444 Lecture 4.6 - Utility

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Plan

To introduce the notion of utility.

Reading

Bonanno, chapter 5 - though note we aren't following the book precisely in this chapter.

Ranking

- So far the theories we've looked just solve games using the **rankings** of various options.
- It doesn't look at how much a player prefers one option over another, just on what is preferred to what.

Ordinal Utility

- To use the technical language, so far our theories have just used **ordinal utilities**.
- The term **ordinal** here means that we only look at the **order** of the options.

Cardinal Utility

- The rules that we'll look at from now on use **cardinal utilities**.
- Whenever we're associating outcomes with numbers in a way that the magnitudes of the differences between the numbers matters, we're using cardinal utilities.

Utility

- Intuitively, think of utilities as measuring how good an outcome is.
- The theory we're building towards is thoroughly subjectivist, so think of 'how good' as meaning 'how good along all and only dimensions the agent making the decision cares about'.

Scale

- Utilities aren't really measured on any scale.
- Indeed, like temperature measures, or year numberings, they don't even have a fixed zero point.
- It is usually convenient to associate 0 utility with the status quo, and then have negative numbers for outcomes worse than status quo, and positive numbers for outcomes better than status quo.
- But that's just a convention; you can set the 0 wherever you like.
- And you can set the utility 1 point at anything better than 0.

Scale (continued)

- But that's where the convention stops.
- Once you fix the 0 and 1 points, nothing else is fixed by pure convention.
- Temperatures are like this too.
- Though years are not - all the different calendars have years of the same length.

Meaning of the Scale

We will come back to this much more in the future, but here is the key equation.

$$U(B) = \frac{U(A) + U(C)}{2}$$

Means that the agent is indifferent between getting B for sure, and a coin flip that means they get A if Heads and C if Tails.

Meaning of the Scale

It's a little unintuitive to think about this (though it helps if you've moved between Celsius and Farenheit countries).

- What matters is the ratio of differences.
- If $U(A) - U(B) = U(B) - U(C)$, that's really meaningful, even if none of the individual numbers are meaningful.

For Next Time

- We will look at how utility relates to money.