

DAT 520 Module Four Overview

This module concentrates on the main ingredients of decision analysis, called **utilities** for short: expected value (aka, expected utility), the standard gamble, QALYs, and ICERs. These four concepts are the stalwarts of decision analysis. When you understand what they are and how they are used, you will be able to easily pick up other measurement styles.

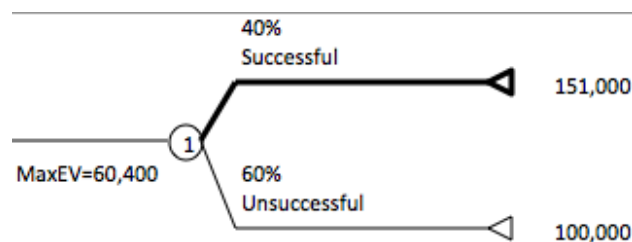
Expected value is the value of an outcome weighted by the probability that the event will occur.

Here is a simple example. Imagine you want to take a chance to make money by selling a house. It is 40% likely to be successful and 60% likely to be unsuccessful. If you are successful, you could make \$151,000. If you are unsuccessful, you will only make \$100,000. Which has the higher expected value (EV)?

Multiply 40% x \$151,000 = 60,400 EV

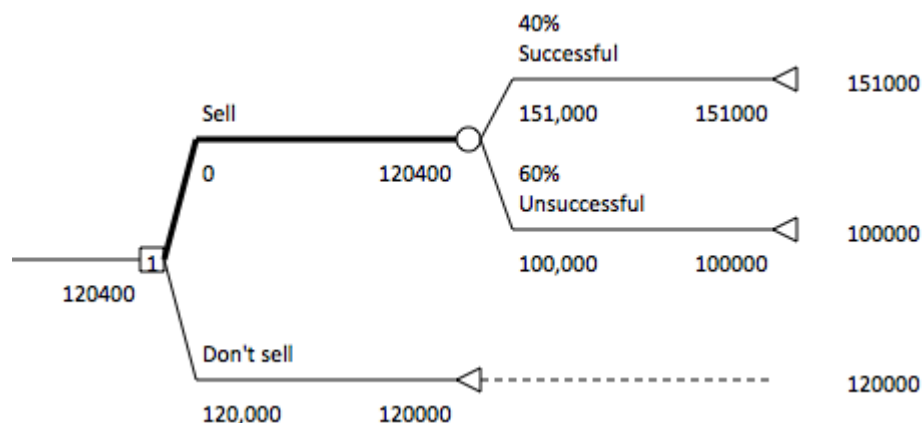
Multiply 60% x \$100,000 = 60,000 EV

In this case, being successful has the higher EV. Here's what this simple tree looks like:



Now, let's complicate things a bit and introduce a choice that needs to be made. Do you sell or not? If you sell, you will either be successful and make the \$151,000 or you will be unsuccessful at selling it at market value and have to make a short sale of only \$100,000. Or you can choose *not* to sell, stay in your house, and save for two years, which will net you \$120,000 in your bank account. Do you sell or not? Which path has the highest EV?

Here is what this decision tree looks like:



What are the expected values?

Sell: $(40\% \times \$151,000) + (60\% \times \$100,000) = 120,400$ EV

Do not sell: $(100\% \times \$120,000) = 120,000$ EV

In this case, the decision barely favors trying to sell the house.

Does this mean that you *should* sell? That is really the million-dollar question. By the expected value, you should sell—but this is a very simplified decision tree. Do you know for a fact that you could save \$120,000 in two years? Do you know for a fact that the house would sell for \$151,000? Do you know for a fact that an unsuccessful short sale would net \$100,000? What if that were zero? There are many factors involved in this decision and you will be learning about some of these other measurable utilities and things to think about in this module.

In the assignment, you will learn how to make two types of very basic decision trees and later on, you will learn how to account for many complications and different styles of rollbacks.

Your final project needs to be one of the two types of decision tree models, i.e., you have a *decision* to make about your chosen data set and research question. Do you use the data to produce probabilities and then construct a top-down model, or do you use the data as the basis for data mining and produce a bottom-up decision analysis?

After gaining exposure to the hands-on construction of both types of trees, we will follow up in the next two modules with more skills to help you make an informed choice about what style of modeling you would like to do for your project.