Minimize risk. Maximize potential.

Deep Dive into Input Distribution Selection with @RISK

Part III: Turning Expert Opinion into Defensible Distributions

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ICEAA Technology Showcase Webinar Series
Deep Dive: Input Distribution Selection with @RISK

Part I – Distribution Fitting of Univariate Data
Fri, Jun 19th, 10am EDT

Part II – Revisiting the Triangular and PERT "Three Point" Distributions
Thurs, Jul 16th, 10am EDT

Part III – Turning Expert Opinion into Defensible Distributions
Thurs Aug 13th, 10am EDT

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Part III Webinar Objectives

- Provide ICEAA members with:
  - an awareness of difficulties associated with subjective probability assessment, especially how the heuristics experts may be using can lead to biases
  - a technique for interviewing experts that attempts to minimize these biases
  - a demonstration of how to use @RISK to identify the best fitting distribution from interview results

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Heuristics Used in Subjective Probability Assessment

People use heuristics (rules of thumb) to cope with the complexities of subjectively estimating probabilities. These heuristics can lead to systematically biased judgments.

- Availability
- Representativeness
- Anchoring and Adjustment

Tversky, A., and D. Kahneman (1974) "Judgment under Uncertainty: Heuristics and Biases." *Science*, 185, 1124 – 1131.

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Five-Point Fractile Specification Technique

- Assess a lower bound (defined as the 0.01 fractile) and an upper bound (defined as the 0.99 fractile). Select these values so that there is only a 1% chance that in each case the true value of the uncertain quantity is more extreme than the fractile.
- Assess the median of the distribution (the 0.5 fractile)
- Assess the interquartile values (the 0.25 and 0.75 fractiles)

… or 0.05 & 0.95; 0.5; and 0.33 & 0.67

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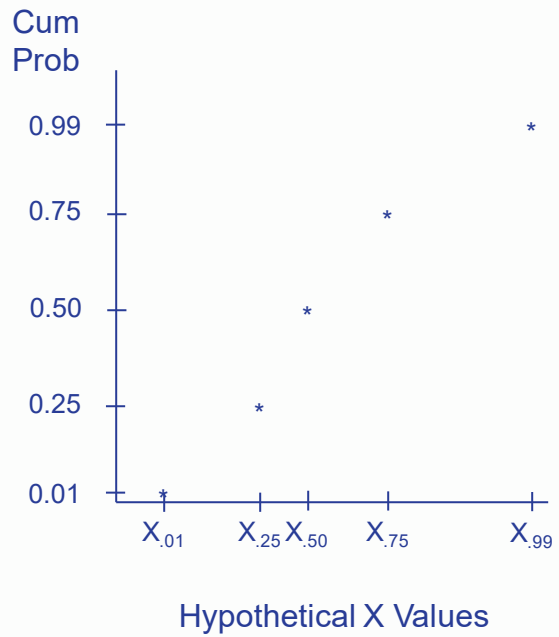
Five-Point Fractile Specification Technique

Fractile Specification Assessment Table	
Cumulative Probability	Representative Value
❶ 0.01	
❸ 0.25	
❷ 0.50	
❸ 0.75	
❶ 0.99	



Identify best fitting distribution using @RISK Distribution Fitting feature with "Cumulative (X,P) Points" as Data Type.
Fit ranking based on Root Mean Squared Error (RMSE).

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Questions?

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Back Up Slides

Availability Biases

- Retrievability of instances
- Effectiveness of search set
- Imaginability
- Illusory correlation

Representativeness Biases

- Insensitivity to prior probability of outcomes
- Insensitivity to sample size
- Misconceptions of chance
- Insensitivity to predictability
- Illusion of validity
- Misconceptions of regression

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Anchoring and Adjustment Biases

- Anchoring in the assessment of subjective probability distributions
- Insufficient adjustment
- Evaluation of conjunctive and disjunctive events
  - Overestimating conjunctive event probabilities, e.g., components in serial (and)
  - Underestimating disjunctive event probabilities, e.g., components in parallel (or)

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Methods for Assessing Subjective Probabilities

- Indirect assessment methods
  - Graphing techniques
  - Betting techniques
- Direct assessment methods
  - Fixed probability techniques
  - Fixed value techniques
  - Fractile specification techniques

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Fixed Value Techniques

Fixed Value Assessment Table	
Representative Value Range { $\Delta = (X_H - X_L)/5$ }	Cumulative Probability
X_L to $(X_L + \Delta)$	
$(X_L + \Delta)$ to $(X_L + 2\,\Delta)$	
$(X_L + 2\,\Delta)$ to $(X_L + 3\,\Delta)$	
$(X_L + 3\,\Delta)$ to $(X_L + 4\,\Delta)$	
$(X_L + 4\,\Delta)$ to X_H	

With this template five subjective probability assessment questions are asked, one from each representative value range. If time (and the expert being interviewed) permits, obtaining more value/cumulative probability data pairs is preferred.

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Fixed Probability Techniques

Fixed Probability Assessment Table	
Cumulative Probability Range	Representative Value
0.0 – 0.2	
0.2 – 0.4	
0.4 – 0.6	
0.6 – 0.8	
0.8 – 1.0	

With this template five subjective probability assessment questions are asked, one from each cumulative probability range. If time (and the expert being interviewed) permits, obtaining more cumulative probability/value data pairs is preferred.

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