Notes on sections 2-4 & 2-5 (pp. 32 – 37)

section 2-4

The next rule is one that you may have thought of already: **the maximax rule**.

Consider this decision problem:

	red is drawn	blue is drawn	yellow is drawn	green is drawn
bet 1	$10	$3	$3	$0
bet 2	$4	$5	$20	$0
bet 3	$2	$6	$4	$1

If we are following the maximin rule, then we choose bet 3 because it has the highest minimum.

Alternatively, however, we might be drawn to bet 2 because it has the highest possible payoff: $20. This is the rational behind the **maximax rule**, which tells us to select the option that gives us the opportunity to get the highest valued outcome. (We can apply this rule by identifying the maximum value for each option and then choosing the option with the highest of those maximums, but just finding the highest value in the table will achieve the same result.)

As you can see on p. 32, Resnik is skeptical that many people would consistently use this rule. That's difficult to judge, but we can, perhaps, see what he has in mind. Many people probably have something like the maximin rule as their default guideline, even before they are faced with a decision problem. Occasionally, when they see a decision problem, they might deviate, but often they will just play it safe with the maximin rule. A person who has the maximax rule as his or her default choice (even before seeing the decision problem) would be a very big risk-taker.

In any event, the next rule that Resnik discusses is, as he says, a "compromise" between the maximin rule and the maximax rule. This is the **optimism-pessimism rule** (which is sometimes called the *Hurwicz criterion* after Leonid Hurwicz who first proposed it).

To apply the rule, the decision maker must decide where he or she is on a scale from 0 to 1. 1 represents complete confidence in the maximax rule. (So that means going all in on getting the highest valued outcome). 0 represents a complete commitment to the maximin rule. (That is, a desire only to ensure that we minimize how poorly we can do).

So, where are you on the scale? (You can also use a scale from 0 to 10, but then convert to 0 to 1 to continue.)

The number that you select is *a* (or sometimes α)—which Resnik calls *the optimism index*, although I'll just call it *a*. In his example on p. 33, Resnik uses *a* = .5. I'll select *a* = .6 for myself, and use that value to illustrate the rule.

Here's Resnik's decision problem on p. 33:

	state 1	**state 2**	**state 3**
act 1	10	4	0
act 2	2	6	6

(You'll notice on p. 33 that he doesn't include labels for the states. I have, but since they don't make any difference at this point, we can leave them off.)

We identify the highest and the lowest valued outcomes for each option. Resnik uses 'MAX' and 'min' to represent these values, which I've circled in green and purple. Then, we do this calculation for each option:

the option's *a*-index: (*a*)(MAX) + (1 – *a*)(min)

This calculation, in effect, weights the maximum and the minimum outcomes for each option and then combines them into a single number.

So, since for me, *a* = .6, I proceed as follows.

act 1, *a*-index = (.6)(10) + (.4)(0) = 6 + 0 = **6**

act 2, *a*-index = (.6)(6) + (.4)(2) = 3.6 + .8 = 4.4

And I choose act 1 because it has the higher *a*-index.

You can see on p. 33 that act 1 will also have a higher *a*-index if a = .5.

If $a = .3$, however, then these are the calculations:

act 1, *a*-index = (.3)(10) + (.7)(0) = 3 + 0 = 3

act 2, *a*-index = (.3)(6) + (.7)(2) = 1.8 + 1.4 = **3.2**

So, using the optimism-pessimism rule, the person with $a = .3$ will choose act 2.

Resnik has a method for helping you choose *a* for yourself on the bottom of p. 33. Changing it slightly, it works as follows. What utility value for *c* would make you indifferent between getting act 1 and act 2?

	state 1	**state 2**
act 1	0	10
act 2	*c*	*c*

Whatever *c* is (converted to a value between 0 and 1) is your *a* value. This method is a little hard to use, however, without knowing what the outcomes actually are. (A trip to Rome? A free meal at McDonalds?) Plus, right now, we've only been introduced to utility values that are on an ordinal scale. Choosing a value for *c* this way implicitly requires us to evenly spread the strength of our desire for outcomes valued between 1 and 9.

So, probably the best way to choose your value for *a* is, first, to think about if you are more of a risk taker or a play-it-safe person. Then, use either 0, 5, or 10 as your starting point and think about how much you want to adjust from one of those values. (For instance, if you know that you're a big play-it-safe person, you might think about how much above 0 would accurately reflect your tolerance for a little bit of risk. Or you might start with 5 and then think about whether a little bit higher or lower is right for you.)

section 2-5

The final rule for decisions under ignorance is the *principle of insufficient reason*. Consider this decision problem:

	red is drawn	**blue is drawn**	**yellow is drawn**	**green is drawn**
bet 1	$25	$8	$4	$4
bet 2	$0	$5	$40	$4

Since we have no information about how likely it is that a red, blue, yellow, or green marble will be drawn, we can make a decision using a rule that is based only on the value of the outcomes: maybe the dominance principle, or maximin, minimax regret, maximax, or the optimism-pessimism rule.

An alternative is to treat each outcome as equally likely, weight each outcome by this likelihood, and then choose the option with the highest sum of weighted outcomes. This can be done in a few ways. In our decision problem, there are four possible states, and so if we assume that each is equally likely, then (we are assuming that) each has a 25 percent chance of happening. We can then do the calculation either of these two ways:

for bet 1 = ($25)(.25) + ($8)(.25) + ($4)(.25) + ($4)(.25) = 6.25 + 2 + 1 + 1 = $10.25

for bet 2 = ($1)(.25) + ($5)(.25) + ($30)(.25) + ($4)(.25) = 0 + 1.25 + 10 + 1 = **$12.25**

Or, since the probability is the same for each outcome, we can also do it this way:

for bet 1 = ($25 + $8 + $4 + $4)(.25) = (41)(.25) = $10.25

for bet 2 = ($1 + $5 + $30 + $4)(.25) = (49)(.25) = **$12.25**

We then choose the option that has the highest result, which is bet 2.

You might have noticed that there is a third way to deploy this rule. If we add up the value of all of the outcomes first, then we have a number for each outcome ($41 and $49) that we are about to multiply by .25. But since both $41 and $49 are being multiplied by the same .25, this final step won't change which one is larger. So, just for the purpose of using the principle of insufficient reason, it is enough to add up the value of the outcomes and choose the option associated with the larger result.

for bet 1 = $25 + $8 + $4 + $4 = 41

for bet 2 = $1 + $5 + $30 + $4 = **49**

Using the principle of insufficient reason might seem more rigorous than the other rules, but it's important to remember that we are just assuming that each state is equally likely to happen. There may be times when we want to do this, but there will probably also be times when, because we don't know how likely each state is, we are more inclined to go with maximin or one of the other rules that don't make any assumptions about the probability of the states happening.