An evil teacher

An important feature of our example is that the probability of a given state of the world (easy exam or hard exam) is independent of which option you select (drinking or studying).

But this needn't be true in general.

Suppose, for example, that you have an evil teacher who knows whether you go out for drinks, and is more likely to assign a hard exam if you do. Whereas the probability of an easy exam *given that you go out for drinks* is 30%, the probability of an easy exam *given that you study* is 90%. The resulting probabilities might be represented as follows:

	easy exam	**hard exam**
drinks	30%	70%
study	90%	10%

Note that each cell in this matrix corresponds to a *conditional probability*. For example, the probability in the lower right corner corresponds to the probability of a hard exam, given that you study.

In the evil teacher scenario, we need to use these conditional probabilities to calculate expected value. For instance, the expected value of going out for drinks (D) should be calculated as follows:

$$EV(D) = \underbrace{35}_{\text{value of drinking with easy exam}} \cdot \underbrace{0.3}_{\text{probability of easy exam, given drinking}} + \underbrace{-25}_{\text{value of drinking with hard exam}} \cdot \underbrace{0.7}_{\text{probability of hard exam, given drinking}} = -7$$

Similarly, the expected value of studying (S) is now calculated as follows:

$$EV(S) = \underbrace{18}_{\text{value of studying with easy exam}} \cdot \underbrace{0.9}_{\text{probability of easy exam}} + \underbrace{18}_{\text{value of studying with hard exam}} \cdot \underbrace{0.1}_{\text{probability of hard exam}} = 18$$

Since $EV(S) > EV(D)$, the Principle of Expected Value Maximization entails that when you have an evil teacher, you ought to study, rather than go out for drinks.

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One more option
Should we take into account a situation that we study and fail the hard exam? 2