Chance Informed Thinking - Syllabus

The course is built around five modules.

Open-source ChanceCalc+ software will be provided for participants' personal laptops. DOD computer users should contact the instructors in advance. Participants are encouraged to submit problems in advance for potential incorporation into the program. The course texts are The Flaw of Averages: Why we Underestimate Risk in the Face of Uncertainty, and Chancification: How to Fix the Flaw of Averages both by Dr. Sam L. Savage, available on Kindle or in paperback through Amazon.

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We will begin with student introductions. Please be prepared to provide the following:

- Name and organization
- Are you familiar with the Flaw of Averages or the discipline of Probability Management?
- Have you used SIPmath or ChanceCalc software?
- Have you used similar software, e.g., Risk or other Monte Carlo software?
- What type of national security analysis that you do?
- How do you adequately analyze uncertainty in your national security work?

What do you hope to learn from the course?

Part I introduces the Flaw of Averages—why plans are consistently behind schedule, beyond budget, and below projected performance—and covers the arithmetic of uncertainty, including how to quantify, combine, and plan around interrelated uncertainties. Participants learn to distinguish uncertainty from risk and to build plans that reflect the full range of possible outcomes rather than a single point estimate.

Part I - The Flaw of Averages and the Arithmetic of Uncertainty (90 min.)

1. Probability Distribution: A nine-syllable term that triggers Post Traumatic Statistics Disorder (PTSD).
2. Risk vs. Uncertainty – Risk Tolerance
3. Uncertain Numbers – Coherent Stochastic Data, SIPs
4. Combinations of Uncertain Numbers – Diversification
5. Plans based on Uncertain Numbers – The Flaw of Averages, Jensen's Inequality
6. Interrelated Uncertainties

Part II focuses on building Chance-Informed dashboards in native Excel using ChanceCalc, with applications to defense planning problems including scheduling, supply chain, and readiness. Dashboards created in ChanceCalc run without the software installed, making them shareable across organizations.

Part II – Interactive Dashboards (240 min.)

1. Connecting the Seat of the Intellect to the Seat of the Pants – Limbic Analytics
    a. Engaging your audience
    b. The ChanceOmeter
    c. Avoiding the PTSD trigger words
2. The Excel Data Table
3. Basic ChanceCalc Commands and Getting Started PDF
4. Tutorial Examples and Libraries
5. Design of Experiments
6. Examples
7. Hands-on Computer Lab

Part III covers extracting uncertainty from data using SIPmath 3.0, the open standard for storing and sharing stochastic data. Topics include the Metalog distribution for flexible uncertainty quantification, the HDR generator for reproducible stochastic samples, and copula structures for capturing dependencies between uncertain quantities.

Part III – From Data to Dashboards (150 min)

1. Array Data
    a. CSV
    b. 2.0 XLSX with Metadata
2. JSON Virtual SIPs
    a. The Metalog Distribution
    b. Using AI to generate Quantiles.
3. Suggestions for Student Projects
    a. Knuth's five stages of model development
    b. Jump-starting your project
    c. Airwing Readiness Rollup Model

Part IV addresses SIP Library infrastructure and Chance-Informed governance, including the role of the Chief Probability Officer in ensuring that uncertainty is managed consistently across an organization.

Part IV Stochastic Data Systems and developing applications (90 min)

1. Last minute help on projects
2. Interrelated Variables
3. Generating Applications with AI

Part V Project Presentations. Students will present small interactive models either of their own choosing, or from an assigned list. (30 Minutes)