Monte Carlo Debugger Specification

1. Debugger clients
   a) Person who uses Monte Carlo simulations
   b) System that uses or performs Monte Carlo simulations

2. Problem description and user requirements

Problem	**Requirement**
Simulation result is a single value and as such cannot be analyzed in detail	Understanding of the result through analysis of its calculation
Large calculation trees	Convenient graphical representation of the tree; Step by step debugging of the calculation
Large number of simulation runs	Detailed analysis of an arbitrary simulation run; Statistics for each tree node and behavior across runs

3. Solution description – Develop a debugger for Monte Carlo simulations
   a) Debugger input – Document containing the results of a Monte Carlo simulation:
      - Configuration – Number of runs and calculation precision
      - Formula description – Tree representation of the calculated property
      - Simulation values – Values for each tree node in each of the simulation runs
   b) Debugger features
      - GUI tree representation of the calculation with expandable and collapsable nodes
      - Zoomable histogram or line chart of the values across simulation runs for each node
      - Statistics extraction for an arbitrary calculation node – min, max, mean, standard deviation and value distribution
      - Simulation run selection and filtering according to a criteria
      - Calculation debugging for an arbitrary simulation run.
        Done by restoring observed values for the chosen run with the following operations:
        - Step over – Restore the value of the current node and move marker to the next sibling or step out to the parent if the current node is the last child
        - Step into – Expand subtree and move marker to the first child of the current node
        - Step out – Restore the subtrees of all siblings of the current node and move marker to the parent node