasm and interest
Response to questions/comments (presentation)	Excellent response; demonstrate in-depth considerations of most issues	Good response; demonstrate in-depth considerations of most issues	Satisfactory response; demonstrate considerations of some of the issues	Limited response; demonstrate a lack of considerations of significant issues

Team member (Name and student ID)	Attendance	Contribution	Quality of work	Collaborative attitude	Time management	Total

Academic Integrity

Students at HKUST are expected to observe the Academic Honor Code at all times (see http://rpghandbook.ust.hk/student-conduct-and-academic-integrity#honor for more information). Zero tolerance is shown to those who are caught cheating on exam. In addition to receiving a zero mark on the exam involved, the final course grade will appear on your record with an X, to show that the grade resulted from cheating. This X grade will stay with your record until graduation. If you receive another X grade, you will be dismissed from HKUST.

Course Outline

The learning goals below should be viewed as the key concepts you should grasp after each session, and also as a study guide before each exam, and at the end of the semester.

Week 1: Course Preliminaries
- Course Intro & Logistics

- Excel Basics

Week 2: Queueing Analytics I
- Fundamentals in Queueing Theories—Part A
- Single- and Multi-Server Queueing Models

Week 3: Queueing Analytics II
- Fundamentals in Queueing Theories—Part B
- Service Level, Capacity Planning, and More
- *Deadline for Group Formation*

Week 4: Queueing Analytics III
- Applications of G/G/s Queueing Models
- Case Study: Emergency Department Congestion at Saintemarie University Hospital

Week 5: Queueing Analytics IV
- Predictive Analytics for Queueing
- Case Study: Announcing Waiting Time in Emergency Departments

Week 6: Queueing Analytics V
- Monte Carlo Simulation for Queueing

Week 7: Optimization Preliminaries
- Optimization Models and Spreadsheet Optimization
- Mini Case Study I: Shelby Shelving
- Mini Case Study II: Online Matching
- *Deadline for One-Page Proposal for the Final Project*

Week 8: Analytics for Personalized Services I
- Regressions and Optimization
- Case Study: Tahoe Healthcare Systems

Week 9: Analytics for Personalized Services II
- Collaborative Filtering
- Case Study: Pandora Internet Radio

Week 10: Analytics for Personalized Services III
- Personalized Pricing
- Case Study: Nomis Solutions

Week 11: Data Envelopment Analysis (DEA)
- Case Study: Din Tai Fung

Week 12-13: Final Presentation of Group Projects and Warp Up