

IEOR 8100 – Stochastic Inventory Theory

The ongoing need for a fundamental understanding of inventory management supports the old adage that ‘the more things change, the more they stay the same’. Inventory theory was introduced in the 1950s by such luminaries as Arrow, Bellman, Karlin, and Scarf (among others), motivated by problems in the industrial economy of that time, and has been an important part of OR ever since. Although there have been many dramatic changes in technology and trade since then, leading to such things as ecommerce, offshoring and the sharing economy, the fundamental issue remains the same: assuring adequate supply to meet demand in a manner that reduces both shortage and waste (in order to minimize costs).

The purpose of this class is to introduce students to some of the classical models of stochastic inventory theory along with the techniques used to solve them, and work done over the decades since, with an emphasis on recent work motivated by current concerns.

The class will be divided into two parts: lectures on (mostly) classical models, and student presentations of more recent work.

The classical models to be covered include: (i) single product, single location (with either backlog or lost sales, with or without lead times, with or without order setup costs), (ii) serial/multi-echelon systems, (iii) distribution systems, (iv) assemble to order systems, and (v) production-inventory systems. It is worth pointing out that, while some of these models have known optimal controls, many do not, and are the subject of ongoing research (some of which, involving various asymptotics, will be covered in the lectures). The lectures will also include a brief introduction to joint inventory and price control as well as revenue management.

The students, for their presentations, will be given a choice from a wide variety of papers covering ongoing efforts related to the unsolved problems mentioned above, as well as work motivated by more recent developments, such as ‘omni-channel’ marketing (selling through both online and physical stores), the availability of ‘big-data’, matching markets (which arise in the sharing economy), dual sourcing, and others.