

# Abstract

This thesis provides a review of several different simulation methods and their application to approximating option prices. Both vanilla call options and barrier call options are discussed but analysis are focused on discrete knock-out barrier call options, of which the price cannot be calculated analytically because of difficulty dealing with high-dimensional integrals. The simulation methods of option pricing are studied in details and illustrated in examples. After comparison and contrast, sequential importance resampling method with ESS threshold, a specific class of sequential Monte Carlo-based algorithms, is revealed to outperform the other algorithms in terms of accuracy and relative variance of the estimated prices.

The Monte Carlo simulation methods studied are: standard Monte Carlo method in Chapter 3, variance reduction mechanism: sequential importance sampling in Chapter 4, and sequential importance resampling (with/without ESS threshold) in Chapter 5. All simulation methods are coded and run in R studio.