# Asian Options Assignment[[1]](#footnote-2)

Introduction

An **Asian option** (or *average value* option) is a special type of option contract. For Asian options the payoff is determined by the average underlying price over some pre-set period of time. This average can be based on either of the two types:

* Arithmetic Averaging: Pay off will be based on arithmetic average of the prices over a period of time.
* Geometric Averaging: Pay off will be based on geometric average of the prices over a period of time.

Outline of the Procedure

The algorithm has been implemented using the Matlab. In order to value the Asian option using Monte Carlo simulation, the following steps are used:

1. The first step is to simulate the asset price with an assumption that the prices follow geometric Brownian option. Three approaches of discretization have been used:
* Milstein Scheme (asked in the question)
* Euler Scheme
* Discretization of ln(S)

 represents the standard normal variate.

1. The asset prices have been simulated with an assumption of 252 business days in a year unless explicitly stated. This effectively means that days.
2. The averaging of the asset prices is performed from the valuation date to the maturity date of the contract as follows:
	* Arithmetic Averaging

 where n is the number of days between t & T

* + Geometric Averaging

 where n is the number of days between t & T

1. The payoff of the Asian option is then calculated using the following equation:

1. The steps 1-4 are repeated for given number of iterations and different combination of standard normal variates as a part of Monte Carlo simulation. The payoffs obtained in each iteration is then stored in some variable and averaged over total iteration to estimate the expected payoff. The payoff is then discounted to the valuation date to arrive at the value of Asian Option.

The value therefore can be represented as follows:

***Note: To achieve faster convergence, two enhancements have been accomodated in the Matlab code:***

* ***An antithetic method of convergence has been employed. Under this, the same set of normal variates but with exactly opposite sign is added to estimate the expected payoff. This helps is achieving the faster convergence because of the following:***
* ***We have now 2\*Iterations over which averaging is estimated***
* ***More iterations and exactly opposite sign helps in reducing the standard error.***
* ***Options of using quasi random numbers have been provided. Quasi random numbers helps in achieving faster convergence. Examples used in this code are Halton & Sobol sequence.***
1. [↑](#footnote-ref-2)