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Monte Carlo Simulation of Project Completion Times: A Case Study for an Electric Vehicle Project

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Abstract

Making strong predictions about the project completion time under uncertainty is crucial for project management. Therefore, when a project task duration is not exactly known, a probability distribution can be fitted to the duration to model randomness. However, choosing the wrong distribution can lead to serious errors. Triangular and beta distributions are generally preferred as task time probability distribution, but it can be very difficult for an expert to estimate the maximum value for triangular distribution and the mean and mode for beta distribution. Due to such shortcomings, instead of beta and triangular distributions, using lognormal and Weibull distributions which have long right tails may provide more accurate results when distributions that can take large values albeit with small probabilities are appropriate for a task time. In this study, data including task dependencies and task time estimates like minimum, most likely, and (probabilistic) maximum time is collected for 120 tasks of an electric vehicle production project. Then, triangular, lognormal, and Weibull probability distributions are fitted to all task times, respectively, and Monte Carlo simulations are performed to produce project completion times. Finally, the probability distribution function of project completion time is obtained for each of the three distributional settings. The 0.9, 0.95, and 0.99 quantiles are used to analyze project completion time distributions and it is revealed that lognormally distributed task times yield significantly larger quantiles than others, also Weibull distribution causes greater quantiles compared to triangular distribution. It shows how unconscious selection of probability distribution can have misleading results.

Keywords

Monte Carlo simulation, Project management, Triangular distribution, Lognormal distribution, and Weibull distribution.

Biographies

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