Quantitative Risk Modelling & Real-World Application:

These units helped Quantitative Risk Modelling (QRM) to measure and forecast cybersecurity and project risks. Using Monte Carlo Simulation, I learnt how probability is used for security planning (Aven & Thekdi, 2025; Fraser et al., 2021).

Tools & Techniques Used:

• Monte Carlo Simulation – probabilistic forecasting of uncertainty (Metropolis, 1987)

• Bayes' Theorem / Bayesian Networks – dynamic risk updating (Downey, 2022)

• Risk Heat Maps & Sensitivity Analysis – highlighting major influence factors (Aven & Thekdi, 2025)

Seminar & Application:

Monte Carlo simulations modelled ransomware probability across 10 000 iterations, visualising uncertainty (Metropolis, 1987). Bayesian inference refined results with new threat-intelligence inputs (Downey, 2022). Using AHP, the group compared encryption, MFA, and EDR by effectiveness and cost (Asadabadi et al., 2019). Together, these methods showed how quantitative outputs enable adaptive, data-driven decisions.
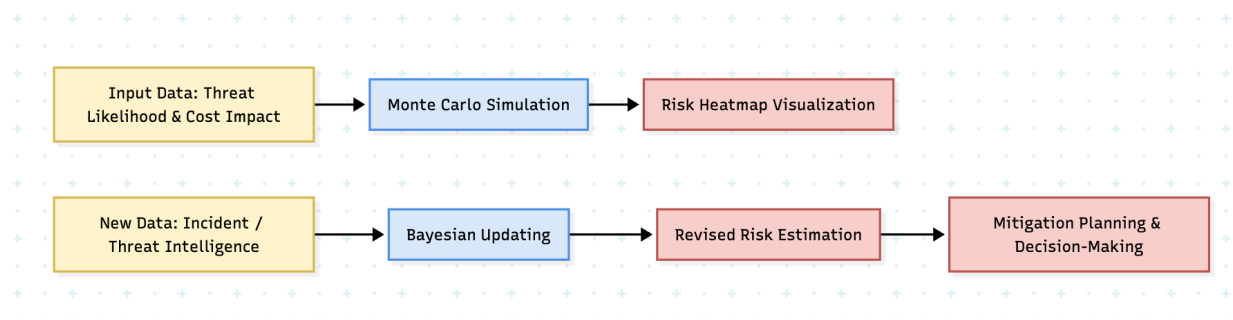
Figure1: QRM Framework Monte Carlo simulation, Bayesian updating, and mitigation planning.

Learning Outcomes:

I learnt to interpret probability results for operational risk and saw how quantitative tools transform risk from static scoring to forecasting. I also realised that data quality and human influence require cross-functional review (Kurtz et al., 2024).

References:

Asadabadi, M.N., Chang, E. and Saberi, M. (2019) 'Are MCDM methods useful? A critical review of Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP)', *Cogent Engineering*, 6(1), p.162315.

Aven, T. and Thekdi, S. (2025) *Risk Science: Concepts and Applications.* Routledge.

Downey, A. (2022) *Think Bayes 2.* 2nd ed. Green Tea Press.

Fraser, J.R.S., Quail, R. and Simkins, B. (2021) *Enterprise Risk Management.* Wiley.

Kurtz, W.J., Morris, J.M., Sengupta, S. and Das, S. (2024) 'Shedding light on CVSS scoring inconsistencies', *IEEE Symposium on Security and Privacy (SP)*, pp.1102–1121.

Metropolis, N. (1987) 'The beginning of the Monte Carlo method', *Los Alamos Science*, 15, pp.125–130.