An Example

Suppose you're wondering what to do tonight.

You have two **options**: *go out for drinks* and *study*.

There are two relevant **states of the world**: *easy exam* and *hard exam*.

With two options and two relevant states of the world, your choice has four possible **outcomes**, which are represented as the empty cells in the following matrix:

	easy exam	**hard exam**
drinks		
study		

How desirable is each of these outcomes?

On the one hand, you'll have fun if you go out for drinks, and be bored if you stay home and study.

On the other hand, you can pass an easy exam without studying, but you'll need to study to pass a hard exam.

	easy exam	**hard exam**
drinks	fun + pass	fun + fail
study	bored + pass	bored + pass

Let us put numerical values on the desirability of our outcomes.

Suppose you think that failing the exam would be twice as bad as passing the exam would be good. So if we assign an arbitrary value of 20 to passing the exam, we should assign a value of -40 to failing the exam.

Going out for drinks would be almost as good as passing the exam, so we'll assign it a value of 15.

Studying, in contrast, would be only somewhat painful, so we'll assign it a value of -2.

This allows us to assign a value to each of our four possible outcomes:

	easy exam	**hard exam**
drinks	$15 + 20$	$15 + (-40)$
study	$-2 + 20$	$-2 + 20$

The next thing we need to so is associate a *probability* with each of the two states of the world that's relevant to our outcome: easy exam, and hard exam.

Let us suppose that the probability of an easy exam is 80%, and therefore that the probability of a hard exam is 20%.

We've now assigned a value to each outcome, and a probability to each relevant state of the world.

We can use this to assign **expected values** to each of the two options you can choose from: going out for drinks and studying. We do so by taking the *weighted average* of the values of the different possible outcomes, with weights given by the probabilities of the relevant states of the world.

The expected value of going out for drinks (D) is:

$$EV(D) = \underbrace{35}_{\text{value of drinking and easy exam}} \cdot \underbrace{0.8}_{\text{probability of easy exam}} + \underbrace{-25}_{\text{value of drinking and hard exam}} \cdot \underbrace{0.2}_{\text{probability of hard exam}} = 23$$

Similarly, the expected value of studying (S) is:

$$EV(S) = \underbrace{18}_{\text{value of studying and easy exam}} \cdot \underbrace{0.8}_{\text{probability of easy exam}} + \underbrace{18}_{\text{value of studying and hard exam}} \cdot \underbrace{0.2}_{\text{probability of hard exam}} = 18$$

We can now look to the Principle of Expected Value Maximization to decide what to do.

The Principle tells us that we ought to choose an option whose expected value is at least as high as that of any rival. Since $EV(D) > EV(S)$, this means that you ought to go out for drinks, rather than study.

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Decision theory vs the human condition
I wonder what proportion of the population actually make decisions based on optimising expect... 3

Fun chapter
I now have officially been told by an professional educator that studying is worse than goofing o... 4