Numerical Methods

Monte Carlo Method for Greeks, Milstein scheme

1   Non Matlab exercises

1. Using Ito's formula prove that if S satisfies the geometrical Brownian motion SDE

$$dS = rSdt + \sigma SdW,$$

   then the probability distribution of $S(T)$ is given by

$$S(T) = S(0)\exp((r - \frac{1}{2}\sigma^2)T + \sigma\sqrt{T}\epsilon)$$

   with $\epsilon \sim N(0,1)$.

2. Using Ito's formula derive the Milstein scheme for the SDE

$$dX = a(X,t)\,dt + b(X,t)\,dW.$$

2   Matlab exercises

1. Implement the Finite difference method to compute delta for European call option. Compare path the recycling method with the "naive" method.

2. Implement the Pathwise derivative method to compute delta for European call option.

3. Implement the Likelihood ratio method to compute delta for European call option.

4. Compare volatilities for all these methods.

5. Can you apply any of the Variance reduction techniques we studied two weeks ago here?