

# Utility

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## Overview

- Certainty Monetary Equivalent (CME)
- Basic Reference Lottery Ticket (BRLT)
- Utilities and utility functions
- Risk Aversion
- Buying and Selling Prices

## How much is this ticket worth?

Suppose you own a lottery ticket which gives you a 50-50 chance of winning \$1000.

- For what price would you be willing to sell the ticket?
- This called your *Certainty Monetary Equivalent* (CME) for the lottery.

## Extensive Form of Analysis

- Construct a decision flow diagram
- Assign payoffs at the leaves.
- Assign probabilities at all chance nodes.
- Assign CME at chance nodes and fold back.

## Basic Reference Lottery Ticket

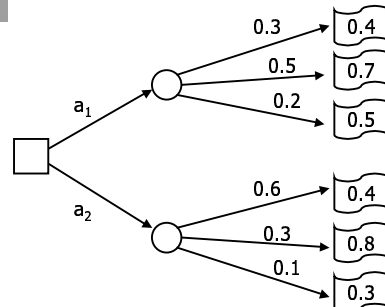
Front:

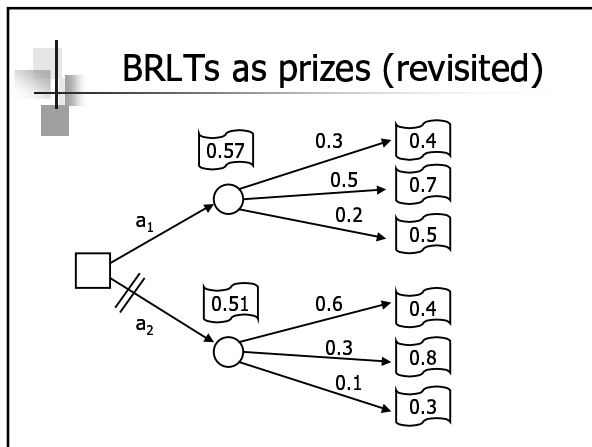
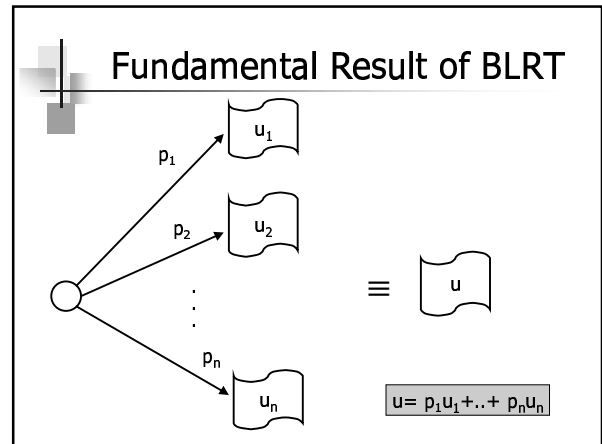
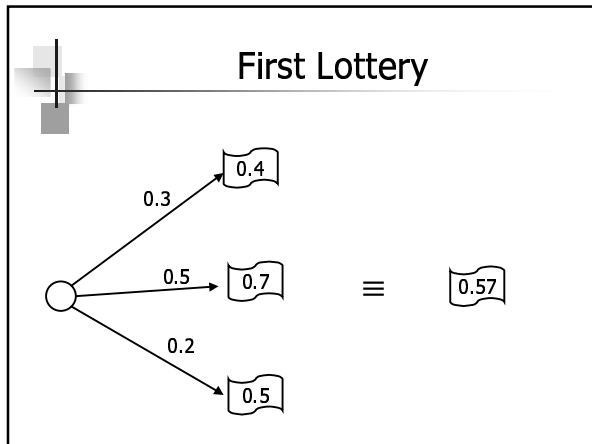
.38

Back:

This ticket entitles the bearer to a **.38** chance of winning W and a complementary chance of winning L (Basic reference prizes W and L are described on the master card).

## BRLTs as prizes





- ### Extensive Form of Analysis using BRLTs
- Construct a decision flow diagram
  - Assign all payoffs to the leaves.
  - Substitute a BRLT for each payoff.
  - Assign probabilities at all chance nodes.
  - Average out and fold back.

- ### Substitution Principle
- Take a lottery.
  - Substitute for one of its prizes another prize, and leave everything else fixed.
  - If you are indifferent between the original prize and its substitute, then you should be indifferent between the original lottery and the modified lottery.

- ### Transitivity Principle
- If you are indifferent between A and B, and B and C, then you should be indifferent between A and C.
  - If you prefer A to B, and prefer B to C, then you should prefer A to C.
  - If you prefer A to B, and indifferent between B and C, then you should prefer A to C.

## Correspondence between BRLT and \$

1. Select a lower monetary value and an upper monetary value which encompass all the payoffs.
2. Associate the lower one with a BRLT of 0, and the upper one with a BRLT of 1.
3. For each \$M find a BRLT of p.

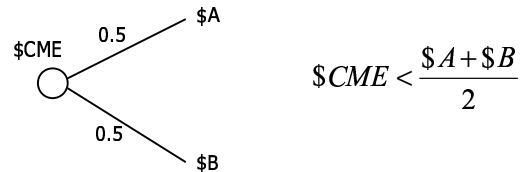
## Utility

- A portrayal of a decision maker's attitude to risk.
- Associated with each payoff is a utility value.
- Associated with each lottery is the expected utility of its payoff.
- The best lottery is the one with the maximum expected utility.

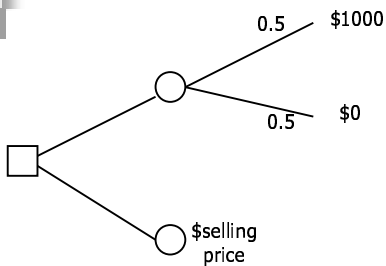
## Utility function

- Associates with each payoff is a utility value.
- Using either the utility function  $u(x)$  or  $a*u(x)+b$ , where  $a > 0$ , produce the same results in a decision analysis.
- Concave utility function corresponds to a decision maker being *risk adverse*.

## Risk Adverse

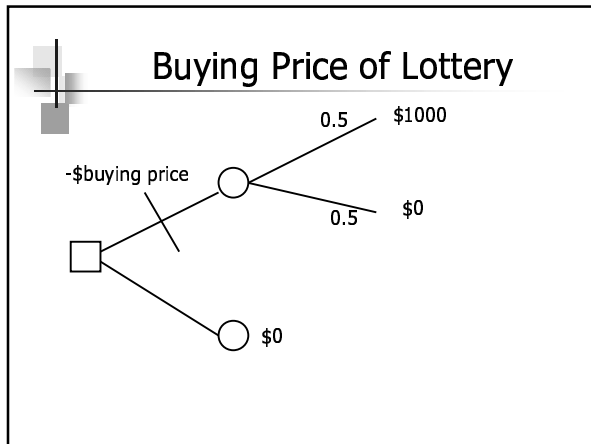


## Selling Price of Lottery



## Selling Price

The *selling price* for a venture is the monetary value associated with the maximum expected utility of the venture.



- ### Buying Price
- To find the *buying price*, **b**, of a venture.
  - Construct the decision flow diagram.
  - Find the value, **b**, such that:
    - when **b** is subtracted from all the payoffs of the decision flow diagram, and
    - the decision flow diagram is averaged out and folded back,
    - the maximum expected utility is the utility associated with  $\text{\$0}$ .