**Notes on section 3-1 (pp. 45 - 47)**

We finished chapter 2 with the principle of insufficient reason. That principle tells us to assume that each state is equally likely to occur. This is an assumption that we sometimes might want to make, but it's still just an assumption. In this section and in chapter 4, we will examine decisions in which the probability of each state is known. When we know the probability of each state, we have a **decision under risk**.

In this section, we will only consider decision problems in which the values of the outcomes are represented with money. Here is one such decision problem.

| | P = .50<br>**red is drawn** | P = .20<br>**blue is drawn** | P = .30<br>**green is drawn** |
|---|---|---|---|
| **bet 1** | $25 | $8 | $4 |
| **bet 2** | $0 | $5 | $40 |

We know that there is a 50 percent chance that a red marble will be drawn, a 20 percent chance that a blue marble will be drawn, and a 30 percent chance that a green marble will be drawn. (Since the states are exhaustive, those probabilities have to add up to 1.0.) With this information we can, first, calculate the **expected value** (or **expected monetary value**) for bet 1. We do that by multiplying the value of each outcome by how likely it is (if we choose bet 1) and then adding up the results.

EV(bet 1) = (\$25)(.50) + (\$8)(.20) + (\$4)(.30) = 12.50 + 1.60 + 1.20 = \$15.30

If someone faces this same decision multiple times and always chooses bet 1, then his or her average payoff will be $15.30. (Sometimes this person will get $25, sometimes $8, and sometimes $4, but he or she will—eventually—average $15.30.)

We do the same calculation for bet 2:

EV(bet 2) = (\$0)(.50) + (\$5)(.20) + (\$40)(.30) = 0 + 1.00 + 12.00 = \$13.00

Resnik doesn't have a name for it besides 'maximizing EMV' (p. 47, top), but let's call the rule that we are following in this situation the **expected value strategy**. The expected value strategy tells us to choose the option with the highest expected value. So, we choose bet 1.

The expected value for an option is what we can expect to average if we choose that option multiple times. If we are just making a one-off decision, though, then the long-term average doesn't really matter to us. We're just going to get, in this case, $25, $8, $4, $0, $5, or $40. Thus, we might still be inclined to use one of the rules from chapter 2. But the probabilities are important information. (For instance, in the decision problem that we've just examined, a red marble is considerably more likely to be drawn than either a blue or a green one). And the only way to incorporate the information about the probabilities into our decision procedure is to use the expected value strategy. So, it is a very important rule. It's also a relatively easy one to use when the outcomes have been assigned monetary values (or when the outcomes just are monetary amounts). All outcomes shouldn't be valued with money, however. Sometimes the value of the outcomes *to the decision maker*—regardless of their monetary value—is more important. But, as we will see, decisions under risk get a little more complicated when we use utility values.