Foundations of Market Design 2024

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Why does a market need to be designed? Because, they don't emerge full born from the head of Zeus but arise organically. They don't scale without institutions that support property rights, promulgate rules and resolve disputes. How are these to be chosen? They are not static, but evolve, but not always according to the needs of all their participants but to those who have the power to influence its rules. Who and how does one decide when the rules need to be changed? If changed, what should the change be? Roth's manifesto (The Economist as Engineer, *Econometrica* 2002) says this:

> "... design involves a responsibility for detail; this creates a need to deal with complications. Dealing with complications requires not only careful attention to the institutional details of a particular market, it also requires new tools, to supplement the traditional analytical toolbox of the theorist."

This class will take the view that the need for design (or redesign) arises from a failure of the first welfare theorem or the non-existence of competitive equilibrium. This can happen for one of six reasons:

1. Failure of the price taking assumption.
2. Indivisibilities.
3. Non-convexities of preferences.
4. Externalities.
5. Absence of a frictionless medium of exchange.
6. Imperfectly defined property rights.

The focus will be on markets with indivisibilities and complementarities (i.e. non-convexities) in preferences. Examples of such settings are combinatorial auctions, electricity markets, course assignment, school closing and matching. Many of the traditional theory tools from the first year sequence are inadequate in these areas. On the technical end I will cover total unimodularity, rounding, the Shapley-Folkman- Starr lemma and Scarf's lemma. I will illustrate the use of these tools in a variety of settings.