Expected Utility

How it works. We often have to make choices with uncertain outcomes. Some of these outcomes are more desirable than others. In such situations, probability can help us figure out which choices lead to the highest expected return

Consider the following scenario, in which you can choose between buying Lottery Ticket #1 for $1, or Lottery Ticket #2 for $5. The possible outcomes are along the top, and below them the are the odds that each outcome occur. (0 = No chance, 1 = Certain.)

	$5 Prize	$50 Prize	$500 Prize	$5,000 Prize	-$1 Cost	-$5 Cost
Lottery Ticket #1	0.1	0.01	0.01	0	1	0
Lottery Ticket #2	0.1	0	.001	.0001	0	1

The *expected value* of each lottery ticket is an estimate of how much you should expect to make with each ticket, if you were to play many times. It is calculated by adding up the "weighted values" and subtracting the "weighted costs":

E(Choice) =

(Probability of payoff 1)×(Payoff 1) + (Probability of payoff 2)×(Payoff 2) + ...

-(Probability of cost 1)×(Cost 1) - (Probability of cost 2)×(Cost 2) - ...

For example, here is how to calculate the expected value of Lottery Ticket #1:

E(Ticket #1) = (.1)($5) + (.01)($50) + (.001)($500) – (1)($1) = $1.50

In other words, if you often by Lottery Ticket #1, you can expect to win an average of about $1.50 each time. On the other hand, here is the expected value of Lottery Ticket #2:

E(Ticket #2) = (.1)($5) + (.001)($500) + (.0001)($5,000) – (1)($5) = -$3.50

In other words, if you often by Lottery Ticket #2, you can expect to *lose* an average of about $3.50 each time.

Names_____

Decision Analysis in Medicine

Find a partner or group of three. Imagine your partner is being asked to decide which procedure to choose: Procedure 1 or Procedure 2. Ask your partner to rate each of the following outcomes on a scale from 0 (the worst) to 100 (the best), and write the number above the corresponding column. For example, if your partner rates the outcome, "Success but with blindness" as 15, then you would write "15" above that column, and so on.

	Death	**Success but with waist-down Paralysis**	**Success but with blindness**	**Success but with chronic pain**	**Hospitalized 6months, then normal life**	**Return to Normal Life**
Procedure 1	0.01	0.01	0.05	0.01	0.01	0.15
Procedure 2	0.04	0.05	0.01	0.05	0.05	0.1

Use your partner's choices to calculate the expected utility of each procedure, and recommend either Procedure 1 and Procedure 2. Discuss this recommendation.