INSE6290 | Jia Yuan Yu

9: Other topics

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In this lecture, we present topics that don't fit nicely in the other lectures, as well as topics that don't fit in this course due to lack to time. The latters will however be covered in the sequel course INSE6300!

We first wrap-up Lecture 8 and give another example of the max-flow problem.

1 Competitive newboys with supply rationing

Figure 1: From `http://www.vancouversun.com/` and `visualizeus.com`

Consider another form of competition between two firms or Newsboys. Suppose that the supply of newspapers is limited to a random variable A with probability density f_A. Note that the event that $A < 2F^{-1}\left(\frac{p}{h+p}\right)$ occurs with non-zero probability. Given order sizes of Q_1 and Q_2 by the two newsboys, the supplier allocates the following amounts to each:

$$a_1(Q_1, Q_2) = \frac{Q_1}{Q_1 + Q_2}A, \quad a_2(Q_1, Q_2) = \frac{Q_2}{Q_1 + Q_2}A.$$

These allocations are proportional to the order sizes.

In turn, the expected cost of each newsboy $i = 1, 2$ can be expressed as

$$\int_{a=0}^{Q_1+Q_2} \left(h \int_0^{\frac{Q_i}{Q_1+Q_2}a} \left[\frac{Q_i}{Q_1 + Q_2}a - z \right] f_D(z) \mathrm{d}z + p \int_{\frac{Q_i}{Q_1+Q_2}a}^{\infty} \left[z - \frac{Q_i}{Q_1 + Q_2}a \right] f_D(z) \mathrm{d}z \right) f_A(a) \mathrm{d}a.$$

We can find a Nash equilibrium by looking for (Q_1^*, Q_2^*) that are optimal for every newsboy, i.e., by setting equal to zero the derivative with respect to the corresponding decision Q_i for each newsboy.

2 Bullwhip effect

Figure 2: From `http://www.northernwhipco.com/`

Causes include

- miscalculations on lead times, uncertain lead times,
- panic,
- irrational decision makers,
- forecast errors,
- pricing changes, market manipulation (e.g., diamonds).

We can eliminate it by communicating the consumer demand to each decision maker of the beer game (use backward induction and knowning the retailer's demand forecast strategy). This is done in Wal-Mart, where purchases at cash registers are transmitted to the headquarter in real-time.

3 Stochastic dominance

In the assignment, we have compared the costs S and Σ associated with two decisions. What is another method for comparing two random variables X and Y (or their probability distribution functions F_X and F_Y)?

Definition 3.1. A random variable X stochastically dominates another random variable Y in the first order if $F_X(z) \leq F_Y(z)$ for all z.

Definition 3.2. A random variable X stochastically dominates another random variable Y in the second order if

$$\int_{-\infty}^{\xi} F_X(z)\mathrm{d}z \leq \int_{-\infty}^{\xi} F_Y(z)\mathrm{d}z$$

for all ξ.

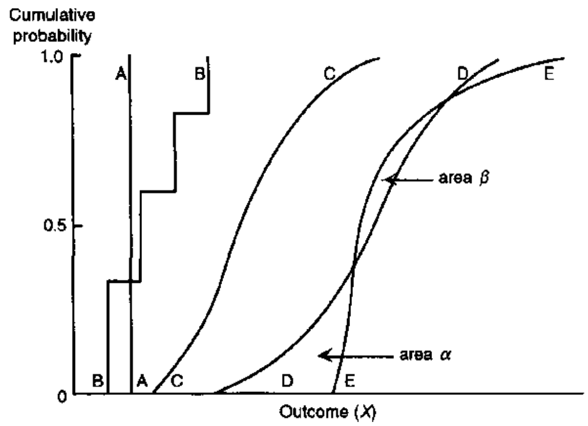

Figure 3: From `http://www.fao.org/`

4 Case studies

We saw a case study last week (opening new sushi shops). We will see more during the project presentations.

5 Reading material

- Chapter 12 of Microeconomics Theory (Mas-Colell, Whinston, Green).