Monte Carlo Simulation

Executive Summary

Purpose

The goal of this Monte Carlo simulation is to study what might happen in a project and the chances of different outcomes. We used statistical methods to figure out the possible range of results and the likelihood of achieving specific goals. The simulation considered things like task relationships and how each task can vary, giving us a complete picture of how the project might perform.

Methodology

In this Monte Carlo simulation report, we used the following approach:

- Simulation Trials: We ran the simulation 2,500 times with different inputs to cover a wide range of outcomes.
- Input Variables: We considered important factors like task durations, costs, and dependencies that affect the project. These variables had probabilistic distributions based on available data.
- Random Sampling: In each simulation trial, we randomly picked values for the input variables from their distributions to mimic real-world uncertainties.
- Calculations and Aggregation: Using the sampled values, we calculated the project's outcome for each trial by combining individual task results or considering how tasks depend on each other.
- Statistical Analysis: We analyzed the simulation results using statistical measures like average, standard deviation, median, and percentile ranges to understand the typical outcomes and their variations.
- Probability Assessment: Based on the simulation, we evaluated the probabilities of specific project outcomes. We compared the expected value to predefined thresholds or calculated the likelihood of results falling within certain ranges, such as 10% or 25% overruns.
- Visualization: We used visual aids like histograms to illustrate the outcomes' distribution, making it easier to understand the probabilities and ranges involved.

Results

We conducted 2,500 simulations to get a good set of results. The average value of the project was 120.00, and it varied around this average by about 8.70. The middle value, or median, was also found to be 120.00. We looked at the range of possible outcomes using percentiles. About 80% of the results were between 110.00 and 140.00 (P80 range), while 90% fell within 110.00 and 140.00 (P90 range). Additionally, we studied how much the variation in the overall project could be explained by the differences in individual tasks.

Simulation Trials	2,500.00
Mean (Average) Value	120.00
Standard Deviation	8.70
Median Value	120.00
Lowest Observed Value	98.00
Highest Observed Value	160.00
P80 Range (10th - 90th percentile)	110.00 - 140.00
P50 Range (25th - 75th percentile)	120.00 - 130.00

Table 1: Projects Statistics

The contribution to variance, also known as single-factor sensitivity, measures the impact of each individual task on the overall project result. It quantifies how much the variability in the project can be attributed to the variability in each specific task.

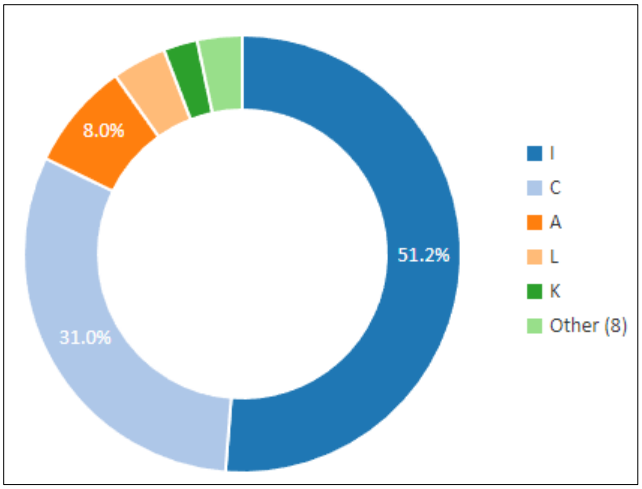

Figure 1 Contribution to Variance

The histogram in the below figure shows how often different outcomes occurred in the project. It helped us identify three important values: the best-case scenario (optimistic value) was 141.00, the most likely scenario (expected value) was 129.00, and the worst-case scenario (pessimistic value) was 123.00. These values give us an idea of the range of possibilities for the project.

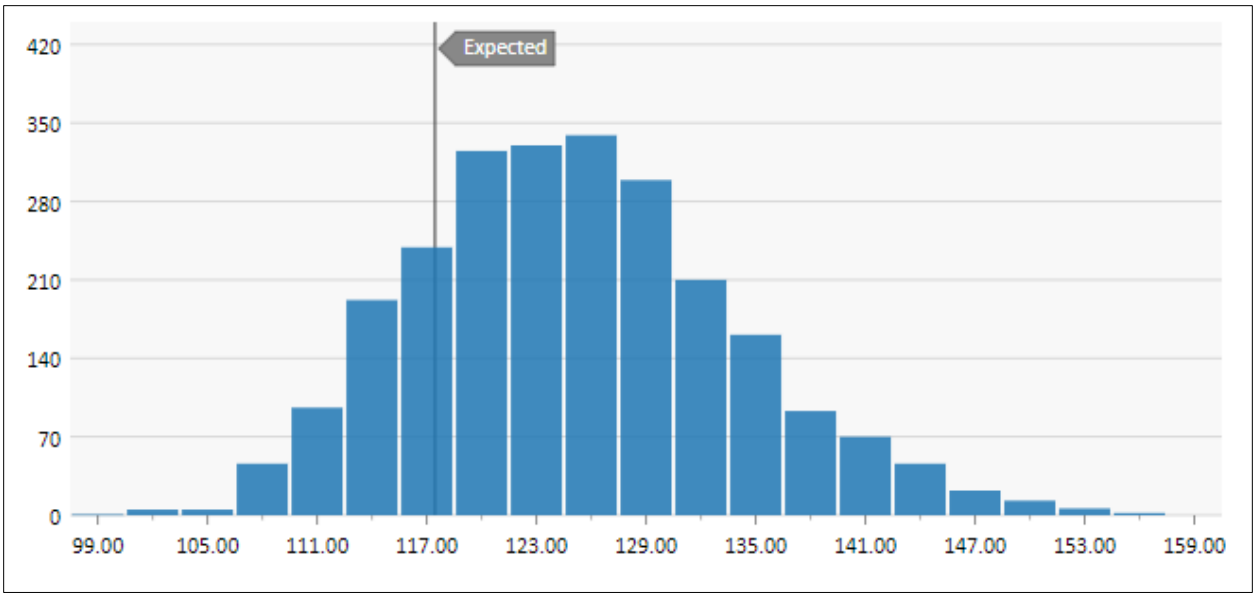

Figure 2 Distribution of Outcomes

By considering the expected values of all tasks and their dependencies, we calculated the expected value for the entire project as 118.00. This value represents the average outcome we can anticipate. We also determined that there is a 27.2% chance of achieving a result that is equal to or less than the expected value.

Furthermore, we examined the probabilities of surpassing the expected value by allowing for overruns of 10% and 25%. The probability of a 10% overrun was found to be 77.4%, meaning there is a high likelihood of the project going slightly over the expected value. Additionally, the probability of a 25% overrun was 99.2%, indicating a very high chance of the project exceeding the expected value by a larger margin. Please refer below table for details.

Expected Value	118.00
Probability of Result <= Expected Value	27.2%
10% Overrun (Expected + 10%)	129.80
Probability	77.4%
25% Overrun (Expected + 25%)	147.50
Probability	99.2%

Table 2: Projects Probabilities

Recommendation

The Monte Carlo simulation results show that the project has uncertainty and variability. The wide range of possible outcomes, as shown by the percentile ranges, emphasizes the importance of managing risks and planning for unexpected events. Since there is a higher chance of overruns, it's recommended to allocate extra resources and have strong strategies in place to handle potential delays or cost increases. It's essential to monitor the project regularly and make proactive adjustments to ensure successful delivery within the expected boundaries.

Summary

In summary, the Monte Carlo simulation gave us useful information about what could happen in the project and the chances of different outcomes. It showed us that the project's performance can vary and has uncertainties. This highlights the need for proactive risk management. The percentile ranges, contribution to variance, and probability assessments help project stakeholders make smart decisions, allocate resources wisely, and create backup plans. By using these insights, the project team can improve their chances of meeting objectives while minimizing any potential issues.