2.5 Regret

Whenever you are faced with a decision problem without a dominating option, there is a chance that you'll end up taking an option that turns out to be sub-optimal. If that happens there is a chance that you'll regret the choice you take. That isn't always the case. Sometimes you decide that you're happy with the choice you made after all. Sometimes you're in no position to regret what you chose because the combination of your choice and the world leaves you dead.

Despite these complications, we'll define the **regret** of a choice to be the difference between the value of the best choice given that state, and the value of the choice in question. So imagine that you have a choice between going to the movies, going on a picnic or going to a baseball game. And the world might produce a sunny day, a light rain day, or a thunderstorm. We might imagine that your values for the nine possible choice-world combinations are as follows.

	Sunny	Light rain	Thunderstorm
Picnic	20	5	0
Baseball	15	2	6
Movies	8	10	9

Then the amount of regret associated with each choice, in each state, is as follows

	Sunny	Light rain	Thunderstorm
Picnic	0	5	9
Baseball	5	8	3
Movies	12	0	0

Look at the middle cell in the table, the 8 in the baseball row and light rain column. The reason that's a 8 is that in that possibility, you get utility 2. But you could have got utility 10 from going to the movies. So the regret level is 10 - 2, that is, 8.

There are a few rules that we can describe using the notion of regret. The most commonly discussed one is called **Minimax regret**. The idea behind this rule is that you look at what the maximum possible regret is for each option. So in the above example, the picnic could end up with a regret of 9, the baseball with a regret of 8, and the movies with a regret of 12. Then you pick the option with the *lowest* maximum possible regret. In this case, that's the baseball.

The minimax regret rule leads to plausible outcomes in a lot of cases. But it has one odd structural property. In this case it recommends choosing the baseball over the movies and picnic. Indeed, it thinks going to the movies is the worst option of all. But now imagine that the picnic is ruled out as an option. (Perhaps we find out that we don't have any way to get picnic food.) Then we have the following table.

	Sunny	Light rain	Thunderstorm
Baseball	15	2	6
Movies	8	10	9

And now the amount of regret associated with each option is as follows.

	Sunny	Light rain	Thunderstorm
Baseball	0	8	3
Movies	7	0	0

Now the maximum regret associated with going to the baseball is 8. And the maximum regret associated with going to the movies is 7. So minimax regret recommends going to the movies.

Something very odd just happened. We had settled on a decision: going to the baseball. Then an option that we'd decided against, a seemingly irrelevant option, was ruled out. And because of that we made a new decision: going to the movies. It seems that this is an odd result. It violates what decision theorists call the **Irrelevance of Independence Alternatives**. Formally, this principle says that if option *C* is chosen from some set *S* of options, then *C* should be chosen from any set of options that (a) includes *C* and (b) only includes choices in *S*. The minimax regret rule violates this principle, and that seems like an unattractive feature of the rule.