The purpose of this blog is to explore how we can reason about what we know to make guesses about what we don’t. We are going to “dip our toes” into this subject by exploring one of the most commonly experienced concepts in probability theory and statistics: measures of central tendency. Specifically, we are going to revisit the common definitions of measures such as the mean, median, and mode; and attempt to build a stronger intuition of what they are and why they are useful in our goal of making better guesses.

We begin by framing our exploration in terms of finding an optimal solution to a guessing game.

* Introduction
* Guessing Game
* A Primer on Measures of Central Tendency
  + What is a measure of central tendency?
  + Mean
    - Simple
      * Simply, the sample mean is the sum of the observations divided by the total number of observations. This is what most people mean when they say “average.”
    - General
      * More generally, the mean (aka expected value) of a random variable is the sum (or integral) of possible outcomes weighted by their probability (or probability density).
    - Applicability
      * The mean is applicable to interval and ratio data.
      * Not all probability distributions have an expectation.
  + Median
    - Simple
      * Simply, the sample median is the value of the observation in the middle of the observations when they are sorted by their values.
    - General
      * More generally, the median is the outcome where the probability of an outcome being less than the given value is equal to the probability of an outcome being greater than the given value, where both are equal to 50%
    - Applicability
      * The median is applicable to ordinal, interval, and ratio data.
      * When a there are two middle values i.e. when there are an even number of observations in a sample, the median is often defined as the sum of the two middle values divided by two.
  + Mode
    - Simple
      * The sample mode is the observed value that occurs most frequently.
    - General
      * More generally, the mode is the outcome with the largest probability.
    - Applicability
      * The mode is applicable to nominal, ordinal, interval, and ratio data.
      * Sometimes there can be more than one mode i.e. a distribution can be multimodal.
      * When all possible values are equally likely, we will say that there are n modes where n is the number of possible outcomes.
* Cost Functions
  + Objective, utility, loss, cost
* Deriving the Mode
  + Inequality Penalty
  + Proof
* Deriving the Median
  + Absolute Difference Penalty
  + Proof
* Deriving the Mean
  + Squared difference penalty
* Deriving the Midrange
  + L^p metrics
  + Mode as lim p -> 0
  + Midrange as lim p -> infty
* Aftermath