Numerical Methods II
M. Giles

Practical 3

1. Look at the Matlab codes `lec9_weak.m` and `lec9_strong.m` and make sure that you understand what they are doing – ask if anything is unclear.

2. Starting with `lec9_strong.m`, try modifying the value of `M2` which controls how many paths are computed at a time. Try values of 1, 10, 100, 10^3, 10^4, 10^5, 10^6. Which is fastest?

   (This is known as strip-mining: if $M2$ is very small the efficiency is poor because of the MATLAB overhead, but if $M2$ is too large you can lose efficiency because the CPU's cache is not big enough.)

3. Modify `lec9_weak.m` to estimate the value of call options with strikes of $K = 80, 90, 100, 110$ using the same set of path calculations for all of them. Also modify the plots so that each plot has 4 sets of lines corresponding to the 4 call options.

4. Modify `lec9_strong.m` to simulate the mean-reverting Ornstein-Uhlenbeck process

   $$\mathrm{d}S = \kappa\,(\theta - S)\,\mathrm{d}t + \sigma\,\mathrm{d}W$$

   with $S(0) = 100, \theta = 110, \kappa = 2, \sigma = 0.5$. There is no exact solution in this case so just plot the comparison between the h and $2h$ solutions. What is the order of strong convergence?

5. Modify `lec10_weak.m` (which generated the plots shown in lecture 10) to improve the weak convergence for both the barrier and lookback options using the methods presented in lecture 10.