IEOR 4615: Service Engineering, Spring 2014

Instructor:

Professor Ward Whitt, ww2040@columbia.edu, 801D Schapiro, (212) 854 7255, (908) 692 6017

(URL: http://www.columbia.edu/~ww2040/) See the course web page on the instructor's web page.

2014 Teaching Assistants:

Ms. Ni Ma, nm2692@columbia.edu

Mr. Ethan Kochav, emk2168@columbia.edu

Ms. Ponni Vel, pvv2001@columbia.edu

Classes:

There will be two 75-minute lecture classes per week and one 60-minute recitation per week, led by Teaching Assistant Ma. In the recitations, the TA will be teaching the students how to use the tools needed to perform the assignments. In addition, TA's will hold office hours.

Course Description:

Service systems currently make up 60-80% of western economies. Important examples are healthcare systems (hospitals), financial services (banks) and telephone and internet services. The course will emphasize telephone-based services, commonly experienced via customer contact centers. In many respects, service systems are similar to manufacturing systems, communication systems, and transportation systems, but there are important differences, largely due to the significant role played by humans in providing the service. There are significant challenges in providing services effectively. Fortunately, there is a growing service science that provides skills and tools to manage service systems. Since many engineers actually work in service systems, it is important to offer a course that introduces students to the state of the art in that field.

In this course, a service system is viewed as a stochastic network. Thus the main theoretical framework is queueing theory, which primarily involves a large class of stochastic models. However, the subject matter is highly multi-disciplinary; hence alternative frameworks will be useful as well, including ones from Statistics, Psychology, and Marketing.

The course will provide a framework for modeling service systems and techniques that are useful to design, analyze, and operate service systems. Service systems are becoming more and more automated, which makes data available for design and automatic control of such systems. We will use real service system data from banks, hospitals, and call centers to demonstrate the use of the decision support tools.

Home assignments will be theoretical, empirical and practical. Students will implement the methods learned in their homework assignments. Empirical analysis will involve real data provided from the SEE Center (SEE = Service Enterprise Engineering) of the Technion - Israel Institute of Technology.
Practical analysis will be based on standard tools such as MS Excel, and the following service engineering tools: SEEStat (student version) and 4CallCenters. The former is a tool developed at the SEE

Center and provides an online graphic-based interface for transactional data (e.g., from call centers and hospitals); the latter tool supports workforce management (staffing).

Prerequisites:

Students should have completed an introductory course or courses in probability and statistics, such as IEOR 3600. Students should also have completed an introduction to stochastic processes, such as IEOR 3106 or IEOR 4106.

Sample Topics:

- Introduction to service systems and queues (people, telephone calls, forms, projects, etc.)
- Analytical models, simulation, approximations (fluid and diffusion): How to use them as tools to support strategic, tactical and operational decisions.
- Measuring methods in face-to-face and computerized systems.
- Phenomena: Economies-of-scale, PASTA, Biased-sampling, expertise vs. cross-training, etc.
- Forecasting methods and demand management in service systems. For example: forecasting of number of calls to a call center.
- Stability of service systems.
- Operational quality of service. Planning of service systems. For example: staffing of call centers.
- Multi-disciplinary aspects: Operations research, Industrial Engineering, Statistics, Psychology, Marketing. For example: Analysis of customer patience during waiting for service.
- Design and control of queueing systems.
- Implementation in various systems: emphasis on the interface of the customers to the system in face-to-face services and call centers.

Textbooks: There is **No Required Textbook,** but we will draw upon**:**

- **Hall**, R.W., "Queueing Methods for Services and Manufacturing", Prentice-Hall, 1991.
- **Fitzsimmons**, J.A. and M.J., "Service Management: Operations, Strategy, and Information Technology", McGraw Hill, 4th Edition, 2004 (or previous editions, which are also OK).
- Optional recommended: **Lovelock**. C.G., "Managing Services: Marketing, Operations and Human Resources", Prentice-Hall, 1992.)
- Additional references for each class will be on the course website.

Lecture Notes:

Lecture notes will be made available for all lectures. These will be posted on CourseWorks.

Recitation:

The recitation section: TBD

The Teaching Assistant will lead the recitation section. The time will be used to go over additional problems that are similar to the homework assignments and to describe service system databases and programs used in those assignments. The TA's will hold office hours to go over specific homework questions and questions about homework grading.

Homework Assignments:

There will be 11 assignments during the semester. These homework assignments are to be performed in groups of 3-4 students (no more and no less). Students are encouraged to divide the assignment among the group members, but everyone should understand all parts of the assignment. We take academic honesty extremely seriously, and expect the same of you. Copying of homework assignments will not be tolerated.

In addition, there will be reading assignments for each class.

Grading:

Homework: 75%

Midterm Exam 25%

possible project: to be determined

Approximate Weekly Schedule

Week	Topic
1	Introduction to Service Engineering
2	Flow Models of Service Networks; Little's Law
3	Measurements - The First Prerequisite; Working with Call Center Data
4	Models - The Second Prerequisite; Processing Networks; DS PERT/CPM
5	Fluid Models of Service Stations and Service Networks
6	Arrival Processes; Predictable and Unpredictable Variability
7	Service Times
8	Customer Patience
9	Markov Chain Models – Part I ; 4CallCenters Software Tool
10	Markov Chain Models – Part II; the Palm/Erlang-A Model
11	Economies of Scale; Approximations for Large-Scale Stochastic Systems
12	Quality-and-Efficiency Driven (QED) Queues Part I; Performance Approximations
13	QED Queues Part II; Staffing
14	Complex Service Networks;
15	Skills-Based Routing (SBR)