



GoExplore Consulting

Free Friday Webinars
Uncertainty Quantification
June 12th 9am Houston Time

- Problem Statement
- Uncertainty Types
- Introduction to the Elicitation Process
- Some words on Biases
- GoExplore: Uncertainty Range Quantification
- Exercise
- Wrap-up

GoExplore: Uncertainty Range Quantification

Quantifying the Uncertainty Range of Variables

Six Methods:

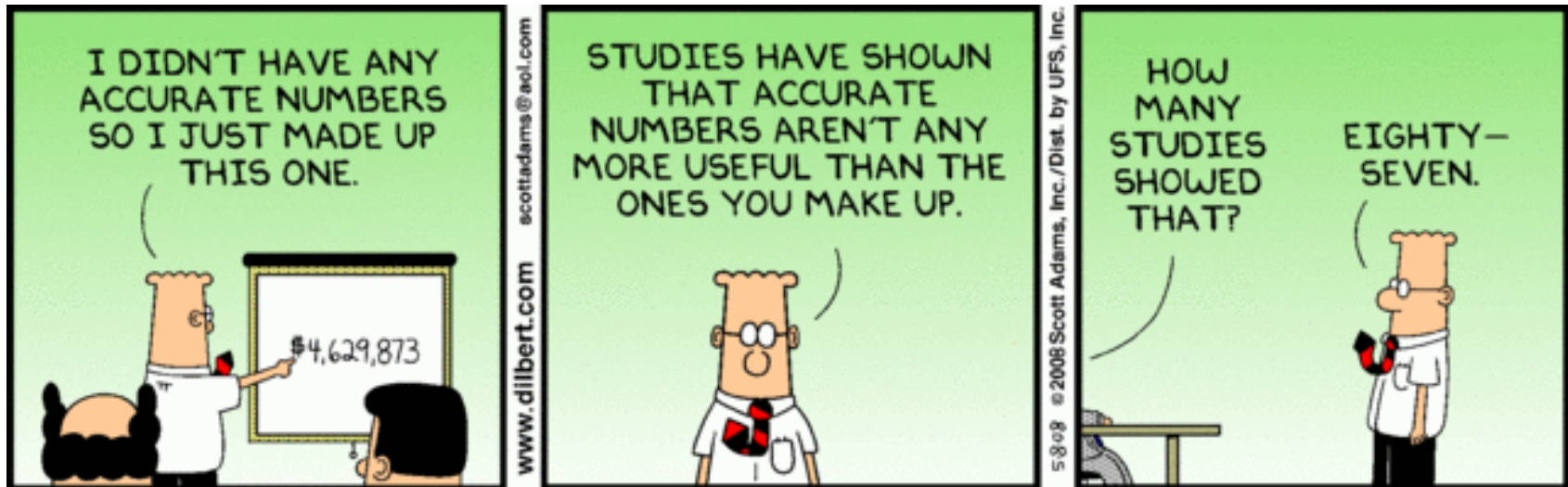
1. Min-Max Method
2. Three-Point Method
3. Larger-Smaller Method
4. Closer Method
5. Binned Method
6. Combined Method

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Hindsight Analysis shows that we are not very good at:

- Estimating uncertain variables
- Estimating the uncertainty range of these variables

Common Practice



With some simple techniques we can do something about this

Statistical Uncertainty, Uncertainty related to **variability in Data or Measurements**

➔ **Epistemic Uncertainty** is related to **ignorance** caused by **incomplete knowledge and / or information**.

Data Distributions

Description of Data Variability

Data defines Shape of distribution

Standard Deviation is a measure of Statistical Uncertainty

Uncertainty Distributions

Description of Uncertainty

- ➔
- Single Value that clusters around “Best Estimate” / “Base-Case”
 - Multi “Either-Or” values can be dealt with as alternative scenarios.

The objective of an Elicitation Process is to obtain a **probability distribution** that describe the **underlying knowledge** of a “Knowledge Holder”

Conscious or subconscious discrepancies between the responses and an accurate description of the underlying knowledge are called **biases**

The sources of biases can be classified as:

Motivational Bias

Cognitive Biases

Motivational People may have incentives to reach a certain conclusion or see things a certain way.

Availability A tendency to give too much weight to readily available data or recent experience (which may not be representative of the required data).

Adjustment and Anchoring Assessments are often unduly weighted toward the conventional value, or the first value given, or to the findings of previous assessments in making an assessment. Thus, they are said to be 'anchored' to this value.

Representativeness A tendency to place more confidence in a single piece of information that is considered representative, rather than in a larger body of more generalized information.

Unstated assumptions A subject's responses are typically conditional on various unstated assumptions (implicit conditioning).

Coherence Events are considered more likely when many scenarios can be created that lead to the event, or if some scenarios are particularly coherent. Probabilities tend to be assigned more based on one's ability to tell coherent stories than based on intrinsic probability of occurrence.

Satisficing This refers to the tendency to search through a limited number of solution options and to pick from among them. Comprehensiveness is sacrificed for expediency in this case.

Selection a distortion of evidence or data that arises from the way that the data are collected.

Confirmation the tendency to search for or interpret information in a way that confirms one's preconceptions.

Expectation We tend to perceive what we expect to perceive

Resistance Perceptions resist change, even in the face of new evidence

Discredited Evidence People may have incentives to reach a certain conclusion or see things a certain way.

Overconfidence Experts tend to over-estimate their ability to make quantitative judgments.

- Structured interview of “Knowledge Holder”
- In general takes between 10-90 minutes.
- Interviewer helps to translate the knowledge of the “Knowledge Holder” into a probability distribution.
- Interviewer can help to detect and correct for biases during the process.
- Interviewer can challenge “knowledge holder”

1. Structuring: Motivate, Define and Clarify variable
 - Clarify Objective.
 - Choose known scale.
 - Clarify implicit and explicit assumptions that could impact the estimate.
 - Hindsight test of variable (in hindsight will there be an unambiguous answer the question?).
2. Condition: Assess extremes
 - Compensate for availability and avoid anchors (biases).
 - Imagine the value is beyond the extreme, explain how it would happen.
 - List all the ways the value falls beyond the extremes.
3. Encode
 - Work from the extremes towards the middle.
 - Probability Questions and Value Questions.
 - Compare with known probabilities e.g. probability wheel, 1 ball in 10, betting bar, card deck etc.
 1. Min-Max Method
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4. Verify
 - Check for balance/symmetry in bets
 - Reality check
 - Recycle ?

Epistemic Uncertainty: Betting Analogy

The Betting Analogy: Comparison of your Probability with known Probabilities

You are offered two Options to choose from:

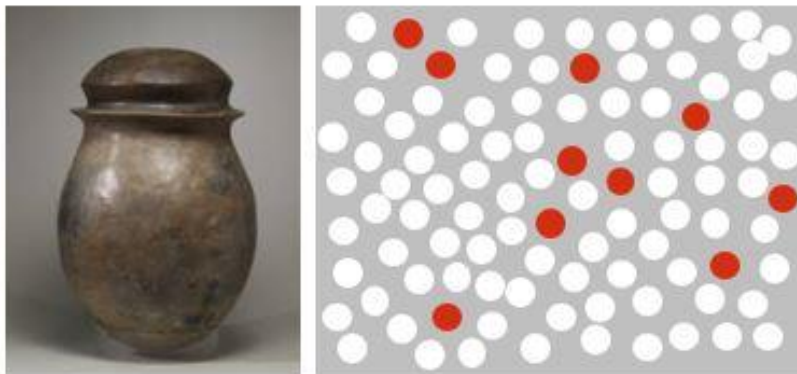
Option1): You get a prize when the actual is greater than your P_{10}

Option2): I have an Urn that contains 10 red balls and 90 white balls.

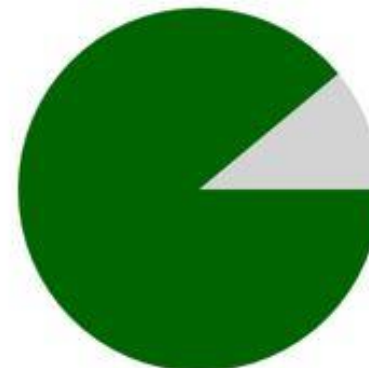
I will randomly pick a Ball out of the Urn. If it is Red you get a prize.

Would you rather participate in Option 1 or 2 ?

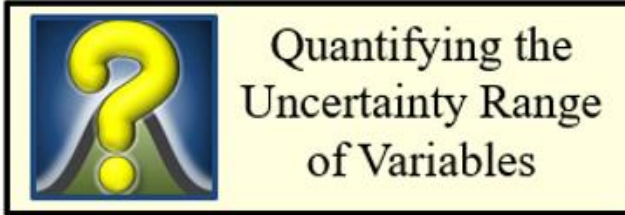
Urn with marbles



Probability Wheel

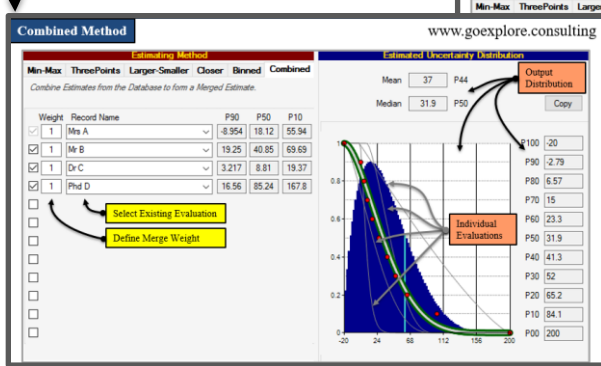
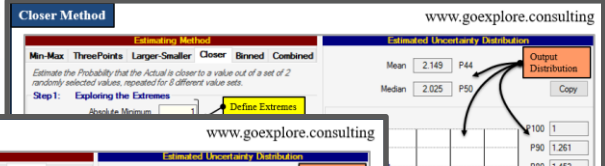
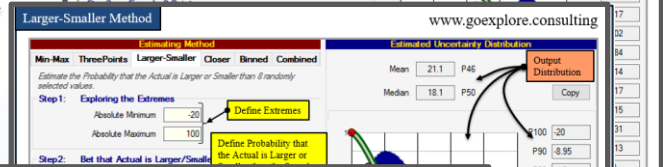
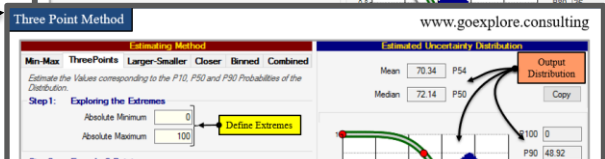


GoExplore: Uncertainty Range Quantification



Six Methods:

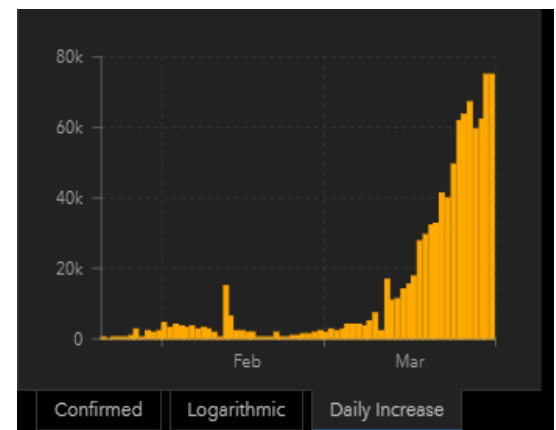
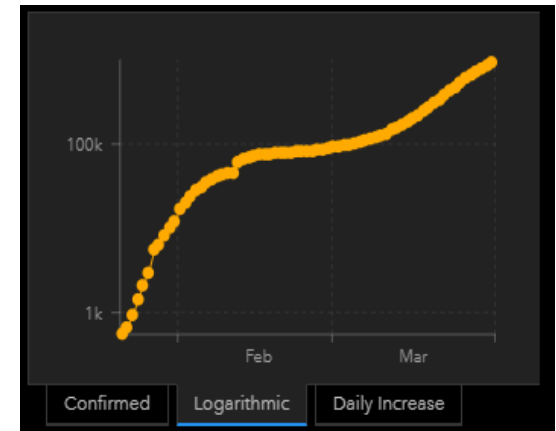
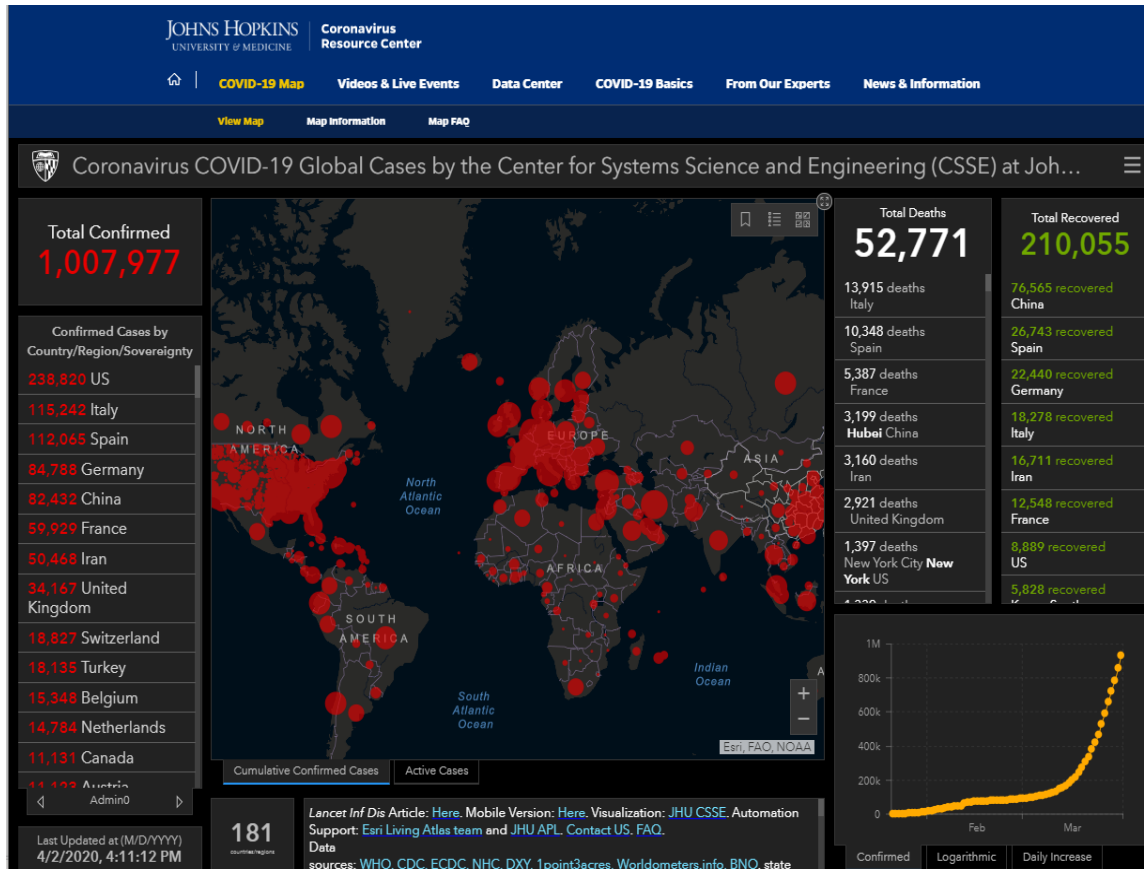
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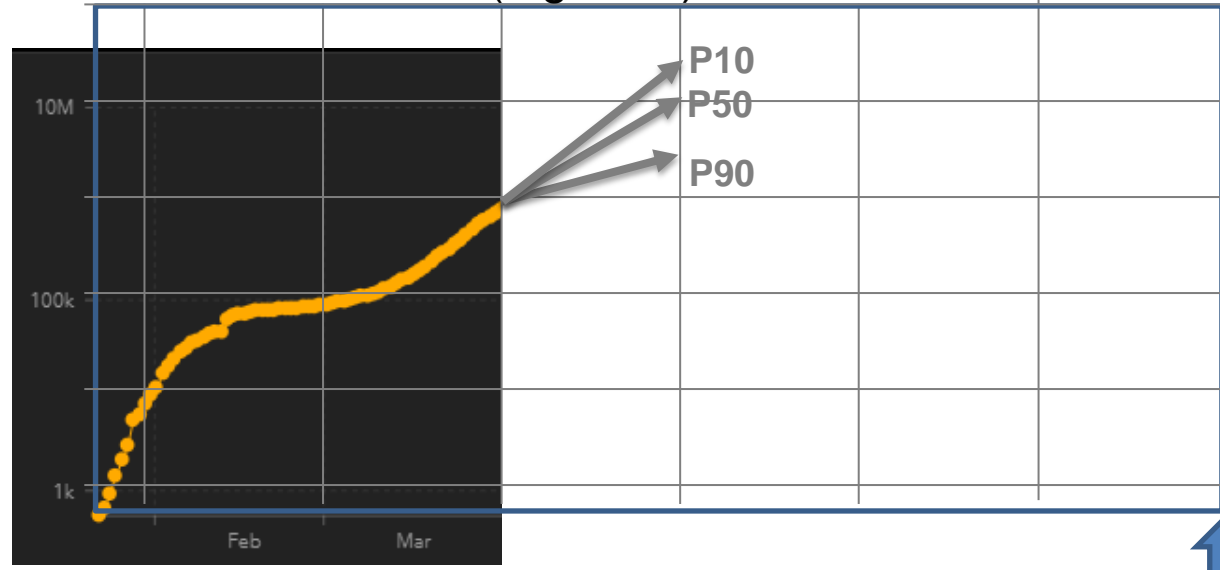
Estimate the following currently unknown parameter:

How many worldwide Covid19 cases will we have by May 1st 2020?

A bit of history (as of April 2nd 5 pm Houston time)



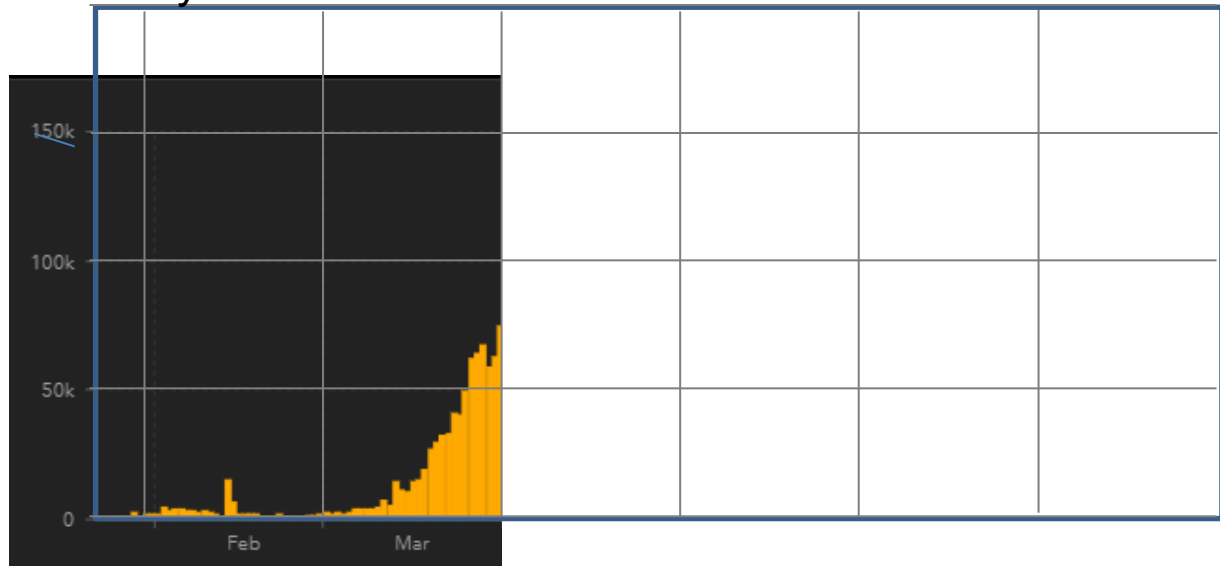
Cumulative Cases (logscale)



Next Question:
How Many cases
On August 1st?



Daily Cases



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When a set of **independent** estimates of the same value are combined:

- The average of these estimates is a better predictor than the individual estimates (more accuracy).
- The uncertainty range of this aggregated estimate is smaller than the individual estimates (more precision).

- Overconfidence: People make in general their ranges too narrow.
- Beware of other common biases: Overconfidence / Anchoring / Availability / Adjustment / Implicit Conditioning / Motivational.
- Beware of the occurrence of groupthink or social bias in group settings during an elicitation process.

- In combining expert-opinions one runs the risk of masking expert disagreement and throwing away important information concerning the problem, especially if the major differences between the expert opinions are not explicitly discussed and explained.
- You can train yourself becoming a better estimator by regular feedback.
- Independent estimates will improve the predictive capability.

I run workshops on
“Critical Thinking in
Prospect Evaluation”



After Kim Scot

You can download the Application at:
www.goexplore.consulting/install-freeware

Contact: Bloemendaal@GoExplore.Consulting



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Any Questions ?



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Thank You