Assignment #6

Fair Division. How to go about it? Brams and Taylor's *Fair Division: From Cake Cutting to Dispute Resolution* (1996) begins with some pungent quotations:

> "Gimme the Plaza, the jet and the $150 million, too."
>   Headline, New York Post February 13, 1990 reporting Ivana Trump's divorce settlement demands of her husband Donald

> "The distribution of the world's good owes little to virtue...There must be better games. If I were to select a research problem without regard to scientific feasibility it would be that of finding out how to persuade human beings to design and play games that all can win."
>   Herbert Simon in *Models of My Life* (1991)

The Boston Globe cutouts in your reading packet describe the Saunders' brothers "divorce" of family holdings and offer a tongue-in-cheek science writer's explanation of Brams and Taylor's recent work on cake cutting.

How to divide fairly a divisible good such as a cake along with the problem of how to divide a collection of indivisible goods fairly among, say, legatees of an estate is a vigorously researched topic. Current work on prescriptive schemes for fair division has led to innovative methods that are equally applicable to resolution of integrative (many issue) bargaining problems. In his revision of his 1982 classic, *Negotiation Analysis: The Science and Art of Collaborative Decision Making* (2005), Howard Raiffa develops the concepts, models and software applications needed to implement such methods. His approach to fair division sets the stage for a compelling, prescriptive approach to resolving integrative (many issue) negotiations. We shall use some of his methodology to summarize class results.

Raiffa expands the possibilities beyond those commonly discussed in the literature by viewing fair division as a very special kind of negotiation problem. I will show you how Raiffa's method works on the illustrative example in the Rothman art collection case.

Brams and Taylor's method for fair division takes its cue from work that began over fifty years ago. Among economists and other analysts, Steinhaus' method (1948) is among the most famous algorithmic procedure for dividing indivisible goods that can be 'priced out'. I was surprised to discover from a friend who deals in Oriental rugs that rug dealers often collude at public auction to acquire desirable rugs, and then go into a 'backroom' and implement a Steinhaus-like procedure for deciding who among them gets what for how much. Of course, most Oriental rug dealers haven't taken a course in the mathematics of fair division, but they are smart and figured out the method with no help from us.

We will briefly discuss the Steinhaus procedure and two other commonly suggested alternatives through the lens of examples taken from Raiffa's book.

An estate composed of four indivisible commodities, paintings and sculptures, for example, must be divided among three heirs. Suppose that the monetary worth to a particular heir of any subset of these

goods is simply the sum of the monetary valuations of each element in that subset. Suppose that these are honest revelations of value by each heir. How should the goods be allocated among the heirs, allowing for side payments among them?

These particular allocation procedures are more interesting for what they leave out than for what they include. To understand what this sentence means read the case below.

READ:
The case in the reading packet entitled, ***"The Equitable Division of Art Collection"*** by Raiffa and Weeks. Here is a thumbnail sketch of this case:

Mrs. J. Rothman began collecting art in the 1930's. While not formally trained as an artist, in art history, or in art appreciation, she had a naturally fine eye, and "discovered" several important artists before they became well known.

One of her favorites is a French portraitist, Edouard MacAvoy. She acquired many of his best works in the 1950's and 1960's, and has decided that her two sons should now own these paintings. They are large impressive canvases.

An appraisal of these paintings was made over 15 years ago by an outstanding art appraiser, now deceased.

"I want you two boys to decide among yourselves how to divide up the paintings," were her only instructions. The brothers both expressed concern about the issue of "regret": "What if I get paintings that turn out to be worth ten times the cite appraisal values in five years, while the paintings you receive are then worth only half of this value?"

How would you advise the brothers to proceed?

We will examine the *realities* of fair division in concert with algorithms for division that purport to yield a "fair" outcome.

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