Business Analytics – Assignment 2 – Question 4

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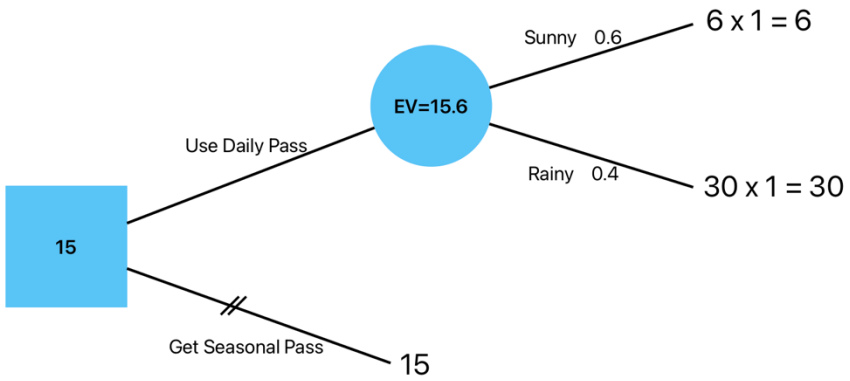
Pool Pass

This task sets up an optimization problem helping the swimmer to decide if they should buy a season pass to a dome pool for the summer or not to minimize his cost. We will tackle this problem using decision trees. Then after calculating the EVPI and EVSI we can determine which decision costs the least, given the information provided.

Initial Assessment and EVPI:

Given that the historical data shows a 60% Sunny and 40% Rainy summer on average, alongside the price of daily and seasonal pass to the pool, our first decision tree is depicted as below:



As we can see without any additional information, getting the season pass is the most cost-efficient way to this problem.

To calculate the EVPI, however, we first need to assume that we have the perfect information. In this case if we know it will be a sunny or rainy summer. After choosing the best option for either outcome, we need to then weight these values by their related described probability:

	Sunny	Rainy
Seasonal Pass	15	15
Daily Pass	6	30

Expected Cost with Perfect Information = 0.6 x 6 + 0.4 x 15 = 9.6

Now we can calculate the EVPI as below:

EVPI = Expected Value without Perfect Information – Expected Value with Perfect Information

EVPI = 15 – 9.6 = 5.4

EVSI

To calculate EVSI, we need to first calculate the expected cost with sample information using the probabilities provided by the problem and ignore the cost of information.

A1 = Sunny Summer Predicted A2 = Rainy Summer Predicted

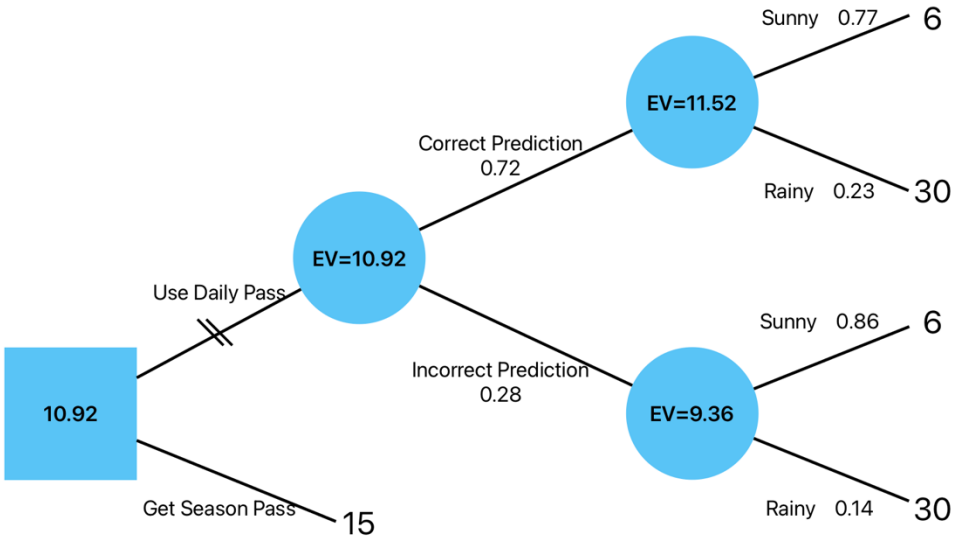
B1 = Correct Prediction B2 = Incorrect Prediction

$$P(A1) = 0.8 \quad P(A2) = 0.2 \quad P(B1|A1) = 0.7 \quad P(B1|A2) = 0.8$$
$$P(B2|A1) = 1 - 0.7 = 0.3 \quad P(B2|A2) = 1 - 0.8 = 0.2$$

With Bayes rule we have:

$$P(B1) = 0.72 \quad P(B2) = 0.28 \quad P(A1|B1) = 0.77 \quad P(A1|B2) = 0.86$$
$$P(A2|B1) = 1 - 0.77 = 0.23 \quad P(A2|B2) = 0.14$$

With the needed probabilities calculated, the decision tree with Sample Information is formed as below:



The decision tree above shows that using the Sample Information the cost will decrease to 10.92 (while ignoring the 1$ cost of Forecast). Therefore, the EVSI is calculated as follows:

EVSI = Expected Value without Sample Information – Expected Value with Sample Information

EVSI = 15 – 10.92 = 4.08

Final Decision

Since the sample information costs 1$ which is less than the calculated EVSI, it is advised to purchase the long-term forecast and not get a season pass. This will lead to a total expected cost (with consideration of long-term forecast price of 1$) of:

$$10.92 + 1 = 11.92\ \$$$