Fair Division

Initial Problem

- Assume you have a set of goods, and a set of people with differing preferences of the items
  - (Anne like apples, Bertrand like oranges, Claire likes both)
- We want to divide goods among agents (people, food shelters, countries) “fairly”

Why it matters

- Food Banks
- Estate Division

Notions of Fairness

- Everyone believes they are close in value to everyone else (Envy-Free up to X)
- Everyone's utility is collectively large while being similar (Nash Social Welfare)
- No one would trade with anyone else (Pareto Optimal)

But not all of these are easy to calculate

- Everyone's utilities being large and similar (MNW) could take until the age of the universe to find
- We don't know if believing they are close in value to everyone else is even possible allocation, much less computing it.

So in Computer Science, we ask

- What can we compute? What kinds of allocations exist?
- Can we find good approximations? How close can we get efficiently?
- Can we guarantee approximations to several notions at once efficiently?

Future Work

- Establish tighter upper/lower approximation bounds
- Improving approximations
- Proving existence/nonexistence
- Different settings