C++ Programming for Financial Engineering Level 9 Group C Writeup

QuantNet

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a)

The Program runs and compiles correctly with no error.

b)

Batch 1 Output



Batch 2 Output



Batch 1 Call Error



Batch 1 Put Error



Batch 2 Call Error



Batch 2 Put Error

From the outputs above, we can that most of the smallest errors occur in the bottom right of the error tables, indicating that the increase of both number of simulations and number of steps should increase the simulation accuracy. However, a close examination reveals that for a given small N (N=100), the increase of number of steps towards infinity don’t necessarily improve the accuracy. For example, for N = 100, errors decrease significantly for increasing small NSIM, but as NSIM grows to 5000000, the error does not show sign of decreasing. On the other hand, for a large N, increasing NSIM indeed deceases error significantly.

For a given NSIM small, N has almost no relationship with the magnitude of error. It is only when NSIM reaches the millions that an increase in N start to reduce the error for call and put options for Batch 2, but the effect soon diminishes. For Batch 1, increase in N shows no sign of decreasing the error.

In general, large N and NSIM tend to produce estimations closer to the exact solution, but their effect on the accuracy of the estimations is only evident when both are large. For a given NSIM, the effect of N is not observed. Increase in N does not decrease error. This is perhaps due to the short expiry time of Batch 1 and Batch 2. Based on the result, I would speculate that there is optimal N relative to each expiry time. N larger than this optimal value will no longer improve the accuracy of the simulation. For further research, I would try larger N on options with larger expiry time to confirm my speculation.

c)

Batch 4 Output



Batch 4 Call Error



Batch 4 Put Error



For put option, the accuracy is already two places behind the decimal point when N reaches 500, and NSIM reaches 100000. Further increase of N to 800 improve the accuracy even more. On the other hand, the accuracy for call option is much harder to improve. Although increase in NSIM and N do seem to improve accuracy slightly, the accuracy is nowhere approaching two places behind the decimal point. Even when NSIM is increased to 10 million, the accuracy still does not show significant improvement. In the end, the cost of computing such a large number of simulations is simply too great to achieve the desired accuracy. This phenomenon is worth an investigation. Perhaps N is supposed to be set much larger in order to achieve the accuracy.

The error output for Batch 4 confirms my speculation in part b. Since Batch 4 has a much longer expiry time than Batch 1 and Batch 2, we expect higher number of steps to obtain an optimal simulation. As the output shows, the accuracy only increases as N increases, indicating that the optimal n has not yet been achieved.